



**JAPAN FUND FOR POVERTY REDUCTION (JFPR)**

**MAINSTREAMING LABOUR - BASED ROAD MAINTENANCE  
TO THE NATIONAL ROAD NETWORK IN CAMBODIA TA-9048**

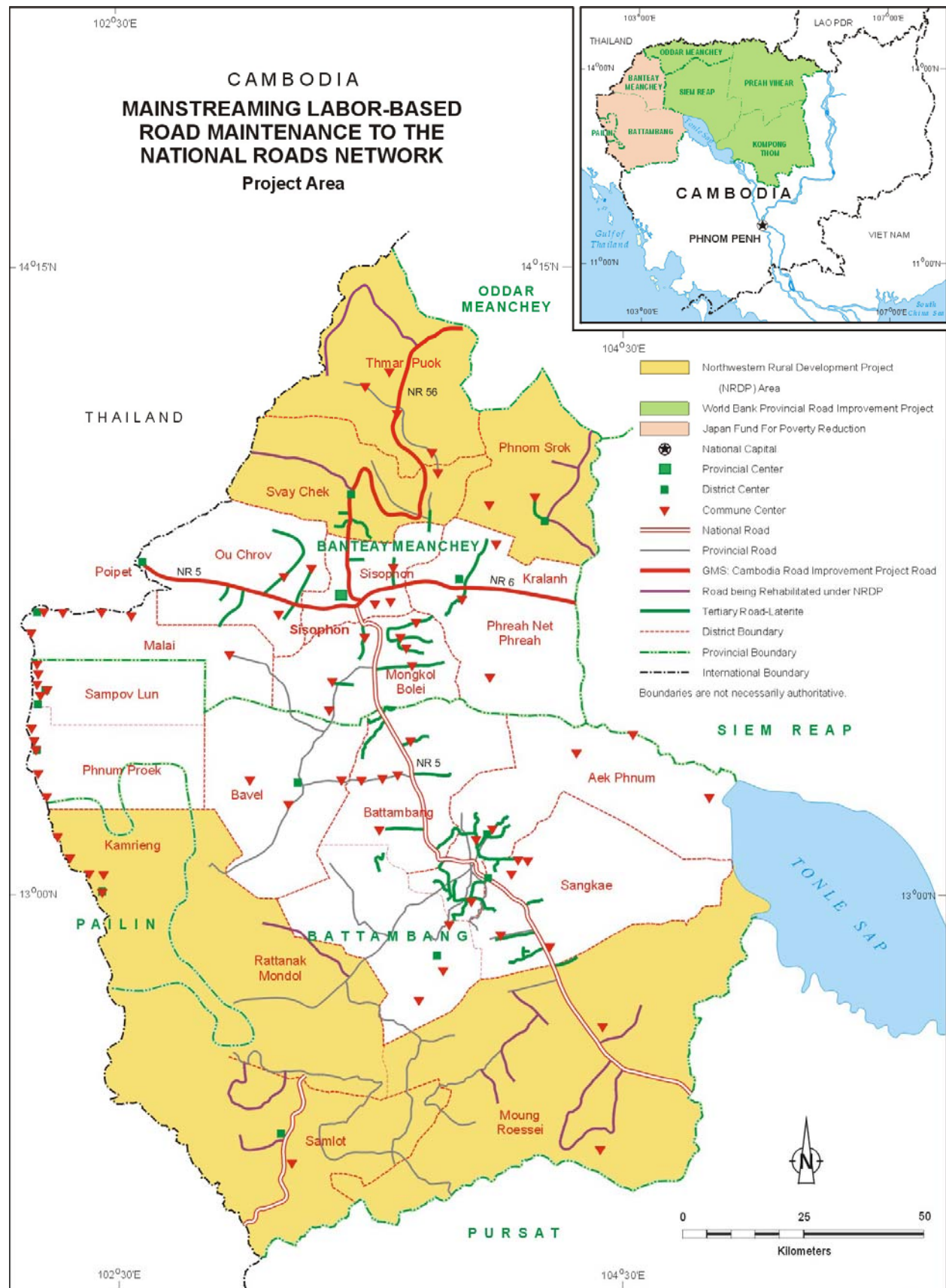
**Final Report**  
(October 2008)



**October 2008**

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# JAPAN FUND FOR POVERTY REDUCTION (JFPR)

ADB

## ROAD MAP SHOWING ROADS UNDER ROUTINE MAINTENANCE AND PREVENTIVE RECURRENT MAINTENANCE (LCS) IN BATTAMBANG BANTEAY MEANCHHEY AND Krong PAILIN

75000\_N

List of Low Cost Bituminous Surfacing Roads in Battambang, Banteay Meanchey and Krong Pailin

No.	Road Name	Length Km	Province	Doing In
1	Preah-Nel Bridge	4.00	Battambang	MPWT
2	RN 5 - Phnom Thong	2.00	Battambang	MRD
3	RN 5 - Krong Pailin	0.50	Battambang	MRD
4	RN 5 - Krong Pailin	0.50	Battambang	MRD
5	RN 5 - Preah-Nel	0.50	Battambang	MRD
6	RN 5 - Preah-Nel	0.50	Battambang	MRD
7	RN 5 - Preah-Nel	0.50	Battambang	MRD
8	RN 5 - Preah-Nel	0.50	Battambang	MRD
9	RN 5 - Preah-Nel	0.50	Battambang	MRD
10	RN 5 - Preah-Nel	0.50	Battambang	MRD
Total		11.00		

List of Road For Routine Road Maintenance in Battambang, Banteay Meanchey Province and Krong Pailin

No.	Road Name	Length Km	Doing In
1	Preah-Nel - Don Chh (RN 100)	14.30	MPWT
2	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
3	Preah-Nel - Preah-Nel (RN 100)	2.20	MPWT
4	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
5	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
6	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
7	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
8	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
9	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
10	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
11	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
12	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
13	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
14	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
15	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
16	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
17	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
18	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
19	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
20	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
21	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
22	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
23	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
24	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
25	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
26	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
27	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
28	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
29	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
30	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
31	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
32	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
33	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
34	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
35	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
36	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
37	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
38	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
39	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
40	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
41	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
42	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
43	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
44	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
45	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
46	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
47	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
48	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
49	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
50	Preah-Nel - Preah-Nel (RN 100)	2.80	MPWT
Total		244.60	

Battambang Meanchey			
No.	Road Name	Length Km	Doing In
1	RN 5 - Chong Hoi	10.00	MRD
2	RN 5 - Chong Hoi	10.00	MRD
3	RN 5 - Chong Hoi	10.00	MRD
4	RN 5 - Chong Hoi	10.00	MRD
5	RN 5 - Chong Hoi	10.00	MRD
6	RN 5 - Chong Hoi	10.00	MRD
7	RN 5 - Chong Hoi	10.00	MRD
8	RN 5 - Chong Hoi	10.00	MRD
9	RN 5 - Chong Hoi	10.00	MRD
10	RN 5 - Chong Hoi	10.00	MRD
11	RN 5 - Chong Hoi	10.00	MRD
12	RN 5 - Chong Hoi	10.00	MRD
13	RN 5 - Chong Hoi	10.00	MRD
14	RN 5 - Chong Hoi	10.00	MRD
15	RN 5 - Chong Hoi	10.00	MRD
16	RN 5 - Chong Hoi	10.00	MRD
17	RN 5 - Chong Hoi	10.00	MRD
18	RN 5 - Chong Hoi	10.00	MRD
19	RN 5 - Chong Hoi	10.00	MRD
20	RN 5 - Chong Hoi	10.00	MRD
21	RN 5 - Chong Hoi	10.00	MRD
22	RN 5 - Chong Hoi	10.00	MRD
23	RN 5 - Chong Hoi	10.00	MRD
24	RN 5 - Chong Hoi	10.00	MRD
25	RN 5 - Chong Hoi	10.00	MRD
26	RN 5 - Chong Hoi	10.00	MRD
27	RN 5 - Chong Hoi	10.00	MRD
28	RN 5 - Chong Hoi	10.00	MRD
29	RN 5 - Chong Hoi	10.00	MRD
30	RN 5 - Chong Hoi	10.00	MRD
31	RN 5 - Chong Hoi	10.00	MRD
32	RN 5 - Chong Hoi	10.00	MRD
33	RN 5 - Chong Hoi	10.00	MRD
34	RN 5 - Chong Hoi	10.00	MRD
35	RN 5 - Chong Hoi	10.00	MRD
36	RN 5 - Chong Hoi	10.00	MRD
37	RN 5 - Chong Hoi	10.00	MRD
38	RN 5 - Chong Hoi	10.00	MRD
39	RN 5 - Chong Hoi	10.00	MRD
40	RN 5 - Chong Hoi	10.00	MRD
41	RN 5 - Chong Hoi	10.00	MRD
42	RN 5 - Chong Hoi	10.00	MRD
43	RN 5 - Chong Hoi	10.00	MRD
44	RN 5 - Chong Hoi	10.00	MRD
45	RN 5 - Chong Hoi	10.00	MRD
46	RN 5 - Chong Hoi	10.00	MRD
47	RN 5 - Chong Hoi	10.00	MRD
48	RN 5 - Chong Hoi	10.00	MRD
49	RN 5 - Chong Hoi	10.00	MRD
50	RN 5 - Chong Hoi	10.00	MRD
Total		512.70	

Krong Pailin			
No.	Road Name	Length Km	Doing In
1	RN 5 - Chong Hoi	10.00	MRD
2	RN 5 - Chong Hoi	10.00	MRD
3	RN 5 - Chong Hoi	10.00	MRD
4	RN 5 - Chong Hoi	10.00	MRD
5	RN 5 - Chong Hoi	10.00	MRD
6	RN 5 - Chong Hoi	10.00	MRD
7	RN 5 - Chong Hoi	10.00	MRD
8	RN 5 - Chong Hoi	10.00	MRD
9	RN 5 - Chong Hoi	10.00	MRD
10	RN 5 - Chong Hoi	10.00	MRD
11	RN 5 - Chong Hoi	10.00	MRD
12	RN 5 - Chong Hoi	10.00	MRD
13	RN 5 - Chong Hoi	10.00	MRD
14	RN 5 - Chong Hoi	10.00	MRD
15	RN 5 - Chong Hoi	10.00	MRD
16	RN 5 - Chong Hoi	10.00	MRD
17	RN 5 - Chong Hoi	10.00	MRD
18	RN 5 - Chong Hoi	10.00	MRD
19	RN 5 - Chong Hoi	10.00	MRD
20	RN 5 - Chong Hoi	10.00	MRD
21	RN 5 - Chong Hoi	10.00	MRD
22	RN 5 - Chong Hoi	10.00	MRD
23	RN 5 - Chong Hoi	10.00	MRD
24	RN 5 - Chong Hoi	10.00	MRD
25	RN 5 - Chong Hoi	10.00	MRD
26	RN 5 - Chong Hoi	10.00	MRD
27	RN 5 - Chong Hoi	10.00	MRD
28	RN 5 - Chong Hoi	10.00	MRD
29	RN 5 - Chong Hoi	10.00	MRD
30	RN 5 - Chong Hoi	10.00	MRD
31	RN 5 - Chong Hoi	10.00	MRD
32	RN 5 - Chong Hoi	10.00	MRD
33	RN 5 - Chong Hoi	10.00	MRD
34	RN 5 - Chong Hoi	10.00	MRD
35	RN 5 - Chong Hoi	10.00	MRD
36	RN 5 - Chong Hoi	10.00	MRD
37	RN 5 - Chong Hoi	10.00	MRD
38	RN 5 - Chong Hoi	10.00	MRD
39	RN 5 - Chong Hoi	10.00	MRD
40	RN 5 - Chong Hoi	10.00	MRD
41	RN 5 - Chong Hoi	10.00	MRD
42	RN 5 - Chong Hoi	10.00	MRD
43	RN 5 - Chong Hoi	10.00	MRD
44	RN 5 - Chong Hoi	10.00	MRD
45	RN 5 - Chong Hoi	10.00	MRD
46	RN 5 - Chong Hoi	10.00	MRD
47	RN 5 - Chong Hoi	10.00	MRD
48	RN 5 - Chong Hoi	10.00	MRD
49	RN 5 - Chong Hoi	10.00	MRD
50	RN 5 - Chong Hoi	10.00	MRD
Total		55.90	

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### Administrative Symbols:

- Provincial Boundary
- District Boundary
- Commune Boundary
- District Center
- Commune centre
- Village centre
- Provincial Center
- Routine Maintenance Roads
- Preventive Recurrent Maintenance

### Other Symbols:

- River, Stream
- National Road All Weather
- National Road Dry weather
- Provincial Road All Weather
- Provincial Road Dry Weather
- Rural Road All Weather
- Rural Road Dry Weather
- Oxcart Road Dry Weather

0 12.5 25

KINGDOM OF CAMBODIA

Battambang

## Executive Summary

<b>Project Title</b>	<b>TA - 9048 Mainstreaming Labor Based Road Maintenance to the National Road Network</b>
<b>Progress Report Period</b>	<b>January 2006 to October 2008</b>
<b>Sector</b>	<b>Infrastructure</b>
<b>Theme</b>	<b>Labour-intensive Road Maintenance</b>
<b>Date of Start</b>	<b>November 2005</b>
<b>Date of Completion</b>	<b>October 2008</b>
<b>Funding JFPR</b>	<b>US\$ 2,200,000</b>
<b>Funding Government</b>	<b>US\$ 2,548,000</b>
<b>Other Sources</b>	<b>US\$ 252,000</b>
<b>Funding Total</b>	<b>US\$ 5,000,000</b>



This Final Report highlights the project activities since inception to its scheduled completion in October 2008. The project focused mainly on the training activities for small scale contractors and the counterpart provincial staff. The newly developed financial systems for the JFPR Funds and the Royal Government of Cambodia (RGC) Funds were successfully introduced.

As agreed during the ADB Review Mission held on 02 February 2007, the administration of the project was formally delegated by the ADB Manila to the ADB Cambodia Resident Mission (CARM) with effect from 15<sup>th</sup> February 2007.

As envisaged, the Project successfully organized several training courses for training of small scale contractors, provincial staff and the JRMU staff for effective planning, designing, construction and maintenance of roads using labour-based methods. 36 local contractors were trained in effective planning, designing and execution of labour-intensive routine maintenance. Another 16 local contractor companies were trained in execution and management of Low Cost Bituminous Surfacing (LCS).

Base Line Surveys (Nov.2006) and the Follow Up Surveys (August 2008) for impact assessment of the project interventions on poverty alleviation were carried out on identified project roads and control roads in the three provinces. Important findings of the Study reveal that the improved access definitely contributes to the increase in traffic volumes and increase in transportation of goods and services hence increasing the opportunities and income of the rural poor.

Bi-annual Tripartite-Review Meetings for the project between ADB, Ministry of Public Works and Transport, Ministry of Rural Development and ILO were held on regular basis. The Joint Road Maintenance Board Members from the three Provinces also participated in the project review meeting.

Routine Maintenance Contracts for 517 km of rural roads awarded to 32 Community Contractors in the provinces of Battambang, Banteay Meanchey and Pailin. Light grading of 140 km of roads which were considered in rather poor condition was carried out with the help of Community Contractors.



Preparation of Contract Documents and Local Competitive Bidding for 91.93 km of roads for low cost bituminous surfacing carried out as per the ADB guidelines and Standard Operating Procedures (SOPs) and 10 contracts awarded to successful bidders amounting to US\$ 2,042,293.03.

During 2007 & 2008, 108,711 work-days of employment was created through low cost bituminous surfacing and routine maintenance activities in the three provinces. The project encouraged employment of female workers and 61% of the above employment generation was for women workers.

The project activities suffered a major setback as no RGC counterpart funds were released for replenishment by the MEF in 2007. As a result, the project could not make payments to the contractors and all the construction and road maintenance activities were stopped from the beginning of October 2007 by the contractors. The worst affected are the 32 Community Contractors for routine maintenance of roads who were required to pay wages to their workers.

The project activities suffered a major setback due to delays in the replenishment of the RGC counterpart funds. The first replenishment of RGC funds was received on 21<sup>st</sup> January 2008. Also, most of the LCS Contractors continued to suspend their field operations during the reporting period due to delays in payment and also due to unprecedented increase in the cost of construction materials. In the absence of any price escalation clause in the bid documents, they requested the project to pay some compensation for this worldwide unprecedented and unforeseen increase in the cost of bitumen and other construction materials.

The Project Steering Committee held bi-annual meetings on a regular basis. In 2008, the Project Steering Committee held two Extra-Ordinary Meetings to find some amicable solution to the stoppage of work by the LCS contractors due to price increase. The Steering Committee after due considerations in its Extra Ordinary Meeting held on 09<sup>th</sup> May 2008 recommended a price increase of 20% (for bitumen items only) to encourage the contractors to complete the remaining works for consideration of the Ministry of Economy & Finance. This recommended price increase was not approved by the MEF. The contractors continued to stop the work and hence the project management had no other options but to terminate 8 out of total 10 LCS contracts with unfinished roads. Only 2 out of 10 LCS road contracts (14.3 km) could be completed and rest 77.63 km of the LCS works remained unfinished at different stages due to abandoning of works by the contractors due to unprecedented increase in the cost of construction materials.

The MEF engaged M/S KPMG for carrying out financial audit of the project. The KPMG Team commenced their audit in June and submitted its report for consideration of the MEF.

## **1. Overview of Project Preparatory and Procurement Activities**

### **1.1 Setting up of Joint Road Maintenance Unit & the Project Office**



MPWT allocated office space for the establishment of the Joint Road Maintenance Unit (JRMU) and the Project Office in the Department of Public Works and Transport premises in Battambang. MPWT also provided all office furniture for the project office. Renovation of 2 additional rooms to accommodate all the JRMU was completed in 2006. As envisaged all the office equipment and computers were procured for the project office using ADB/JFPR funds.

## **1.2 Allocation of Project Vehicles by the MPWT & Other Office Procurement**

As indicated in the project technical proposal, MPWT allocated 2 used FORD Pick-Up (4WD Double Cabin) for use by the project. All the vehicles received were in poor state of maintenance and required repairs and maintenance on continuous basis. The MPWT transferred old office furniture from another project for use by the Joint Road Maintenance Unit in Battambang. The project procured computers, photocopier, printers etc using ADB/JFPR funds.

As envisaged, the project procured 8 Suzuki Motor Cycles through local competitive bidding for supervision of road maintenance activities in the three provinces. The registration of the motor cycles was done as per the guidelines and procedures and the “State” Registration Number were obtained from the Transport Department of the MPWT in Phnom Penh.

## **1.3 Technical Assistance - TA- 9048 CAM**

ADB, through its direct selection procedures and in accordance with *Guidelines on the Use of Consultants by Asian Development Bank and Its Borrowers* has contracted the Technical Assistance Component of the Project (TA 9048 CAM) to the International Labour Organisation (ILO) . As per the Contract for Consultant's Services between ADB and ILO , the field work commenced on 01 November 2005 and be completed by 31<sup>st</sup> October 2008. The ILO deployed the following personnel under the framework of above mentioned Consultant's Services:

Project Manager	Mr.Mukesh C. Gupta
Training Engineer	Mr.Van Samsan
Admn. & Finance Support	Ms.Chea Somalina

The Project Manager has been responsible for the overall management of the support to the JRMU and supervision of the overall implementation of the services and ensures that the outputs and objectives of the services are delivered in a timely and effective manner. The TA Team was stationed at the JRMU in Battambang, and responsible for joint planning and implementation of road maintenance of MPWT and MRD roads in the provinces and for producing the necessary monthly, periodic and progress reports and financial reports in the format required by the Government, ADB and the ILO. The TA Team organized training course for the small scale contractors and the provincial staff and introduced the procurement and financial systems for the disbursement of ADB/JFPR and the RGC Funds.

## **1.4 Joint Road Maintenance Unit (JRMU)**

The Joint Road Maintenance Unit (JRMU) staffed with Engineers and technicians from the two Ministries and their provincial departments became fully operational in November 2006. The JRMU dealt with road maintenance planning, road condition surveys, preparation of annual road maintenance plans, securing road maintenance funds from MEF, contracting and supervision of road maintenance works in the 3 provinces.

The ILO TA Team continued to provide technical assistance to the JRMU on labour-based road maintenance planning, contract management, supervision of labor-based road maintenance activities, budgeting, capacity building for labor-based road maintenance, policy up-scaling, and coordination. The following staff from the MPWT and MRD in the three provinces were nominated as counterpart staff to work with the project in the JRMU:

<b>Post Title</b>	<b>No. of Posts</b>	<b>Name</b>	<b>Telephone</b>	<b>Remarks</b>
<b>Head of Unit</b>	<b>1</b>	<b>Mr.Ky Vyrin</b>	<b>012- 831385</b>	
<b>Secretary</b>	<b>1</b>	<b>Ms.Touch Rany</b>	<b>012- 900754</b>	
<b>Senior Road Engineer</b>	<b>2</b>	<b>Mr.Sum Dy Noch</b> <b>Mr. Lean Phirun</b> <b>Mr.Sang Bunthen</b>	<b>012- 952164</b> <b>012- 822030</b> <b>012- 413681</b>	<b>Repatriated to PDRD</b> <b>Planning &amp; Reporting</b> <b>Operations and Maintenance</b>
<b>Road Condition Surveyor</b>	<b>1</b>	<b>Ms.Ham Syna</b>	<b>012- 834133</b>	
<b>Road Technician</b>	<b>3</b>	<b>Mr.Orn Siphea</b> <b>Mr.Soun Nat</b> <b>Mr.Sang Saron</b>	<b>012- 686196</b> <b>016- 380771</b>	<b>Banteay Meanchey</b> <b>Pailin</b> <b>Battambang</b>
<b>Material Testing Technician</b>	<b>1</b>	<b>Mr.Pin Sovann</b>	<b>092- 914323</b>	<b>Resigned in May 2007</b>
<b>Provincial Counterpart Staff</b>	<b>6</b>	<b>Mr.Chheang Moeun</b> <b>Mr.Sok An</b>  <b>Mr.Souk Vy</b> <b>Mr.Chhoeun Roeurth</b>  <b>Mr.Sok Phakdey</b> <b>Mr.Chhim Kim</b>	<b>012- 380955</b> <b>012- 786244</b>  <b>012- 338916</b> <b>012- 221024</b>  <b>016- 941581</b> <b>016- 350294</b>	<b>PDRD Banteay Meanchey</b> <b>PWT Banteay Meanchey</b>  <b>PDRD Battambang (Resigned)</b> <b>PWT Battambang</b>  <b>PDRD Pailin</b> <b>PWT Pailin</b>
<b>Driver</b>	<b>3</b>	<b>Mr. Chan Roath</b> <b>Mr. Roeun Ta</b> <b>Mr. Kun Phean</b> <b>Mr.Mon Sammoaun</b>	<b>092- 991288</b> <b>012- 1952156</b> <b>012- 589526</b>	<b>Vehicle 4198</b> <b>Vehicle 4569</b>  <b>Vehicle 0-22</b>
<b>Messenger</b>	<b>1</b>	<b>Ms. Yong Ponloeu</b>		

Mr.Pin Sovann, Materials Testing Technician resigned from the JRMU with effect from May 2007. Mr.Sum Dy Noch, Senior Engineer on account of his unsatisfactory work performance was repatriated to his parent department (PDRD Banteay Meanchey) with effect from 01<sup>st</sup> June 2007. Mr.Souk Vy Provincial Counterpart staff resigned from the JRMU with effect from 01 November 2007. In addition, the project also engaged local consultants in consultation with the ADB for providing technical supervision and monitoring for the LCS contracts.

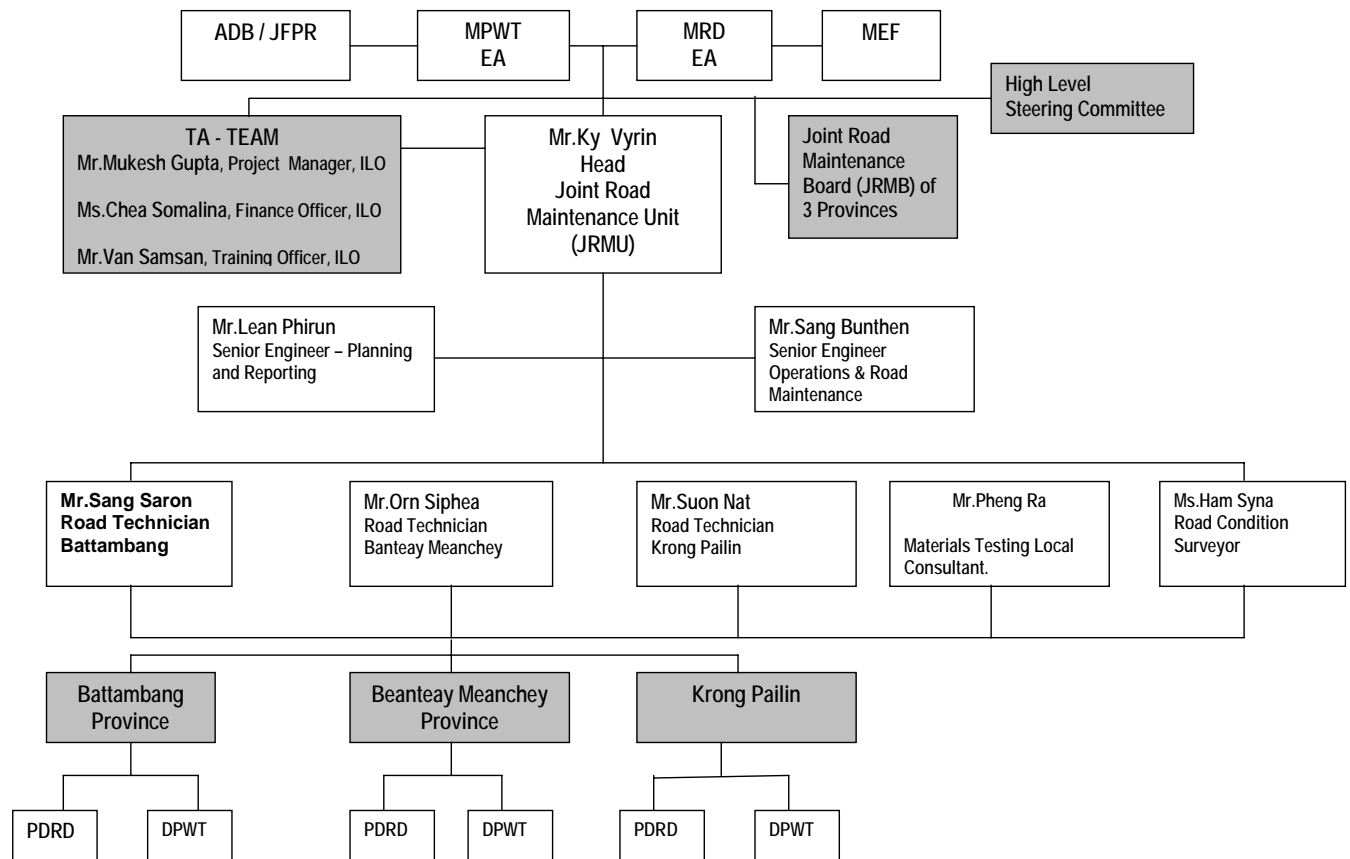




MAINSTREAMING LABOUR - BASED ROAD MAINTENANCE  
TO THE NATIONAL ROAD NETWORK IN CAMBODIA TA - 9048



**ORGANISATION CHART – JOINT ROAD MAINTENANCE UNIT (JRMU)**



## **2. Implementation Arrangements**

The Project's aimed to pilot-test sustainable decentralized finance and management of labor-intensive road maintenance in 3 Provinces by sharing the knowledge already built up through establishment of direct working relationship across Ministerial boundaries at central and provincial level. The attached diagram depicts the relationship of the three Ministries, the JFPR Project, the Provincial Departments and the implementing agents.

### **2.1 Flow of Fund**

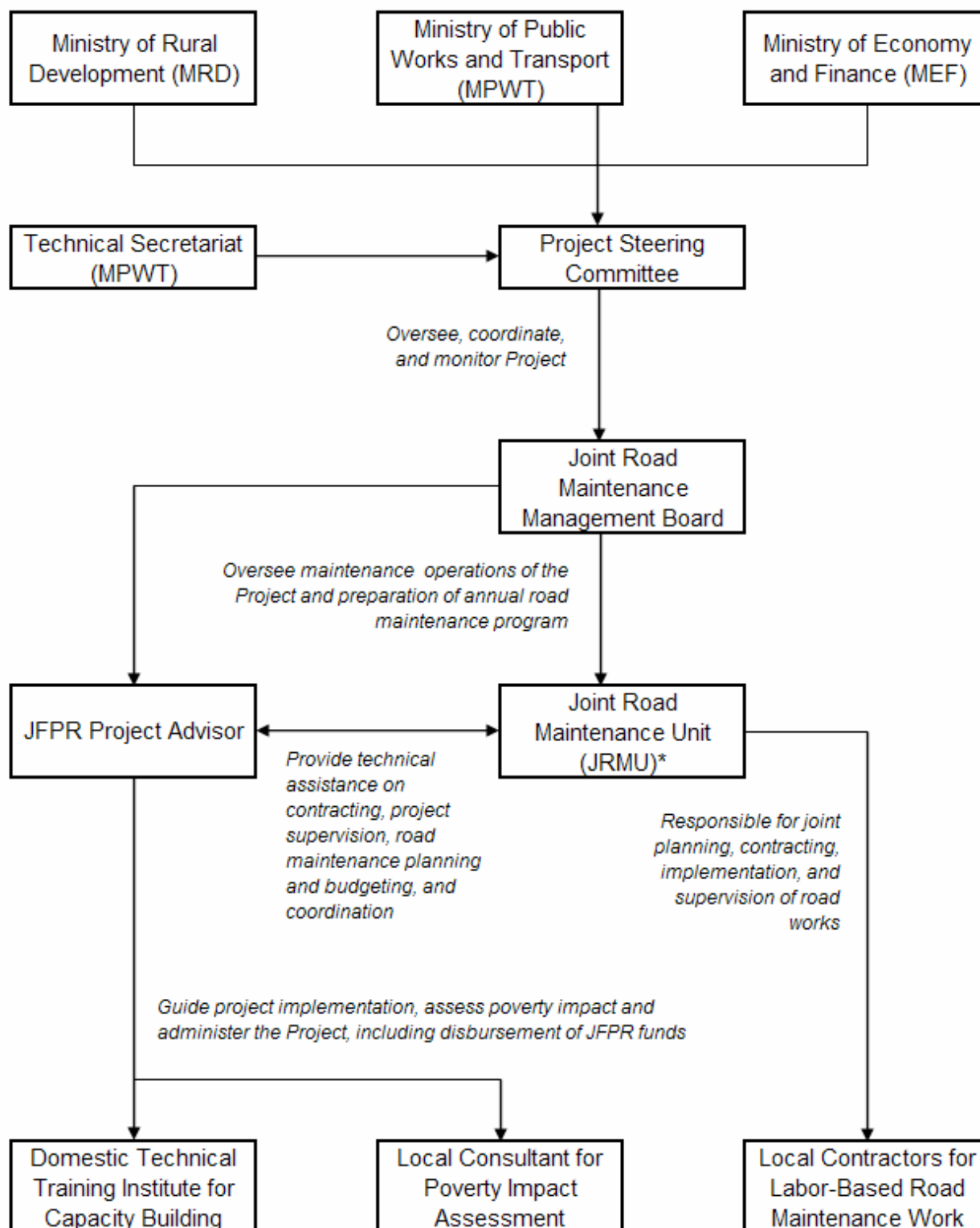
The flow of funds took place as specified in the Project Technical Proposal (refer attached diagrams) for activities funded by JFPR and by the Government. The flow of funds arrangements were discussed during ADB Project Inception Mission and agreed upon with the MEF and MPWT.

For implementation of the project MPWT after approval from MEF opened an Imprest Account with the National Bank of Cambodia in Phnom Penh. All the funding request for replenishment of JFPR funds were made by the Executing Agency (MPWT) through MEF to the ADB.

The MPWT also established a Second Generation Imprest Account (SGIA) for TA funds at ACLEDA Bank in Battambang on 18<sup>th</sup> September 2006 to meet the project expenditure. As agreed, the Head of JRMU was the designated signatory to SGIA subject to the condition that all payments through the Imprest Account had to be endorsed by the JFPR Project Manager. The ADB was requested to replenish the funds at regular intervals.

For the RGC counterpart funds, the project opened a separate Imprest Account at ACLEDA Bank in Battambang on 18<sup>th</sup> September 2006. The government counterpart funds for road maintenance as agreed in the project technical proposal were allocated by the MEF and disbursed through this Bank Account by the Head of JRMU / Project Manager to the implementing agents in conformity with the procedures and guidelines stated in the Grant Implementation Manual (GIM).

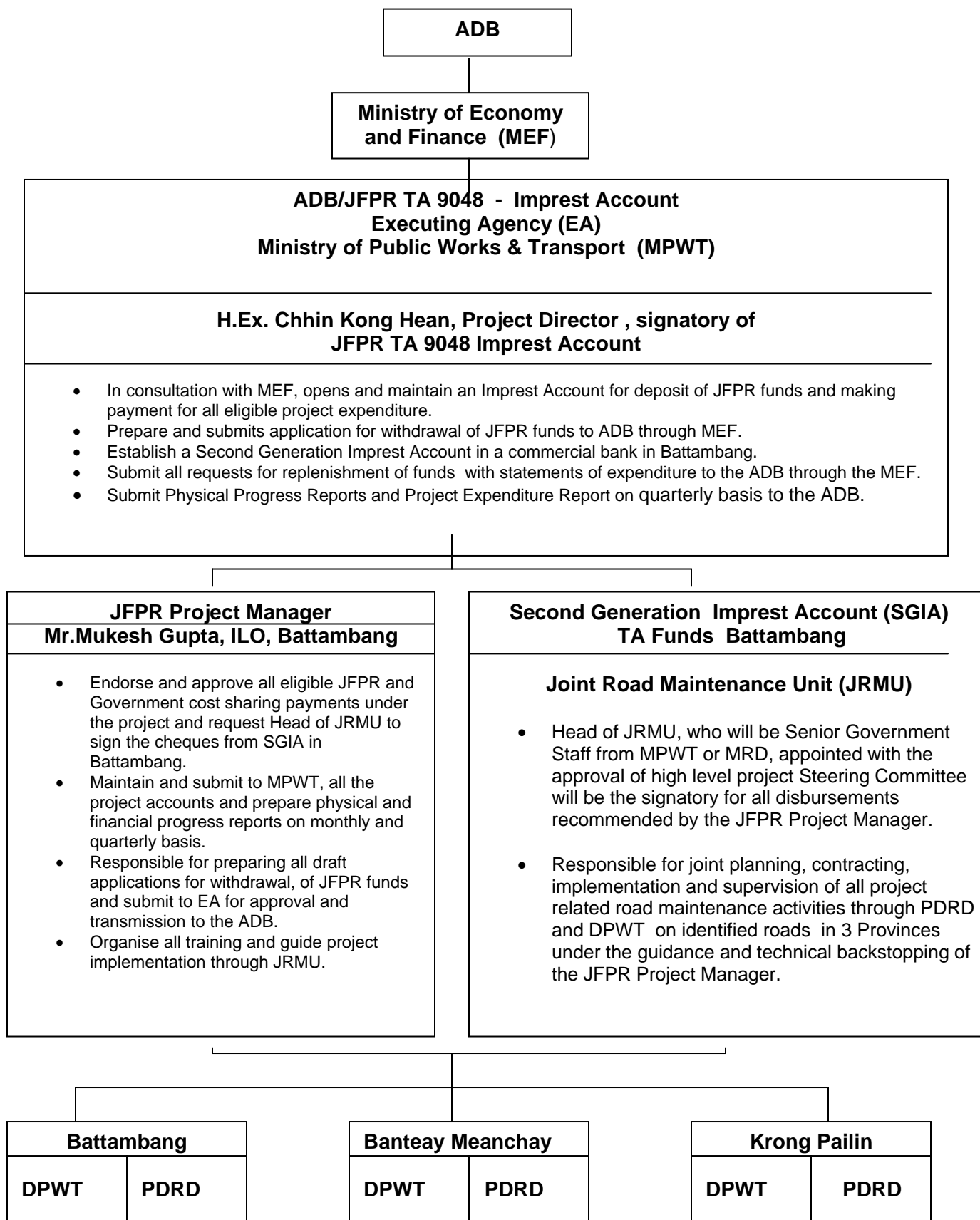
## IMPLEMENTATION ARRANGEMENTS



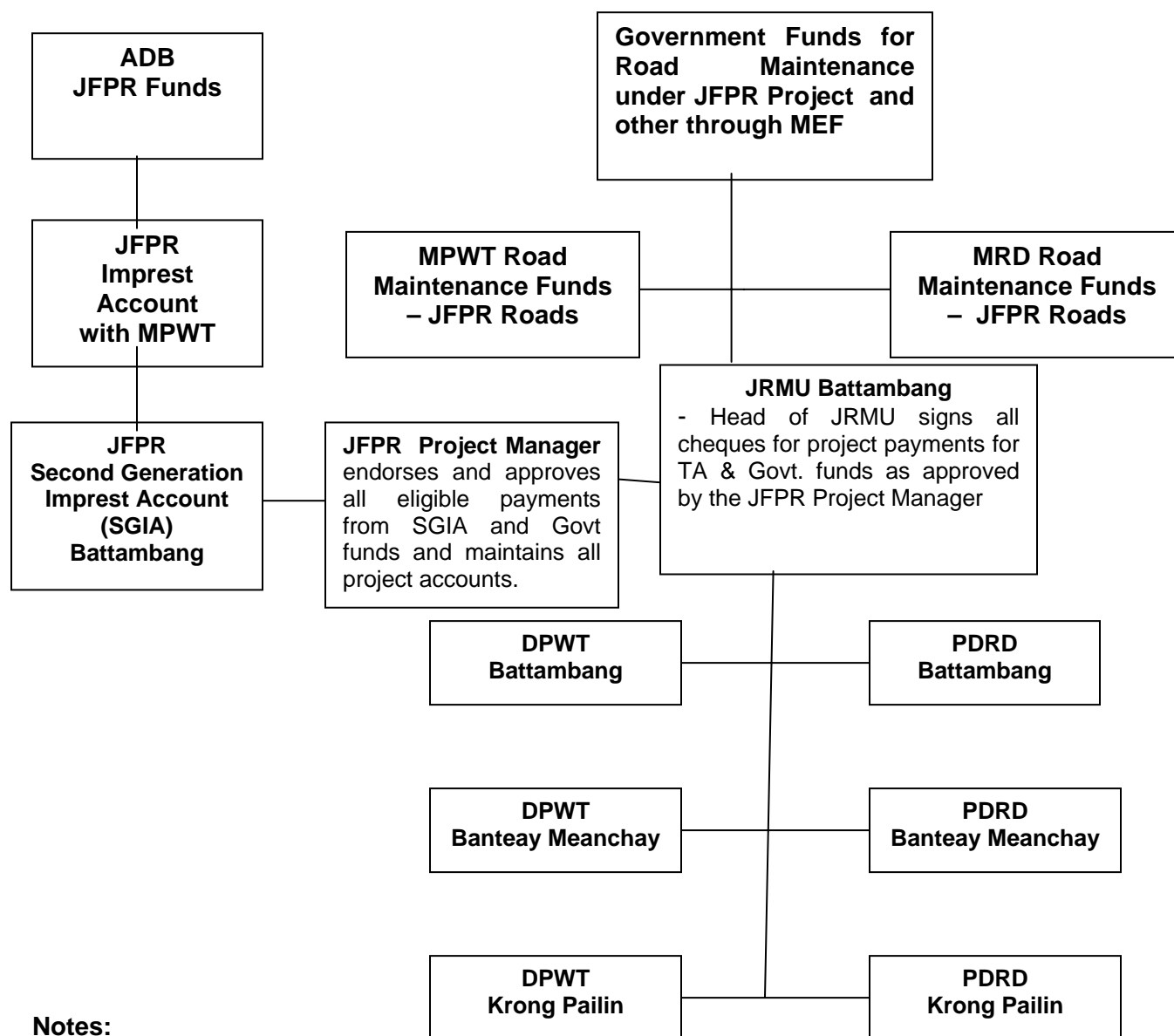
\* Six staff from provincial departments of MPWT and MRD (Banteay Meanchey, Battambang, and Krong Pailin provinces) will be seconded to the JRMU



## ARRANGEMENTS - FLOW OF JFPR FUNDS TA-9048



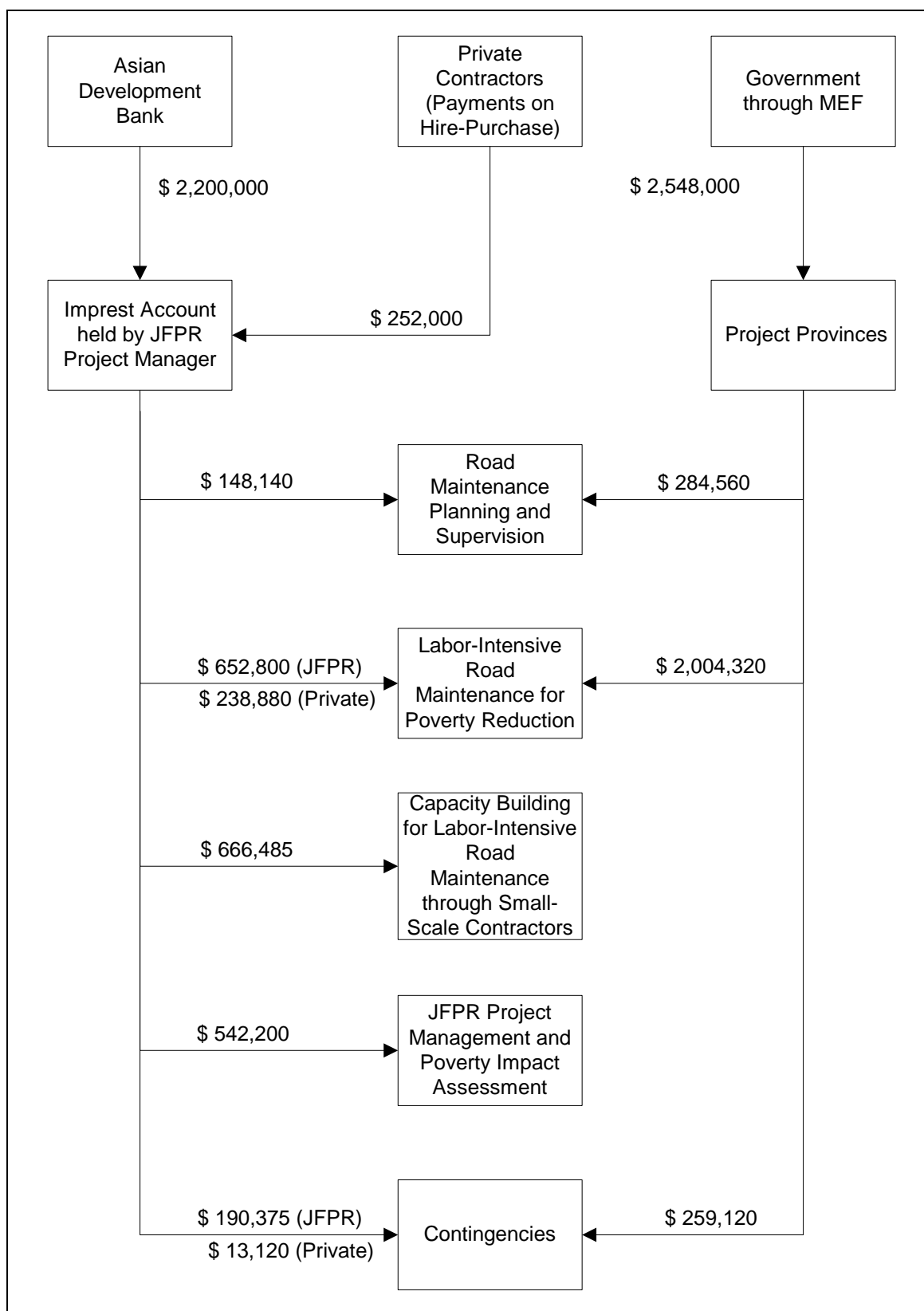
## **FLOW OF GOVERNMENT & JFPR FUNDS**



**Notes:**

1. All the payment for road maintenance for JFPR roads (MPWT & MRD roads) in the 3 provinces will be disbursed through Imprest Account (Govt. Funds) after approval of the JRMU and upon certification by the JFPR Project Manager.
2. Road Maintenance Payments where JFPR cost sharing is involved, contractors will be paid through separate cheques (TA Funds & Govt. Funds) by the JRMU.

## FUND FLOW ARRANGEMENTS FOR JFPR FUNDS



JFPR = Japan Fund for Poverty Reduction, MEF = Ministry of Economy and Finance.



### 3 Training Activities

#### 3.1 General

The following training courses were organized by the project:

Date	Training Course Title	No. of Participants	Beneficiaries
15.01.2007 to 01.03.2007	Labour-Based Road Construction and Maintenance For Paved and Unpaved Roads	41	Small Scale Contractors + Provincial Staff + JRMU Staff
05 Nov. 2007	Routine Maintenance - Roads	32	Commune Chiefs Battambang Province, Community Contractors and Provincial Staff
06 Nov. 2007	Routine Maintenance - Roads	41	Commune Chiefs Banteay Meanchey & Pailin Province, Community Contractors and Provincial Staff
14 -16 Nov. 2007	Low Cost Bituminous Surfacing	30	Local Contractors MRD Technical Staff PRIP Staff – 1, TRIP Staff - 2 Provincial Staff



The above mentioned training course were attended by local contractors, provincial staff from PDRD & DPWT and Commune Chiefs from Battambang, Banteay Meanchey and Pailin Provinces. For the Low Cost Bituminous Surfacing Training Course (14-16 November 2007) technical staff from Ministry of Rural Development, PRIP & TRIP projects also participated in the training. The list of participants to the above mentioned training courses is attached (Annex - 1)

The above training focused on theoretical class room training on various topics for labour-based road construction and maintenance for paved and unpaved roads. The training also comprised of in-field practical training regarding setting out, choice of good materials, materials testing, contracts management and clear understanding of the technical specifications for the road works.

At the request of Provincial Governments, the project organized Routine Maintenance for Roads Training for Commune Chiefs from the 3 Provinces. During this training, the Commune Chiefs along with the Community Contractors and Provincial Staff from 3 PDRDs and 3 DPWTs were trained in planning, design and implementation of routine maintenance activities on roads. They were also briefed about the type of contract, contractual conditions, supervision and monitoring arrangements so that these contracts could be used by them for any other funding (RGC or any other donor funding).

In addition, JRMU staff also participated in English Language courses. Other trainings such as Computer Aided Designs and on Integrated Rural Accessibility Planning were also organized for the JRMU staff in 2008.



**Photograph – Different Training Courses**





**Photo - Dynamic Cone Penetration Test**

For the participating Contractors, the training course took special care of the needs of the Director of the Construction Companies and their technical supervisory staff. The training course covered topics such as resource planning, financial planning, materials planning, equipment and human resource planning, cash flow requirements, analysis of rates for various items for road works, exposure to the bidding procedures, understanding of standard bidding documents, quality control guidelines and technical specifications and road works. For the Contractor's Road Supervisors, training focused on field construction aspects of the road rehabilitation and maintenance.

Mr.Ky Vyrin, Head, JRMU attended ADB sponsored Workshop on “Result-Based Project Design and Management from 19-23 March 2007 in Phnom Penh.

Mr.Ky Vyrin and Mr.Gupta attended an ILO Sponsored Workshop on Introduction of Local Resource Based Approaches to Rural Infrastructure Development and Service Delivery” Bangkok 23-27 April 2007.

Mr.Ky Vyrin and Mr. Gupta were sponsored by the ILO to attend SEACAP Practitioners Meeting 12-13 September 2007 in Hanoi, Vietnam

### **3.2 Preparation of Training Manuals:**



The following Training Manuals in English with Khmer translation were produced by the project and distributed to the trainees during the Training Course.

- Technical Manual on Labour-Based Road Construction and Maintenance For Paved and Unpaved Roads
- Technical Manual on Vertical Distance Measurements
- Technical Manual on Materials Testing for Road Construction.
- Technical Manual on Rate Analysis, Tendering and Specifications for Road Works.
- Technical Manual – Materials and Equipment for Road Construction, November 2007
- Gravel Road Routine Maintenance Manual, November 2007

The locally available expertise in the field of labor-based technology for roads and the materials testing was chosen as Trainer for the above training course. The Materials Testing Laboratory of Ministry of Public Works and Transport for Road No.6 was used for imparting practical training to the participants on materials testing and quality controls. Professor Chrea Rada from ITC Phnom Penh was invited to inputs in the training programs organized by the project.



### **3.3 Contents – Small Contractors Training Course**

The Contents of the Training Course are described as under:

#### *Planning & Feasibility of Labour-Based Road Projects*

#### *Surveying & Setting Out Using Profile Board*

- Profile Board Method
- Centre Line Method
- Setting of ditches, side slope, camber formation and side drain

#### *Surveying & Setting Out Using Leveling Equipment*

- Definitions
- The Leveling Equipment / Instrument
- Basic Operating Procedures
- Practical Training
  - Leveling Equipment practice on determining the differences in elevation
  - Recording of levels
  - Rise and Fall Method
  - Height of Collimation Method
- Applications of Leveling
  - Longitudinal Sections
  - Cross-Sections
  - Contouring

#### *Labour-Based Road Construction Procedures*

- Clearing
- Earth works
- Embankment Construction
- Drainage
- Gravelling, Compaction

#### *Soil, Materials Testing, Bitumen and Dynamic Cone Penetrometer*

- Sieve Analysis of Fine and Coarse Aggregates
- Determination of Moisture-Density Relationship of Soils
- Determination of California Bearing Ratio (CBR)
- Density of In-Situ soil by the Sand Replacement Cone method
- Method of sampling of aggregate.
- Bitumen Types and specifications;

#### *Bituminous Road Construction*

- General, volume of traffic,
- Embankment
- Sub base
- Base Course
- Shoulder

- Wearing Course
- Aggregate
- Bitumen binders
- Determining the average least dimension of chippings
- Determining the basic bitumen spray rate
- Types of Bituminous Surface Treatment including Surface Dressing;

#### *Site Administration , Planning, Reporting & Work Organisation*

#### *Contract Management*

- Bid Document
  - Instructions to Bidders
    - Preparation of Bid
    - Submission of bids
    - Bid opening and elevation
    - Post qualification and award of contract
    - Guarantees
    - Bid evaluation process
  - Contract Agreement.
  - Bid Data sheet and Contract data sheet
  - Bills of Quantities
  - Specifications of Road Works
  - Payment
  - Work plans
  - Filling of unit rate in the Bills of Quantities in the Bid Document

#### *Financial and Accounting*

##### Financial Management Procedure

- Accounting System
- Operational Bank Account
- Bank Reconciliation
- Establishment Petty Cash Account
- Replenishment petty Cash Account
- Payment to Contractors
- Withdrawal application
- Financial Statement

##### Payment Certificate

- Certificate of Practical Completion of the Works
- Interim & Final Certificate of Completion of the Works
- Retention Money
- Cash flow

#### *Bills of Quantities, Analyses of Rates and Cost Estimates*

- The Bills of Quantities
- Calculation of the Quantities
- Tendering
- Planning & Resource Mobilisation
- Financing
- Execution
- Typical Examples of Unit Price Calculation for road works;

- Pricing the Quantities for Bidding / Tendering)
- Direct Project Cost
- Indirect Project Cost
- Risk allowance
- Company's administrative cost
- Profit

#### *Routine Maintenance*

- Labour-based routine maintenance through Community Contractors;
- Simplified Contract for routine maintenance based on monthly work-plans;
- Monitoring and supervision of community contractors through Commune Chiefs;

#### *Periodic Maintenance*

#### *Emergency Maintenance*

#### *Type and causes of pavement defects in bituminous roads.*

#### *Methodology for repair of bituminous roads i.e Pot hole repairs, cracks repair, edge breaks and depressions repairs;*

## 4.0 Trial Sections for Low Cost Bituminous Surfacing



### 4.1 General:

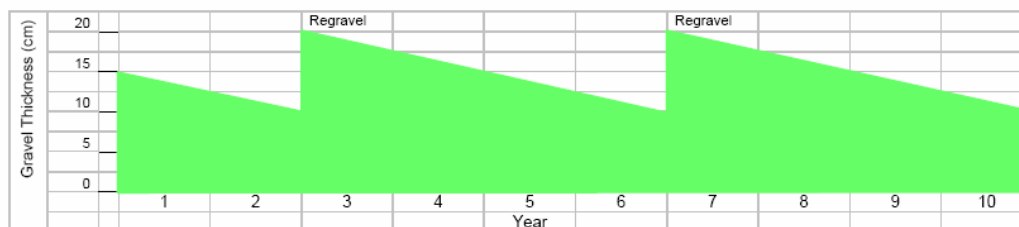


The project aimed at the promotion of low-cost surface sealing on gravel and laterite roads to increase the sustainability of the rural road network. The gravel and laterite roads have short life cycle and deteriorate rapidly and the road assets are lost in few years. The gravel/ laterite wearing course depletes in a period of 2-3 years (depending on traffic volume) and these roads require re-gravelling costing about US\$ 5,000 -7000 / km each time. In Cambodia, access to gravel in certain parts of the country is restricted and gravel is depleting at a faster rate in view of the large requirements for re-gravelling. The Sealed roads though expensive have longer life cycle and reduce the risk of losing the road asset. The project envisage application of

low-cost bituminous surface sealing using innovative specifications which can also make effective use of laterite / gravel in its natural state instead of expensive crushed stone aggregate which is scarce and often has to be transported from long distances at high costs. During the first quarter of 2007, the project made several trial sections using laterite with emulsions and varying specifications described as under:



Figure 1 - GRAVEL THICKNESS WITH PREVENTATIVE MAINTENANCE (Including timely re-gravelling)



Sustainability of gravel surfacing is particularly dependent on timely availability of considerable financial & physical resources at frequent intervals for regraveling. Many road authorities/communities have difficulty in achieving this.

Figure 2 - GRAVEL THICKNESS WITHOUT PREVENTATIVE MAINTENANCE (No timely re-gravelling - investment is lost!)



## 4.2 Trial Sections for Otta Seal and DBST:

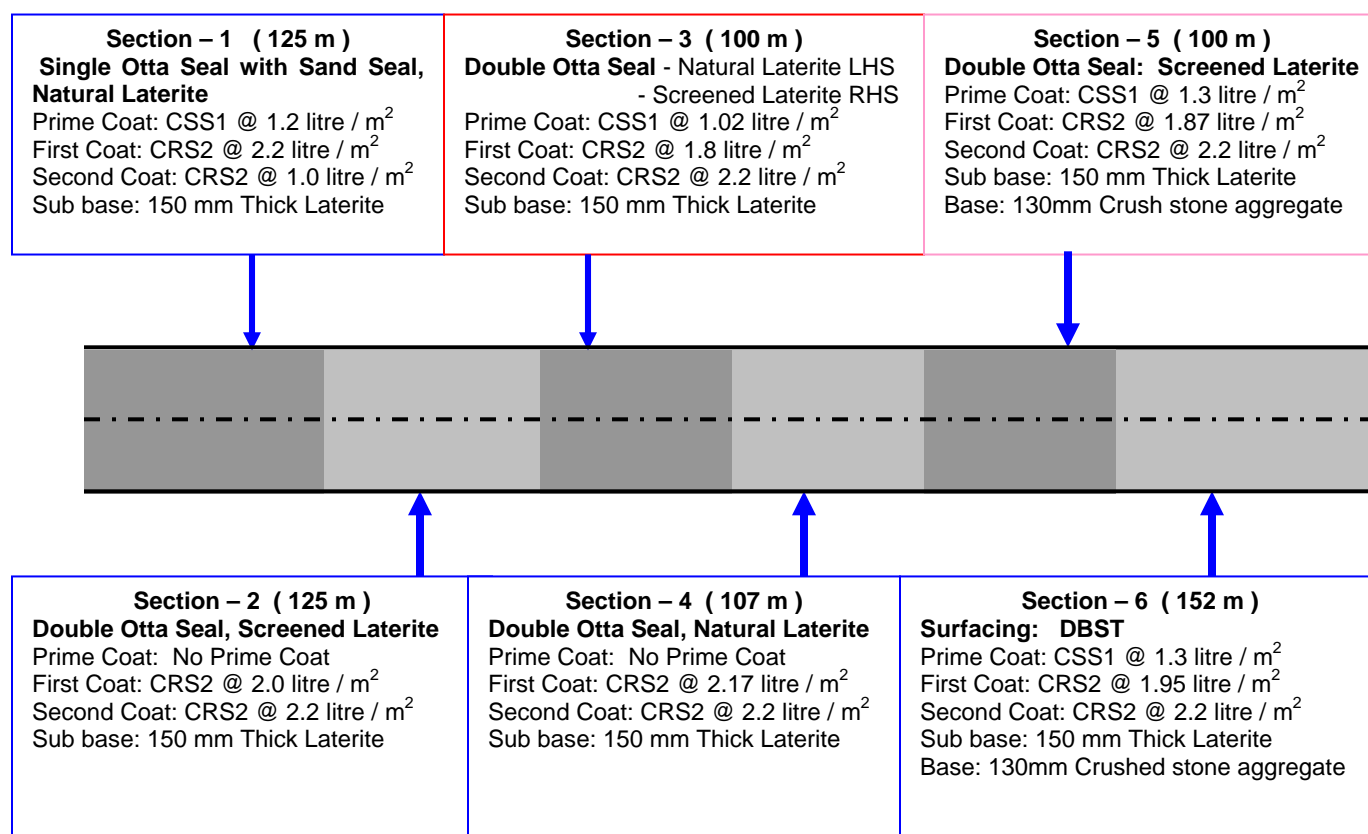
Otta Seal is the name derived from the valley in Norway where it first was used is formed by Placing graded aggregates (crushed or uncrushed) including the fines on a relatively thick film of comparatively soft binder which on rolling and trafficking can make its way upwards through the aggregate interstices. In this manner, the graded aggregate relies both on mechanical interlocking and bituminous binding for its strength similar to a bituminous premix.

### What is Otta Seal ?

Otta Seal consist essentially of a 16-30 mm thick bituminous surfacing constituted of an admixture of graded aggregates ranging from natural gravel to crushed rock in combination with suitable bituminous binder. The dense closed texture of Otta Seal is particularly advantageous in hot climatic conditions where high solar radiations increase the rate of oxidation of the bituminous binder which occurs less quickly in Otta Seal as compared to the conventional single size surface dressings. Long service lives for Otta Seal have been observed in Norway and Kenya. One of the other advantages offered by the Otta Seal is their ability to perform well with aggregates of relatively low quality in terms of strength, shape and fines content. This can result in cost savings and could be very useful in areas where conventional crushed stone chipping is not available or has to be transported from very long distances and where stone crushing facilities are not feasible or extremely expensive. One of the main disadvantages of Otta Seals is their initial inconsistent patchy look and relatively extra care during first 4-6 months.

### Low Cost Surfacing Trial Sections in Battambang Province

Otta Seal is new to Cambodia. Therefore, in view to explore the technical feasibility and economic viability of Otta Seal, the project decided to make trial sections and make concrete findings and recommendations for any large scale applications using naturally occurring laterite. The site for Trial Sections was chosen on Road No. 5 – Phum Trang Road in Otaka Commune in Battambang Province. Six Trial Sections were constructed as per the following specifications (attached as Annex -2 )



## Construction Methods

For application of aggregate and binder both equipment supported and labour-based methods were used during the construction of trial sections. The preparation of existing gravel road comprised of laying laterite 150mm thick sub-base through the entire length of the trial section. In Trial Section 5 & 6 additional crushed stone base course layer 130 mm thick was constructed prior to application of the low cost surfacing. Trial Section 2 & 4 were constructed with out Prime Coat whereas in all other sections, Prime Coat was used.

In Section 2 & 5 screened laterite was used where as in other sections for Otta Seal, laterite in its naturally occurring form was used. All these combinations were tried in order to have complete and comprehensive understanding of the Otta Seal behavior under similar traffic conditions. The First Coat of Otta Seal was constructed successfully in all the designated Trial Sections. The Second Coat of Otta Seal was applied after about 2 months in May 2007.



**OTTA SEAL - Construction of Trial Sections**

#### First Impression from the Otta Seal Trial Sections:

- The first impression of the Otta Seal were quite positive and encouraging. The Bitumen Emulsion CRS-2 seemed to bind well with the naturally occurring laterite with excess fines.
- The trial sections immediately after construction were quite dusty due to plying of traffic.
- Trial Sections with Prime Coat appeared to be performing better.

The above findings are preliminary and the performance of trial sections will have be monitored by the MRD for several years before making any concrete recommendations for their wide scale application in Cambodia.

## 5. Procurement

All project procurement was carried out in accordance with ADB's *Guidelines for Procurement Under Asian Development Bank Loans* using the budget disbursement manual agreed on between ADB and MEF. Most of the items to be procured were of standard prices (e.g., tools and equipment, construction materials, training material, labor inputs for civil works), and costs were below \$10,000. Consistent with JFPR criteria, such goods and services were procured under ADB's direct purchase procedure and awarded directly by the Project Manager. For contracts above \$10,000, competitive bidding and pre-approval by ADB was required. The Inventory of goods procured by the project using ADB and RGC funds is attached as Annex-3.

The project issued advertisement in the newspapers for the interested suppliers to submit their bids for the following works/materials:

Item / Description	Last Date for Receipt of Bids	Newspaper Name
Hand Tools for Road Maintenance	18 <sup>th</sup> January 2007	Resmey Kampuchea
Supply for Gravel in Battambang, Banteay Meanchey and Pailin	19 <sup>th</sup> February 2007	Resmey Kampuchea
Photocopier with Sorter	03 February 2007	Quotations were obtained
Invitation of Bids through LCB for Low Cost Bitumionus Surfaing LOT -1	03 <sup>rd</sup> May 2007	Resmey Kampuchea, Kampuchea Thmey
Invitation of Bids through LCB for Low Cost Bituminous Surfacing Lot -2	27 <sup>th</sup> June 2007	Resmey Kampuchea, Kampuchea Thmey
Invitation of Bids through LCB for Low Cost Bituminous Surfacing Lot -3	16 <sup>th</sup> August 2007	Resmey Kampuchea, Kampuchea Thmey
Gravel for Road Maintenance	03.03.2008	Resmey Kampuchea on 22.02.2008
Gravel for Road Maintenance - Pailin	06.05.2008	Through Quotations
Gravel for Banteay Meanchey	08.05.2008 Various	Through Quotations
Hiring of Motor Grader and Roller for Grading of Roads	08.05.2008 Various	Through Quotations



## 5.1 Direct Contracting for Routine Maintenance of Roads:

The project in consultation with Commune Chiefs identified Community Contractors living along the road sides to undertake routine maintenance activities on 517 km of identified roads in Battambang, Banteay Meanchey and Pailin. The average contract size for labour-contracts was about US\$ 3,000 to US\$ 4,000 over a period of one year. For the purpose of award of works through Direct Contracts to the identified Community Contractors, the project sought prior approval of the Ministry of Economy and Finance. This approval was granted by the MEF in April 2007.

## 5.2 Local Competitive Bidding for Low Cost Bituminous Surfacing on Identified Roads

During the Tripartite Review Meeting held on 31<sup>st</sup> January 2007, ADB informed the project management that re-gravelling of existing gravel roads was not allowed under the current scope of the project. However, the project was allowed to go for stage construction where in the existing gravel road would require some works such as preparation of road surface or provision of suitable base course prior to the application of low cost bituminous surfacing.

The project prepared and submitted the Draft Standard Bidding Documents for the first such contract in Battambang to the ADB for their consideration and approval. The ADB approved the Bidding Documents on 27<sup>th</sup> March 2007. The Invitation for Bids for the low cost surfacing works were issued in local news papers for the following roads:

### Lot – 1 Roads

Province	Road Name	Contract Number	Length	District
Battambang	Norear – Bailey Bridge	JRMU-BTB-LCS- 01	3.7 km	Aek Phnom
Battambang	RN 5 - Phum Trang	JRMU-BTB-LCS- 02	7.0 km	Thma Koul
Banteay Meanchey	RN 5 (Bat Trang) – Rohat Tuck	JRMU-BMC-LCS- 01	9.1 km	Mongkol Borey

The last date for receipt of bids was 03<sup>rd</sup> May 2007. Bids were opened and evaluated as per ADB/MEF guidelines and after due consideration, the Procurement Committee recommended the award of contracts to the following bidders specified contract price:

Sub-Project Number	Road Name	Contractor	Bid Price US\$	Remarks
JRMU-BTB-LCS- 01	Norear – Bailey Bridge	HONG CHHAYHENG Construction Co., Ltd	85,772.25	Lowest Bid
JRMU-BTB-LCS- 02	RN 5 - Phum Trang	MONY Construction Ltd	140,854.66	Lowest Bid
JRMU-BMC-LCS- 01	RN 5 (Bat Trang) – Rohat Tuck	MONY Construction Ltd	190,057.30	Lowest Bid

The Bid Evaluation Reports were forwarded to the ADB for review and consideration. The “No Objection” letter in respect of the above three Sub-Projects was received from ADB On 06 June 2006 and the Contract Agreements with successful bidders were signed on 15<sup>th</sup> June 2006,

## **Lot - 2 Roads**

The JRMU also issued invitation of bids through LCB for the following roads in **Lot-2** and the last date for the receipt of bids is 27<sup>th</sup> June 2007:

Province	Road Name	Contract Number	Length	District
Battambang	RN5 – Reang Kesey	JRMU-BTB-LCS- 03	8.7 km	Sang Kae
Battambang	RN57- Chheuteal	JRMU-BTB-LCS- 04	8.1 km	Banan
Pailin	Various Roads	JRMU-PL-LCS- 01	13.3 km	Pailin

The bids received were evaluated and ADB's No Objection Letter in respect of the successful bidders was received on 06 August 2007 and the Contracts Agreement with the successful bidders were signed subsequently.

Sub-Project Number	Road Name	Contractor	Bid Price US\$	Remarks
JRMU - BTB-LCS- 03	Road No.5 to Reang Kesey 8.7 km	Heng Chhat Co.	182,543.67	Lowest Evaluated Bid
JRMU - BTB-LCS- 04	Road No.57 to Chheuteal 8.1 km	Heng Chhat Co.	226,979.04	Lowest Evaluated Bid
JRMU - PL - LCS- 01	Various Roads in Pailin 13.3 km	Ung Sim Sia Co.	337,561.17	2 <sup>nd</sup> Lowest Evaluated Bid
Lot – 2 Roads Total			747,083.88	
ADB/JFPR Funds 1/3 <sup>rd</sup> = US\$ 249,027.96				
RGC Counterpart Funds 2/3 <sup>rd</sup> = US\$ 498,055.92				

## **Lot – 3 Roads**

Finally, the JRMU issued invitation of bids through LCB for the following roads in **Lot-3** and the last date for the receipt of bids was 16<sup>th</sup> August 2007:

Province	Road Name	Sub Project No.	Length	District
Battambang	Phsa Cheav (RN 57) to Spean Dangtung	JRMU-BTB-LCS- 05	10.3 km	Ratonak Modol
Pailin	Tuol Lvea – Boeng Prolit (RN57)	JRMU-PL-LCS-02	7.0 km	Pailin
Banteay Meanchey	Phnum Srok –Tuek Chour	JRMU-BMC-LCS-02	15.6 km	Phnum Srok
	RN 6 –Tuek Chour	JRMU-BMC-LCS-03	9.75 km	Preah Netr Preah

The bids received were evaluated and ADB's No Objection Letter in respect of the successful bidders was received on 24<sup>th</sup> September 2007 and the Contracts Agreement with the successful bidders were signed on 15<sup>th</sup> October 2007.

Sub-Project Number	Road Name	Contractor	Bid Price US\$	Remarks
JRMU-BTB-LCS- 05	Phsa Cheav (RN 57) to Spean Dangtung 10.3 km	HONG HUOT LY Construction Co., Ltd	207,075.00	Lowest Evaluated Bid
JRMU-PL-LCS-02	Tuol Lvea – Boeng Prolit (RN57) 7 km	LEANG BOU Construction Co., Ltd	182,127.29	3 <sup>rd</sup> Lowest Evaluated Bid
JRMU-BMC-LCS-02	Ta Pon RN6 –Tuek Chour (9.75 km)	UNG SIM SIA Construction Co., Ltd	208,302.92	Lowest Evaluated Bid
JRMU-BMC-LCS-03	Tuek Chour – Phnom Srok 15.7 km	HONG HUOT LY Construction Co., Ltd	271,664.50	Lowest Evaluated Bid
<b>LOT – 3 Roads Total US\$ 869,169.71</b>				
<b>ADB/JFPR Funds 1/3<sup>rd</sup> = US\$ 289,723.24</b>				
<b>RGC Counterpart Funds 2/3<sup>rd</sup> = US\$ 579,446.47</b>				

## **6. Road Maintenance Programme**

The ILO TA Team in close cooperation with the provincial counterpart staff carried out road condition surveys and identified 521 km of roads in 2007 and 517 km in 2008 for routine maintenance in the 3 provinces. Road condition surveys were carried out by the PDRD and DPWT counterpart staff in collaboration with the ILO TA Team. All the recommended roads were screened using the “Selection Criteria” and approved by the JRMB in their meeting held in June 2006. In addition, low cost bituminous surfacing on identified DPWT/PDRD roads was planned to be implemented during the project period.

### **6.1 Selection Criteria – Routine Maintenance of Roads**

Eligible roads for routine maintenance and surface sealing are all maintainable roads in the project area. As recommended by the ADB Road Maintenance Study, road condition will be measured based on traffic speed. Typically, roads, where the average traffic speed for a minimum of 10 kilometers is less than 40 km per hour, will be classified as non-maintainable.

The overall criteria for including roads for maintenance funding under the Project are :

- road should be in a maintainable state;
- road should not be maintained by another donor project, inclusive of roads under rehabilitation and maintained by the contractor.
- the road should connect to the primary road network, either directly or via intermediary all-year passable roads.
- roads identified as maintenance priorities Integrated Rural Accessibility Planning (IRAP) in various districts shall get highest priority while formulating the annual road maintenance plan

All eligible roads will be taken into routine maintenance under the Project, subject to the availability of funds. In case routine maintenance of all eligible roads cannot be financed due to budgetary constraints, preference will be given to roads that are in the best condition and to those that are essential to ensure access to the primary road network.

it was very difficult to follow the above mentioned selection criteria. In all the 3 provinces not even 20 percent of the roads qualified the above criteria because of poor condition of roads due to huge backlog of road maintenance. Hence, in consultation with the project steering committee and the joint road maintenance board, it was decided to include the roads in best condition in the project annual plan.

### **6.2 Identification of Community Contractors & Launching of Routine Maintenance on Roads**

The project engaged small scale community contractors for carrying out routine maintenance works on the identified roads at an estimated price of US\$ 400 / km / year in the three provinces. The proposed routine maintenance activities were carried out by labour intensive methods by the people living along the road sides. In order to achieve this small scale community contractors were engaged who mainly acted as the Labour Contractors for 15-20 km stretches of the selected roads.

The average size of such Community Labour Contract for labour cost was in the range of US\$ 3,000 – 4,000 per year. The Contractors were paid 15% profit on labour costs plus US\$ 30 per month for their supervision inputs. The project supplied all the hand tools and gravel to these contractors through separate procurement. The proposed methodology and Direct Contracting had been approved in principle by the Project Steering Committee and the ADB Review Mission (Feb. 2007). The first list of Community Contractors chosen for the routine maintenance packages for Direct Contracting in the 3 provinces was finalized in consultation with Provincial Departments and the Communes and approved



by the Joint Road Maintenance Board (JRMB) . The sample contract for the Community Contractors is shown in Annex- 4.

As per the Standard Operating Procedures (SOPs), prior approval of the MEF is required for any Direct Contracting. On 22<sup>nd</sup> February 2007, the Project through MPWT submitted its formal request to the MEF for grant of their approval for direct contracting to the identified Community Contractors for routine maintenance activities on 521 km of roads. The MEF approved this request for direct contracting on 27.03.07. The JRMU awarded routine road maintenance direct contracts to 32 Community Contractors in the 3 provinces for 521 km of roads. The details of these roads and contractors are shown in the attached Annex -5. The JRMU procured gravel and hand tools for these contractors separately and these items were supplied to the contractors.

In 2007, routine maintenance activities were launched on the above mentioned roads. The distribution of roads belonging to MPWT and MRD in the three provinces is shown in the table as under:

No.	Province	Routine Maintenance 2007			Remarks
		MPWT Km	MRD Km	Total Km	
1	Battambang	115.35	129.05	244.40	
2	Banteay Meanchey	58.30	154.40	212.70	
3	Pailin	14.40	49.80	64.20	
<b>Total km</b>		<b>188.05</b>	<b>333.25</b>	<b>521.30</b>	

The routine maintenance activities which are 100% funded through the RGC funds suffered a major setback due to delays in the replenishment of RGC funds and hence payment to the community contractors could not be made during October 2007 until February 2008.

In 2008, based on the Road Condition Surveys, the JRMU prepared a list of 517 km of roads which was subsequently approved by the JRMB for inclusion in 2008 road maintenance plan. The roads in 2008 were the same as in 2007 except for some minor changes.

No.	Province	Routine Maintenance - 2008			Remarks
		MPWT Km	MRD Km	Total Km	
1	Battambang	112.35	132.25	244.60	
2	Banteay Meanchey	58.30	154.40	212.70	
3	Pailin	13.00	46.80	59.80	
<b>Total km</b>		<b>183.65</b>	<b>333.45</b>	<b>517.10</b>	

The JRMU in close cooperation with the provincial counterpart staff continued to provide technical backstopping to the Community Contractors in effective implementation of the routine road maintenance activities. Due to the delays in the receipt of the replenishment of RGC funds, these direct contracts were awarded to the community contractors with effect from 01 March 2008.

### 6.3 Acute Labour Shortage in Pailin and Banteay Meanchey Province

In 2008, the Community Contractors engaged by the project in Pailin and Banteay Meanchey faced acute shortage of labour for road maintenance works. The project cost estimates for Community Contractors provide for daily wage of US\$ 3.0 /day in Krong Pailin and US\$ 2.0 / day in Banteay

Meanchey. In Pailin it was not possible to recruit unskilled labour at US\$ 3.0/day as most of the labourers prefer to cross the border and work in neighboring districts in Thailand where they earn a daily wage of about US\$ 4-5/day. The labour problem was more acute due to the onset of rainy season and increase in their demand in the agricultural activities.

In view of above, the project had on other option but to cancel the routine road maintenance contracts of the Community Contractors with effect from 01 June 2008. In Banteay Meanchey, the Community Contractors managed to get some labour in consultation with the Commune Chiefs and continued to perform their routine maintenance activities.

#### 6.4 Equipment Supported + Labour Based Reshaping and Grading of Identified Roads

With the approval of Project's Steering Committee, the project launched light grading and reshaping of 140.50 km of identified roads in the 3 provinces using heavy equipment (motor grader + vibrating roller) supported by the labour inputs provided by the Community Contractors. This approach would enable these roads to be brought to maintainable condition so that the Community Contractors could continue to perform their future labour-based routine maintenance activities more effectively on sustainable basis.

The project hired a set of equipment (1 Grader + 1 Vibrating Roller) and this equipment supported with Community Contractors was able to grade and reshape almost 2.0 km length of road per day. Hiring of equipment was carried out through local competitive quotations from the provincial contractors.

**LIST OF ROAD FOR GRADING ON ROAD ROUTINE MAINTENANCE FOR YEAR 2008**  
As on 30 September 2008

No.	Road Name	Length (km)	Remarks
<b>I- Province: Battambang</b>			
1	Phsa Bavel - Don Ok (PR160)	9.30	
2	Preahpunlea-Lvea	2.50	
3	RN5 - Anlong Run	9.00	
4	Anlong Run - Ou Pong Moan	10.00	
5	Omal-Chrey	6.35	
6	Andong Chenh - Krawat Krong	4.00	
<b>Sub Total-I</b>		<b>41.15</b>	
<b>II- Province: Banteay Meanchey</b>			
1	RN 5 -Ta Kong	7.00	
2	Preah Punlea-kohpong Sat	4.60	
3	RN5 - Chang Ha	15.00	
4	Thma Puok - Boeung Trakuon (1)	12.00	
5	Thma Puok - Boeung Trakuon (2)	12.30	
6	RN 5 - Kouk Tunloab	4.00	
7	RN 5 - KoukThnong	2.50	
8	RN 5 - Prey Toteung	3.90	
9	RN5 - Ou Chuob	5.00	
10	RN 5 - Kouk Balaing	14.00	
11	Dang Trang -Tasal	10.00	
<b>Sub Total-II</b>		<b>90.30</b>	
<b>III- Krong Pailin</b>			
1	Rathkrasches - Phnom Koy	7.8	
2	Steung Kach - Bos Am	1.2	
<b>Sub Total-III</b>		<b>9.0</b>	
<b>Total</b>		<b>140.5</b>	

### **Routine Maintenance – Grading of Poor Condition Roads**

BEFORE GRADING	AFTER GRADING
	
	
	

## 7 Low Cost Bituminous Surfacing on Identified Roads

### 7.1 LCS Contracts

After successful completion of trial sections using Otta Seal and DBST, the project successfully awarded contracts for the construction of bituminous surface dressing on 91.93 km of roads amounting to US\$ 2,042,393.32 in the province of Battambang, Banteay Meanchey and Pailin as under:

No.	Province	MPWT Road Km	MRD Road Km	Total Length Km
1	Battambang	20.83	17.30	38.13
2	Banteay Meanchey	0	34.55	34.55
3	Pailin	4.9	14.35	19.25
<b>Total</b>		<b>25.73</b>	<b>66.20</b>	<b>91.93</b>





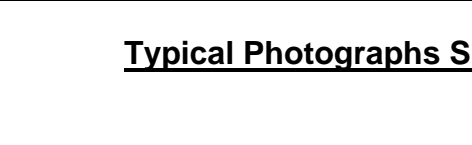
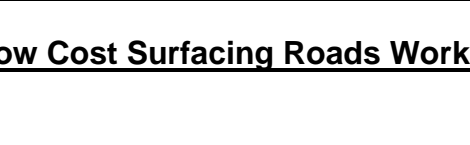


The details of the individual contract for the above works and physical progress in respect of each contract are shown in the attached Tables.

This activity suffered a major setback due to cash-flow problems and unprecedented worldwide increase in the cost of bitumen and other construction material. As a result, most of the contractors stopped field activities since October 2007 and only 14.30 km roads could be finished and the remaining roads remained unfinished as the contractors did not resume the field work. Only 2 roads i.e Norear-Bailey Bridge Road (4 km) and Chiev Road (10.30 km) were completed by the Contractors in the first quarter of 2008.

Unfortunately, the MEF turned down the Steering Committee 's recommendation for price increase leaving no other option for the project but to terminate all the remaining LCS contracts with unfinished works on 25<sup>th</sup> August 2008.

The status and progress in respect of each individual LCS road contract is shown in the attached bar-charts.



	
<p>Norear-Bailey Bridge Road</p>	<p>Norear-Bailey Bridge Road</p>
	
<p>HIV-AIDS Training at Norear Road Site</p>	<p>HIV-AIDS Training at Norear Road Site</p>
	
<p>Norear-Bailey Bridge Road</p>	<p>Norear-Bailey Bridge Road</p>
	
<p>Norear-Bailey Bridge Road</p>	<p>Norear-Bailey Bridge Road</p>

**Typical Photographs Showing Low Cost Surfacing Roads Works**



View Completed Road



View – Agriculture Crop



View – Agriculture Crop



DBST Seal Coat



DBST Seal Coat



DBST Seal Coat



View – Heavy Trucks



DBST Seal Coat

## Photos - Phsa Chiev-Dan Tung Road (10.30km)

Contractor – M/S Hong Hou Ly Construction Company





Phsa Chiev- Dang Tung Road – Battambang Province



Phsa Chiev- Dang Tung Road – Battambang Province



Norear - Bailey Bridge Road – Battambang Province



RN 5 - Phoum Trang Road – Battambang Province



Norear - Bailey Bridge Road – Battambang Province



RN 5 - Rohat Tuek Road – Banteay Meanchey Province

### **Typical Photographs Showing Low Cost Surfacing Roads Works**

Kingdom of Cambodia  
Ministry of Public Works and Transport  
Mainstreaming Labour-Based Road Maintenance to the National Roads Network  
ADB/JFPR CAM: TA 9048  
Joint Road Maintenance Unit

**SUMMARY - LOW COST BITUMINOUS SURFACING ON ROADS**

No.	Road Name	Length Km	Province	District	Commune	Sub Project No.	Contract No.	Bid Price US\$	Remarks
<b>Lot - 1</b>									
1	Norear- Bailey Bridge	4.03	Battambang	Aek Phnum	Norea & Samrong Knong	JRMU-BTB-LCS-01	JRMU-7-1-01	93,523.35	MPWT
2	RN 5- Phoum Trang	7.00	Battambang	Thma Koul	Otaki	JRMU-BTB-LCS-02	JRMU-7-1-02	140,854.66	MRD
3	RN 5- Rohat Tuek	9.10	Banteay Meanchey	Mongkol Borey	Bat Trang & Rohat Tuek	JRMU-BMC-LCS-01	JRMU-7-1-03	190,057.30	MRD
<b>Sub total Lot - 1</b>		<b>20.13</b>						<b>424,435.31</b>	
<b>Lot - 2</b>									
4	RN 5- Reang Kesey	8.70	Battambang	Sang Kae	Reang Kesey	JRMU-BTB-LCS-03	JRMU-7-2-04	182,543.67	MPWT
5	RN 57- Phsa Chheuteal	8.10	Battambang	Battambang & Banan	Wat Kor & Chheu Teal	JRMU-BTB-LCS-04	JRMU-7-2-05	228,343.63	MPWT
6	Various Road	12.25	Pailin	Pailin	Pailin, Ou Tavau, Tul Lvea & Ba Yakha	JRMU-PL-LCS-01	JRMU-7-2-06	337,901.00	MPWT = 4 km MRD 7.35 km
<b>Sub total Lot - 2</b>		<b>29.05</b>						<b>748,788.30</b>	
<b>Lot - 3</b>									
7	Phsa Cheav (RN 57) - Spean Dangtung	10.30	Battambang	Ratanak Mondol	Plov Meas & Traeng	JRMU-BTB-LCS-05	JRMU-7-3-07	207,075.00	MRD
8	Ta Pon (RN 6 ) - Tuek Chour	9.75	Banteay Meanchey	Preah Netr Preah	Tuek Chour	JRMU-BMC-LCS-02	JRMU-7-3-08	208,302.92	MRD
9	Tuek Chour - Phnom Srok	15.70	Banteay Meanchey	Phnum Srok	Srah Chik & Spean Sraeng	JRMU-BMC-LCS-03	JRMU-7-3-09	271,664.50	MRD
10	Tuol Lvea - Boeung Prolit	7.00	Pailin	Pailin & Salakrav	Tuol Lvea & Stueng Kach	JRMU-PL-LCS-02	JRMU-7-3-10	182,127.29	MRD
<b>Sub total Lot - 3</b>		<b>42.75</b>						<b>869,169.71</b>	
<b>Grand Total</b>		<b>91.93</b>						<b>2,042,393.32</b>	



**Mainstreaming Labour-Based Road Maintenance**  
**ADB/JFPR TA 9048**  
**Joint Road Maintenance Unit**

**Physical Progress of Road Low Cost Bituminous Surfacing**

As on 30 September 2008



No.	Road Name Length Total (km)	Progress  Status	Completed			2007												2008												Total Completed  %		
			%			Jul		Aug		Sep		Oct		Nov		Dec		Jan		Feb		Mar		Apr		May		June				
			Last Cum.	June	Cum. Total	W <sub>3</sub>	W <sub>4</sub>	W <sub>1</sub>	W <sub>2</sub>	W <sub>3</sub>	W <sub>4</sub>	W <sub>1</sub>	W <sub>2</sub>	W <sub>3</sub>	W <sub>4</sub>	W <sub>1</sub>	W <sub>2</sub>	W <sub>3</sub>	W <sub>4</sub>	W <sub>1</sub>	W <sub>2</sub>	W <sub>3</sub>	W <sub>4</sub>	W <sub>1</sub>	W <sub>2</sub>	W <sub>3</sub>	W <sub>4</sub>	W <sub>1</sub>	W <sub>2</sub>		W <sub>3</sub>	W <sub>4</sub>
1	Norear - Bailey Bridge	General and Miscellaneous	100%	0%	100%																											100%
	4.03 km	Road Base	100%	0%	100%																											
	Date start: 16-Jul-07	DBST	100%	0%	100%																											
	Date finish: 15-Feb-08	HIV/AIDS Awareness	100%	0%	100%																											
2	RN 5 - Phoum Trang	General and Miscellaneous	60%	0%	60%																											32%
	7.0 Km	Road Base	100%	0%	100%																											
	Date start: 16-Jul-07	Double Otta Seal & DBST	0%	0%	0%																											
	Date finish: 15-Mar-08	HIV/AIDS Awareness	0%	0%	0%																											
3	RN 5 - Rohatuek	General and Miscellaneous	60%	0%	60%																											23%
	9.1Km	Road Base	54%	0%	54%																											
	Date start: 16-Jul-07	DBST	0%	0%	0%																											
	Date finish: 15-Mar-08	HIV/AIDS Awareness	0%	0%	0%																											
4	RN5-Reang Kesey	General and Miscellaneous	0%	0%	0%																											0%
	8.7 km	Road Base	0%	0%	0%																											
	Date start: 15-Sep-07	DBST	0%	0%	0%																											
	Date finish: 15-Apr-08	Structure	0%	0%	0%																											
		HIV/AIDS Awareness	0%	0%	0%																											

**As on 30 September 2008**

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**Note:**

- Plan 
- Actual 

**Mainstreaming Labour-Based Road Maintenance**  
**ADB/JFPR TA 9048**  
**Joint Road Maintenance Unit**  
**Physical Progress of Road Low Cost Bituminous Surfacing**

As on 30 Sept 2008

No.	Road Name Length Total (Km)	Name of Contractor	Contract No.	Progress Status	Contract Amount US\$	Completed %			Amount Paid US\$	Total Completed %
						Last Cum.	Jun	Cum. Total		
1	Norear - Bailey Bridge 4.03 km	Hong Chhayheng Construction Co., Ltd	JRMU-7-1-01	General and Miscellaneous	500.00	100%	0%	100%		100%
				Road Base	38,567.35	100%	0%	100%		
				DBST	53,956.00	100%	0%	100%		
				HIV/AIDS Awareness	500.00	100%	0%	100%		
Total -1				93,523.35				84,171.01		
2	RN 5 - Phoum Trang 7.0 Km	Mony Construction Co., Ltd	JRMU-7-1-02	General and Miscellaneous	2,000.00	60%	0%	60%		32%
				Road Base	43,934.66	100%	0%	100%		
				DBST	94,420.00	0%	0%	0%		
				HIV/AIDS Awareness	500.00	0%	0%	0%		
Total -2				140,854.66				40,621.19		
3	RN 5 - Rohatuek 9.1Km	Mony Construction Co., Ltd	JRMU-7-1-03	General and Miscellaneous	2,000.00	60%	0%	60%		23%
				Road Base	77,083.30	54%	0%	54%		
				DBST	110,474.00	0%	0%	0%		
				HIV/AIDS Awareness	500.00	0%	0%	0%		
Total -3				190,057.30				38,448.13		
4	RN5 - Reang Kesey 8.7 km	Heng Chhat Construction Co., Ltd	JRMU-7-2-04	General and Miscellaneous	270.00	0%	0%	0%		0%
				Road Base	84,401.10	0%	0%	0%		
				DBST	93,960.00	0%	0%	0%		
				Structure	3,462.57	0%	0%	0%		
Total -4				182,543.67				0.00		
5	RN57 - Phsa Chheuteal 8.1 Km	Heng Chhat Construction Co., Ltd	JRMU-7-2-05	General and Miscellaneous	276.00	50%	0%	50%		43%
				Road Base	113,275.37	84%	0%	84%		
				DBST	111,780.00	0%	0%	0%		
				Structure	2,552.26	100%	0%	100%		
Total -5				228,343.63				87,705.55		
6	Pailin Various Road 12.25 Km	Ung Sim Sia Construction Co., Ltd	JRMU-7-2-06	General and Miscellaneous	6,600.00	59%	0%	59%		25%
				Road Base	135,881.00	50%	0%	50%		
				DBST	181,670.00	0%	0%	0%		
				Structure	11,650.00	95%	0%	95%		
Total -6				337,901.00				73,194.32		
7	Phsa Chiev - Dang Tung 10.3 Km	Hong Huot Ly Construction Co., Ltd	JRMU-7-3-07	General and Miscellaneous	250.00	100%	0%	100%		100%
				Road Base	69,054.00	100%	0%	100%		
				DBST	146,334.50	100%	0%	100%		
				Structure	818.50	100%	0%	100%		
Total -7				216,757.00				195,081.30		
8	RN6 - Tuek Chour 9.75 km	Ung Sim Sia Construction Co., Ltd	JRMU-7-3-08	General and Miscellaneous	1,500.00	70%	0%	70%		8%
				Road Base	73,220.10	20%	0%	20%		
				DBST	128,700.00	0%	0%	0%		
				Structure	4,532.82	0%	0%	0%		
Total -8				208,302.92				0.00		
9	Tuek Chour - Phnom Srok 15.7 Km	Hong Huot Ly Construction Co., Ltd	JRMU-7-3-09	General and Miscellaneous	250.00	50%	0%	50%		18%
				Road Base	50,411.90	100%	0%	100%		
				DBST	230,635.00	0%	0%	0%		
				HIV/AIDS Awareness	300.00	0%	0%	0%		
Total -9				281,596.90				45,505.71		
10	Tuol Lvea - Boeung Prolit 7.0 Km	Leang Bou Construction Co., Ltd	JRMU-7-3-10	General and Miscellaneous	356.00	50%	0%	50%		15%
				Road Base	71,079.85	23%	0%	23%		
				DBST	99,991.50	0%	0%	0%		
				Structure	10,254.94	100%	0%	100%		
Total -10				182,127.29				24,295.46		
Grand Total ( 91.93 km )					2,062,007.72				589,022.67	33%

## 7.2 Bitumen and Other Materials Price Increase - Issue

As reported earlier, during June- November 2007, the project had invited bids and awarded contracts to the successful local bidders for the low cost bituminous surfacing on 91.93 km of identified roads amounting to US\$ 2,042,393.32 ( refer attached list) in the province of Battambang, Banteay Meanchey and Pailin. There was a tough competition between the local contractors and in most cases lowest bid prices were below the Engineer's Estimate (EE) and the award of contracts to the successful bidders was done at 4.6% below the EE.

Since the above mentioned contracts were of short term duration (6-8 months), the standard contract conditions (in consultation and approved by the ADB) did not include for any price escalation clause in the bid documents due to increase in the cost of construction materials. There was an unprecedented and unforeseen global increase in the price of fuel during second half of 2007 from US\$ 65 to US\$ 130 per barrel (100%). The oil price increase has adversely affected the prices of all oil based products such as bitumen, cost of operating the stone crushers and transportation through out the world.

In December 2007, the contractors working with the project submitted their petition to the project management highlighting the increase in the cost of bitumen and other construction materials and requested the project to consider increase in their bid prices. Almost all the contractors stopped the ongoing works on account of price increase and delays in the payment. This issue was discussed during the Steering Committee Meeting held in Battambang on 15th January 2007 where in it was decided that the Project Procurement Committee should critically analyze and look into this problem and submit its recommendations to the MEF/ADB.

Table below depicts the prices of various construction materials in June 2007, February 2008 and April 2008:

### I - Bitumen and Diesel Cost

Description	June-2007	Feb-08	% Increase	Apr-08	% Increase
Price of Bitumen (CRS2) US\$/Tone	390	465	+ 19%	485	+ 24%
Price of Diesel US\$/Litre	0.77	0.95	+ 23%	1.2	+ 56%

### II - Crushed Stone Aggregates

Description	June-2007 US\$/m <sup>3</sup>	Feb-08 US\$/m <sup>3</sup>	% Increase	Apr-08 US\$/m <sup>3</sup>	% Increase
19mm Stone Chipping	12.00	15.00	+ 25%	20.00	+ 67%
12mm Stone Chipping	7.00	12.00	+ 71%	17.00	+ 143%

### III - Analysis of Rate DBST

Item	Engineer Estimate In June 2007 US\$/m <sup>2</sup>	Engineer Estimate In February 2008 US\$/m <sup>2</sup>	% Increase	Engineer Estimate In April 2008 US\$/m <sup>2</sup>	% Increase
Prime Coat	0.70	0.83	+ 19%	0.86	+ 24%
DBST - 1 <sup>st</sup> Coat	1.38	1.69	+ 23%	1.87	+ 35%
DBST - 2 <sup>nd</sup> Coat	0.93	1.17	+ 25%	1.31	+ 40%
<b>Total DBST US\$/m<sup>2</sup></b>	<b>3.01</b>	<b>3.70</b>	<b>+ 23%</b>	<b>4.04</b>	<b>+ 34%</b>



The Steering Committee noted that the contractors should be encouraged to complete the works by offering them reasonable price increase compensation through negotiations. The project had no time left to invite new bids and even if fresh bids are invited they will be at least 40-50% higher in view of the increase in the prices of materials. If the contractors are not offered reasonable compensation, all the road works shall remain unfinished and it will leave a very poor impression with all the stake holders including donor agencies.

The Steering Committee also noted that the earlier (in March 2008) recommended price increase of 10% for bitumen items was based on Feb.2008 prices was a partial relief to the contractors against 23% increase as per the Engineer's estimate. There has been a further sharp increase in prices of bitumen, diesel and stone aggregates after February 2008 (refer attached price increase details) and as per April 2008 prices, the Engineers Estimate for bitumen items(DBST) only works out to 34%. If the project contract document had price escalation clause in the contract, the project would have paid over 30% price increase to the contractors as per the formula as in the case of similar other donor funded projects in Cambodia.

After consultation with all the LCS Contractors on 09 May 2008, the Steering Committee made a revised recommendations to the MEF for price increase of 20% for bitumen items only so as to encourage the contractors to finish the remaining works before October 2008 and also requested the MEF to approve the entire price increase from the RGC counterpart budget. The proposed compensation was supposed to be partial relief to the contractors so as to encourage them to complete the works otherwise all these projects will remain unfinished and force the project management to launch legal proceedings against the contractors and confiscate their Performance Bond.

### **7.3 Termination of Remaining LCS Contracts**

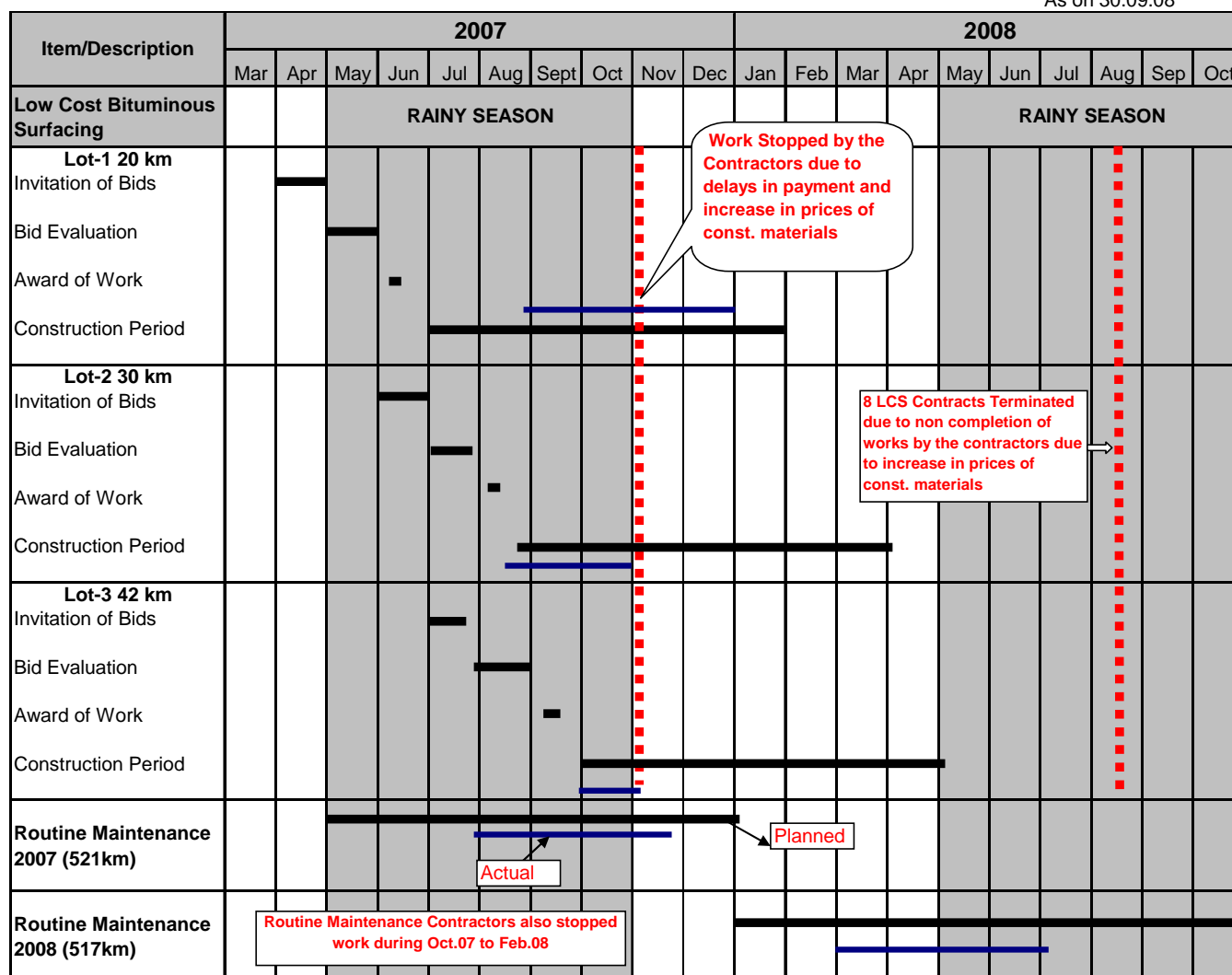
Unfortunately, the MEF turned down the above recommendation for price increase leaving no other option but to terminate all the remaining LCS contracts with unfinished works on 25<sup>th</sup> August 2008.

## 8.0 Project - Work Plan

The approved Work-Plan for the proposed activities for the project is attached. It would be noticed that launching of the planned routine maintenance activities was delayed and commenced in March 2008.

### Updated Work Plan for Low Cost Bituminous Surfacing & Routine Maintenance of Roads in the Province of Battambang, Banteay Meanchey and Pailin ADB/JFPR TA-9048

As on 30.09.08



Mainstreaming Labor-Based Road Maintenance to the National Road Networks Work Plan (1st Revision December 2006)													
Legend - <span style="color: red;">■</span> Dec.06 Revised Plan; <span style="color: blue;">■</span> Actual													
No	Description	2006				2007				2008			Action by
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	
<b>A</b>	<b>Preparatory Activities</b>												
1	Set-up of Steering Committee	■											Government
2	Set-up Maintenance Board and JRMU	■											Government
3	Establish Office and Recruiting Staff	■											PM
4	Select/Agree Road Maintenance Trials		■										PM
5	Road Maintenance Planning 2006		■										JRMU
6	Approval of Maintenance Plan & Budget			■									MEF, MPWT, MRD
7	Road Maintenance Contracting			■									JRMU
<b>A1</b>	<b>Small Scale Contractor's Training</b>												
8	Small Scale Contractors			■		■	■	■	■				PM
9	Counterpart Staff (DPWT and PDRD)			■		■	■	■	■	■	■	■	PM
10	Contract Management			■		■	■	■	■	■	■	■	PM
11	On-the job-Training			■	■	■	■	■	■	■	■	■	JRMU
<b>A2</b>	<b>Implementation</b>												
12	Road Maintenance Trials			■		■	■	■	■				
13	Road Routine Maintenance			■	■	■	■	■	■				Contractors
14	Road Periodic Maintenance Trials			■	■	■	■	■	■				Contractors
15	Monitoring and Supervision			■	■	■	■	■	■	■	■	■	JRMU
<b>B</b>	<b>Preparation 2007</b>												
16	Road Maintenance Planning & Budget			■									JRMU
17	Approval of Maintenance Plan & Budget			■		■	■	■	■				MEF, MPWT, MRD
18	Bidding Process			■	■	■	■	■	■				
19	Road Maintenance Contracting			■	■	■	■	■	■				JRMU
<b>B1</b>	<b>Implementation 2006 &amp; 2007 Plan</b>												
20	Road Routine Maintenance 600 km			■	■	■	■	■	■				Contractors
21	Road Periodic Maintenance			■	■	■	■	■	■				Contractors
22	Monitoring and Supervision			■	■	■	■	■	■				JRMU
<b>B2</b>	<b>Preparation 2008</b>												
23	Road Maintenance Planning & Budget					■	■	■	■				JRMU
24	Approval of Maintenance Plan & Budget					■	■	■	■	■	■	■	MEF, MPWT, MRD
25	Bidding Process					■	■	■	■	■	■	■	
26	Road Maintenance Contracting					■	■	■	■	■	■	■	JRMU
<b>B3</b>	<b>Implementation</b>												
27	Road Routine Maintenance									■	■	■	Contractors
28	Road Periodic Maintenance									■	■	■	Contractors
29	Monitoring and Supervision									■	■	■	JRMU
30	Poverty Impact Assessment									■	■	■	PM
<b>C</b>	<b>Reporting</b>												
31	Inception Report	★											PM
32	Quarterly Progress Reports		★	★		★	★	★		★	★		PM
33	Annual Report									★			PM
34	Project Completion Report					★				★			PM
35	Poverty Reduction Impact Report												PM
36	Audit									★	★	★	Audit Company

MEF = Ministry of Economic and Finance, MPWT = Ministry of Public Works and Transport, MRD = Ministry of Rural Development,

JRMU = Joint Road Maintenance Unit, PM = Project Manager, LBES = Labour-based Equipment Supported Technology.

## **9.0 Tripartite ADB/RGC/ILO Grant Review Meeting**

The ADB's Grant Review Meetings for the project between Ministry of Public Works and Transport, Ministry of Rural Development and ILO were held regularly on bi-annual basis. Two Tripartite-Review Meetings for the project between ADB, Ministry of Public Works and Transport, Ministry of Rural Development and ILO were held in Battambang on 31<sup>st</sup> January 2007 and 26-27 July 2007. The Joint Road Maintenance Board Members from the three Provinces also attended the project review meeting. As agreed during the Wrap Up meeting of the ADB Review Mission held on 02 February 2007, the administration of the project was formally delegated by the ADB Manila to the ADB Cambodia Resident Mission (CARM) with effect from 15<sup>th</sup> February 2007.

The last review was held in Battambang on 28<sup>th</sup> February – 06 March 2008. The Review Mission noted the progress and constraints in respect of routine maintenance, preventive recurrent maintenance (LCS) and capacity building for labour-intensive road maintenance.

The Review Mission noted JRMU's concerns over the fact that most contractors had stopped their work since October 2007 due to price increase of construction materials especially the petroleum products and delays in disbursement of funds. The Mission noted that over the past 5-6 months, the increase in the prices of petroleum products is unprecedented and unforeseen. Although the contract conditions don't contain a price escalation clause, the Project's Procurement Committee could use their judgment on approving minor increase in price items. The Mission informed that the ADB would consider approving the minor contract variations once they are approved by the Procurement Committee and the MEF member. The Meeting noted that the project had encountered cash flow problems from September 2007 to January 2008 and requested that the procedures for the disbursements and replenishments of the RGC funds as outlined in the Standard Operating procedures (SOPs) should be followed in order to avoid further delays.

The Mission reminded that ADB would not be able to extend closing date beyond 31 October 2008 given that the grant closing date is maximum four years after JRPR grant effectiveness.

Subsequently, the ADB informed that in the absence of price escalation clause in the contracts, they will not be able to support any price increase in the bid prices and suggested that MEF should consider meeting the entire amount of proposed increase from the RGC funds.

## **10.0 Financial Report & Audit of Project Accounts**

The Consolidated Summary of Project's Receipt and Expenditure of ADB/JFPR and Government Cost Sharing Funds for the period ending October 2008 is attached. In March 2008, the MEF approved an increase in the ceiling of the RGC Imprest Account to US\$ 300,000.00. This report does not include the details of expenditure by ILO (reported directly by the ILO to the ADB) for providing project management services.

In May 2008, the MEF engaged the services of Audit Firm M/S KPMG to carryout audit of the project in as per the TOR approved by the ADB. M/S KPMG Auditors Team visited the project during 02-06 June 2008, held discussion with the project management team and examined all the project financial and procurement transactions since the inception of the project. The Audit Report is expected to be released in July 2008.

The two project accounts (RGC Funds Account + ADB Funds Second Generation Imprest Account with ACLEDA Bank have been closed on 27<sup>th</sup> October 2008 and the balance funds as shown in the Table below have been transferred to the MEF account in Phnom Penh (RGC Funds) and the ADB funds have been transferred to the MPWT project imprest account with the NBC in Phnom Penh.







## 11.0 Review of Monitoring Indicators

Review of monitorable deliverables / outputs for various components of the project as on 31<sup>st</sup> October 2008 is as under:

<b>Component – A</b> <b>Road Maintenance Planning and Supervision</b>		
<b>Monitorable Deliverables / Outputs</b>	<b>Achievements So far</b>	<b>Remarks</b>
<ul style="list-style-type: none"> <li>A joint annual road maintenance program harmonized in a participatory approach between concerned provincial departments, and sufficiently justified and documented on the project level to satisfy requirements for financing by the road fund</li> <li>Engineering designs and contracting documents for the prioritized road maintenance projects</li> <li>Site supervision and technical audit of construction</li> <li>Approximately 600 km of roads under regular routine maintenance for 3 years and approximately 160 km of roads sealed over 3 years</li> </ul>	<ul style="list-style-type: none"> <li>Annual Road Maintenance Program for 3 provinces made in active consultation with the 6 provincial departments and the JRMB.</li> <li>Design standards and contract documents prepared.</li> <li>Continuous site supervision by the JRMU staff.</li> <li>517 km of roads subjected to routine maintenance through Community Contractors.</li> <li>Sealing works on 91.93 km of roads ongoing</li> </ul>	<p>Road length reduced to 517 km because of budget restrictions. Maintenance period also reduced from 3 years to 1 year &amp; 5 months</p> <p>Only 91.93 km could be accommodated within available budget</p>

<b>Component – B</b> <b>Labor – Intensive Road Maintenance for Poverty Reduction</b>		
<b>Monitorable Deliverables / Outputs</b>	<b>Achievements So far</b>	<b>Remarks</b>
<ul style="list-style-type: none"> <li>Approximately 4,100 person-years of paying part-time jobs created, benefiting approximately 2,800 people in the project area over 3 years</li> <li>Approximately 2,200 person-years of paying full-time jobs created, benefiting approximately 6,500 people in the project area over 3 years</li> <li>Approximately 60 contracts for routine maintenance, and approximately 53 contracts for low-cost road sealing signed and completed over 3 years</li> </ul>	<ul style="list-style-type: none"> <li>108,711 work-days of employment created in project area.</li> <li>61% of employment generation was for women</li> <li>32 contracts for routine maintenance signed for 517 km of roads.</li> <li>10 contracts for bitumen sealing works signed for 91.93 km roads</li> </ul>	<p>Employment creation reduced because of reduction in length of roads for sealing and routine maintenance.</p> <p>8 LCS Contracts had to be terminated because contractors did not finish the works</p> <p>Project envisaged routine maintenance for 3 years but due to delays in launching of project and cash-flow problems this period was reduced to 1 Year and 5 months only.</p> <p>Only 2 contracts (14.30 km) of LCS roads were completed and the remaining 8 contracts for 77.63 km could not be completed due to stoppage of works by the contractors on account of unprecedented increase in the prices of bitumen and other materials.</p>

<b>Component – C</b> <b>Capacity Building for Labor-Intensive Road Maintenance through Small Scale Contractors</b>		
<b>Monitorable Deliverables / Outputs</b>	<b>Achievements So far</b>	<b>Remarks</b>
<ul style="list-style-type: none"> <li>Fourteen emerging local contractors trained in execution and management of labor-intensive routine maintenance</li> <li>Fourteen emerging local contractors trained in execution and management of labor-intensive low-cost road surfacing.</li> <li>Fourteen emerging contractors have acquired road maintenance equipment</li> </ul>	<ul style="list-style-type: none"> <li>36 local contractors trained in effective planning, designing and execution of labour-intensive routine maintenance.</li> <li>16 local contractor companies trained in execution and management of Low Cost Bituminous Surfacing.</li> <li>This item not executed as the contractors already had sufficient equipment.</li> </ul>	<p><b>Exceeds Target</b></p> <p><b>Exceeds Target</b></p>

<b>Component – D</b> <b>JFPR Project Management and Poverty Impact Assessment</b>		
<b>Monitorable Deliverables / Outputs</b>	<b>Achievements So far</b>	<b>Remarks</b>
<ul style="list-style-type: none"> <li>Inception report</li> <li>Quarterly/Half Yearly progress reports</li> <li>Annual joint project review reports</li> <li>Monthly financial reports</li> <li>Annual financial audit reports</li> <li>Project completion report</li> <li>Poverty profiles for each project road</li> <li>Poverty reduction impact report</li> </ul>	<ul style="list-style-type: none"> <li>Done</li> <li>Done</li> <li>Done</li> <li>Done</li> <li>KPMG conducted audit of the project in June 2008</li> <li>Done</li> <li>Done for identified roads</li> <li>Done</li> </ul>	<p>Audit firm KPMG engaged by MEF</p> <p>Base Line Surveys carried out in Nov.2006</p> <p>Follow up Surveys carried out in August 2008</p>

## **12.0 Project Linkage to Decent Work Priorities**

The project in all aspects of its engagement supported creation of productive employment opportunities. The decent work indicators / International Labour Standards and Cambodian Labour Law Decree No.CS/RKM/3097/01 of March 13, 1997 were suitably integrated and reflected in the Contracts offered to the Small Scale Contractors as under:

- the freely exercised right of workers, without distinction, to organise, to further and concerned and to defend their interest as well as the protection of those workers who exercise their right to organise;
- prohibition of forced or compulsory labour in all its forms;
- equal remuneration for men and women for work of equal value;
- prohibition of employment of children below 14 years of age or the minimum age for
- employment permitted by the law of the country where the work is carried out or the age of the end of compulsory schooling in that country, which ever is higher;
- equality of opportunity and treatment in respect of employment and occupation with out discrimination on grounds of race, colour, sex, religion, political opinion, national extraction or social origin.

### **Decent Work Conditions in the Contracts**

The following decent work conditions were incorporated in the road work contracts:

Timeliness of payment; The contractor shall ensure that wages are paid in Cambodian legal tender (Riel) in full and directly to the workers concerned at least fortnightly (every 2 weeks). The project closely monitored strict compliance of the above standards during the project implementation.

Health and safety; The contractor shall be responsible for the health and safety of the workers and should ensure that they have access to safe drinking water during working hours. The contractor shall maintain a Cambodian Ministry of health approved First aid Kit and facilities on each construction site and maintain a register of all work related accidents. The contractor shall also be responsible for the evacuation of any injured worker to a hospital as a result of any work related accident.

Sanitation amenities; The contractor shall ensure that all of the workforce have access to a sanitary latrine and washing facilities during and immediately after working hours, with separate facilities for men and women and shall, if necessary, provide and maintain latrines in a clean and sanitary condition. The contractor shall also thoroughly disinfect and fill latrine pits, swamps and trenches when no longer required for the works. Information to workers; All workers shall be provided with information contained in this Labour Clause to this contract and additionally the contractor shall inform the workers of the basis of payment under which they are engaged: that is; whether engaged on a daily wage or on piece work or task work, the expected output for the payment made and whether the worker is engaged as a skilled or unskilled worker.

### HIV/AIDS Awareness:

All civil works contractors have been mandated to provide HIV/AIDS awareness training through trained agencies. The contracts included the cost of such training in the overall bid price of the contractors. The following clauses were included in the Special Conditions of Contracts in respect of HIV/AIDS training:



**Photos – HIV/AIDS Training Session at Norear Road Work Site in Battambang Province**

“the Contractor’s Employees” means, without prejudice to any other definition contain in the Contract, all workers who are under the Contractor’s control and on the Site in connection with the Contract, including any workers who are under the control of any person or entity to whom the Contractor has sub-contracted any its obligations under the Contract other than those responsibilities set out in this Clause;

“the HIV Awareness Programme” means an HIV Awareness Programme [as set out in the Project documentation/in compliance with the HIV Awareness Programme curriculum and guidelines published by UNAIDS and available on its website [www.hiv-development.org](http://www.hiv-development.org) or on request];

“the Local Community” means the communities local to the Site most likely to have contact with the Contractor’s Employees and, in particular, sex workers in those communities;

“National AIDS Authority” shall mean the authority in the country where the Site is located designated by the relevant national government to have responsibility for preventing and/or combating HIV/AIDS; “UNAIDS” shall mean [the agency of the United Nations of that name or the United Nations Regional Task Force on mobile population and HIV vulnerability].

It shall be a Condition of the Contract that the Contractor: Sub-contracts with an Approved Service Provider to provide an HIV Awareness Programme to the Contractor’s Employees and the Local Community as soon as practicable after the Contractor’s Employees arrive at the Site but in any case within two weeks after the Contractor’s Employees arrive at Site;

Gives any representative of the Approved Service Provider, the Employer and the National HIV/AIDS Authority all reasonable access to the Site in connection with the HIV Awareness Programme



If the National Aids Authority has not provided the names of available Approved Service Providers within two weeks after being asked the contractor may select its own service provider after consultations with the appropriate UNAIDS office;

Instructs the Contractor's Employees to attend the HIV Awareness Programme in the course of their employment and during their normal working hours or any period of overtime provided for in the relevant employment contracts and uses all reasonable endeavors to ensure this instruction is followed;

Provides suitable space for delivery of the HIV Awareness Programme and does nothing to dissuade the Contractor's Employees from attending the HIV Awareness Programme; As soon as practicable, notifies the National HIV/AIDS Authority of its sub-contract with an Approved Service Provider to facilitate the National HIV/AIDS Authority's audit of Approved Service Providers; and gives all reasonable co-operation to the National HIV/AIDS Authority if it exercises its right to audit the provision by the Approved Service Provider of the HIV Awareness Programme. The Contractor shall be entitled to be reimbursed by the Employer for any payments made under a sub-contract made for the purpose of Clause [16.2.1] in accordance with the relevant provisions in the Contract.

Where the Contract does not provide for reimbursement of named costs, the amount paid by the Contractor to the Approved Service Provider shall be added to any lump sum to be paid by the Employer to the Contractor under the Contract and, before such lump sum is paid, the Contractor shall provide to the Employer evidence of:

- payment of the amount claimed to the Approved Service Provider; and
- provision of the HIV Awareness Programme (e.g. a certificate issued by the Approved Service Provider).

Where a clinic is provided on behalf of the Contractor on Site, the Contractor shall ensure that such clinic provides to the Contractor's Employees, on request and without charge:

- counseling and advice on AIDS in compliance with UNAIDS guidelines; and
- condoms that comply with either the current ISO standard or WHO/UNAIDS Specification and

Guidelines for Condoms 1998 or any more recent equivalent publication to a maximum of [number] per member of the Contractor's Employees per year on a [weekly/monthly] basis.

- Where the Contractor sub-contracts any of its obligations under the Contract, it shall require any sub-contractor to comply with sub-clauses [16.2.2 to 16.2.6] of the Contract as if it were the Contractor.

## 13.0 Poverty Reduction through Employment Creation

### 13.1 Employment Generation

Up to 30<sup>th</sup> September 2008, the project generated 108,711 work-days of employment through low cost bituminous surfacing and routine maintenance activities in the three provinces as per the following details:

#### SUMMARY OF WORKERS EMPLOYED AND EMPLOYMENT GENERATED FOR LOW COST BITUMINOUS SUFACING

As on 30 September 2008

Province	Road Name	Length Total Km	Contract No.	No. of Workers			No. of Work-Days		Total Work- Days
				Male	Female	Total	Male	Female	
Battambang	Norear - Bailey Bridge	4.03	JRMU-7-1-01	20	30	50	1,618	2,426	4,044
	RN 5 - Phoum Trang	7.0	JRMU-7-1-02	13	22	35	1,690	2,860	4,550
	RN5-Reang Kesey	8.7	JRMU-7-2-04						
	RN57-Phsa Chheuteal	8.1	JRMU-7-2-05	13	29	42	1,344	2,998	4,342
	Phsa Chiev- Dang Tung	10.3	JRMU-7-3-07	48	72	120	4,089	6,170	10,259
	<b>Sub-Total</b>	<b>38.13</b>		<b>94</b>	<b>153</b>	<b>247</b>	<b>8,740</b>	<b>14,454</b>	<b>23,195</b>
Banteay Meanchey	RN 5 - Rohatuek	9.1	JRMU-7-1-03	9	16	25	1,179	2,097	3,276
	RN6-Tuek Chour	9.75	JRMU-7-3-08	8	12	20	562	842	1,404
	Tuek Chour-Phnom Srok	15.7	JRMU-7-3-09	71	120	191	3,998	5,570	9,568
	<b>Sub-Total</b>	<b>34.55</b>		<b>88</b>	<b>148</b>	<b>236</b>	<b>5,739</b>	<b>8,509</b>	<b>14,248</b>
Pailin	Ou Ta Prang	1.0	JRMU-7-2-06	7	13	20	196	364	560
	Konklong(RN57)-Kbal Prolean	2.55	JRMU-7-2-06	7	13	20	469	870	1,339
	RN 57 - Orphan Center	1.35	JRMU-7-2-06	5	10	15	90	181	271
	Ouchra (RN 57)-Barhuy	5.7	JRMU-7-2-06	10	15	25	534	800	1,334
	Ouchra Kandal (RN 57)-Plov Bambek Phsa Thmey	1.0	JRMU-7-2-06	7	13	20	119	221	340
	Ou Tavau	0.65	JRMU-7-2-06	7	13	20	131	243	374
	<b>Sub-Total -(JRMU-7-2-06)</b>	<b>12.25</b>		<b>43</b>	<b>77</b>	<b>120</b>	<b>1,539</b>	<b>2,680</b>	<b>4,218</b>
	Tuol Lvea-Boeung Prolit	7.0	JRMU-7-3-10	8	12	20	464	696	1,159
	<b>Sub-Total</b>	<b>19.25</b>		<b>51</b>	<b>89</b>	<b>140</b>	<b>2,002</b>	<b>3,375</b>	<b>5,378</b>
<b>Total</b>		<b>91.93</b>		<b>233</b>	<b>390</b>	<b>623</b>	<b>16,482</b>	<b>26,338</b>	<b>42,820</b>
							<b>38%</b>	<b>62%</b>	

For Low Cost Surfacing works employment creation suffered a setback due to stoppage of works by most of the Contractors since October 2007.

**SUMMARY OF WORKERS EMPLOYED AND EMPLOYMENT GENERATED FOR ROUTINE ROAD MAINTENANCE FOR YEAR 2008**  
As on 30 September 2008

No.	Province	Length Total Km	No. of Workers			No. of Work-Days		
			Male	Female	Total	Male	Female	Total
1	Battambang	244.60	157	204	361	9,747	12,664	22,411
2	Banteay Meanchey	212.70	95	100	195	6,400	6,737	13,137
3	Pailin	59.80	-	-	-	-	-	-
Total		517.10	252	304	556	16,147	19,401	35,548
						45%	55%	

**SUMMARY OF WORKERS EMPLOYED AND EMPLOYMENT GENERATED FOR ROUTINE ROAD MAINTENANCE FOR YEAR 2007**  
As at 31<sup>st</sup> December 2007

No.	Province	Length Total Km	No. of Workers			No. of Work-Days		
			Male	Female	Total	Male	Female	Total
1	Battambang	244.40	202	320	522	9,003	14,261	23,264
2	Banteay Meanchey	212.70	386	553	939	2,570	3,683	6,253
3	Pailin	64.20	120	177	297	334	492	826
Total		521.30	708	1,050	1,758	11,907	18,436	30,343
						39%	61%	

**Cumulative Employment Generated in 2007 & 2008**

As on 30 Sept 2008

No.	Province	Length Km	No. of Workers			No. of Work-Days		
			Male	Female	Total	Male	Female	Total
1	Battambang	244.60	202	320	522	17,675	28,000	45,675
2	Banteay Meanchey	212.70	386	553	939	7,971	11,419	19,390
3	Pailin	59.80	120	177	297	334	492	826
Total		517.10	708	1,050	1,758	25,980	39,911	65,891
						39%	61%	

For routine maintenance activities employment creation suffered a setback due to non-availability of labour in Krong Pailin and also because of delays in the issue of 2008 maintenance contracts due to cash-flow problems faced by the project.

It would be seen from above that 61 percent of the total employment generated for routine maintenance activities was for women workers.

### 13.2 Poverty Reduction Impact Study

The ongoing project also launched an Poverty Alleviation Impact Study to prepare a data bank and obtain information to measure social and economic changes during and after the project implementation. The Study focused on the impact of road maintenance on poverty reduction and employment creation. The Base-Line Surveys on identified roads were carried out in November 2006 and the Follow up surveys on these roads were carried out in July 2008 after the road maintenance to determine the impact on poverty alleviation in the areas of influence of the roads.

Six road alignments were selected for Impact Study by the project. The Project Roads are those where periodic maintenance / routine maintenance works were carried out and the Control Roads are those located

in the vicinity of the Project Roads where no maintenance activities was undertaken during the course of the project. The Control Roads have been chosen to study and compare the impact of road maintenance on social-economic development and poverty alleviation in the project areas.

Name of Province	Road Category	Road Length	Location	
			Starting Point	End Point
Project Roads				
Battambang	T2	8.0 km	From National Road No. 5	To Aek Phnum District Boundary
Banteay Meanchey	T2	10.0 km	From National Road No. 6	To Phnum Srok District Boundary
Pailin	PR	17.0 km	From Secondary National Road No. 57	Kamrieng District Boundary
Control Roads				
Battambang	T3	13.0 km	From National Road No. 5	To Kruos village, Anlong Run commune
Banteay Meanchey	T3	8.5 km	From National Road No. 6	To Kambaor, Phnom Leab commune
Pailin	T2	10.0 km	From Thnal Kaeng, village, Ou Andoung commune.	To Secondary National Road No. 57 (Ou Ro'el village)

The double difference technique has been used to measure impact of the project on poverty reduction in the project areas. This Study used a simple comparison of 'before' and 'after' comparing the collective situation of villages before the roads to their situation now the roads have been fully operational for over 12 months.



The Study findings have been linked with the impact on poverty alleviation in the area of influence of the project roads and the control roads. Changes in access were analysed as possible improvements in physical, economical and social ease of transportation of goods and services to village to market centres. This resulted in increased income and additional employment opportunities and contributed in poverty alleviation. One of the important finding of the study is that almost 50% travel needs of the rural poor are for social visits. This reflects the importance of social needs and social travel of rural population in Cambodia. Other important findings of the Study are:

- As per the Follow Up Surveys in August 2008, the traffic volume increased by 28% on the Project Roads and traffic volume reduced by an average of 12% on the Control Roads. The increase in traffic can be clearly attributed to the improved access due to road maintenance on the Project Roads while the decrease in traffic was due to further deterioration of the road access due to no maintenance.

- The average travel time on project roads reduced by 40% in Pailin, 28% in Battambang and 21% in Banteay Meanchey.
- Base Line surveys data reveal that on an average the load carrying capacity on the Control Roads was 60 percent of the load carried by similar means of transport on the Project Roads. For example Motor Cycle in Battambang which represent 87% of share of transportation carried on an average of 62 kg of load on Project Road compared to only 39 kg on the Control Road.
- Follow up survey reveal that average daily sales of the vendors along the Project Roads increased on an average of 225% in the three provinces. Some increase ( 54%) was observed on the Control Roads. The above increase on the Project Roads is attributed to increased traffic and hence increased economic activities.
- According to Market Price Survey, bad road conditions and high transportation costs account for almost 90% of the problems and challenges faced by the market vendors and operators.
- The Follow-Up surveys reveal that along the Project Road (8.0 km) in Battambang 17 new shops / vendors have opened new businesses during the last 2 years. Whereas 12 new vendors opened their business along the PR in Banteay Meanchey on account of increase in business opportunities due to road maintenance activities.
- The market value of land also observed an upward trend during past two years. For example in Battambang Project Road, last year people in Kokoh Village sold their land at US\$2.5/sq.m and this year (2008) the land price in the village is about US\$ 12/sq.m. Some 30-40% price increase was observed in areas adjoining the Control Road too. In Banteay Meanchey Project Road, the price of land shot up from US\$4,000/hectare in 2006 to US\$ 8,000 to 10,000 per hectare in August 2008.

In view of above it is evident that improved access contributes to better quality and economic productivity of the assets. The boost in the quantities of transported goods and services, the reduction in travel time and transport fees and increase in the business opportunities and profits indicate improved living conditions and higher income for the rural poor.

The rehabilitated roads have importantly improved and facilitated the conditions for productive development. Rural population availed increased employment opportunities in road maintenance activities and new potential of transport and business due to improved access. Therefore it clearly proves that improving access and reducing poverty are closely linked.



## **14.0 Lessons Learned**

### **14.1 Sharing of Scarce Skilled Human Resources Amongst Ministries at Provincial Level**

The transfer of LBAT from MRD to MPWT through establishment of JRMU has been successfully demonstrated by the pilot project. Through this cluster approach, the provincial departments of MRD and MPWT in the three provinces successfully tested the new model approach in the planning and implementation of routine and recurrent maintenance of road network in a professional manner. This approach helped them to overcome human resource constraints, reduce the cost of maintenance management, and increase the efficiency and professionalism in the field of road management.

The Joint Road Maintenance Unit (JRMU) established by the MPWT and MRD at Provincial Cluster level in Battambang proved to be a dynamic arrangement to suit the development requirements by making optimum utilization of scarce skilled human resources available at the provincial level. The road maintenance planning for the 3 Province Cluster (6 provincial departments) was carried out in a unified and integrated manner based on agreed selection criteria under the supervision and guidance of the Joint Road Maintenance Board. This model was successfully tested over a period of about 2 years.

### **14.2 Community Contracting for Routine Maintenance of Rural Roads**

The pilot project successfully demonstrated a bottom-up contractual approach for routine maintenance of roads through Community Contractors living along the roads. This novel method gave empowerment to the communities in choosing their road maintenance contractor. The Commune Councils were also involved in the whole process and the project also organized special training sessions on labour-based routine maintenance for the Commune Chiefs and the Community Contractors. This approach developed local community technical and negotiation skills through training, in conformity with the Government's De-centralization & De-concentration policy and resulted in effective partnerships between local communities, administrations and the community contractors.

### **14.3 Development of Private Sector Small Scale Contractors**

ADB/JFPR project re-affirmed the appropriateness of labour-based methods for road rehabilitation and routine maintenance activities. The project successfully demonstrated that the efficiency of rural infrastructure service delivery can be considerably improved through participation of private sector small scale contractors.

Development of private sector small scale contractors witnessed continuous growth in terms of their assets and annual turnover. On account of the increase in wage rates and labour shortages, the contractors improvised their work methods through use of labour-based and equipment supported methods for road rehabilitation. For routine maintenance works, labour-based methods through Community Contractors continue to remain as the preferred and appropriate approach.

Future training inputs for local contractors should focus on Labor-Based and Equipment Supported technology with special emphasis on its application for bituminous roads or other innovative surfacing materials. The training programmes should provide special focus on financial management, asset management, cost-benefit analysis and resource planning for the contractors.

### **14.4 Capacity Development of Supervisory Staff**

Clustering of provinces (Battambang, Banteay Meanchey and Pailin) and creation JRMU definitely proved to increase efficiency of scale in effective planning and implementation of decentralized road maintenance in an integrated manner. Through joint working and active participation of JRMU and other provincial counterpart staff there was definite improvement in capacity development and horizontal transfer of LBAT and mainstreaming of labour-based methods for road maintenance. Since

Low Cost Bituminous Surfacing is new to MRD staff, there is a clear cut opportunity for horizontal transfer of this technology for future projects from MPWT to MRD through similar cluster approach and JRMU . The supervisory staff in the Client Ministries would also require continuous training to enhance their capacity and understanding about the upgrading of existing gravel roads to bituminous standards in a phased manner. So far, MRD only dealt with the rehabilitation and maintenance of gravel roads.

#### **14.5 Provision of Price Increase Clause in the Bid Document**

Only 2 out of 10 LCS road contracts could be completed and rest of the works remained unfinished due to abandoning of works by the contractors due to unprecedented increase in the cost of construction materials. The MEF/ADB although fully recognised the price increase but did not agree to any compensation due to price increase to the contractors as the bid documents did not contain any price escalation clause. As a result all the remaining unfinished contracts had to be cancelled causing lot of resentments amongst the stake holders in the three provinces. If fresh bids are invited to complete the remaining works, it is evident that based on the prevailing material prices the revised bid prices would be at least 60 – 100% higher than the earlier bid prices. For similar donor funded projects where the bid documents contained price escalation clause, the MEF/ADB paid almost 40% price increase compensation to the contractors. In order to avoid such situation, it is recommended that all future bid documents should include a price escalation clause in order to compensate the contractors for any price increase in the cost of construction materials during the contract period.

#### **14.6 Delays in Payment**

Delays in payments to the contractors are critical for effective and timely execution of the contracts. It is high time that the MEF and the donor agencies streamline their funds replenishment procedures on a priority basis.

#### **14.7 Proportion of RGC Counterpart Funding**

In this pilot project, the cost sharing by the RGC counterpart funds varied from 67% for LCS work to 100% for the Routine Maintenance activities. The entire civil works for the project suffered a major setback in 2007/2008 due to delays in the replenishment of the RGC funds and as a result most of the contractors had to stop the work. There could be many reasons for these delays but such a situation could have been avoided if the RGC cost-sharing was restricted to about ten percent only as is the case in most other ADB / World Bank funded projects. It is not that the other projects do not face such delays, but the only difference is that in other projects where Loan /Grant funding level is about 90 percent, the replenishment delays in respect of donor funding are within reasonable limits and hence contractors do not face with cash-flow problems. Even if there are delays in the replenishment of RGC counterpart funds, the contractors can afford to wait as this payment is not very significant (only about 10% of their payment certificates).

#### **14.8 Selection Criteria for Road Maintenance**

As per the Selection Criteria for identification of roads for routine maintenance, only those roads which are in a maintainable condition are to be selected for routine maintenance. At the field level, it was very difficult to follow the above mentioned selection criteria. In all the 3 provinces not even 20 percent of the roads qualified the above criteria because of poor condition of roads and due to huge backlog of road maintenance. Hence, in consultation with the project steering committee and the joint road maintenance board, it was decided to include the roads in best condition (not meeting the Selection Criteria) in the project annual plan. Based on the Road Condition Surveys, the JRMU prepared a list of 517 km of roads in consultation with the provincial departments. The condition of these roads was so poor that labour-based community contractors could hardly make any significant improvement in the road condition. This issue was discussed in the project Steering Committee and it was decided to carry out spot improvements including light grading using heavy grading equipment supported by the labour-based community contractors. This approach worked very well in improving the condition of roads. After

light grading, the roads were handed over to the Community Contractors to continue their monthly routine maintenance activities on sustainable basis. In view of above, the most important lesson learnt was that the identified roads should first be improved to maintainable condition through light grading before handing them over to the Community Routine Maintenance Contractors.

## **14.9 Labour Shortage**

Cambodia has gradually transited through an early period since the 1990s when the country faced the challenge of mass scale employment generation for the rural unskilled masses to a current scenario when labour shortages are being felt in the road sector due to increased labour demand in other sectors. This would mean reduced participation of labour and increased deployment of equipment for certain road sector activities. On account of the increase in wage rates and labour shortages, the contractors have improvised their work methods through use of labour-based and equipment supported methods for road rehabilitation. For routine maintenance works, labour-based methods through Community Contractors continue to remain as the preferred and appropriate approach.

## **15.0 Recommendations**

The pilot project has successfully demonstrated that the Cluster Approach as experimented for road maintenance can be an effective tools for dealing with the capacity constraints faced by the Ministries at the provincial level. This approach should be continued in the Road Sector and could be further replicated in other sectors as well.

A more pragmatic approach to road maintenance matching the ground realities is needed while determining the criteria for identification of roads for routine maintenance. In view of above, the most important lesson learnt was that light grading of poor conditions roads is a pre-requisite to the application of labour-based road maintenance by the Community Contractors. Hence adequate funding provisions for at least annual grading of the roads should be made in the provincial road maintenance budget allocations.

With increased economic activities, the traffic volumes on many of the gravel roads in the provinces now qualify for upgrading to bitumen roads. The MRD should plan to undertake this upgrading in a phased manner. In the absence of any other suitable surfacing material, DBST is the cheapest and universally accepted and best option compared to other surfacing materials. The project successfully tested Otta Seal but its efficacy of the trial sections has to be studied for a number of years before any concrete recommendation for wider usage can be made. Hence, the MRD staff at central and provincial level will have to be geared up to meet this new challenges as they do not have enough experience in the construction of DBST. The pilot project has already launched this initiative in the 3 provinces wherein the provincial staff and the contractors were trained in effective planning and implementation of low cost bituminous surfacing (DBST). The bid documents, design standards and specifications for these works developed under the pilot project needs to be replicated on a wider scale. Hence an expanded programme would also require further effort in training of small scale contractors and supervisory staff in effective designing and execution of bituminous roads.





# BANTEAY MEANCHHEY PROVINCIAL MAP

JAPAN FUND FOR POVERTY REDUCTION (JFPR)

MAINSTREAMING LABOUR-BASE ROAD MAINTENANCE TO THE NATIONAL ROAD NETWORK IN CAMBODIA TA-S048

## ROAD MAP SHOWING ROADS UNDER ROUTINE MAINTENANCE AND PREVENTIVE RECURRENT MAINTENANCE (LCS) IN BANTEAY MEANCHHEY PROVINCE

ADB

List of Road For Routine Road Maintenance in Banteay Meanchhey Province

No.	Road Name	Length Km	Belong to
1	RM 5 - Chantla	15.00	MRO
2	RM 5 - Senheng	6.00	MRO
3	Peak Pongro - Kuthong Sal	6.00	MRO
4	RM 5 - Phnom	6.00	MRO
5	RM 5 - Boe Sboe	6.00	MRO
6	RM 5 - Kouk Galing	14.00	MRO
7	RM 5 - Kouk Tue Loak	6.50	MRO
8	RM 5 - Ta Sant	13.00	MRO
9	Boe Rong - Ta Lom	7.00	MRO
10	Boe Rong - Ta Sant	6.00	MRO
11	RM 5 - Ou Chhok	4.00	MRO
12	RM 5 - Prey Tomsing	2.90	MRO
13	RM 5 - Kouk Theng	2.50	MRO
14	Thong Pook - Boeong Thakok (1)	12.00	BPWT
15	Thong Pook - Boeong Thakok (2)	12.30	BPWT
16	Prey Meas - Phnom Srok	35.00	BPWT
17	RM 5 - O Bay Chhok	10.00	BPWT
18	RM 5 - Ta Kong	10.00	MRO
19	RM 5 - Phnom Phnom	10.00	MRO
20	RM 5 - Loko - Prey Chhok	6.20	MRO
21	Prey Meas - Ou Kakhok	10.00	MRO
22	Boe Chhok - Ta Sant	2.20	MRO
Total		212.70	

List of Low Cost Bituminous Surfacing Roads in Banteay Meanchhey Province

No.	Road Name	Length Km	Belong to
1	RM 5 - Rong Tuek	9.10	MRO
2	Ta Rong (RM 5) - Taek Chhok	9.75	MRO
3	Taek Chhok - Phnom Srok	15.70	MRO
Total		34.55	

### LEGEND:

#### Administrative Symbols:

- Provincial Boundary
- District Boundary
- Commune Boundary
- District Center
- Commune center
- Village center
- Provincial Center

#### Other Symbols:

- River, Stream
- National Road All Weather
- National Road Dry Weather
- Provincial Road All Weather
- Provincial Road Dry Weather
- Rural Road All Weather
- Rural Road Dry Weather
- Occasional Road Dry Weather
- Railway

KINGDOM OF CAMBODIA



0 10 20  
kilometers

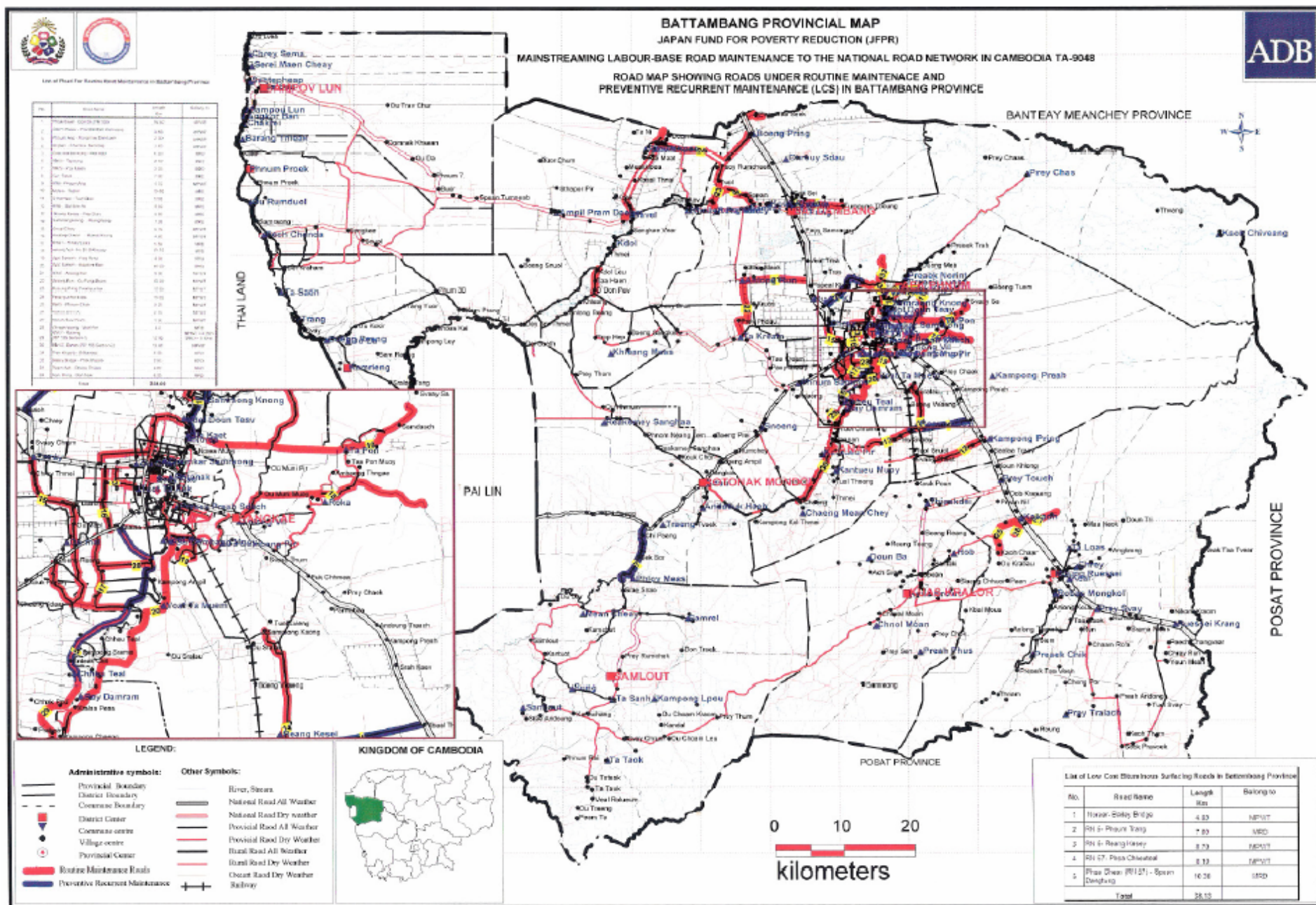


OTDOR MEANCHHEY PROVINCE

SIEM REAP PROVINCE

BATTAMBANG PROVINCE









# KRONG PAILIN MAP

JAPAN FUND FOR POVERTY REDUCTION (JFPR)

MASTREAMING LABOUR-BASE ROAD MAINTENANCE TO THE NATIONAL ROAD NETWORK IN CAMBODIA TA-9048

ROAD MAP SHOWING ROADS UNDER ROUTINE MAINTENANCE AND PREVENTIVE RECURRENT MAINTENANCE (LCS) IN Krong Pailin

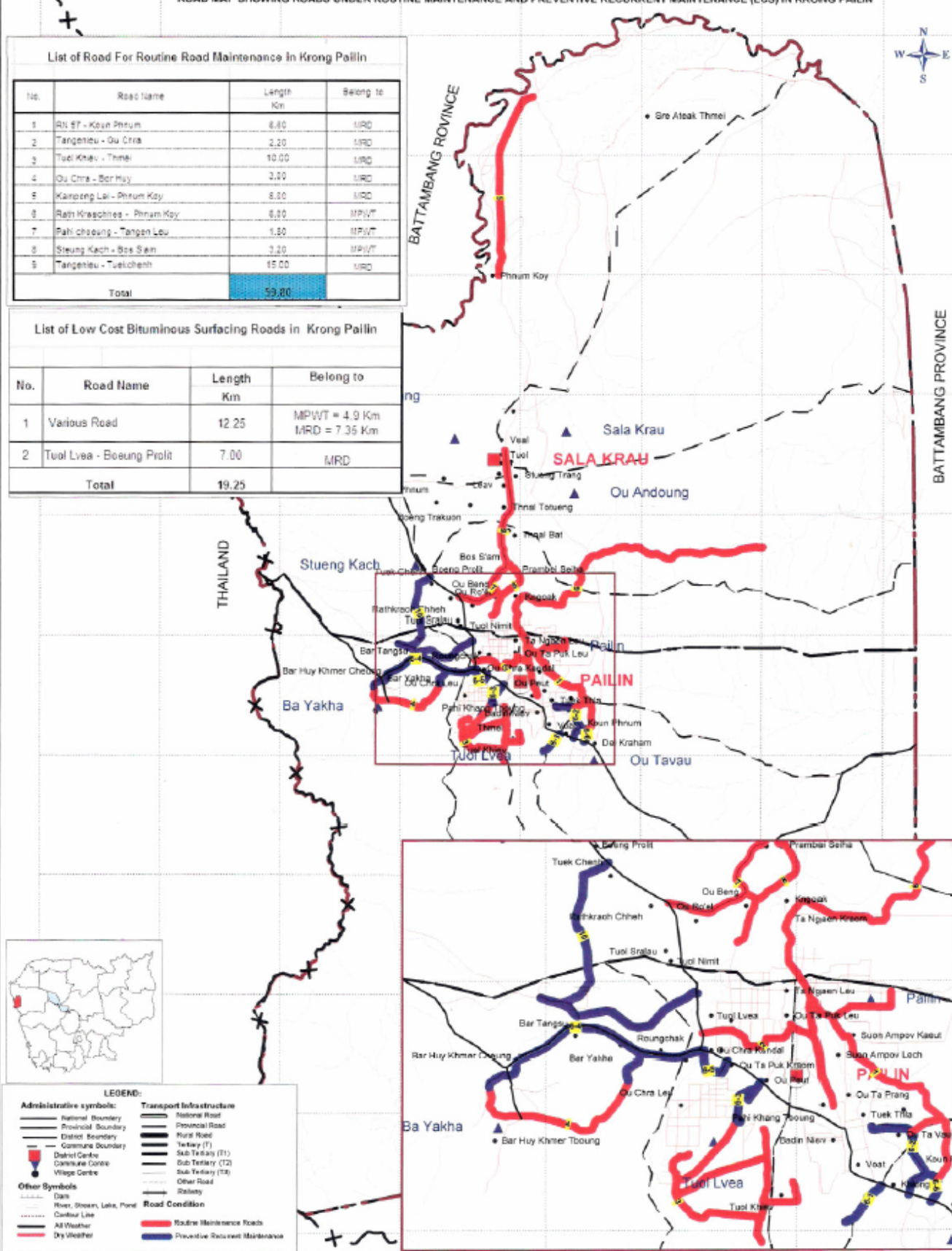
ADB

## List of Road For Routine Road Maintenance in Krong Pailin

No.	Road Name	Length Km	Belong to
1	RN 5T - Koun Phnum	8.60	MRD
2	Tangenieu - Ou Chra	2.20	MRD
3	Tuol Khieu - Thmei	10.00	MRD
4	Ou Chra - Bar Huy	3.00	MRD
5	Kampeng Lai - Phnum Koy	8.00	MRD
6	Rath Kraschies - Phnum Koy	8.00	MPWT
7	Rath Chroung - Tangenieu	1.80	MPWT
8	Stueng Kach - Bos Sam	3.20	MPWT
9	Tangenieu - Tuol Chheh	15.00	MRD
Total		59.80	

## List of Low Cost Bituminous Surfacing Roads in Krong Pailin

No.	Road Name	Length Km	Belong to
1	Various Road	12.25	MPWT = 4.9 Km MRD = 7.35 Km
2	Tuol Lvea - Boeung Proit	7.00	MRD
Total		19.25	





**MAINSTREAMING LABOUR-BASED ROAD MAINTENANCE  
TO THE NATIONAL ROAD NETWORK IN CAMBODIA TA-9048**

**Training Course - Labour-Based Road Construction And Maintenance Methods  
15.01.2007 to 01 March 2007 in Battambang**

No.	Name	Position	Organization-Contractor	Province	Phone Number
1	Chan Sothy	Admin/Finance	M/S Heng Chat	Battambang	012 734 646
2	Heng Horn	Technician	M/S Heng Chat	Battambang	092 215 949
3	Chray Bun	Admin/Finance	M/S Tok Song Sour	Battambang	012 951 044
4	Em Savan	Technician	M/S Tok Song Sour	Battambang	092 816 499
5	Ung Kimly	Director	M/S Hong Huotly	Battambang	012 927 020
6	Loeup Bunyo	Technician	M/S Hong Huotly	Battambang	092 893 250
7	Tang Seng Bou	Director	M/S Leang Bou	Battambang	012 968 777
8	Koy Deth	Technician	M/S Leang Bou	Battambang	092 907 147
9	Chhay Sitha	Director	M/S Hong chhay Heng	Battambang	012 950 421
10	Yim Thyro	Technician	M/S Hong chhay Heng	Battambang	012 956 208
11	Meng Bunly	Admin/Finance	M/S T.S.K Construction	Battambang	012 355 093
12	Mean Sokunthea	Technician	M/S T.S.K Construction	Battambang	011 998 100
13	Plong Mom	Director	M/S Plong Mom	Banteay Meanchey	012 558 455
14	Math Poern	Technician	M/S Plong Mom	Banteay Meanchey	092 760 357
15	Tan Kim Huot	Deputy Director	M/S Tan Kim Eng	Banteay Meanchey	012 643 464
16	Youen Yat	Technician	M/S Tan Kim Eng	Banteay Meanchey	012 241 592
17	Vat Chhinh	Director	M/S Vath Chhinh	Banteay Meanchey	012 776 262
18	Choung Sereyvath	Technician	M/S Vath Chhinh	Banteay Meanchey	012 441 842
19	Poun Bun Chheun	Deputy Director	M/S Sip Poun	Banteay Meanchey	092 794 959
20	Sem Khemra	Technician	M/S Sip Poun	Banteay Meanchey	012 567 658
21	Phao Nguon	Director	M/S Phao Nguon	Banteay Meanchey	012 912 457
22	Ly Kakada	Technician	M/S Phao Nguon	Banteay Meanchey	012 448 424
23	Chao Yin	Admin/Finance	M/S Taing Thai Kheang	Banteay Meanchey	012 833 251
24	Suon Sereyvuth	Technician	M/S Taing Thai Kheang	Banteay Meanchey	092 315 498
25	Prak Sarak	Director	M/S Prak Sarak	Banteay Meanchey	012 362 121
26	Sroeun Sokha	Technician	M/S Prak Sarak	Banteay Meanchey	012 739 898
27	Son Seut	Admin/Finance	M/S Kim Douk	Pailin	012 768 996
28	Kim Douk	Technician	M/S Kim Douk	Pailin	012 618 700
29	Van Chor	Admin/Finance	M/S Pheng Sokpath	Pailin	016 716 903
30	Pheng Sokpath	Technician	M/S Pheng Sokpath	Pailin	092 720 473
31	Suon Nat	Provincial Staff	DPWT	Pailin	016 380 771
32	Chhim Kim	Provincial Staff	DPWT	Pailin	016 350 294
33	Sok Phakdey	Provincial Staff	PDRD	Pailin	016 941 581
34	Sok An	Provincial Staff	DPWT	Banteay Meanchey	012 786 244
35	Orn Siphea	Provincial Staff	DPWT	Banteay Meanchey	012 686 196
36	Chheang Moeun	Provincial Staff	PDRD	Banteay Meanchey	012 380 955
37	Pin Sovann	Provincial Staff	DPWT	Battambang	092 914 323
38	Ham Sina	Provincial Staff	DPWT	Battambang	012 834 133
39	Sang Bunthen	Provincial Staff	DPWT	Battambang	012 413 681
40	Chhoeurn Roeurth	Provincial Staff	DPWT	Battambang	012 221 024
41	Souk Vy	Provincial Staff	PDRD	Battambang	012 338 916

**MAINSTREAMING LABOR-BASED ROAD MAINTENANCE  
TO THE NATIONAL ROADS NETWORK IN CAMBODIA TA-9048**

**List of Participants For Training Course Of Low Cost Bituminous Surfacing  
For Engineer , Technician and Contrators  
On 14-16 November 2007**

<b>No</b>	<b>Name</b>	<b>Organization</b>	<b>Province</b>
1	Soeng Sothy	Mony Contruction Construction Co., Ltd	Phnom Penh
2	Y Yong	Mony Contruction Construction Co., Ltd	Phnom Penh
3	Chea Chip	Gold Van Long Contruction Co., Ltd	Phnom Penh
4	Chea Chhorn Narun	Lap Technician Ung Sim Sia Co.Ltd	Phnom Penh
5	Toch Rattanak	Lim Heng Group Contruction Co., Ltd	Phnom Penh
6	Kim Sean	Engineer MRD	Phnom Penh
7	Dy Kiden	Engineer MRD/PRIP	Phnom Penh
8	Mean Ravuth	Engineer MRD	Phnom Penh
9	Him Socheat	Engineer MRD/TRIP IV	Phnom Penh
10	MeanTong	Engineer MRD/TRIP IV	Phnom Penh
11	Sok An	Technical staff DPWT	Banteay Meanchey
12	Orn Sipear	Technical JRMU	Banteay Meanchey
13	Chhang Moeurn	Technical staff PDRD	Banteay Meanchey
14	Ly Kakada	Phaov Nguon Contruction	Banteay Meanchey
15	Sroeun Sokha	Prak Sarak Contruction	Banteay Meanchey
16	Taing Samnang	Taing Thai Kheang Contruction	Banteay Meanchey
17	Suon Vuthea	Phaov Nguon Contruction Co., Ltd	Banteay Meanchey
18	Sok Phakdey	PDRD	Pailin
19	Soun Nat	Technician - JRMU	Pailin
20	Chhim Kim	DPWT	Pailin
21	Meng Dara	JRMU - Site Supervisor	Pailin
22	Chhay Sithea	Engineer Hong Chhay Heng Co.Ltd	Battambang
23	Chham Oeum	Technician Leang Bou Co.Ltd	Battambang
24	Chen Mony	Site Engineer Hong Chhay Heng Co.	Battambang
25	Chan Sothy	Technician Heng Chhat Co.Ltd	Battambang
26	Ly Cheng	Deputy Tok Song Sour Construction Co.Ltd	Battambang

## MAINSTREAMING LABOR-BASED ROAD MAINTENANCE TO THE NATIONAL ROADS NETWORK IN CAMBODIA TA-9048

**List of Participants For Training Course Routine Road Maintenance  
For Technician , Commune , Supervisor and Community Contrators in Battambang  
On 06 November 2007**

No	Name	Position	Province
1	Dol Sochet	Community Contractor	Banteay Meanchey
2	Soe Rin	Community Contractor	Banteay Meanchey
3	Hea It	Community Contractor	Banteay Meanchey
4	Ko Bo Chhok	Community Contractor	Banteay Meanchey
5	Thuok Ruos	Community Contractor	Banteay Meanchey
6	Phea Saret	Community Contractor	Banteay Meanchey
7	Sok Muth	Community Contractor	Banteay Meanchey
8	Nin So Thea	Community Contractor	Banteay Meanchey
9	Pann Moeung	Community Contractor	Banteay Meanchey
10	Uon Bun Loeung	Community Contractor	Banteay Meanchey
11	Chhaing Hoeut	Community Contractor	Banteay Meanchey
12	Meak Dom	Chief Commune, Kok Balaing	Banteay Meanchey
13	Khaw Warin	Chief Commune, Ou Prasat	Banteay Meanchey
14	Pok Lourn	Chief Commune, Talam	Banteay Meanchey
15	Duong Pek	Chief Commune, Srah Rang	Banteay Meanchey
16	Thong Lan	Chief Commune, Kut Tasoat	Banteay Meanchey
17	Rer Vin	Chief Commune, Takong	Banteay Meanchey
18	Hul Kim Thon	Chief Commune, Tuek Chor	Banteay Meanchey
19	Chea Sang	Chief Commune, Phnom Toch	Banteay Meanchey
20	Chhoeur Thai San	Chief Commune, Kok Romeat	Banteay Meanchey
21	Sok Voeurt	Chief Commune, Ta Pho	Banteay Meanchey
22	Koev Sun	Chief Commune, Ou Bay Choan	Banteay Meanchey
23	Til Hev	Chief Commune, Samrong	Banteay Meanchey
24	Tum Meal	Chief Commune, Phneat	Banteay Meanchey

<b>No</b>	<b>Name</b>	<b>Position</b>	<b>Province</b>
25	Im Keuy	Chief Commune, Bosbov	Banteay Meanchey
26	Sok An	Technical staff DPWT	Banteay Meanchey
27	Chheang Moeun	Technical staff PDRD	Banteay Meanchey
28	Orn Siphea	Technician - JRMU	Banteay Meanchey
29	Ok Channthoeun	Community Contractor	Krong Pailin
30	Chen Sok Kea	Community Contractor	Krong Pailin
31	Chuon Doeun	Community Contractor	Krong Pailin
32	Oum Phy	Community Contractor	Krong Pailin
33	Soung Ros	Community Contractor	Krong Pailin
34	Oun Vuthy	Chief Commune, Pailin	Krong Pailin
35	Tem Toeum	Chief Commune, Pailin	Krong Pailin
36	Sang Phirun	Chief Commune, Tuol Lvea	Krong Pailin
37	Prom Sarath	Chief Commune, Pailin	Krong Pailin
38	Chinh Bot	Chief Commune, Bo Yakha	Krong Pailin
39	Suon Nat	Technician - JRMU	Krong Pailin
40	Chhim Kim	Technical staff DPWT	Krong Pailin
41	Sok Phak Dey	Technical staff PDRD	Krong Pailin



## **MAINSTREAMING LABOR-BASED ROAD MAINTENANCE TO THE NATIONAL ROADS NETWORK IN CAMBODIA TA-9048**

### **List of Participants For Training Course Routine Road Maintenance For Technician , Commune , Supervisor and Community Contrators in Battambang On 05 November 2007**

<b>No</b>	<b>Name</b>	<b>Position</b>	<b>Province</b>
1	Ho Da vy	Community Contractor	Battambang
2	Hok Sam At	Community Contractor	Battambang
3	Chan Pach	Community Contractor	Battambang
4	Seng Phal	Community Contractor	Battambang
5	Chek Song	Community Contractor	Battambang
6	Deab Torng	Community Contractor	Battambang
7	Dul The	Community Contractor	Battambang
8	Chheun An	Community Contractor	Battambang
9	Chhurm Chamreun	Community Contractor	Battambang
10	Sim Kong	Community Contractor	Battambang
11	Ko Kroeuy	Community Contractor	Battambang
12	Ath Choeuth	Community Contractor	Battambang
13	Hong Bunthen	Community Contractor	Battambang
14	Tep Kosal	Community Contractor	Battambang
15	Chhorng Ho	Community Contractor	Battambang
16	Keong Koun	Chief Commune, Lvea	Battambang
17	Sim Sam Un	Chief Commune, Bavel	Battambang
18	Heng Ly	Chief Commune, Chamkar Samrong	Battambang
19	Em Siroeun	Chief Commune, Kdol	Battambang
20	Lay Se	Chief Commune, Ta Poug	Battambang
21	You Soeirm	Chief Commune, ROUNG CHREY	Battambang
22	Pal Chom	Chief Commune, Kakosh	Battambang

<b>No</b>	<b>Name</b>	<b>Position</b>	<b>Province</b>
23	Mao Rorm	Chief Commune, Ta pon	Battambang
24	Pinh Phoeurt	Chief Commune, Reang Kesey	Battambang
25	San Ry	Chief Commune, Omal Chrey	Battambang
26	Pen Chhan	Chief Commune, Wat Kor	Battambang
27	Loch Chhon	Chief Commune, Ou Dam Bang 1	Battambang
28	Mol Roun	Chief Commune, Anlong Run	Battambang
29	Mao Seng	Chief Commune, Prek khporb	Battambang
30	Deng Yoeun	Chief Commune, ChheuTeal	Battambang
31	Saing Roeun	Chief Commune, Peam Aek	Battambang
32	Kong Lim	Chief Commune, Balang	Battambang
33	Chheun Reuth	Technical Staff of DPWT	Battambang
34	Seng Savuth	Technical Staff Officer PDRD	Battambang

## **Annex – 2 Specifications of Materials for Otta Seal**

### **Aggregate Grading & Strength**

Aggregates of relatively low strength may be used for Otta Seals. The grading and aggregate strength are as under:

<b>Material Properties</b>	<b>Requirements</b>	<b>AASHTO or BS Test</b>
Plasticity Index	Max. 10	T 90-61
Flakiness Index	Max.30 (for crushed stone only)	BS 812
<b>Sieve Sizes (mm)</b>	<b>Grading Requirement (% passing)</b>	
19	100	T 146-49
16	80-100	
13.2	52-100	
9.5	36-98	
6.7	20-80	
4.75	10-70	
2.0	0-48	
1.18	0-38	
0.425	0-25	
0.075	0-10	

### **Maximum Particle Size**

The maximum particles size is 16-19 mm but 16 mm is preferred.

### **Fines Content**

The amount of fines passing 0.075mm should preferably not exceed 10 percent. Higher fines up to 15 percent are reported to have performed well in certain countries such as Botswana.

### **Aggregate Strength**

The required aggregate strength for Otta Seal is less than for Chip Seal. Lower particle strengths are permissible because of the use of soft binders, any aggregates crushed due to passage of traffic or during rolling can be accommodated in the sealing coat.

### **Bituminous Binders**

The choice of appropriate binders is critical for the expected performance of the Otta Seal. Binders should be soft enough to coat the aggregates and move up in the matrix of aggregates with the action of rolling and passage of traffic. In addition, the binder should be viscous enough to provide to be applied in prescribed rates in one spray operation, be environment friendly and should be able to deliver the expected results. In other countries Penetration Grade Bitumen 80/100 or 150/200 are normally used but require heating to 150-170 degree Celsius. Otherwise Cutback Bitumen MC 3000 and MC 800 are most commonly used but these too require heating. Bitumen Emulsions have not been much used or practiced in other countries.

## **Specification - Materials Used in Trial Sections**

### **Aggregate**

Naturally occurring laterite in Battambang has been used. The samples of the laterite were tested for its properties (refer Annex – 1) for Test Results) as under:

Los Angeles Abrasion Test - 33.54 % ( Permissible Limit is 35%)

Sieve Analysis by AASHTO T27/T88 - Within the Prescribed Grading Envelop

%age of fines passing 0.075 mm Sieve - 14.95 % ( Permissible limit is 10%)

Plasticity Index of the Fines - 15.76 ( Permissible is 10 )

Although percentage of fines and PI for the fines was little high, it was used at the trial sites. In order to reduce the percentage of fines and removal of oversized material, the project arranged sieving of the natural laterite. But, trials sections were made using sieved laterite and natural laterite with excess fines.

### **Binder**

Since Emulsions are widely used in and available in Cambodia, the project decided to use Cationic Emulsion CRS2 for the trial sections. The application of Emulsion does not require heating and it could also be used during the rainy season. The Provincial Departments of Pubic Works and Transport are very well familiar with the usage and application norms for the Emulsions.

### **Prime Coat**

For Prime Coat also Emulsion CSS1 was used for the trial sections. Trials Sections were prepared with Prime Coat and with out Prime Coat as well to study the pavement behavior.