

TO CHIEF REPRESENTATIVE JICA GHANA OFFICE

PROJECT MONITORING SHEET

Project Title: The Project for Developing Labour Based Bituminous Surfacing Technology  
(LBST)

Version of the sheet: Ver. 3 (January-2017)

Submission Date: 1<sup>st</sup> February, 2017



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**Director**  
**Department of Feeder Roads**  
**Ministry of Roads and Highways**



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**Chief Advisor /Rural Road Development**  
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## I. SUMMARY

### 1. PROGRESS

#### 1-1 Progress of Inputs

##### (1) Japanese Side

Item	Achievement (as of 31 <sup>st</sup> January)																														
Japanese Experts	<p>Following 8 experts in total have been dispatched to the Project, under the titles below. The total Man/Month of these experts was 14.93 MM up to 31<sup>st</sup> January. Details are given in <b>Attachment-1</b>.</p> <ul style="list-style-type: none"> <li>● Motoki OGAWA(Chief Adviser /Rural Road Development) 4.70MM</li> <li>● Seiji KADOOKA(Deputy Chief Advisor/Road Pavement technology ) 2.23MM</li> <li>● Kazunori KOBAYASHI (Cost Estimation /Safety Guard) 1.53MM</li> <li>● Tetsuo SAKAMOTO (Site Supervisor) 0.90 MM</li> <li>● Masanori TAKEISHI (Maintenance and Machinery Equipment) 1.50MM</li> <li>● Yumiko TAKEDA (Project Coodination1 /Training Plan) 0.70MM</li> <li>● Takaaki HIRAKAWA (Monitoring and Evaluation 1) 2.24MM</li> <li>● Mayumi SHOJI (Project Coordination 2/Monitoring and Evaluation 2) 1.13MM</li> </ul>																														
Local Operation Cost	<p>Local operation cost was mainly utilized for the following items</p> <table border="1"> <thead> <tr> <th>No.</th> <th>Items</th> <th>US\$</th> <th>No.</th> <th>Items</th> <th>US\$</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Transport Cost (domestic)</td> <td>19,332</td> <td>5</td> <td>Meeting, Workshop and JCC</td> <td>271</td> </tr> <tr> <td>2</td> <td>Communication Cost</td> <td>613</td> <td>6</td> <td>Allowance and Accommodation</td> <td>1,768</td> </tr> <tr> <td>3</td> <td>Equipment Purchased</td> <td>187,017.10</td> <td>7</td> <td>Local Consultants</td> <td>N/A</td> </tr> <tr> <td>4</td> <td>Third Country Training</td> <td>N/A</td> <td>8</td> <td>Others</td> <td>8,150</td> </tr> </tbody> </table>	No.	Items	US\$	No.	Items	US\$	1	Transport Cost (domestic)	19,332	5	Meeting, Workshop and JCC	271	2	Communication Cost	613	6	Allowance and Accommodation	1,768	3	Equipment Purchased	187,017.10	7	Local Consultants	N/A	4	Third Country Training	N/A	8	Others	8,150
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3	Equipment Purchased	187,017.10	7	Local Consultants	N/A																										
4	Third Country Training	N/A	8	Others	8,150																										
Equipment	Copy machine, projector and construction machinery were provided. Details are given in <b>Attachment-2</b> .																														
Study tour in the Third country	N/A (Scheduled in mid-2017)																														

##### (2) Ghana's side

Item	Achievement (as of 31 <sup>st</sup> January)		
C/P's	<p>34 Counter parts have been participating in the project.</p> <table border="1"> <tbody> <tr> <td>23 from DFR</td> <td>           1 Director of DFR            1 Deputy Director            7 Chief Engineer            1 Chief planning officer            1 Chief Engineer Survey and design            3 Chief Quantity Surveyor            1 Principal Quantity Surveyor            2 Principal Engineer         </td> </tr> </tbody> </table>	23 from DFR	1 Director of DFR 1 Deputy Director 7 Chief Engineer 1 Chief planning officer 1 Chief Engineer Survey and design 3 Chief Quantity Surveyor 1 Principal Quantity Surveyor 2 Principal Engineer
23 from DFR	1 Director of DFR 1 Deputy Director 7 Chief Engineer 1 Chief planning officer 1 Chief Engineer Survey and design 3 Chief Quantity Surveyor 1 Principal Quantity Surveyor 2 Principal Engineer		

		3 Engineer 1 Mechanical Engineer 1 Operation Manager /Environmentalist 1 Environmentalist
	11 from Eastern Region	1 Regional Manager 4 Operations Manager 1 Contract Manager 2 Assistant Quantity Surveyor 2 Technician Engineer
	Details are given in <b>Attachment-3</b> .	
Local Operation Cost	Operation cost was mainly utilized for running office cost for the first six months. Details are given in <b>Attachment-4</b> .	

### 1-2 Progress of Activities

Details are given in **Attachment-5**.

### 1-3 Achievement of Output

Since the activities of the Output 1 had favorably been promoted as scheduled, the Output 1 based on the indicator 1-1 (clarification of current conditions and issues) was achieved in September 2016. In the 2nd Technical Working Group Meeting, C/P had the presentation on the “Report on Analysis of Current Status for Labour-Based Bituminous Surfacing Technology (refer to the Appendix 1),” and shared the current status of road network in Ghana, the progress of LBT works in 2015, road contractors for LBT works by categories and classes, the summary and lessons learned of field trial for otta seal in the past, and the information of materials (bituminous emulsion, chipping aggregates, gravel, etc.) with project stakeholders. Also, they discussed the necessity of LBT bituminous surfacing treatment, types of surfacing treatment for LBT, technical challenges, etc. Ultimately, the Report has been approved.

Other than this, it is not ready to measure the achievements of other Outputs at this moment because only certain activities in the Output 2 have just been launched.

### 1-4 Achievement of Project Purpose

There are two (2) indicators in the Project Purpose. The indicator 1 (development of labour-based bituminous surfacing technology) will be measured during and after the field trials from February 2017 as scheduled in the PO.

On the other hand, the indicator 2 is the self-evaluation of DFR officials, including Eastern Region, for acquiring labour-based bituminous surfacing technology, and the target value has already been set at 65.0% since the baseline value was 44.7%. In order to confirm the progress of their understandings, the second questionnaire survey was conducted on the basis of the question items as follows:

- 1) Planning skills and knowledge of road works;
- 2) Road structure design and/or drawing;
- 3) Contents of Bill of Quantities (BOQ);
- 4) Cost estimation;
- 5) Road inspection tasks;
- 6) Safety practice for workers and road users during road works;
- 7) Technical advice and supports for a contractor;
- 8) Time management of road works during the execution periods;
- 9) Monitoring of road works; and
- 10) Standard specification of the labour-based bituminous surfacing technology.

DFR officials assessed themselves along the above question items by five-point scale with “5” in full-scale points. The results of their self-evaluation on the labour-based bituminous surfacing technology indicate the strength and weakness of DFR officials objectively. As the Project is able to identify such information, the technical assistance for DFR officials will efficiently be provided by concentrating on the specific items as required.

Table 1: The self-rating results of DFR officials, including Eastern region, for acquiring labour-based bituminous surfacing technology (Five-point scale)

	1st Questionnaire (July 2016) 31 respondents	2nd Questionnaire (January 2017) 30 respondents
Q1. Planning skills and knowledge of road works	45.16%	56.67%
Q2. Road structure design and/or drawing	46.45%	52.00%
Q3. Contents of Bill of Quantities (BOQ)	49.68%	55.33%
Q4. Cost estimation	46.45%	54.67%
Q5. Road inspection tasks	45.81%	55.33%
Q6. Safety practice for workers and road users during road works	47.10%	52.67%
Q7. Technical advice and supports for a contractor	40.00%	50.00%
Q8. Time management of road works during the execution periods	43.87%	46.00%
Q9. Monitoring of road works	45.16%	51.33%
Q10. Standard specification of the labour-based bituminous surfacing	37.42%	51.33%

technology		
<b>Total Rating on Average (Q1 – Q10)</b>	<b>44.71%</b>	<b>52.53%</b>
Q11. Overall rating of the labour-based bituminous surfacing technology	47.74%	52.00%

Source: Questionnaire survey through the Form 2 of the Monitoring System

According to the result of the 2nd questionnaire survey in the Table 1, the question item quite below the total rating on average (52.5%) is the “time management of road works (Q8: 46.0%).” However, since the field trial has not been started yet, there are prospects that this rating point will be increased after the completion of the road construction. On the other hand, DFR officials highly rated the “planning skills and knowledge (Q1: 56.7%)”, “technical advice and supports (Q7: 50.0%)”, and “standard specification of the labour-based bituminous surfacing technology (Q10: 51.3%).” Those three items were increased by more than 10% compared to the previous survey. It is considered that certain project activities, such as technical working group (TWG) meetings (three times) and training on equipment operations, have positively affected the competency of DFR officials on the labour-based bituminous surfacing technology.

Also, it is specially required to enhance the time management of road works during the execution period of field trial through the technical transfers of JICA experts who can provide certain instructions for the counterpart personnel. As the 3rd survey is planned to be conducted in July 2017, the influence of the field trial will be confirmed after the construction works.

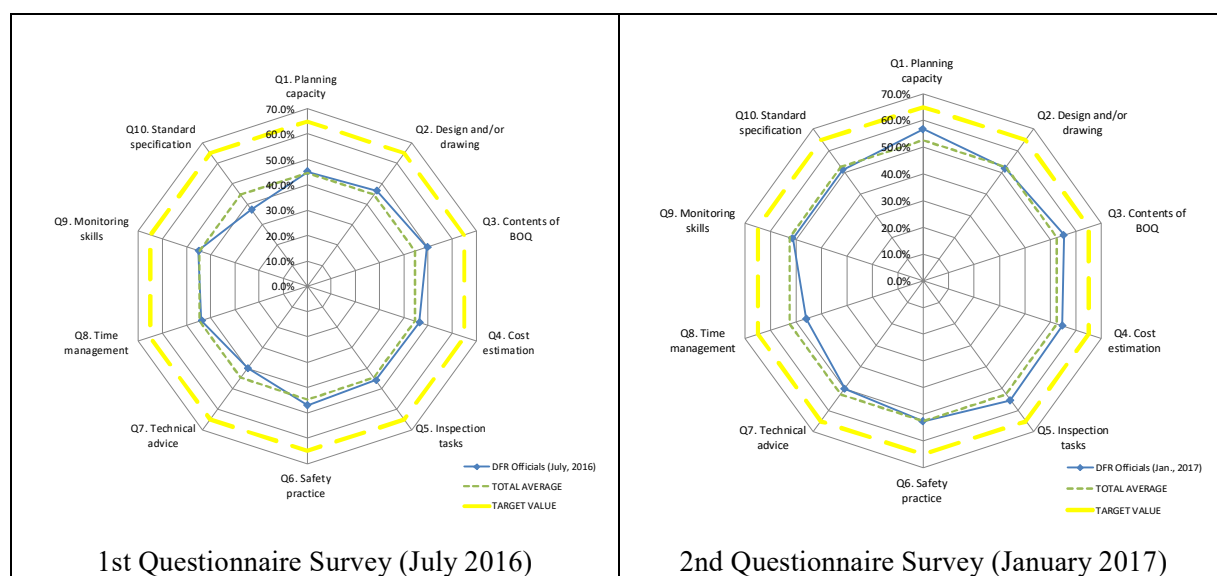


Figure 1: Self-rating results of DFR officials, including Eastern Region (Spider Chart)

The rating results are visualized in the Figure 1 so as to indicate the level of their current

capacity of the labour-based bituminous surfacing technology. Ideally, it is desirable to come to a “round shape” balanced among each item rather than a “polygonal shape” unbalanced among them. Moreover, it is expected to gradually expand the area of round shape because it implies that the rating points of each question item are steadily increased.

### 1-5 Changes of Risks and Actions for Mitigation

In terms of the Important Assumptions, the Project shall pay attention to those conditions for the achievement of the Outputs and Project Purpose during the cooperation period. It seems that there are no risks to be found for those conditions at this moment.

(1) Important Assumption for the achievement of the Outputs:

DFR was able to utilize and mobilize available resources related to labour-based bituminous surfacing treatment on rural roads in Ghana (*e.g.*, KTC, KNUST, GHA Central Lab, etc.) for the implementation of the Project.

(2) Important Assumption for the achievement of the Project Purpose:

Although the position of Dy. Director (Planning) of DFR, Project Manager, was changed from Mr. Asiedu to Dr. Ampadu on 4th April 2016, it is considered that this condition does not severely affect to the achievement of the Project Purpose because of passing two months only after the commencement of the Project. Apart from this, there are no significant changes in C/P assignment.

### 1-6 Progress of Actions undertaken by JICA

Following equipment was delivered by JICA and and handover to DFR.

**Table-2 Equipment procured by JICA**

Name of Equipment	Model/ Specification	Location to deliver	Manufacture	Deliver and Handover
Tractor with spare parts	Approx. 70 to 90 HP Diesel Engine Rear Attachment	KTC	John Deere	4 <sup>th</sup> August, 2016
Trailer with spare parts	Towed type 3-5000 kg(2-3 m3) capacity Front attachment	KTC	John Deere	4 <sup>th</sup> August, 2016
DCP and cones	British standard model	KTC	Askia	23 <sup>rd</sup> , November, 2016

### 1-7 Progress of Actions undertaken by Government of Ghana

According to the PDM<sub>2</sub>, following 3 items were indicated as a pre-condition for implementation. Since all the conditions were cleared, it could be said there is no action which has to

be taken by the Ghana side at this moment.

**Table-3 Pre-conditions taken by the Ghana side and its progress**

Pre-Condition	Progress
Ghanaian side provides technical documents on LBT	Technical manual and guidelines relate to road design and construction which the MRH has created were submitted to the Project
Laboratory testing of materials is available	Material testing could be conducted at central laboratory of GHA located in Accra.
The site for field trials are ensured (these sites must be prepared with the road bed and filled with subbase course materials, etc.)	The trial site has been selected at Akote-Obomofodensua village near KTC, and the target section has completed its construction up to sub-base including concrete ditch.

**1-8 Progress of Environmental and Social Considerations**

N/A

**1-9 Progress of Considerations of gender/peace building/poverty reduction**

N/A

**1-10 Other remarkable/considerable issues related/affected to the Project**

N/A

**2. DELAY OF WORKS SCHEDULE AND/OR PROBLEMS**

In terms of equipment, since all procurement procedures went smooth, delivery was done a month ahead of schedule. Hand over was also made as soon as the equipment was delivered to DFR which it made 6 months ahead of schedule. So, for the equipment, all procurement procedures was done and completed ahead of schedule.

Japanese expert in charge of “LBT Guideline” was not dispatched this year due to focusing on preparation of trial construction, and the preparation of Guideline shall be concentrated in the latter half of the next year after completion of the field trial construction. The second dispatch of the Japanese expert in charge of “Maintenance of Machinery and Equipment” was not made since the equipment was already delivered and handed over to DFR with inspection by the project leader and the deputy leader of the Project. The assignment for this works shall be integrated to the third dispatch which is planned to be during the trial construction for inspect and monitor the use of the equipment by the contractor.

For the assignment of “Identify the safeguarded issues”, since the items to be monitored of this activity shall be found during the trial construction, the assignment will be postponed to duration

of the first trial construction which is planned from beginning of February, 2017.

### 3. MODIFICATION OF THE PROJECT IMPLEMENTATION PLAN

#### 3-1 PDM

PDM<sub>3</sub> was approved by the key stakeholders, including the Project Director (DFR Director) and Project Manager (Dy. Director of Planning, DFR). The Inputs were modified as shown in the Table 1 because Japanese side mainly came to be responsible for the operational cost of the field trials, including labour forces, through subcontracting agreement with contractors.

For clarification, the daily allowances for the counterpart during the field trials shall also be allocated by Ghanaian side.

**Table 1: Modification of the PDM**

Components of the PDM		Corrections
Inputs	Japanese side	At the line of the field trials, the labour forces (supervisors, workers, etc.) and other necessary expenses were added to the “base and bituminous surface treatment.”
	Ghanaian side	At the same portion as shown above, the labour forces were deleted from the Ghanaian side because they were moved into the Japanese side.

#### 3-2 PO

Although the implementation schedule in the PO has not drastically been changed, the minor adjustments of the schedule were done as follows.

- **JICA experts**

In the first year, since the Project has focused on the field trial preparation, *i.e.*, developing the plan, the preparation of LBT Guideline was not carried out. Therefore, the JICA expert for “LBT Guideline” was not dispatched in the first year, and the preparation will be concentrated and promoted in the latter half of the second year after the completion of the field trial.

In terms of the “Maintenance of Machinery and Equipment”, the operations were integrated into one longer assignment in March 2017 because the equipment has already been delivered and handed over to DFR under the assistance of the leader (chief advisor) and deputy leader (deputy chief advisor) of the Project. The remaining works are to instruct how to use and maintain the equipment during and after the field trials.

- **Procedure for equipment provision**

All the equipment was smoothly delivered and handed over to the DFR immediately after the



procurement without wasting the time. In this way, these procedures were carried out ahead of the schedule indicated in the PO.

- **Activities**

Activity 2-7 “Identify the safeguard issues” will be postponed to be implemented during the first field trial. This is because the safeguard issues are clarified and identified during the field trial.

### **3-3 Other modification on detail implementation plan**

N/A

## **4. PREPARATION ON GOVERNMENT OF GHANA TOWARD AFTER COMPLETION OF THE PROJECT**

From the discussion made between the DFR and the Project, it was agreed and determined to shift the input of supervisor and worker of the field trials to the Japanese side, and this was compiled as PDM<sub>3</sub>.

As mentioned in the MS Ver.1.0 (previous version), sustainability is one of the critical key works of after the project completion, and therefore, importance of three factors which were 1) maintaining the government policy on LBT works, 2) allocation of budget to LBT works and 3) technical transfer were emphasized. Shifting part of the responsibility from the Ghana side to Japanese side might concern affecting the ownership of the counterpart in terms of above-mentioned three factors in particular. However, from the following reasons, it could be said that the sustainability would be secured even the roll of each party changes.

- 1) The counterpart would focus and concentrate on the preparation of the Guideline by using the data found from the field trial. Collection of data would be done by the supervisor, instead how to use or analysis shall be given to the counterpart.
- 2) The Project would support the counterpart in terms of operation of the construction works and collecting data.

**II. PROJECT MONITORING SHEET I & II**

## II-1 Project Monitoring SheetI (Version 3: 31st January, 2017)

### Project Design Matrix (PDM<sub>3</sub>)

**Project Title:** Project for Developing Labour Based Bituminous Surfacing Technology (LBST) in the Republic of Ghana  
**Implementation Agency in Ghana:** Department of Feeder Roads (DFR), Ministry of Roads and Highways (MRH)  
**Target Groups:** DFR officials and the officials concerned in Eastern Region

Version No. 3  
Date: Xth January, 2017

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions	Achievements	Remarks
<p><b>Overall Goal</b></p> <p>Measures are taken to make labour-based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.</p>	<ol style="list-style-type: none"> <li>Field trials along the LBST construction standard are conducted for further improvement and additional validation of labour-based bituminous surfacing technology in different climate and traffic conditions.</li> <li>Labour-based bituminous surfacing technology is officially adopted by DFR for feeder road surfacing.</li> <li>Training course for labour-based bituminous surfacing technology is set up according to the guidelines at the Koforidua Training Centre (KTC).</li> </ol>	<ol style="list-style-type: none"> <li>Field trial records, including the checklist of the LBST construction standard, prepared by DFR</li> <li>Approved guidelines by DFR</li> <li>Training records at KTC</li> </ol>			
<p><b>Project Purpose</b></p> <p>The methodology and application of labour-based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.</p>	<ol style="list-style-type: none"> <li>Labour-based bituminous surfacing technology fulfilling the criteria defined in the monitoring checklist is developed through the field trials.</li> <li>The self-rating of DFR officials and the officials concerned in Eastern Region for acquiring labour-based bituminous surfacing technology exceeds 65% on average.</li> </ol>	<ol style="list-style-type: none"> <li>Monitoring checklist filled out by JICA experts</li> <li>Questionnaire surveys to DFR officials and the officials concerned in Eastern Region</li> </ol>	<ol style="list-style-type: none"> <li>There is no significant change for the activities of DFR for feeder road services.</li> <li>There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road.</li> <li>The budget for the measures necessary for the labour-based bituminous surfacing technology is secured.</li> </ol>		
<p><b>Outputs</b></p> <ol style="list-style-type: none"> <li>Current conditions and issues for labour-based bituminous surfacing technology in Ghana are identified.</li> <li>Field trials of labour-based bituminous surfacing technology are carried out.</li> <li>Guidelines for labour-based bituminous surfacing technology are prepared.</li> </ol>	<ol style="list-style-type: none"> <li>1-1. Issues and results analysed by the experts and counterparts are indicated in the Project Monitoring Sheet (Summary).</li> <li>2-1. Lab tests of materials are conducted in accordance with the material standard.</li> <li>2-2. The field trials are conducted in line with the construction standard for labour-based bituminous surfacing technology (LBST construction standard).</li> <li>2-3. Task rates for labour-based bituminous surfacing technology are defined.</li> <li>3-1. Draft guidelines for labour-based bituminous surfacing technology is completed.</li> </ol>	<ol style="list-style-type: none"> <li>1-1. Project Monitoring Sheet (Summary)</li> <li>2-1. Certificate ("Results") of the lab tests</li> <li>2-2. Checklist of the LBST construction standard</li> <li>2-3. Summary table of task rates</li> <li>3-1. Draft guidelines for labour-based bituminous surfacing technology</li> </ol>	<p>There is no significant change in C/P assignment.</p>		

<p><b>Activities</b></p> <p>1-1 Collect and analyse information on the counterparts (C/Ps) organisational capacity (e.g., personnel, budget, experiences, etc.).</p> <p>1-2 Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana.</p> <p>1-3 Review and evaluate the similar technical standards and manuals prepared by such organisations as Department for International Development (DFID), South African Department of Public Works, etc.</p> <p>1-4 Confirm the procurement and cost of materials (e.g., gravels, etc.).</p> <p>1-5 Test and evaluate characteristics of the materials as stipulated by respective technical standards.</p> <p>1-6 Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana.</p> <p>1-7 Check the quality control systems and the procedures of road pavement work in Ghana.</p> <p>1-8 Check the maintenance management systems of feeder roads in Ghana.</p> <p>1-9 Compile and report the analysis on issues on labour-based bituminous surfacing technology in Ghana.</p> <hr/> <p>2-1 Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials).</p> <p>2-2 Conduct necessary lab tests to assess the characteristics of materials.</p> <p>2-3 Identify technical requirements (e.g., materials, methodology and process, quality control, etc.) through the field trials.</p> <p>2-4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials.</p> <p>2-5 Collect information on task rates.</p> <p>2-6 Identify the applicable conditions of the labour-based bituminous surfacing technology.</p> <p>2-7 Identify the safeguard issues.</p> <p>2-8 Prepare a report on above.</p> <p>2-9 Carry out on-the-job training (OJT) through above activities.</p> <hr/> <p>3-1 Determine the contents of the guidelines by reviewing the result of the first field trials.</p> <p>3-2 Prepare and agree with the outline of the guidelines by both sides.</p> <p>3-3 Draft the guidelines.</p> <p>3-4 Carry out the second field trial following the guidelines.</p> <p>3-5 Revise the draft based on the result of the second field trials as necessary.</p> <p>3-6 Carry out OJT through above activities.</p>	<p><b>Inputs</b></p> <p><b>Japanese side</b></p> <ol style="list-style-type: none"> <li>Experts <ul style="list-style-type: none"> <li>Chief Advisor/Feeder Road Development</li> <li>Road Pavement Technology</li> <li>LBT Guideline</li> <li>Cost Estimate/Safe Guard</li> <li>Site Supervisor</li> <li>Maintenance of Machinery and Equipment</li> <li>Environment</li> <li>Project Coordination/Training Planning</li> <li>Monitoring and Evaluation</li> <li>Project Review</li> </ul> </li> <li>Provision of machinery and equipment <ul style="list-style-type: none"> <li>Compactor</li> <li>Asphalt sprayer</li> <li>Asphalt heater</li> <li>Tractor</li> <li>Trailer</li> <li>Impact tamping rammer</li> <li>Equipment for Dynamic Cone Penetrometer (DCP) testing</li> </ul> </li> <li>Transportation for the experts</li> <li>Provision of third country training (e.g., South Africa)</li> <li>Costs for the field trials <ul style="list-style-type: none"> <li>Base and bituminous surface treatment</li> <li>Supervisors</li> <li>Workers</li> <li>Others as necessary</li> </ul> </li> </ol>	<p>DFR is able to utilize and mobilise available resources related to labour-based bituminous surfacing technology in Ghana (e.g., KTC, KNUST, GHIA Central Lab and their expertise, etc.) for the implementation of the Project.</p>
	<p><b>Ghanaian side</b></p> <ol style="list-style-type: none"> <li>Personnel <ul style="list-style-type: none"> <li>Project Director (DFR Director)</li> <li>Project Manager (Dy. Director of Planning, DFR)</li> <li>C/P (Mainly Planning Section and Eastern Region Office of DFR)</li> </ul> </li> <li>Expenses necessary for the field trials <ul style="list-style-type: none"> <li>Transportation for C/P staff</li> <li>Material test conducted at DFR (equipment, cost, etc.)</li> <li>Hand tools for pavement</li> <li>Road preparation at sub-base level for the field trials</li> </ul> </li> <li>Office space</li> <li>Furniture (e.g., desks, etc.)</li> <li>Means of communication at the head office (e.g., internet connection)</li> </ol>	<p><b>Pre-conditions</b></p> <ol style="list-style-type: none"> <li>Ghanaian side provides technical documents on LBT.</li> <li>Laboratory testing of materials is available.</li> <li>The sites for field trials are ensured (these sites must be prepared with the road bed and filled with sub base course materials, etc.).</li> </ol> <p>&lt;Issues and Countermeasures&gt;</p>

II-2. Project Monitoring Sheet II (Plan of Operations)

Version 3  
 Dated 12/17/17

Project Title: The Project for Developing Labour Based Bituminous Surfacing Technology	2016												2017												2018												2019												Monitoring	
	I			II			III			IV			V			VI			VII			VIII			IX			X			XI			XII			Issue	Solution												
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12			1	2	3	4	5	6	7	8	9	10	11	12
<b>Inputs</b>																																																		
<b>Expert</b>																																																		
Mitsuo OGAWA (Leader/Rural Road Planner)																																																		
Seiji KUROKI (Road Pavement Technology)																																																		
Hiroaki TAKAHASHI (LBT Guidelines)																																																		
Kazuo AKASHI (Cost Estimation/Field Check)																																																		
Tatsuo SHIMAZU (Site Supervisor)																																																		
Masao TAKECHI (Maintenance of Machinery and Equipment)																																																		
Nobuo SASAKI (Environment)																																																		
Takashi HIRAKAWA (Monitoring and Evaluation)																																																		
Yoshitaka TAKEDA (Project Coordination)																																																		
Mayumi SHOUJI (Project Coordination/ Monitoring and Evaluation)																																																		
Tetsuro TOKUNAGA (Project Review)																																																		
<b>Equipment</b>																																																		
Procurement																																																		
Delivery																																																		
Handover																																																		
Seminar																																																		
South Africa (Tentative)																																																		
<b>Activities</b>																																																		
<b>Sub-activities</b>																																																		
<b>Output 1: Current Conditions and Issues of Labour Based Bituminous Surfacing Technology in Ghana are Identified</b>																																																		
1.1 Collect and analyze information on the competitive (CPI) organizations																																																		
1.2 Collect budget requirements for materials and design guidelines for bituminous surface technology in Ghana																																																		
1.3 Review and evaluate the similar technical standards and manuals prepared by each country																																																		
1.4 Confirm the procurement and cost of materials (e.g. gravel)																																																		
1.5 Test and evaluate characteristics of the materials as stipulated by respective countries																																																		
1.6 Assess the procedures for design and procurement of road works maintenance and rehabilitation in Ghana																																																		
1.7 Check the quality control systems and the procedures of road pavement work in Ghana																																																		
1.8 Check the maintenance management systems of feeder roads in Ghana																																																		
1.9 Compile and report the analysis on issues on labor-based bituminous surfacing technology in Ghana																																																		
<b>Output 2: Field trials of labor based bituminous surfacing technology are carried out</b>																																																		
2.1 Prepare the equipment, manpower, materials, and the road appropriate line for the trials																																																		
2.2 Conduct necessary tasks to assess the characteristics of materials																																																		
2.3 Identify (test) requirements for materials, methodology and process, quality control, etc.) through the field trials																																																		
2.4 Identify planning and managerial requirements (operable and section, budget, strategy for dissemination, etc.) through the field trials																																																		
2.5 Collect information on task rates																																																		
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Set-up the indicators and means of verification																																																		
Submission of Monitoring Sheet																																																		
<b>Reports/Documents</b>																																																		
Project Progress Report																																																		
Project Completion Report																																																		
<b>Public Relations</b>																																																		
Project news																																																		
<b>Issues &amp; Comments</b>																																																		



Attachment-2 List of equipment

No	Date of registration	Description/Name of equipment/ Goods	Specification - Standard	QTY	Price	unit	Provider	User	Purpose of Use	Place of Use	Responsible Person	Hand Over
1	23-Jan-16	Projector	EPSON EB-S31	1	445.68	USD	(Electronic retail shop in Japan)	Expert	Workshop /Presentation	DFR	Expert	
2	12-Feb-16	Printer	Ricoh MPC2011	1	6,075.91	USD	IMPC Intercom Programming & Manufacturing Co. Ltd.	Expert	Means of Documentation	DFR	Expert	
3	3-Aug-16	Cold Bitumen Sprayer	ID10CB	2	5,950.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
4	3-Aug-16	Plate Compactor	Bell, PCX450	2	4,475.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
5	3-Aug-16	Mobile Concrete Mixer	Bell, 400D	1	2,987.50	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
6	18-Aug-16	Tractor	75 HP, Diesel Engine, Tools	2	73,000.00	USD	Afgrl Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	
7	18-Aug-16	Tralor	Towed Type, 5000kg capacity, Tools	2			Afgrl Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	
8	18-Aug-16	Spare parts for tractor and tralor	-	1	1,441.00	USD	Afgrl Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	
9	26-Aug-16	Duplex Roller	Atlas, LP750	2	32,373.18	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	
10	26-Aug-16	Engine Suction Water Pump	Technoele, KGP80D	2	1,297.48	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	
11	26-Aug-16	Mechanical Tool Set	-	1	530.21	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	
12	8-Nov-16	Water Bowser	ID5000L	1	8,850.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
13	8-Nov-16	Manual hand Asphalt Sprayer	ID10M	2	3,880.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
14	8-Nov-16	Chip Spreader	NCA, Chippy	4	27,580.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
15	8-Nov-16	Spare parts	-	1	3,143.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
16	8-Dec-16	TRL Dynamic Cone Penetrometer (DCP)	Code: 16-T0012/A, Weight, 86K-gs, Dims: 117x51x40cm	2	4,374.20	USD	Askia Ltd	C/P	For Project Activities	KTC	KTC/DFR	
17	8-Dec-16	Spare parts	-	1	10,613.94	USD	Askia Ltd	C/P	For Project Activities	KTC	KTC/DFR	
Total					186,571.42	USD						





**Attachment-4 Local Operation Costs (Ghana Side)**

Local Cost Allocated by Ghana Side		Local Cost				
		MS Ver. 2 Feb. 2016 to Jul. 2016	MS Ver. 3 Aug. 2016 to January 2017	MS Ver. 4 *** 2017 to *** 2017	MS Ver. 5 *** 2017 to *** 2018	MS Ver. 6 *** 2018 to *** 2018
<b>1-1</b>	<b>Personals</b>					
	1 C/P Salaries	Director DFR Deputy Director of Planning Principal Engineer (Coordinator) Principal Engineer (Technical Workshop) Mechanical Engineer Director of Eastern Region	Director DFR Deputy Director of Planning Principal Engineer (Coordinator) Principal Engineer (Technical Workshop) Mechanical Engineer Director of Eastern Region			
<b>1-2</b>	<b>Human Resources and expenses necessary for the field trials</b>					
	1 Supervisors	N/A	N/A			
	2 Workers	N/A	N/A			
	3 Transportations for C/P staff	Travel allowance and accomodation, fuel borne by DFR	N/A			
	4 Material test conducted at DFR	N/A	N/A			
	5 Hand tools for pavement	N/A	N/A			
	6 Road preparation at the sub-based level	N/A	N/A			
<b>1-3</b>	<b>Office Space</b>					
	1 Office space	DFR prepared Room 106 at DFR head office for the Project				
<b>1-4</b>	<b>Furniture</b>					
	1 office facilities	DFR provide desks, chairs, power, air conditioner and HP color printer for the Project				
<b>1-5</b>	<b>Means of communication at the head office</b>					
	1 Communication Tools	Internet WiFi and a land line prepared for the Project				
<b>1-6</b>	<b>Others</b>					
	1					

## Activity Performed (as of end of January, 2017)

OUTPUT-1 Current Conditions and issues for labour based bituminous surfacing technology in Ghana are identified.									
Activity 1-1 <b>Completed</b>	<p>&lt;Collect and analyze information on the counterparts (C/P's) organizational capacity (e.g. personal, budget, experiences, etc.)&gt;</p> <ul style="list-style-type: none"> <li>• Origination, number of engineers, budget and experience on LBT of DFR as well as the eastern region office were surveyed</li> <li>• Visited KTC and surveyed the capacity maintaining equipment. It was confirmed that KTC will be the appropriate organization to place and do the maintenance for the equipment which the Project and JICA will procure.</li> </ul>								
Activity 1-2 <b>Completed</b>	<p>&lt;Collect information regarding technical standards and design guidelines for bituminous surface technology on Ghana&gt;</p> <ul style="list-style-type: none"> <li>• Technical standards and guideline relating to LBT works from African countries in particular were collected. Totally, 24 numbers of standards and guideline such as Ethiopian, Tanzanian, Kenyan, South African and others were collected and evaluated.</li> </ul>								
Activity 1-3 <b>Completed</b>	<p>&lt;Review and evaluate the similar technology standards and manual prepared by such organizations as Department for International Development (DFID), South African Department of Public Works, etc.&gt;</p> <ul style="list-style-type: none"> <li>• From discussion with DFR, it was determined to apply cold emulsion asphalt rather than heated asphalt from the research in the past as well as safety. KNUST has attempted applying Otta seal pavement which requires heated cutback asphalt and was found difficultly utilizing it in Ghana's condition. From this, it was recommended to choose cold asphalt pavement, Sand seal and single surface dressing in the trial construction.</li> <li>• Evaluation through the collected documents, it was found that technical manual of Ethiopia covers most of the target pavements mentioned above. From this, referring to the Ethiopian manual was considered.</li> <li>• KTC was implementing a road design training utilizing DCP by World Bank support. This training was following the contents of the Ethiopian Manual, and from this, it was decided refer to Ethiopian Manual dominant.</li> </ul>								
Activity 1-4 <b>Completed</b>	<p>&lt;Confirm the procurement and cost of materials (e.g. gravels, etc.)&gt;</p> <ul style="list-style-type: none"> <li>• From interview, following were found as a general price of materials to be used in the trial construction. <table border="1" data-bbox="849 663 1062 1469"> <thead> <tr> <th>Materials</th> <th>General Unit Price from interview</th> </tr> </thead> <tbody> <tr> <td>Cold emulsion</td> <td>560 GHS /drum include transport to trial site (drum =200 liters)</td> </tr> <tr> <td>Chippings</td> <td>65 GHS /m<sup>3</sup> (20-25mm) 40 GHS/m<sup>3</sup> (Dust) 56 GHS/m<sup>3</sup> (0-40 mixed)</td> </tr> <tr> <td>Gravel</td> <td>33 GHS/m<sup>3</sup> incl. transport to trial site</td> </tr> </tbody> </table> </li> <li>• Price fluctuation were surveyed and it was found that unit price of local labour and chipping continuously increased over the pass 1.5 years, and conversely the price of bitumen easily get influence from the international market which means not stable.</li> <li>• From the record, it was found the unit price of labour grow double in 1.5 years from the baseline where chipping were 1.5 times higher as well. For bitumen, price has escalated 2.4 times higher tentatively and came down to the original price eventually. It can be said that price of the bitumen is quite difficult to predict compare with the chippings and labours.</li> </ul>	Materials	General Unit Price from interview	Cold emulsion	560 GHS /drum include transport to trial site (drum =200 liters)	Chippings	65 GHS /m <sup>3</sup> (20-25mm) 40 GHS/m <sup>3</sup> (Dust) 56 GHS/m <sup>3</sup> (0-40 mixed)	Gravel	33 GHS/m <sup>3</sup> incl. transport to trial site
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Activity 1-5 <b>Completed</b>	<p>&lt;Test and evaluate characteristics of the materials as stipulated by respective technical standards&gt;</p> <ul style="list-style-type: none"> <li>• Confirmed implementing material testing will be conducted at the central material laboratory. The Capacity and capability of the laboratory was confirmed by observing the tests actually and interview to the technicians.</li> <li>• Quality and general cost for chipping (aggregate), gravel and cold emulsion were confirmed through interview to suppliers, contractors and DFR engineers.</li> </ul>								
Activity 1-6 <b>Completed</b>	<p>&lt;Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana&gt;</p> <ul style="list-style-type: none"> <li>• From interview to counterparts, it was grasped that there is a roll between headquarter and regional office. Most of the field works such as inventory survey,</li> </ul>								

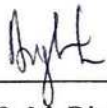
	<p>designing cost estimation, tendering and quality control are under jurisdiction of the regional office while the headquarter has roll to monitor and give approval to the planning as well as payment to the contractors. So, regarding the procedures for design and procurement, the system is established appropriately.</p> <ul style="list-style-type: none"> <li>• Most of the feeder roads in Ghana are gravel surface and bituminous surface is very little. The design of the surface is done by following the MRH standards. The design of the single surface is indicated in the MRH design manual and although this manual is based in EBT method, since the structure itself doesn't have difference between LBT, it can be understood still valid applying on feeder roads. From the above-mentioned discussion, the necessity of creating a new guideline for LBT in use of bitumen, which is the major output of this Project, was re-confirmed.</li> </ul>												
Activity 1-7 <b>Completed</b>	<p><u>&lt;Check the quality control systems and the procedures of road pavement work in Ghana&gt;</u></p> <ul style="list-style-type: none"> <li>• Quality control in actual construction is a roll of the regional office. The regional office does the quality control followed by the MRH standard.</li> </ul>												
Activity 1-8 <b>Completed</b>	<p><u>&lt;Check the maintenance management systems of feeder roads in Ghana&gt;</u></p> <ul style="list-style-type: none"> <li>• It was grasped that DFR has system which names RPM (Road Prioritisation Methodology), GIS (Database and Geographical Information System) and MPBS (Maintenance Performance Budgeting System). So, most of the DFR's activities from selecting the annual target road to making BOQ of it is systemized and confirmed working under the solid total system.</li> </ul>												
Activity 1-9 <b>Completed</b>	<p><u>&lt;Compile and report the analysis on issues on labour-based bituminous surfacing technology in Ghana&gt;</u></p> <ul style="list-style-type: none"> <li>• Contents of the activity 1-1 to activity 1-9 have been compiled in a report including the results of the materials which was the missing item in MS2.</li> </ul>												
<b>OUTPUT-2 Field Trials of labour-based bituminous surfacing technology are carried out.</b>													
Activity 2-1 <b>Completed</b>	<p><u>&lt;Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials&gt;</u></p> <ul style="list-style-type: none"> <li>• The technical workshop was conducted as follows</li> </ul>												
	<table border="1"> <thead> <tr> <th data-bbox="710 1675 734 1765">S/N</th> <th data-bbox="710 1422 734 1675">Date</th> <th data-bbox="710 1041 734 1422">Participants</th> <th data-bbox="710 239 734 1041">Major discussion and Conclusion</th> </tr> </thead> <tbody> <tr> <td data-bbox="734 1675 758 1765">1</td> <td data-bbox="734 1422 758 1675">27<sup>th</sup> July, 2016</td> <td data-bbox="734 1041 758 1422">DFR, Eastern Region, JICA, LBST</td> <td data-bbox="734 239 965 1041"> <ul style="list-style-type: none"> <li>• Basic contents of the trial construction plan were confirmed.</li> <li>• Cold Bitumen, Sand Seal and Single Surface were chosen as a target pavement type to be incorporated in the guideline.</li> <li>• A contractor shall be hired by DFR to conduct the trial construction while the materials shall be provided by the Project.</li> <li>• A private consultant shall be hired by the Project to collect data from the trial construction.</li> <li>• The essence of utilizing LBT is the construction cost and durability.</li> </ul> </td> </tr> <tr> <td data-bbox="965 1675 989 1765">2</td> <td data-bbox="965 1422 989 1675">14th Sep., 2016</td> <td data-bbox="965 1041 989 1422">DFR, Eastern Region, JICA, LBST</td> <td data-bbox="965 239 1383 1041"> <ul style="list-style-type: none"> <li>• The objective of implementing the trial construction was defined as 1) determined the appropriate construction method to apply LBT on bituminous works, 2) confirm the balance between both labour and equipment based constructions, 3) record the spray and consumption rate of materials, 4) found findings related to safety and environment, and 5) reflect the lesson obtained to the Guideline.</li> <li>• Target road and section of the trial construction was chosen between Obomofe Densua-Atoke villages at Suhun, Municipal, and Eastern Region near KTC. The distance was approx. 3.2 km</li> <li>• Since the construction of sub-base is now implemented by LBT, it was discussed and approved that the procurement of the labour which is the responsibility of DFR according to the PDM<sub>2</sub>, shall be made with the same contractor by amending the current contract.</li> <li>• Based on the submitted current status report, it was discussed and approved that the work items method should be single chip seal and cold mix asphalt. However,</li> </ul> </td> </tr> </tbody> </table>	S/N	Date	Participants	Major discussion and Conclusion	1	27 <sup>th</sup> July, 2016	DFR, Eastern Region, JICA, LBST	<ul style="list-style-type: none"> <li>• Basic contents of the trial construction plan were confirmed.</li> <li>• Cold Bitumen, Sand Seal and Single Surface were chosen as a target pavement type to be incorporated in the guideline.</li> <li>• A contractor shall be hired by DFR to conduct the trial construction while the materials shall be provided by the Project.</li> <li>• A private consultant shall be hired by the Project to collect data from the trial construction.</li> <li>• The essence of utilizing LBT is the construction cost and durability.</li> </ul>	2	14th Sep., 2016	DFR, Eastern Region, JICA, LBST	<ul style="list-style-type: none"> <li>• The objective of implementing the trial construction was defined as 1) determined the appropriate construction method to apply LBT on bituminous works, 2) confirm the balance between both labour and equipment based constructions, 3) record the spray and consumption rate of materials, 4) found findings related to safety and environment, and 5) reflect the lesson obtained to the Guideline.</li> <li>• Target road and section of the trial construction was chosen between Obomofe Densua-Atoke villages at Suhun, Municipal, and Eastern Region near KTC. The distance was approx. 3.2 km</li> <li>• Since the construction of sub-base is now implemented by LBT, it was discussed and approved that the procurement of the labour which is the responsibility of DFR according to the PDM<sub>2</sub>, shall be made with the same contractor by amending the current contract.</li> <li>• Based on the submitted current status report, it was discussed and approved that the work items method should be single chip seal and cold mix asphalt. However,</li> </ul>
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	3		9 <sup>th</sup> Nov., 2016	DFR, Eastern Region, JICA, LBST, KNUST, ILO	<p>it was also confirmed that the standard structure of single chip seal in Ghana means 2 layers which applies 14mm chip on first and 9mm chip on second layer.</p> <ul style="list-style-type: none"> <li>Based on the conclusion of 2<sup>nd</sup> TW, BoQ applying single chip seal and cold mix asphalt was reported and due to budgetary reasons, it was recommended to adjust the construction length to meet the fixed sealing price. However, it was also discussed the necessity of having practice of spraying and spreading prior to actual construction for lesson obtained from the equipment operation training conducted at KTC.</li> <li>It was reported from the Chief Consultant that demarcation between the Project and DFR, the Project shall bear the labour and the contractor which it is the responsibility of DFR currently. From this, the PDM should be amended at the next Monitoring Sheet accordingly.</li> <li>Since the Ethiopian manual covers most of the area which this project aims, it was discussed and approved to refer this manual to build technical specification of the tendering documents. Relate to technical matters, the thickness of cold mix asphalt was discussed and approved to apply 14mm which is stated as the standard according to the Ethiopia manual.</li> <li>The Chief Consultant explained the further schedule that the tendering shall be implemented by restrict tendering and pre-tendering around begging of December, and tendering on 24<sup>th</sup> January tentatively. With collaboration of DFR and the Project, the tendering documents shall be made before end of November.</li> </ul>
<ul style="list-style-type: none"> <li>From discussion made above, preparation of tendering documents which includes agreement and technical specification was completed by end of November. In the technical specification, both objective and methodology of implementing the trial construction was clearly mentioned. This tendering documents were sold to contractors who show the interest and passed the criteria of restrict tendering. Pre-tendering meeting was held on 6<sup>th</sup> December and tendering on 24<sup>th</sup> of January, 2017 as scheduled. A. Naggesten Ltd. presented the lowest price and expect have signing between Eight-Japan Engineering Consultants Inc. on early February.</li> </ul>					
Activity 2-2					<Conduct necessary lab tests to assess the characteristics of materials>
Activity 2-3					<Identify technical requirements (e.g., materials, methodology and process, quality control, etc.) through the field trials>
Activity 2-4					<Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials>
Activity 2-5					<Collect information on task rates>
Activity 2-6					<Identify the applicable conditions of the labour-based bituminous surfacing technology>
Activity 2-7					<Identify the safeguard issues>
Activity 2-8					<Prepare a report on above>
Activity 2-9					<Carry out on-the-job training (OJT) through above activities>
<b>Under Implementation</b>					<ul style="list-style-type: none"> <li>All of the activities from Activity 1-1 to Activity 2-1 were carried out with collaboration between the DFR members and Japanese Experts.</li> <li>The DFR members with KTC and the contractors had a equipment operational training at KTC. The trainees had opportunity how to maintain the equipment as well as operation systemically. The JICA provided equipment was used for the training.</li> </ul>
<b>OUTPUT-3 Guidelines for labour-based bituminous surfacing technology are prepared</b>					

Activity 3-1				<Determine the contents of the guidelines by reviewing the result of the first field trials>			
S/N	Date	Participants	Major discussion and Conclusion				
4	Scheduled on Jun., 2017	-	-				
5	Scheduled on Sep. 2017	-	-				
6	Scheduled on Nov. 2017	-	-				
7	Scheduled on Jun. 2018	-	-				
8	Scheduled on Sep. 2018	-	-				
Activity 3-2				<Prepare and agree with the outline of the guidelines by both sides>			
Activity 3-3				<Draft the guidelines>			
Activity 3-4				<Carry out the second field trial following the guidelines>			
Activity 3-5				<Revise the draft based on the result of the second field trials as necessary>			
Activity 3-6				<Carry out OJT through above activities>			
<b>OTHER OUTPUTS</b>							
Procurement of equipment		Completed		<ul style="list-style-type: none"> <li>All equipment was delivered and inspected properly by the Japanese Experts. For details, refer to Attachment-2.</li> <li>Equipment operational training was conducted from 21<sup>st</sup> to 24<sup>th</sup> November, 2016 at KTC.</li> </ul>			
The third country Training		N/A					
Technical Seminar		N/A					

MINUTES OF THE MEETING  
ON  
THE MODIFICATION OF THE PROJECT DESIGN MATRIX (PDM)  
FOR  
THE PROJECT FOR DEVELOPING LABOUR-BASED BITUMINOUS  
SURFACING TECHNOLOGY (LBST)  
IN THE REPUBLIC OF GHANA  
AGREED UPON BETWEEN  
THE DEPARTMENT OF FEEDER ROADS (DFR)  
AND  
THE EXPERT TEAM OF JAPAN INTERNATIONAL COOPERATION  
AGENCY (JICA)

Accra, 31<sup>st</sup> January, 2017



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Mr. F.O. M. Digber  
Director  
Department of Feeder Roads  
Ministry of Roads and Highways



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Mr. Motoki Ogawa  
Chief Advisor  
LBST Project  
Eight-Japan Engineering Consultants Inc.

Based on a series of discussions between the Department of Feeder Roads (DFR) of the Ministry of Roads and Highways (MRH) and the expert team of Japan International Cooperation Agency (JICA), both sides agreed on the revision of the Project Design Matrix 2 (PDM<sub>2</sub>) and the major modifications discussed as indicated in the Appendix I for the smooth implementation of the Project.

Both sides also agreed on the implementation of the Project according to the revised version of the PDM<sub>2</sub>, *i.e.*, “PDM<sub>3</sub>”, as described in the Appendix II and III to ensure that the self-reliant operation of the Project is sustained during and after the implementation period.

Appendix I: Modification of the PDM<sub>2</sub>

Appendix II: PDM<sub>3</sub>

Appendix III: PDM<sub>2</sub>

## Appendix I: Modification of the PDM<sub>2</sub>

The Inputs were modified as shown in the Table below because Japanese side mainly came to be responsible for the operational cost of the field trials, including labour forces, through subcontracting agreement with contractors.

The current version (PDM<sub>2</sub>) explicitly describes that the expenses for transportation for the counterparts and the material tests are supposed to be secured by Ghanaian side. For clarification, moreover, the daily allowances for the counterpart during the field trials shall also be allocated by Ghanaian side.

**Table: Modification of the PDM<sub>2</sub>**

Components of the PDM		Corrections
Inputs	Japanese side	At the line of the field trials, the labour forces (supervisors, workers, etc.) and other necessary expenses were added to the “base and bituminous surface treatment.”
	Ghanaian side	At the same portion as shown above, the labour forces were deleted from the Ghanaian side because they were moved into the Japanese side.



**Appendix II  
Project Design Matrix (PDM<sub>3</sub>)**

**Project Title:** Project for Developing Labour Based Bituminous Surfacing Technology (LBST) in the Republic of Ghana  
**Implementation Agency in Ghana:** Department of Feeder Roads (DFR), Ministry of Roads and Highways (MRH)  
**Target Groups:** DFR officials and the officials concerned in Eastern Region

Version No. 3  
 Date: Xth January, 2017

**Project Period:** February, 2016 – December, 2018  
**Project Sites:** Accra (capital) and feeder roads in Eastern Region

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions	Achievements	Remarks
<p><b>Overall Goal</b>                      Measures are taken to make labour-based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.</p>	<ol style="list-style-type: none"> <li>Field trials along the LBST construction standard are conducted for further improvement and additional validation of labour-based bituminous surfacing technology in different climate and traffic conditions.</li> <li>Labour-based bituminous surfacing technology is officially adopted by DFR for feeder road surfacing.</li> <li>Training course for labour-based bituminous surfacing technology is set up according to the guidelines at the Koforidua Training Centre (KTC).</li> </ol>	<ol style="list-style-type: none"> <li>Field trial records, including the checklist of the LBST construction standard, prepared by DFR</li> <li>Approved guidelines by DFR</li> <li>Training records at KTC</li> </ol>			
<p><b>Project Purpose</b>                      The methodology and application of labour-based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.</p>	<ol style="list-style-type: none"> <li>Labour-based bituminous surfacing technology fulfilling the criteria defined in the monitoring checklist is developed through the field trials.</li> <li>The self-rating of DFR officials and the officials concerned in Eastern Region for acquiring labour-based bituminous surfacing technology exceeds 65% on average.</li> </ol>	<ol style="list-style-type: none"> <li>Monitoring checklist filled out by JICA experts</li> <li>Questionnaire surveys to DFR officials and the officials concerned in Eastern Region</li> </ol>	<ol style="list-style-type: none"> <li>There is no significant change for the activities of DFR for feeder road services.</li> <li>There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road.</li> <li>The budget for the measures necessary for the labour-based bituminous surfacing technology is secured.</li> </ol>		
<p><b>Outputs</b></p> <ol style="list-style-type: none"> <li>Current conditions and issues for labour-based bituminous surfacing technology in Ghana are identified.</li> <li>Field trials of labour-based bituminous surfacing technology are carried out.</li> <li>Guidelines for labour-based bituminous surfacing technology are prepared.</li> </ol>	<ol style="list-style-type: none"> <li>1-1. Issues and results analysed by the experts and counterparts are indicated in the Project Monitoring Sheet (Summary).</li> <li>2-1. Lab tests of materials are conducted in accordance with the material standard.</li> <li>2-2. The field trials are conducted in line with the construction standard for labour-based bituminous surfacing technology (LBST construction standard).</li> <li>2-3. Task rates for labour-based bituminous surfacing technology are defined.</li> <li>3-1. Draft guidelines for labour-based bituminous surfacing technology is completed.</li> </ol>	<ol style="list-style-type: none"> <li>1-1. Project Monitoring Sheet (Summary)</li> <li>2-1. Certificate ("Results") of the lab tests</li> <li>2-2. Checklist of the LBST construction standard</li> <li>2-3. Summary table of task rates</li> <li>3-1. Draft guidelines for labour-based bituminous surfacing technology</li> </ol>	<p>There is no significant change in C/P assignment.</p>		

<p><b>Activities</b></p> <p>1-1 Collect and analyse information on the counterparts (C/Ps) organisational capacity (e.g., personnel, budget, experiences, etc.).</p> <p>1-2 Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana.</p> <p>1-3 Review and evaluate the similar technical standards and manuals prepared by such organisations as Department for International Development (DFID), South African Department of Public Works, etc.</p> <p>1-4 Confirm the procurement and cost of materials (e.g., gravels, etc.).</p> <p>1-5 Test and evaluate characteristics of the materials as stipulated by respective technical standards.</p> <p>1-6 Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana.</p> <p>1-7 Check the quality control systems and the procedures of road pavement work in Ghana.</p> <p>1-8 Check the maintenance management systems of feeder roads in Ghana.</p> <p>1-9 Compile and report the analysis on issues on labour-based bituminous surfacing technology in Ghana.</p> <hr/> <p>2-1 Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials).</p> <p>2-2 Conduct necessary lab tests to assess the characteristics of materials.</p> <p>2-3 Identify technical requirements (e.g., materials, methodology and process, quality control, etc.) through the field trials.</p> <p>2-4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials.</p> <p>2-5 Collect information on task rates.</p> <p>2-6 Identify the applicable conditions of the labour-based bituminous surfacing technology.</p> <p>2-7 Identify the safeguard issues.</p> <p>2-8 Prepare a report on above.</p> <p>2-9 Carry out on-the-job training (OJT) through above activities.</p> <hr/> <p>3-1 Determine the contents of the guidelines by reviewing the result of the first field trials.</p> <p>3-2 Prepare and agree with the outline of the guidelines by both sides.</p> <p>3-3 Draft the guidelines.</p> <p>3-4 Carry out the second field trial following the guidelines.</p> <p>3-5 Revise the draft based on the result of the second field trials as necessary.</p> <p>3-6 Carry out OJT through above activities.</p>	<p><b>Inputs</b></p> <p><b>Japanese side</b></p> <ol style="list-style-type: none"> <li>Experts <ul style="list-style-type: none"> <li>Chief Advisor/Feeder Road Development</li> <li>Road Pavement Technology</li> <li>LBT Guideline</li> <li>Cost Estimate/Safe Guard</li> <li>Site Supervisor</li> <li>Maintenance of Machinery and Equipment</li> <li>Environment</li> <li>Project Coordination/Training Planning</li> <li>Monitoring and Evaluation</li> <li>Project Review</li> </ul> </li> <li>Provision of machinery and equipment <ul style="list-style-type: none"> <li>Compactor</li> <li>Asphalt sprayer</li> <li>Asphalt heater</li> <li>Tractor</li> <li>Trailer</li> <li>Impact tamping rammer</li> <li>Equipment for Dynamic Cone Penetrometer (DCP) testing</li> </ul> </li> <li>Transportation for the experts</li> <li>Provision of third country training (e.g., South Africa)</li> <li>Costs for the field trials <ul style="list-style-type: none"> <li>Base and bituminous surface treatment</li> <li>Supervisors</li> <li>Workers</li> <li>Others as necessary</li> </ul> </li> </ol>	<p>DFR is able to utilize and mobilise available resources related to labour-based bituminous surfacing technology in Ghana (e.g., KTC, KNUST, GHIA Central Lab and their expertise, etc.) for the implementation of the Project.</p>
	<p><b>Ghanaian side</b></p> <ol style="list-style-type: none"> <li>Personnel <ul style="list-style-type: none"> <li>Project Director (DFR Director)</li> <li>Project Manager (Dy. Director of Planning, DFR)</li> <li>C/P (Mainly Planning Section and Eastern Region Office of DFR)</li> </ul> </li> <li>Expenses necessary for the field trials <ul style="list-style-type: none"> <li>Transportation for C/P staff</li> <li>Material test conducted at DFR (equipment, cost, etc.)</li> <li>Hand tools for pavement</li> <li>Road preparation at sub-base level for the field trials</li> </ul> </li> <li>Office space</li> <li>Furniture (e.g., desks, etc.)</li> <li>Means of communication at the head office (e.g., internet connection)</li> </ol>	<p><b>Pre-conditions</b></p> <ol style="list-style-type: none"> <li>Ghanaian side provides technical documents on LBT.</li> <li>Laboratory testing of materials is available.</li> <li>The sites for field trials are ensured (these sites must be prepared with the road bed and filled with sub base course materials, etc.).</li> </ol> <p>&lt;Issues and Countermeasures&gt;</p>

### Appendix III

#### Project Design Matrix (PDM<sub>2</sub>)

**Project Title:** Project for Developing Labour Based Bituminous Surfacing Technology (LBST) in the Republic of Ghana  
**Implementation Agency in Ghana:** Department of Feeder Roads (DFR), Ministry of Roads and Highways (MRH)

Version No. 2  
 Date: 26th July, 2016

**Project Sites:** Accra (capital) and feeder roads in Eastern Region

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions	Achievements	Remarks
<p><b>Overall Goal</b></p> <p>Measures are taken to make labour-based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.</p>	<ol style="list-style-type: none"> <li>Field trials along the LBST construction standard are conducted for further improvement and additional validation of labour-based bituminous surfacing technology in different climate and traffic conditions.</li> <li>Labour-based bituminous surfacing technology is officially adopted by DFR for feeder road surfacing.</li> <li>Training course for labour-based bituminous surfacing technology is set up according to the guidelines at the Koforidua Training Centre (KTC).</li> </ol>	<ol style="list-style-type: none"> <li>Field trial records, including the checklist of the LBST construction standard, prepared by DFR</li> <li>Approved guidelines by DFR</li> <li>Training records at KTC</li> </ol>			
<p><b>Project Purpose</b></p> <p>The methodology and application of labour-based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.</p>	<ol style="list-style-type: none"> <li>Labour-based bituminous surfacing technology fulfilling the criteria defined in the monitoring checklist is developed through the field trials.</li> <li>The self-rating of DFR officials and the officials concerned in Eastern Region for acquiring labour-based bituminous surfacing technology exceeds 65% on average.</li> </ol>	<ol style="list-style-type: none"> <li>Monitoring checklist filled out by JICA experts</li> <li>Questionnaire surveys to DFR officials and the officials concerned in Eastern Region</li> </ol>	<ol style="list-style-type: none"> <li>There is no significant change for the activities of DFR for feeder road services.</li> <li>There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road.</li> <li>The budget for the measures necessary for the labour-based bituminous surfacing technology is secured.</li> </ol>		
<p><b>Outputs</b></p> <ol style="list-style-type: none"> <li>Current conditions and issues for labour-based bituminous surfacing technology in Ghana are identified.</li> <li>Field trials of labour-based bituminous surfacing technology are carried out.</li> <li>Guidelines for labour-based bituminous surfacing technology are prepared.</li> </ol>	<ol style="list-style-type: none"> <li>1-1. Issues and results analysed by the experts and counterparts are indicated in the Project Monitoring Sheet (Summary).</li> <li>2-1. Lab tests of materials are conducted in accordance with the material standard.</li> <li>2-2. The field trials are conducted in line with the construction standard for labour-based bituminous surfacing technology (LBST construction standard).</li> <li>2-3. Task rates for labour-based bituminous surfacing technology are defined.</li> <li>3-1. Draft guidelines for labour-based bituminous surfacing technology is completed.</li> </ol>	<ol style="list-style-type: none"> <li>1-1. Project Monitoring Sheet (Summary)</li> <li>2-1. Certificate ("Results") of the lab tests</li> <li>2-2. Checklist of the LBST construction standard</li> <li>2-3. Summary table of task rates</li> <li>3-1. Draft guidelines for labour-based bituminous surfacing technology</li> </ol>	<p>There is no significant change in C/P assignment.</p>		

<p><b>Activities</b></p> <p>1-1 Collect and analyse information on the counterparts (C/Ps) organisational capacity (e.g., personnel, budget, experiences, etc.).</p> <p>1-2 Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana.</p> <p>1-3 Review and evaluate the similar technical standards and manuals prepared by such organisations as Department for International Development (DFID), South African Department of Public Works, etc.</p> <p>1-4 Confirm the procurement and cost of materials (e.g., gravels, etc.).</p> <p>1-5 Test and evaluate characteristics of the materials as stipulated by respective technical standards.</p> <p>1-6 Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana.</p> <p>1-7 Check the quality control systems and the procedures of road pavement work in Ghana.</p> <p>1-8 Check the maintenance management systems of feeder roads in Ghana.</p> <p>1-9 Compile and report the analysis on issues on labour-based bituminous surfacing technology in Ghana.</p> <hr/> <p>2-1 Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials).</p> <p>2-2 Conduct necessary lab tests to assess the characteristics of materials.</p> <p>2-3 Identify technical requirements (e.g., materials, methodology and process, quality control, etc.) through the field trials.</p> <p>2-4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials.</p> <p>2-5 Collect information on task rates.</p> <p>2-6 Identify the applicable conditions of the labour-based bituminous surfacing technology.</p> <p>2-7 Identify the safeguard issues.</p> <p>2-8 Prepare a report on above.</p> <p>2-9 Carry out on-the-job training (OJT) through above activities.</p> <hr/> <p>3-1 Determine the contents of the guidelines by reviewing the result of the first field trials.</p> <p>3-2 Prepare and agree with the outline of the guidelines by both sides.</p> <p>3-3 Draft the guidelines.</p> <p>3-4 Carry out the second field trial following the guidelines.</p> <p>3-5 Revise the draft based on the result of the second field trials as necessary.</p> <p>3-6 Carry out OJT through above activities.</p>	<p><b>Inputs</b></p> <p><b>Japanese side</b></p> <ol style="list-style-type: none"> <li>Experts <ul style="list-style-type: none"> <li>Chief Advisor/Feeder Road Development</li> <li>Road Pavement Technology</li> <li>LBT Guideline</li> <li>Cost Estimate/Safe Guard</li> <li>Site Supervisor</li> <li>Maintenance of Machinery and Equipment</li> <li>Environment</li> <li>Project Coordination/Training Planning</li> <li>Monitoring and Evaluation</li> <li>Project Review</li> </ul> </li> <li>Provision of machinery and equipment <ul style="list-style-type: none"> <li>Compactor</li> <li>Asphalt sprayer</li> <li>Asphalt heater</li> <li>Tractor</li> <li>Trailer</li> <li>Impact tamping rammer</li> <li>Equipment for Dynamic Cone Penetrometer (DCP) testing</li> </ul> </li> <li>Transportation for the experts</li> <li>Provision of third country training (e.g., South Africa)</li> <li>Costs for base and bituminous surface treatment</li> </ol>	<p><b>Ghanaian side</b></p> <ol style="list-style-type: none"> <li>Personnel <ul style="list-style-type: none"> <li>Project Director (DFR Director)</li> <li>Project Manager (Dy. Director of Planning, DFR)</li> <li>C/P (Mainly Planning Section and Eastern Region Office of DFR)</li> </ul> </li> <li>Human resources and expenses necessary for the field trials <ul style="list-style-type: none"> <li>Supervisors</li> <li>Workers</li> <li>Transportation for C/P staff</li> <li>Material test conducted at DFR (equipment, cost, etc.)</li> <li>Hand tools for pavement</li> <li>Road preparation at sub-base level for the field trials</li> </ul> </li> <li>Office space</li> <li>Furniture (e.g., desks, etc.)</li> <li>Means of communication at the head office (e.g., internet connection)</li> </ol>	<p>DFR is able to utilize and mobilise available resources related to labour-based bituminous surfacing technology in Ghana (e.g., KTC, KNUST, GHIA Central Lab and their expertise, etc.) for the implementation of the Project.</p>
<p><b>Pre-conditions</b></p> <ol style="list-style-type: none"> <li>Ghanaian side provides technical documents on LBT.</li> <li>Laboratory testing of materials is available.</li> <li>The sites for field trials are ensured (these sites must be prepared with the road bed and filled with sub base course materials, etc.).</li> </ol>			<p>&lt;Issues and Countermeasures&gt;</p>

TO CHIEF REPRESENTATIVE JICA GHANA OFFICE

## PROJECT MONITORING SHEET

**Project Title: JICA Project for Developing Labour Based Bituminous Surfacing Technology  
(LBST)**

**Version of the sheet: Ver. 4 (July-2017)**

**Submission Date: 2<sup>nd</sup> August, 2017**



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**Mr. E. Duncan Williams**  
**Director**  
**Department of Feeder Roads**  
**Ministry of Roads and Highways**



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**Motoki Ogawa**  
**Chief Advisor /Rural Road Development**  
**Eight-Japan Engineering Consultants Inc.**

## I. Summary

### 1. Progress

#### 1-1. Progress of Inputs

##### (1) Japanese Side Input

Item	Achievement (as of 31 <sup>st</sup> July)					
Japanese Experts	Following 10 experts in total have been dispatched to the Project, under the position below. The total Man/Month of these experts was 14.93 MM up to 31 <sup>st</sup> January. Details are given in <b>Attachment-1</b> .					
	Expert		Position		Man/Month (MM)	
	Motoki Ogawa		Chief Adviser / Rural Road Development		6.43	
	Seiji Kadooka		Deputy Chief Advisor / Road Pavement technology		2.23	
	Kazunori Kobayashi		Cost Estimation /Safety Guard		2.53	
	Tetuo Sakamoto		Site Supervisor		5.30	
	Masanori Takeishi		Maintenance and Machinery Equipment		2.50	
	Naoko Sasaki		Environment Considerations		0.97	
	Yumiko Takeda		Project Coodination 1 / Training Plan		1.50	
	Takaaki Hirakawa		Monitoring and Evaluation 1		2.67	
	Mayumi Shoji		Project Coordination 2 / Monitoring and Evaluation 2		1.13	
	Tomoe Iehisa		Project Coordination 2		0.57	
Total (by the end of 31 <sup>st</sup> July, 2017 )				25.83		
Local Operation Cost	Local operation cost was mainly utilized for the following items					
	No.	Items	US\$	No.	Items	US\$
	1	Transport Cost (domestic)	39,765	6	Allowance and Accommodation	3,282
	2	Communication Cost	1,024	7	Local Consultants/ Advisor	18,981
	3	Equipment Purchased	187,017	8	Others	13,891
	4	Third Country Training	N/A	9	Sub-Contract (1st Trial Construction)	1,150,659.90 / GHS
	5	Meeting, Workshop and JCC	8,625			
Equipment	Copy machine, projector and construction machinery were provided. Details are given in <b>Attachment-2</b> .					
Study tour in the Third country	N/A (Scheduled in mid- November, 2017)					

**(2) Ghana Side Input**

Item	Achievement (as of 31 <sup>st</sup> July)				
Counterparts	<p>The following Counterparts have been assigned for the project.</p> <table border="1" data-bbox="512 398 1286 741"> <tr> <td data-bbox="512 398 767 600">DFR Head Office</td> <td data-bbox="767 398 1286 600">                     Director                      Deputy Director of Planning                      Principal Engineer                      Senior Engineer                      Mechanical Engineer                      Assistant Engineer                 </td> </tr> <tr> <td data-bbox="512 600 767 741">DFR Eastern Region</td> <td data-bbox="767 600 1286 741">                     Regional Manager                      Principal Quality Surveyor                      Senior Engineer                      Senior Technician Engineer                 </td> </tr> </table> <p>Details are given in <b>Attachment-3</b>.</p>	DFR Head Office	Director Deputy Director of Planning Principal Engineer Senior Engineer Mechanical Engineer Assistant Engineer	DFR Eastern Region	Regional Manager Principal Quality Surveyor Senior Engineer Senior Technician Engineer
DFR Head Office	Director Deputy Director of Planning Principal Engineer Senior Engineer Mechanical Engineer Assistant Engineer				
DFR Eastern Region	Regional Manager Principal Quality Surveyor Senior Engineer Senior Technician Engineer				
Local Operation Cost	<p>Operation cost for the Project funded by Ghana side includes the running office cost, the material test, and road preparation up to sub-based level of the 1<sup>st</sup> Trial Construction. Details are given in <b>Attachment-4</b>.</p>				

**1-2 Progress of Activities**

Details are given in **Attachment-5**.

**1-3 Achievement of the Outputs**

**1-3-1 Achievement of the Output 1**

Since the activities of the Output 1 had favorably been promoted as scheduled, the Output 1 based on the indicator 1-1 (clarification of current conditions and issues) was achieved in September 2016.

**1-3-2 Achievement of the Output 2**

**(1) Lab tests of materials:**

There were 18 lab tests of materials separated into two categories, *i.e.*, “pre-tests of materials before first field trial (nine (9) tests)” and “lab tests of materials during the first field trial (nine (9) tests).” The findings indicate seven (7) “acceptable” and two (2) “unacceptable” in the former (pre-tests) as well as six (6) “acceptable,” one (1) “satisfactory,” and two (2) “unacceptable” in the latter (lab tests during field trial).

During the field trial, acceptable materials (partly satisfactory ones) were used for the construction works, and the unacceptable ones were eliminated from construction works.

**Table 1-1: Indicator 1 of the Output 2: Results of the lab tests**

No.	Date	Test Item	Test Result	Ref. No
Pre-tests of materials before first field trial				
1	14th Jul., 2016	Aggregates (chippings)	Acceptable	GHA/CML/TF13/2100
2	19th Jul., 2016	Quarry chippings (stripping test)	Acceptable	GHA/CML/TF.13/
3	9th Aug., 2016	Bitumen emulsion KI-70	Acceptable	GHA/CML/TF13/
4	8th Sep., 2016	Aggregate (Stripping test)	<i>Unacceptable</i>	GHA/CML/FT13/2388
5	14th Sep., 2016	Gravel (Base material)	<i>Unacceptable</i>	GHA/CML/TF13/146
6	16th Sep., 2016	Aggregates at Anigord quarry (stripping test)	Acceptable	GHA/CML/TF13/2388
7	16th Sep., 2016	Aggregates at Anigord quarry	Acceptable	GHA/CML/TF13/145
8	16th Sep., 2016	Soils at Akote borrow pit 1	Acceptable	GHA/CML/TF13/146
9	19th Sep., 2016	14mm & 10mm chippings	Acceptable	N/A
Lab tests of materials during the first field trial				
10	10th Mar., 2017	Gravel at Akote borrow pit 1	Acceptable	DFR/RML/BDBP-1
11	14th Mar., 2017	14mm chippings	Acceptable	DFR/RML/1403
12	21st Mar., 2017	10mm chippings	Acceptable	DFR/RML/BDBP-4
13	22nd Mar., 2017	Sand	<i>Unacceptable</i>	DFR/RML/BDBP-2
14	22nd Mar., 2017	Quarry Dust	Satisfactory	DFR/RML/BDBP-3
15	11th Apr., 2017	14mm chippings	Acceptable	DFR/RML/BDBP-5
16	17th Apr., 2017	Gravel at Akote borrow pit 2	Acceptable	DFR/RML/BDBP-6
17	18th Apr., 2017	Bitumen emulsion KI-70	Acceptable	GHA/CML/TF13/1471
18	22nd May, 2017	Aggregate	<i>Unacceptable</i>	GHA/CML/TF13/1536

Note 1

Acceptable: Lab test of materials was passed and fully utilized.

Satisfactory: Lab test was fairly good, and the materials were used in mix design.

Unacceptable: Lab test was not passed, so that the materials were not used.

Note 2

GHA: Central Laboratory - Accra

CML: Central Material Laboratory

DFR: Regional Laboratory - Koforidua

RML: Regional Material Laboratory



**(2) LBST construction standard (Form 3):**

The first field trial is still being conducted in line with the checklist (Form 3) of the LBST construction standard as required in indicator 2, Output 2. The specific construction standards are shown below.

**I. Formation Standard for Pavement**

- 1) Base treatment
  - (a) Gradient of the camber (%)
  - (b) Width (m)
  - (c) Thickness (mm)
  - (d) Compaction
- 2) Surfacing treatment
  - (a) Gradient of the camber (%)
  - (b) Width (m)
  - (c) Thickness (mm)
  - (d) Compaction

**II. Construction Standard for Bituminous Surfacing Treatment**

- ① Spraying (priming)
  - (a) Spray rate (l/min.)
- ② Surface dressing
  - (a) Bitumen specification
  - (b) Aggregate grading
  - (c) Priming operation
  - (d) Others
- ③ Cold mix asphalt
  - (a) Emulsion specification
  - (b) Tack coat specification
  - (c) Aggregate grading
  - (d) Others

**III. General Issues**

- ① Safety and health measures
  - (a) Safety vest
  - (b) Safety boots
  - (c) Dust mask
  - (d) Others
- ② Contents of the sign board
  - (a) Location of sign boards
  - (b) Project name

- (c) Road name
- (d) Others

There is a prospect that this indicator will be achieved by the end of the first field trial because it has been conducted so far in line with the LBST construction standard as mentioned above. Specifically, as the checklist of LBST construction standard (Form 3) influences the perfection level of roads, it is crucial to confirm the construction progress in line with the checklist. This is why filling in the checklist is greatly meaningful.

**(3) Task rates:**

The first field trial is still ongoing and will be completed by the end of August, 2017. Thus, the task rates will be prepared after the completion of the construction works and described in the next Project Monitoring Sheet (Ver. 5) in February, 2018.

**1-3-3 Achievement of the Output 3**

It is not ready to measure the achievement of Output 3 at this moment because the activities of the Output 3 have not been started yet.

**1-4 Achievement of the Project Purpose**

**(1) Development of labour-based bituminous surfacing technology (LBST):**

There are two (2) indicators in the Project Purpose. In terms of the indicator 1, there is a prospect that LBST fulfilling this monitoring checklist (Form 1) will be developed through the first and second field trials as required in indicator 1, Project Purpose. This is because the first field trial has been so far monitored based on the checklist. The specific criteria defined in the checklist are indicated below.

**【Preparation Phase】**

- ① Work planning
- ② Construction materials
- ③ Requisite equipment

**【Implementation Phase (Base Treatment)】**

- ① Compaction
- ② Traffic management
- ③ Quality assurance
- ④ Quality control
- ⑤ Construction method

**【Implementation Phase (Surface Treatment)】**

- ① Pre-coating of chippings

- ② Spotting and spreading of aggregates
- ③ Priming operation
- ④ Primer seal operation
- ⑤ Quality assurance
- ⑥ Quality control
- ⑦ Spraying operation
- ⑧ Seal operation
- ⑨ Cold mix asphalt operation

**【Inspection Phase】**

- ① Road furniture
- ② Surface texture
- ③ Smoothness of road surface

**(2) Self-evaluation of DFR officials, including Eastern Region, for acquiring LBST:**

The indicator 2 is the self-evaluation of DFR officials for acquiring LBST, and the target value was set in 65.0% since the baseline value was 44.7%. In order to confirm the progress of their understandings, the third questionnaire survey was conducted on the basis of the question items as follows:

- ① Planning skills and knowledge of road works;
- ② Road structure design and/or drawing;
- ③ Contents of Bill of Quantities (BOQ);
- ④ Cost estimation;
- ⑤ Road inspection tasks;
- ⑥ Safety practice for workers and road users during road works;
- ⑦ Technical advice and supports for a contractor;
- ⑧ Time management of road works during the execution periods;
- ⑨ Monitoring of road works; and
- ⑩ Standard specification of the labour-based bituminous surfacing technology.

DFR officials assessed themselves along the above question items by five-point scale with “5” in full-scale points. The results of their self-evaluation on the LBST indicate the strength and weakness of DFR officials objectively. As the Project is able to identify such information, the technical assistance for DFR officials will efficiently be provided by focusing on the specific items as required.

**Table 1-2: The self-rating results of DFR officials for acquiring LBST (Five-point scale)**

	1st Questionnaire (July 2016) 31 respondents	2nd Questionnaire (January 2017) 30 respondents	3rd Questionnaire (July 2017) 29 respondents
Q1. Planning skills and knowledge of road works	45.2%	56.7%	78.5%
Q2. Road structure design and/or drawing	46.5%	52.0%	69.3%
Q3. Contents of Bill of Quantities (BOQ)	49.7%	55.3%	70.7%
Q4. Cost estimation	46.5%	54.7%	64.3%
Q5. Road inspection tasks	45.8%	55.3%	80.0%
Q6. Safety practice for workers and road users during road works	47.1%	52.7%	69.3%
Q7. Technical advice and supports for a contractor	40.0%	50.0%	76.4%
Q8. Time management of road works during the execution periods	43.9%	46.0%	60.7%
Q9. Monitoring of road works	45.2%	51.3%	75.0%
Q10. Standard specification of the labour-based bituminous surfacing technology	37.4%	51.3%	71.4%
<b>Total Rating on Average (Q1 – Q10)</b>	<b>44.7%</b>	<b>52.5%</b>	<b>71.5%</b>
Q11. Overall rating of the labour-based bituminous surfacing technology	47.7%	52.0%	70.3%

Source: Questionnaire survey through the Form 2 of the Monitoring System

According to the result of the 3rd questionnaire survey in the Table 2-2, the total rating on average (Q1 – Q10) exceeded the target value (65.0%). It is considered that the rating result has been increased because DFR officials are just going through the transitional period of the first field trial. At this moment, therefore, the target value is retained for a while, and the ratings shall be observed until the next questionnaire survey in January 2018. If the tendency of the results has not been changed, then the Project redefines the target value to be modified.

DFR officials highly rated the “planning skills and knowledge (Q1: 78.5%)”, “road inspection tasks (Q5: 80.0%)”, “technical advice and supports for contractors (Q7: 76.4%)”, and “monitoring of road works (Q9: 75.0%).” The ratings of those four items went beyond more than 10% of the target value. It is considered that field trial in Eastern Region with the great supports of JICA experts has positively affected the capacity enhancement of DFR officials on the labour-based bituminous surfacing technology applicable to the construction works on site.

However, two items did not attain to the target, *i.e.*, the “cost estimation (Q4: 64.3%)” and “time

management of road works (Q8: 60.7%).” Thus, it is required to enhance the cost estimation and time management of road works before and during the execution of second field trial in 2018 through the technical transfer of JICA experts who can provide specific instructions for the DFR officials.

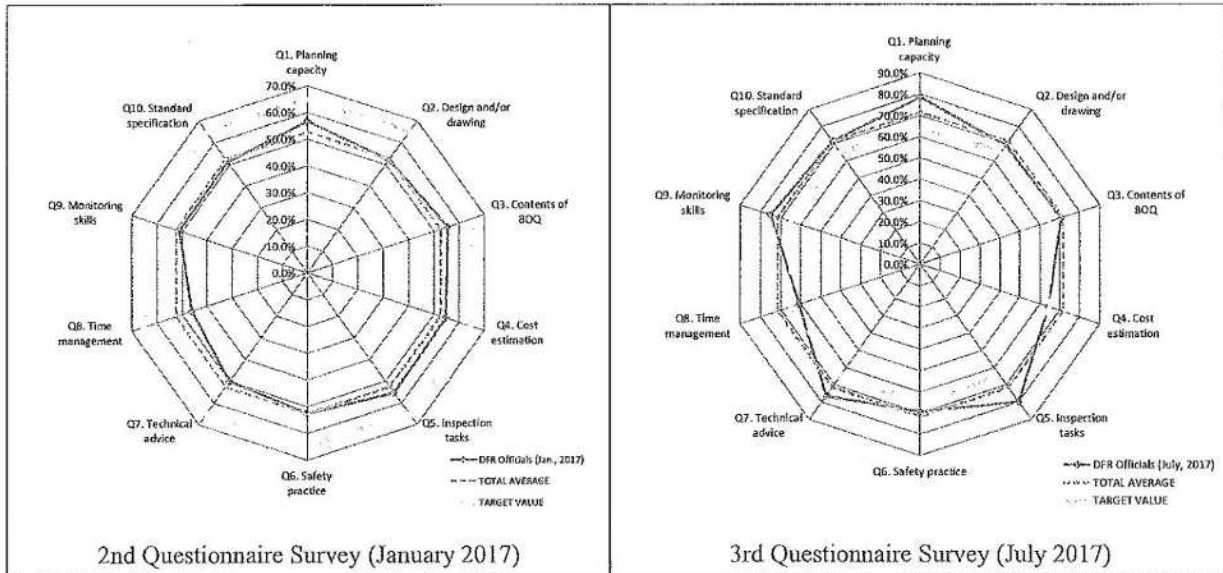


Figure 1-1: Self-rating results of DFR officials, including Eastern Region (Rader Chart)

The rating results are visualized in the Figure 1-1 so as to indicate the level of their current capacity of the labour-based bituminous surfacing technology. Ideally, it is desirable to come to a “round shape” balanced among each item rather than a “polygonal shape” unbalanced among them. Moreover, it is expected to gradually expand the area of round shape because it implies that the competency of each question item is steadily being enhanced. In this way, the Project will monitor how the self-rating results have been changing as shown in the Figure 1-2.

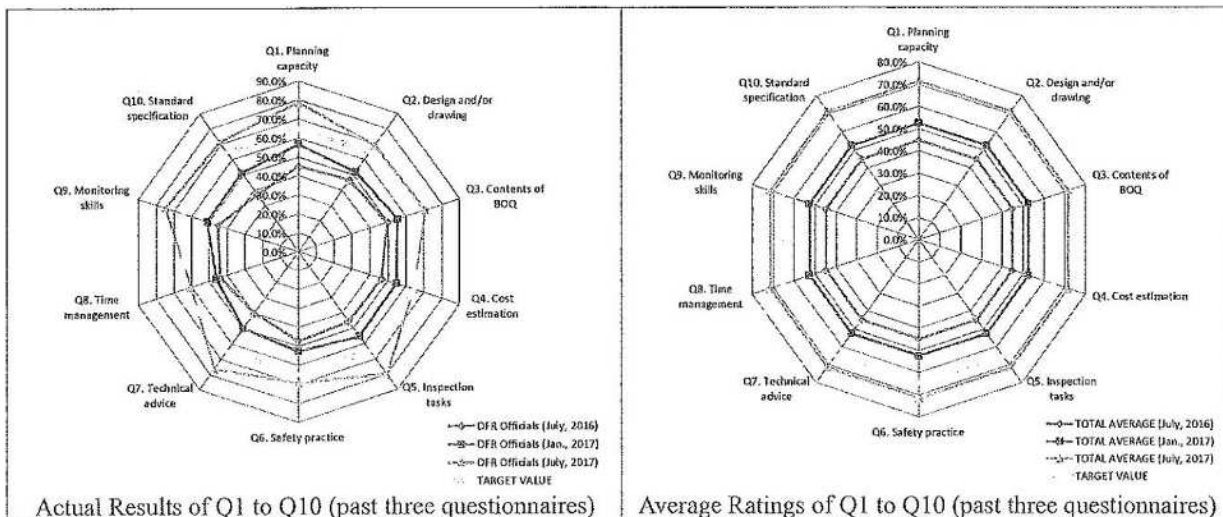


Figure 1-2: Tendency of past self-rating results of DFR officials

(“Actual Results” and “Average Ratings” of each question item from July 2016 to July 2017)

### **1-5 Changes of Risks and Actions for Mitigation**

In terms of the Important Assumptions, the Project shall pay attention to those conditions for the achievement of the Outputs and Project Purpose during the cooperation period. It seems that there are no risks to be found for those conditions at this moment.

#### **(1) Important Assumption for the achievement of the Outputs:**

DFR is able to utilize and mobilize available resources related to LBST in Ghana for the implementation of the Project. For example, KTC has been involved in the field trial to acquire the knowledge and experiences which will be fed back into the training courses at KTC. Also, KNUST provides the Project with the professional advice on labor-based bituminous surfacing technology, and GHA Central Lab supports material tests for the field trial.

#### **(2) Important Assumption for the achievement of the Project Purpose:**

The position of DFR Director, Project Director, was changed from Mr. F.O.M. Digber to Mr. Duncan Williams in April 2017. Also, Mr. Seth Osei Nketia was newly assigned as the Regional Manager of Eastern Region from June 2017. However, it is considered that this condition does not severely affect to the achievement of the Project Purpose because they still have the second half of the project period (1.5 years). Further, the Regional Manager of Eastern Region can go through the second field trial in 2018. Thus, there are prospects that they will be able to catch up with the project activities. Moreover, there were two (2) officials in DFR additionally assigned from April 2017.

### **1-6 Progress of Actions undertaken by JICA**

N/A.

### **1-7 Progress of Actions undertaken by Government of Ghana**

N/A.

### **1-8 Progress of Environmental and Social Considerations**

There is an environment section in DFR and this section had prepared the Environment and Social Management Plan (ESMP) of the trial construction on October, 2016, and authorized in the DFR. However, since explanation regarding how to handle emulsion in the report was not included, it was advised to revise the contents adding pre-caution about construction using bitumen. DFR also realized the importance of the indication and agreed to do lecture to the contractor and labour before commencement of the works.

From this, safety guidance to the labours and contractor was carried out on 20th April at site by DFR-HQ, DFR Eastern Region, KTC and EJEC. A quarantine officer from the Obomofe-Densua Clinic also joined and explained the importance to prevent from HIV/AIDS. Safety checklist and emergency contact network was provided to the participants.

## **2. Delay of Work Schedule and/or Problems**

Although the signing to the contract of the trial construction was made on 3rd February 2017, the commencement of the works was delayed for about two months. This was due to financial situation of the contractor, and the contractor had difficulty starting the preparation works unless the contractors receive the advance payment. The contractor actually did not have adequate cash and credit to procure materials and hiring labour without receiving the advance payment. The advance payment was remitted to the contractor's account on 27th March, 2017 and reason of the delay was because the contractor need time to open a dollar account and receive guarantee of the advance payment from the bank.

After receiving the advance payment, the contractor started procuring materials and labour, and since that, the construction started from trials. Initially, the contractor was able to achieve just ten meters a day for both surface dressing and cold mix asphalt. The contractor kept issuing the invoice frequently to receive the interim payment as soon as there was progress. The consultant kept giving advice and instructions what kind of preparation needed and how to do the work practically. Also, DFR has assigned two engineers from DFR Head Office and one from the Eastern Region to be intervened exclusively for the Project. The principal engineer from DFR has also attended to the weekly meeting that was held every Monday at site.

From these efforts, the contractor and labour slowly became get used to the methodology, and as they gained experience, the production speed was improved dramatically. The end of the contract is made on the date of 19th August, 2017 and it is expected to complete the work by that day.

### **3. Modification of the Project Implementation Plan**

N/A.

### **4. Preparation of Government of Ghana toward after completion of the Project**

In the trial construction, it was observed that both the contractor and labours need lecture about methodology of bituminous surfacing construction by LBT. For this, it was understood that preparation of Guideline is not enough for dissemination, and it needs a further explanation of the background for solid understanding. Method and material which needs to solve this issue shall be collected from the coming activities and the second trial construction.



## II. Project Monitoring Sheet I & II

**II-1. Project Monitoring Sheet I (PDM 3)**

**II-2. Project Monitoring Sheet II (PO 4)**

## **Attachments**

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- 1: Japanese Experts Assignment**
- 2: Equipment**
- 3: Counterparts Designation**
- 4: Local Operation Cost (Ghana side)**
- 5: Progress of Activities**



Attachment-2: Equipment (as of 31<sup>st</sup> July, 2017)

No	Date of registration	Description/Name of equipment / Goods	Specification - Standard	QTY	Price	unit	Provider	User	Purpose of Use	Place of Use	Responsible Person	Hand Over
1	23-Jan-16	Projector	EPSON EB-S31	1	445.68	USD	(Electronic retail shop in Japan)	Expert	Workshop /Presentation	DFR	Expert	✓
2	12-Feb-16	Printer	Ricoh MPC2011	1	6,075.91	USD	IMPC Intercom Programming & Manufacturing Co. Ltd.	Expert	Means of Documentation	DFR	Expert	✓
3	3-Aug-16	Cold Bitumen Sprayer	1D10CB	2	5,950.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
4	3-Aug-16	Plate Compactor	Bell, PC450	2	4,475.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
5	3-Aug-16	Mobile Concrete Mixer	Bell, 400D	1	2,987.50	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
6	18-Aug-16	Tractor	75 HP, Diesel Engine, Tools	2	73,000.00	USD	Agri Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	✓
7	18-Aug-16	Tractor	Towed Type, 5000kg capacity, Tools	2			Agri Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	✓
8	18-Aug-16	Spare parts for tractor and tralor	-	1	1,441.00	USD	Agri Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	✓
9	26-Aug-16	Duplex Roller	Atlas, LP750	2	32,373.18	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
10	26-Aug-16	Engine Suction Water Pump	Technole, KGP80D	2	1,297.48	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
11	26-Aug-16	Mechanical Tool Set	-	1	530.21	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
12	8-Nov-16	Water Bowser	IDS000L	1	8,850.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
13	8-Nov-16	Manual hand Asphalt Sprayer	1D10M	2	3,880.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
14	8-Nov-16	Chip Spreader	NCA, Chippy	4	27,580.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
15	8-Nov-16	Spare parts	-	1	3,143.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
16	8-Dec-16	TRL Dynamic Cone Penetrometer (DCP)	Cover: 10-10012/3, weight, 86Kgs, Dims: 447x140x140	2	4,374.20	USD	Ascia Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
17	8-Dec-16	Spare parts	-	1	10,613.94	USD	Askia Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
Total					186,571.42	USD						



Attachment-4: Local Operation Cost (Ghana saide)

Local Cost Allocated by Ghana Side		Attachment-4 Local Operation Costs (Ghana Side)			
Items	Local Cost				
	MS Ver. 2 Feb 2016 to Jul 2016	MS Ver. 3 Aug 2016 to January 2017	MS Ver. 4 Feb 2017 July 2017	MS Ver. 5 *** 2017 to *** 2018	MS Ver. 6 *** 2018 to *** 2018
1-1	Personals				
1	Director DFR Deputy Director of Planning Principal Engineer (Coordinator Workshop) Mechanical Engineer Director of Eastern Region	Director DFR Deputy Director of Planning Principal Engineer (Coordinator Workshop) Mechanical Engineer Director of Eastern Region	Director DFR Deputy Director of Planning / DFR Senior Engineer / DFR Mechanical Engineer / DFR Assts. Engineer / DFR Director of Eastern Region / DFR-E Principal QS / DFR-E Senior Engineer / DFR-E Senior Technician Engineer / DFR-E		
1-2	Human Resources and expenses necessary for the field trials				
1	N/A	N/A	Principal Engineer / DFR (Site MTG) Assts. Engineer / DFR (Site MTG) Principal QS / DFR-E Senior Engineer / DFR-E Senior Technician Engineer / DFR-E		
2	N/A	N/A	inclusive at JICA-LBST contract		
3	Travel allowance and accommodation, fuel borne by DFR	N/A	Travel allowance and accommodation, fuel funded by both DFR/JICA-LBST occasionally		
4	N/A	N/A	3,840 GHS		
5	N/A	N/A			
6	N/A	N/A	74,0240.16 GHS		
1-3	Office Space				
1	DFR prepared Room 106 at DFR head office for the Project				
1-4	Furniture				
1	DFR provides desks, chairs, power, air conditioner and HP color printer for the Project				
1-5	Means of communication at the head office				
1	Internet WiFi and a land line prepared for the Project				
1-6	Others				
1					



# Attachment-5: Progress of Achievement

## Attachment -5 Progress of Activities

Activity Performed (as of end of July, 2017)									
Activity 1-1 <b>Completed</b>	<p><b>OUTPUT-1 Current Conditions and Issues for labour based bituminous surfacing technology in Ghana are identified.</b></p> <p>&lt;Collect and analyse information on the counterparts (CP's) organisational capacity (e.g. personal, budget, experiences, etc.)&gt;</p> <ul style="list-style-type: none"> <li>• Origination, number of engineers, budget and experience on LBT of DFR as well as the eastern region office were surveyed</li> <li>• Visited KTC and surveyed the capacity maintaining equipment. It was confirmed that KTC will be the appropriate organization to place and do the maintenance for the equipment which the Project and JICA will procure.</li> </ul>								
Activity 1-2 <b>Completed</b>	<p>&lt;Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana&gt;</p> <ul style="list-style-type: none"> <li>• Technical standards and guidelines relating to LBT works from African countries in particular were collected. Totally, 24 numbers of standards and guidelines such as Ethiopian, Tanzanian, Kenyan, South African and others were collected and evaluated.</li> </ul>								
Activity 1-3 <b>Completed</b>	<p>&lt;Review and evaluate the similar technology standards and manual prepared by such organizations as Department for International Development (DFID), South African Department of Public Works, etc.&gt;</p> <ul style="list-style-type: none"> <li>• From discussion with DFR, it was determined to apply cold emulsion asphalt rather than heated asphalt from the research in the past as well as safety. KNUST has attempted applying Ota seal pavement which requires heated cutback asphalt and was found difficult utilizing it in Ghana's condition. From this, it was recommended to choose cold asphalt pavement, Sand seal and single surface dressing in the trial construction.</li> <li>• Evaluation through the collected documents, it was found that technical manual of Ethiopia covers most of the target pavements mentioned above. From this, referring to the Ethiopian manual was considered.</li> <li>• KTC was implementing a road design training utilizing DCP by World Bank support. This training was following the contents of the Ethiopian Manual, and from this, it was decided refer to Ethiopian Manual dominant.</li> </ul>								
Activity 1-4 <b>Completed</b>	<p>&lt;Confirm the procurement and cost of materials (e.g. gravels, etc.)&gt;</p> <ul style="list-style-type: none"> <li>• From interview, following were found as a general price of materials to be used in the trial construction.</li> </ul> <table border="1" data-bbox="826 728 1013 1433"> <thead> <tr> <th>Materials</th> <th>General Unit Price from interview</th> </tr> </thead> <tbody> <tr> <td>Cold emulsion</td> <td>560 GHS /drum include transport to trial site (drum =200 liters)</td> </tr> <tr> <td>Chippings</td> <td>65 GHS /m<sup>3</sup> (20-2.5mm) 40 GHS/m<sup>3</sup> (Dust) 56 GHS/m<sup>3</sup> (0-40 mixed)</td> </tr> <tr> <td>Gravel</td> <td>33 GHS/m<sup>3</sup> incl. transport to trial site</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>• Price fluctuation were surveyed and it was found that unit price of local labour and chipping continuously increased over the past 1.5 years, and conversely the price of bitumen easily get influence from the international market which means not stable.</li> <li>• From the record, it was found the unit price of labour grow double in 1.5 years from the baseline where chipping were 1.5 times higher as well. For bitumen, price has escalated 2.4 times higher tentatively and came down to the original price eventually. It can be said that price of the bitumen is quite difficult to predict compare with the chippings and labours.</li> </ul>	Materials	General Unit Price from interview	Cold emulsion	560 GHS /drum include transport to trial site (drum =200 liters)	Chippings	65 GHS /m <sup>3</sup> (20-2.5mm) 40 GHS/m <sup>3</sup> (Dust) 56 GHS/m <sup>3</sup> (0-40 mixed)	Gravel	33 GHS/m <sup>3</sup> incl. transport to trial site
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Activity 1-5 <b>Completed</b>	<p>&lt;Test and evaluate characteristics of the materials as stipulated by respective technical standards&gt;</p> <ul style="list-style-type: none"> <li>• Confirmed implementing material testing will be conducted at the central material laboratory. The Capacity and capability of the laboratory was confirmed by observing the tests actually and interview to the technicians.</li> <li>• Quality and general cost for chipping (aggregate), gravel and cold emulsion were confirmed through interview to suppliers, contractors and DFR engineers.</li> </ul>								
Activity 1-6 <b>Completed</b>	<p>&lt;Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana&gt;</p> <ul style="list-style-type: none"> <li>• From interview to counterparts, it was grasped that there is a roll between headquarter and regional office. Most of the field works such as inventory survey.</li> </ul>								

<p>designing cost estimation, tendering and quality control are under jurisdiction of the regional office while the headquarter has roll to monitor and give approval to the planning as well as payment to the contractors. So, regarding the procedures for design and procurement, the system is established appropriately.</p> <ul style="list-style-type: none"> <li>Most of the feeder roads in Ghana are gravel surface and bituminous surface is very little. The design of the surface is done by following the MRH standards. The design of the single surface is indicated in the MRH design manual and although this manual is based in EBT method, since the structure itself doesn't have difference between LBT, it can be understood still valid applying on feeder roads. From the above-mentioned discussion, the necessity of creating a new guideline for LBT in use of bitumen, which is the major output of this Project, was re-confirmed.</li> </ul>	<p>&lt;Check the quality control systems and the procedures of road pavement work in Ghana&gt;</p> <ul style="list-style-type: none"> <li>Quality control in actual construction is a roll of the regional office. The regional office does the quality control followed by the MRH standard.</li> </ul> <p>&lt;Check the maintenance management systems of feeder roads in Ghana&gt;</p> <ul style="list-style-type: none"> <li>It was grasped that DFR has system which names RPM (Road Prioritisation Methodology), GIS (Database and Geographical Information System) and MPBS (Maintenance Performance Budgeting System). So, most of the DFR's activities from selecting the annual target road to making BOQ of it is systemized and confirmed working under the solid total system.</li> </ul>	<p>Activity 1-7 <b>Completed</b></p> <p>Activity 1-8 <b>Completed</b></p>												
<p>Activity 1-9 <b>Completed</b></p>	<p>&lt;Compile and report the analysis on issues on labour-based bituminous surfacing technology in Ghana&gt;</p> <ul style="list-style-type: none"> <li>Contents of the activity 1-1 to activity 1-9 have been compiled in a report including the results of the materials which was the missing item in MSE.</li> </ul>	<p>OUTPUT-2 Field Trials of labour-based bituminous surfacing technology are carried out.</p>												
<p>Activity 2-1 <b>Completed</b></p>	<p>&lt;Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials)&gt;</p> <ul style="list-style-type: none"> <li>The technical workshop was conducted as follows</li> </ul>	<table border="1"> <thead> <tr> <th data-bbox="901 291 949 504">SN</th> <th data-bbox="901 504 949 705">Date</th> <th data-bbox="901 705 949 996">Participants</th> <th data-bbox="901 996 1292 1800">Major discussion and Conclusion</th> </tr> </thead> <tbody> <tr> <td data-bbox="949 291 997 504">1</td> <td data-bbox="949 504 997 705">27<sup>th</sup> July, 2016</td> <td data-bbox="949 705 997 996">DFR, Eastern Region, JICA, LBST</td> <td data-bbox="949 996 1292 1800"> <ul style="list-style-type: none"> <li>Basic contents of the trial construction plan were confirmed.</li> <li>Cold Bitumen, Sand Seal and Single Surface were chosen as a target pavement type to be incorporated in the guideline.</li> <li>A contractor shall be hired by DFR to conduct the trial construction while the materials shall be provided by the Project.</li> <li>A private consultant shall be hired by the Project to collect data from the trial construction.</li> <li>The essence of utilizing LBT is the construction cost and durability.</li> </ul> </td> </tr> <tr> <td data-bbox="997 291 1045 504">2</td> <td data-bbox="997 504 1045 705">14<sup>th</sup> Sep., 2016</td> <td data-bbox="997 705 1045 996">DFR, Eastern Region, JICA, LBST</td> <td data-bbox="997 996 1292 1800"> <ul style="list-style-type: none"> <li>The objective of implementing the trial construction was defined as 1) determined the appropriate construction method to apply LBT on bituminous works, 2) confirm the balance between both labour and equipment based constructions, 3) record the spray and consumption rate of materials, 4) found findings related to safety and environment, and 5) reflect the lesson obtained to the Guideline.</li> <li>Target road and section of the trial construction was chosen between Obomfo Densaa-Atoke villages at Suhun, Municipal, and Eastern Region near KTC. The distance was approx. 3.2 km</li> <li>Since the construction of sub-base is now implemented by LBT, it was discussed and approved that the procurement of the labour which is the responsibility of DFR according to the PDM<sub>2</sub>, shall be made with the same contractor by amending the current contract.</li> <li>Based on the submittal current status report, it was discussed and approved that the work items method should be single chip seal and cold mix asphalt. However,</li> </ul> </td> </tr> </tbody> </table>	SN	Date	Participants	Major discussion and Conclusion	1	27 <sup>th</sup> July, 2016	DFR, Eastern Region, JICA, LBST	<ul style="list-style-type: none"> <li>Basic contents of the trial construction plan were confirmed.</li> <li>Cold Bitumen, Sand Seal and Single Surface were chosen as a target pavement type to be incorporated in the guideline.</li> <li>A contractor shall be hired by DFR to conduct the trial construction while the materials shall be provided by the Project.</li> <li>A private consultant shall be hired by the Project to collect data from the trial construction.</li> <li>The essence of utilizing LBT is the construction cost and durability.</li> </ul>	2	14 <sup>th</sup> Sep., 2016	DFR, Eastern Region, JICA, LBST	<ul style="list-style-type: none"> <li>The objective of implementing the trial construction was defined as 1) determined the appropriate construction method to apply LBT on bituminous works, 2) confirm the balance between both labour and equipment based constructions, 3) record the spray and consumption rate of materials, 4) found findings related to safety and environment, and 5) reflect the lesson obtained to the Guideline.</li> <li>Target road and section of the trial construction was chosen between Obomfo Densaa-Atoke villages at Suhun, Municipal, and Eastern Region near KTC. The distance was approx. 3.2 km</li> <li>Since the construction of sub-base is now implemented by LBT, it was discussed and approved that the procurement of the labour which is the responsibility of DFR according to the PDM<sub>2</sub>, shall be made with the same contractor by amending the current contract.</li> <li>Based on the submittal current status report, it was discussed and approved that the work items method should be single chip seal and cold mix asphalt. However,</li> </ul>
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<p>3</p>	<p>DFR, Eastern Region, JICA, LBST, KNUST, ILLO</p>	<p>9<sup>th</sup> Nov., 2016</p>	<p>It was also confirmed that the standard structure of single chip seal in Ghana means 2 layers which applies 14mm chip on first and 9mm chip on second layer.</p> <ul style="list-style-type: none"> <li>Based on the conclusion of 2<sup>nd</sup> TW, BoQ applying single chip seal and cold mix asphalt was reported and due to budgetary reasons, it was recommended to adjust the construction length to meet the fixed sealing price. However, it was also discussed the necessity of having practice of spraying and spreading prior to actual construction for lesson obtained from the equipment operation training conducted at KTC.</li> <li>It was reported from the Chief Consultant that demarcation between the Project and DFR, the Project shall bear the labour and the contractor which it is the responsibility of DFR currently. From this, the PDM should be amended at the next Monitoring Sheet accordingly.</li> <li>Since the Ethiopian manual covers most of the area which this project aims, it was discussed and approved to refer this manual to build technical specification of the tendering documents. Relate to technical matters, the thickness of cold mix asphalt was discussed and approved to apply 14mm which is stated as the standard according to the Ethiopia manual.</li> <li>The Chief Consultant explained the further schedule that the tendering shall be implemented by: restrict tendering and pre-tendering around begging of December, and tendering on 24<sup>th</sup> January tentatively. With collaboration of DFR and the Project, the tendering documents shall be made before end of November.</li> </ul> <p>From discussion made above, preparation of tendering documents which includes agreement and technical specification was completed by end of November. In the technical specification, both objective and methodology of implementing the trial construction was clearly mentioned. This tendering documents were sold to contractors who show the interest and passed the criteria of restrict tendering. Pre-tendering meeting was held on 6<sup>th</sup> December and tendering on 24<sup>th</sup> of January, 2017 as scheduled. A. Naggesien Ltd. presented the lowest price and expect have signing between Eight-lepar Engineering Consultants Inc. on early February.</p>
<p>Activity 2-2 Under Implementation</p>	<p>&lt;Conduct necessary lab tests to assess the characteristics of materials&gt;</p> <ul style="list-style-type: none"> <li>In the first trial construction, following lab test were carried out to confirm the quality of the materials and construction <ul style="list-style-type: none"> <li>Sieve test for gravel and aggregates, MDD and OMC test for gravels, FI, ACV, LAA and A.D tests for aggregates, Sand replacement test for base course</li> </ul> </li> </ul>		<p>&lt;Identify technical requirements (e.g., materials, methodology and process, quality control, etc.) through the field trials&gt;</p>
<p>Activity 2-3 Under Implementation</p>	<p>From the first trial construction, following knowledge was observed. Details are given in Activity 3-1 below.</p> <ul style="list-style-type: none"> <li>Pre-coating the aggregate will seal the aggregate with emulsion and dust which adhere on the surface. For this, it was observed that pre-scoating will prevent the aggregate comes off from the surface on surface dressing</li> <li>One layer of base course should be less than 150mm on doing compaction by LBT.</li> <li>Camber shall be attempted to be 3% for bituminous surface</li> <li>Emulsion needs proper storage method to keep the quality</li> <li>For spread rate of aggregate, more trials are needed to get closer to design rate</li> <li>For cold mix asphalt, how to remove dust balls was the one of the largest issue</li> </ul>		<p>&lt;Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials&gt;</p>

<p><u>Under Implementation</u></p>	<ul style="list-style-type: none"> <li>From the first trial construction, following knowledge was observed. Details are given in Activity 3-1 below. <ul style="list-style-type: none"> <li>Rainy season is not appropriate for bituminous work since water affects the asphalt adhere on aggregate</li> <li>Since labour start farming in rainy seasons, it is desirable to finish works before that</li> <li>One month preparation was needed for the contractor and labour to understand the works. For this, training manual /guideline is needed for dissemination.</li> <li>Currently, the contractors do not have clumpy or low grader which is an equipment needed for bituminous surface works by LBT. Strategy and involvement in government level required.</li> </ul> </li> </ul>								
<p>Activity 2-5 <u>Under Implementation</u></p>	<p>&lt;Collect information on task rates&gt;</p> <ul style="list-style-type: none"> <li>Information to prepare the task rates are collected and now under analysis.</li> </ul>								
<p>Activity 2-6 <u>Under Implementation</u></p>	<p>&lt;Identify the applicable conditions of the labour-based bituminous surfacing technology&gt;</p> <ul style="list-style-type: none"> <li>Area where the terrain is heavy and steep is not applicable for LBT works</li> <li>Area where doesn't have basic access road to carry the equipment is not applicable for LBT works</li> <li>Area where difficult to hire labour or no residents are not applicable for LBT Works</li> <li>Area where difficult to carry bituminous materials is not applicable for bituminous LBT works since the production is made only at the greater Accra region.</li> </ul>								
<p>Activity 2-7 <u>Under Implementation</u></p>	<p>&lt;Identify the safeguard issues&gt;</p> <ul style="list-style-type: none"> <li>Guidance of how to do bituminous sealing works by LBT to the labours was carried out.</li> <li>Guidance of HIV/AIDS and pre-cautions during construction was carried out.</li> </ul>								
<p>Activity 2-8 <u>Under Implementation</u></p>	<p>&lt;Prepare a report on above&gt;</p> <ul style="list-style-type: none"> <li>Technical reports as follows were prepared. <ul style="list-style-type: none"> <li>Proportion of mixed aggregate</li> <li>Appropriate mixing rate of pre-coated aggregate</li> <li>Appropriate spray rate of emulsion</li> <li>Appropriate spread rate of aggregate</li> <li>Design mix of the cold mix asphalt</li> </ul> </li> <li>Comprehensive summary report was prepared.</li> <li>Discussion regarding the outline of the guideline was carried out and summarized in a table based on document submitted in the 3<sup>rd</sup> technical meeting</li> </ul>								
<p>Activity 2-9 <u>Under Implementation</u></p>	<p>&lt;Carry out on-the-job training (OJT) through above activities&gt;</p> <ul style="list-style-type: none"> <li>All of the activities from Activity 1-1 to Activity 2-1 were carried out with collaboration between the DFR members and Japanese Experts.</li> <li>The DFR members with KTC and the contractors had an equipment operational training at KTC. The trainees had opportunity how to maintain the equipment as well as operation systematically. The JICA provided equipment was used for the training.</li> <li>All of the activities from Activities 2-2 to Activity 2-5 were carried out with collaboration between the DFR members and Japanese Experts</li> </ul>								
<p><b>OUTPUT-3 Guidelines for labour-based bituminous surfacing technology are prepared</b></p>									
<p>Activity 3-1 <u>Under Implementation</u></p>	<p>&lt;Determine the contents of the guidelines by reviewing the result of the first field trials&gt;</p> <table border="1" data-bbox="1129 280 1295 1644"> <thead> <tr> <th data-bbox="1129 1585 1161 1644">SN</th> <th data-bbox="1129 1473 1161 1585">Date</th> <th data-bbox="1129 1003 1161 1473">Participants</th> <th data-bbox="1129 280 1161 1003">Major discussion and Conclusion</th> </tr> </thead> <tbody> <tr> <td data-bbox="1161 1585 1193 1644">4</td> <td data-bbox="1161 1473 1193 1585">26<sup>th</sup> to 28<sup>th</sup> July, 2017</td> <td data-bbox="1161 1003 1193 1473"> <ul style="list-style-type: none"> <li>Dr. K. Osafo Ampadu Deputy Director of Planning, DFR Head Office</li> <li>K. Omana-Brimpang Principal Engineer, DFR Head Office</li> <li>Dr. Patrick Bekoe Anonah Senior Engineer, DFR Head Office</li> </ul> </td> <td data-bbox="1161 280 1193 1003">           The First Intensive Workshop was held in Papease, Eastern Region from 26 to 28<sup>th</sup> July, 2017. The purpose of the workshop was to review the lesson learnt from the first trial construction and to discuss way forward for the preparation of the second trial construction. The outline of the review is given as follows:            (a) Preparation            - Cut back asphalt is usually applied to prepare pre-coated aggregate. However,         </td> </tr> </tbody> </table>	SN	Date	Participants	Major discussion and Conclusion	4	26 <sup>th</sup> to 28 <sup>th</sup> July, 2017	<ul style="list-style-type: none"> <li>Dr. K. Osafo Ampadu Deputy Director of Planning, DFR Head Office</li> <li>K. Omana-Brimpang Principal Engineer, DFR Head Office</li> <li>Dr. Patrick Bekoe Anonah Senior Engineer, DFR Head Office</li> </ul>	The First Intensive Workshop was held in Papease, Eastern Region from 26 to 28 <sup>th</sup> July, 2017. The purpose of the workshop was to review the lesson learnt from the first trial construction and to discuss way forward for the preparation of the second trial construction. The outline of the review is given as follows: (a) Preparation - Cut back asphalt is usually applied to prepare pre-coated aggregate. However,
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		in Peppers)	<ul style="list-style-type: none"> <li>• <b>Bernard William Amoaib</b> Mechanical Engineer, DFR Head Office</li> <li>• <b>Frank Amofa Agyemem</b> Assistant Engineer, DFR Head Office</li> <li>• <b>Joseph Mawvusi Adokponya</b> Assistant Engineer, DFR Head Office</li> <li>• <b>Isaac Mensah</b> Principal Quality Surveyor, DFR Eastern region</li> <li>• <b>Frederick Addison</b> Senior Engineer, DFR Eastern region</li> <li>• <b>Christopher Ampah Essel</b> Senior Technician, Engineer, DFR Eastern region</li> <li>• <b>Motoki Ogawa</b> Team Leader, JICA-LBST</li> <li>• <b>Takanaki Hiraakawa</b> Monitoring, JICA-LBST</li> <li>• <b>Yumiko Taketa</b> Training/Coordinator, JICA-LBST</li> <li>• <b>Tomoo Ichisa</b> Coordinator, JICA-LBST</li> <li>• <b>Anthony Mensah</b> Resident Eng., JICA-LBST</li> <li>• <b>Gifty Gbenyo</b> Secretary, JICA-LBST</li> </ul>	<p>considering the characteristics of LBT that the works shall be done by labour, emulsion has a high privilege that it doesn't use heat. For this, using emulsion for both pre-coating and priming was decided and design was made by existing manuals and trial test at field.</p> <p>Base Course</p> <ul style="list-style-type: none"> <li>• MD9/6% was achieved where 98% is required under the MRH specification for base course. It is figured out that this shortage is caused by 150mm thickness of single layer to compact by pedestrian roller, and by adjusting the moisture content after and not before the compaction.</li> <li>• Undulation was observed on surface after compaction. Although the range of deviation was acceptable for gravel surface; for bituminous surface, it is desirable to secure higher evenness. For this, it is advised to utilize tow- grader before compaction.</li> <li>• The camber was made in 8% for the usual amount of gravel surface. However, 3% is usually applied in bituminous pavement roads and hence both gradients should be compared at the next trial construction. By lowering the gradient, matter of sprayed extra emulsion flow out to the shoulder is expected to be solved and appropriate spray rate should be considered as well.</li> <li>• Constructing a 6m width surface on the 6m width base course is difficult to ensure the required density and eventually the shoulder become loose. It is difficult to achieve sufficient compaction density unless the compaction width is wider than the design and cutting the edge and reforming the slope. Although the volume of emulsion that has flowed out was less than the primer coat, the same tendency was observed on the seal coat also.</li> </ul> <p>(c) Surface Dressing</p> <ul style="list-style-type: none"> <li>• Since water affects the adhesion of emulsion to the aggregates, appropriate curing measures after pre-coating the aggregate is required.</li> <li>• Regarding hauling and storage of the emulsion, initially contractor used empty drums to fill at the plant and convey to the site. However, to reduce times of hauling, the contractor changed to convey emulsion by using 5,000 liter tank. The emulsion was poured from the tank to buckets and then to drums every day. After this method was applied, clog in the asphalt distributor pipes was observed. This was considered because the viscosity of the emulsion has changed for it has stored in the tank for a long time than before and the emulsion has decomposed. To solve this matter, truck asphalt distributor was applied to storage the emulsion. This equipment will circulate the emulsion in the distributor and will avoid the emulsion to be decomposed.</li> <li>• Controlling the spray rate of emulsion was made by measuring the area sprayed and consumed volume, and its spraying speed. This method worked very well and even practical. It was able to adjust the area to be sprayed and its speed by</li> </ul>
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	<p>observing the works.</p> <ul style="list-style-type: none"> <li>• Chippy was applied to spread aggregates. However, approx. 15% beyond the designed spread rate was observed.</li> </ul> <p>(d)</p> <ul style="list-style-type: none"> <li>• Cold Mix Asphalt       <ul style="list-style-type: none"> <li>• A lot of dust balls came out during producing cold mix. According to the existing LBT manuals, it says that proper moisture control of the materials is required that excessively moist or dry will be the cause making the dust balls. For our case, since the construction was carried out during the rainy season, it is considered that the quarry dust had too much moisture. For this, the quarry dust was dried under the sun before mixture, and then it had an improvement extremely.</li> </ul> </li> <li>• During the construction it was found that the number of particular tools for cold mix such as guide rail will become the control of the construction speed. The maximum construction length of a section is about 50 m. Guide rail to construction 50m will be 2 lines (100 m) of thickness 20 mm rail, and 1 line (50 m) of thickness 6 mm rail. This will be a set for one section and at least tools for 2 sections is desired to be prepared for smooth implementation.</li> <li>• Waste material stick on the surface inside the concrete mixer and this affects the quality of the next cold mix. For this, sufficient amount of diesel oil, strong Keien stick to remove sticky asphalt and cleaning at the end of every work was required.</li> </ul> <p>(e)</p> <ul style="list-style-type: none"> <li>• Others       <ul style="list-style-type: none"> <li>• At least one month was needed to train and let understand the works to the contractor and labours. Training manual needed separately to the technical guideline.</li> <li>• The contractor did not possess any LBT equipment except concrete mixer and compactor. However, for the bituminous surface works, other equipment such as engine sprayer, chippy, tractor and low grader are needed. Considering the dissemination of the guideline, strong involvement and strategy of the government for solution is needed.</li> </ul> </li> </ul> <p>The contents discussed above were reflected to the table which describes the chapter and its outline of the guideline that was prepared at the 3<sup>rd</sup> technical meeting held on 9<sup>th</sup> November. This table shall be updated and more information shall be added as project progress obtained. After the lesson of the second trial construction incorporated in this table, it is expected that this shall be the source of the Guideline.</p> <p>Also, under the discussion, the contents to be incorporated in the second trial were given as follows;</p> <p>(a) Another contractor shall be hired to compare the performance (however, same</p>
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				route and labours) (b) To confirm the strength of the cold mix asphalt academically, Marshall tests shall be carried out in several test cases (c) Do trial by changing spray rate of primer coat and seal coat (d) Observe the behaviour of the sprayed emulsion by changing the camber of the base course. (e) Do trial of spread rate of the Chippy by adjusting the guide. (f) Improvement of surface dressing methodology to get closer to the design spread rate. (g) Other production rates such as brooming, watering, mixing asphalt, Spreading, Spraying, Compaction and etc. shall be recorded.
	5	Scheduled on Sep 2017	-	
	6	Scheduled on Nov. 2017	-	
	7	Scheduled on Jun. 2018	-	
	8	Scheduled on Sep. 2018	-	
Activity 3-2	<Prepare and agree with the outline of the guidelines by both sides>			
Activity 3-3	<Draft the guidelines>			
Activity 3-4	<Carry out the second field trial following the guidelines>			
Activity 3-5	<Revise the draft based on the result of the second field trials as necessary>			
Activity 3-6	<Carry out OJT through above activities>			
<b>OTHER OUTPUTS</b>				
Procurement of equipment	<ul style="list-style-type: none"> <li>All equipment was delivered and inspected properly by the Japanese Experts. For details, refer to Attachment-2.</li> <li>Equipment operational training was conducted from 21<sup>st</sup> to 24<sup>th</sup> November, 2016 at KTC.</li> </ul>			
Completed				
The third country Training	N/A			
Technical Seminar Under Preparation	<ul style="list-style-type: none"> <li>Technical Seminar is scheduled to do twice, first at middle stage of the Project mainly to present and discuss the lesson learnt from the First Trial Construction, and the second one at the end of the Project to present the contents of the prepared Guideline and to do discussion of methodology how to disseminate the Guideline nationwide. The first Seminar is tentatively scheduled to be held on 17<sup>th</sup> August, 2017 at Koforidua Training Centre.</li> </ul>			

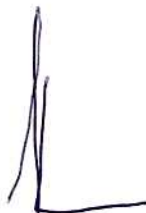
TO CHIEF REPRESENTATIVE JICA GHANA OFFICE

## PROJECT MONITORING SHEET

**Project Title: JICA Project for Developing Labour Based Bituminous Surfacing Technology (LBST)**

**Version of the sheet: Ver. 5 (February-2018)**

**Submission Date: 15th February, 2018**



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**Mr. E. Duncan-Williams**  
**Director**  
**Department of Feeder Roads**  
**Ministry of Roads and Highways**



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**Motoki Ogawa**  
**Chief Advisor /Rural Road Development**  
**Eight-Japan Engineering Consultants Inc.**



## I. Summary

### 1. Progress

#### 1-1. Progress of Inputs

##### (1) Japanese Side Input

Item	Achievement (as of 31 <sup>st</sup> July)					
Japanese Experts	Following <u>12 experts</u> in total have been dispatched to the Project, under the position below. The total Man/Month of these experts was <u>33.43 MM</u> up to 31 <sup>st</sup> January. Details are given in <b>Attachment-1</b> .					
		Expert		Position		Man/Month (MM)
		Motoki Ogawa		Chief Adviser / Rural Road Development		7.63
		Seiji Kadooka		Deputy Chief Advisor / Road Pavement technology		4.23
		Kazunori Kobayashi		Cost Estimation /Safety Guard		1.73
		Hiroaki Takahashi		LBT Guidelines		1.73
		Kazunori Kobayashi		Cost Estimation/ Safety Gard		2.50
		Tetuo Sakamoto		Site Supervisor		5.30
		Masanori Takeishi		Maintenance and Machinery Equipment		2.50
		Naoko Sasaki		Environment Considerations		1.00
		Yumiko Takeda		Project Coordination1 / Training Plan		2.17
		Takaaki Hirakawa		Monitoring and Evaluation 1		3.77
		Mayumi Shoji		Project Coordination 2 / Monitoring and Evaluation 2		1.13
		Tomoe Iehisa		Project Coordination 2		1.17
		Total (by the end of 31 <sup>st</sup> January, 2018 )				
Local Operation Cost	Local operation cost was mainly utilized for the following items					
	N o.	Items	US\$	No.	Items	US\$
	1	Transport Cost (domestic)	45,178	6	Allowance and Accommodation	6,488
	2	Communication Cost	2,066	7	Local Consultants/ Advisor	30,342
	3	Equipment Purchased	187,017	8	Others	14,211
	4	Third Country Training	6,187,459 /YEN	9	Sub-Contract (1st Trial Construction)	1,150,659.90 / GHS
	5	Meeting, Workshop and JCC	24,315			

Equipment	Copy machine, projector and construction machinery were provided. Details are given in <b>Attachment-2</b> .																								
Study tour in the Third country	<p>The study tour to the third country, titled “The study tour for developing guideline of bituminous sealing technology” was implemented from 5<sup>th</sup> to 18<sup>th</sup> November, 2017 in South Africa and Ethiopia. The name and position of the Ghanaian counterparts are given in the following table.</p> <table border="1"> <thead> <tr> <th>Name of Participants</th> <th>Position /Organization</th> </tr> </thead> <tbody> <tr> <td>Mr. Ibrahim Seidu (Only for Ethiopia)</td> <td>Director, RSIM/MRH</td> </tr> <tr> <td>Dr. K. Osafo Ampadu</td> <td>Deputy Director of Planning/DFR</td> </tr> <tr> <td>Eng. K. Omane-Brimpong</td> <td>Principal Engineer/DFR</td> </tr> <tr> <td>Dr. Patrick Bekoe Amoah</td> <td>Senior Engineer/DFR</td> </tr> <tr> <td>Eng. Bernard Williams Amoah</td> <td>Mechanical Engineer/DFR</td> </tr> <tr> <td>Eng. Frank Amofa Agyemang</td> <td>Assistant Engineer/DFR</td> </tr> <tr> <td>Eng. Joseph Mawusi Adekponya</td> <td>Assistant Engineer/DFR</td> </tr> <tr> <td>Dr. Issac Mensah</td> <td>Principal Quality Surveyor/DFR</td> </tr> <tr> <td>Eng. Frederick Addison</td> <td>Senior Engineer/DFR</td> </tr> <tr> <td>Eng. Christopher Ampah Essel</td> <td>Senior Technician Engineer/DFR</td> </tr> <tr> <td>Eng. Emmanuel Opoku-Adusei</td> <td>Assistant Engineer/DFR</td> </tr> </tbody> </table> <p>The outline of the activities is given in <b>Attachment-5</b>.</p>	Name of Participants	Position /Organization	Mr. Ibrahim Seidu (Only for Ethiopia)	Director, RSIM/MRH	Dr. K. Osafo Ampadu	Deputy Director of Planning/DFR	Eng. K. Omane-Brimpong	Principal Engineer/DFR	Dr. Patrick Bekoe Amoah	Senior Engineer/DFR	Eng. Bernard Williams Amoah	Mechanical Engineer/DFR	Eng. Frank Amofa Agyemang	Assistant Engineer/DFR	Eng. Joseph Mawusi Adekponya	Assistant Engineer/DFR	Dr. Issac Mensah	Principal Quality Surveyor/DFR	Eng. Frederick Addison	Senior Engineer/DFR	Eng. Christopher Ampah Essel	Senior Technician Engineer/DFR	Eng. Emmanuel Opoku-Adusei	Assistant Engineer/DFR
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## (2) Ghana Side Input

Item	Achievement (as of 31 <sup>st</sup> July)				
Counterparts	<p>The following Counterparts have been assigned for the project.</p> <table border="1"> <tbody> <tr> <td>DFR Head Office</td> <td>Director Deputy Director of Planning Principal Engineer Senior Engineer Mechanical Engineer Assistant Engineer</td> </tr> <tr> <td>DFR Eastern Region</td> <td>Regional Manager Principal Quality Surveyor Senior Engineer Senior Technician Engineer</td> </tr> </tbody> </table> <p>Details are given in <b>Attachment-3</b>.</p>	DFR Head Office	Director Deputy Director of Planning Principal Engineer Senior Engineer Mechanical Engineer Assistant Engineer	DFR Eastern Region	Regional Manager Principal Quality Surveyor Senior Engineer Senior Technician Engineer
DFR Head Office	Director Deputy Director of Planning Principal Engineer Senior Engineer Mechanical Engineer Assistant Engineer				
DFR Eastern Region	Regional Manager Principal Quality Surveyor Senior Engineer Senior Technician Engineer				
Local Operation Cost	Operation cost for the Project funded by Ghana side includes the running office cost, the material test, and road preparation up to sub-based level of the 1 <sup>st</sup> Trial Construction. Details are given in <b>Attachment-4</b> .				

### 1-2 Progress of Activities

Details are given in **Attachment-5**.

### 1-3 Achievement of the Outputs

#### 1-3-1 Achievement of the Output 2

##### (1) LBST construction standard (Form 3):

The first field trial has been completed in line with the checklist of LBST construction standard (Form 3) as required in the indicator 2. The main items of construction standard are shown below (refer to Attachment 6

on the Result of Form 3).

#### I. Formation of Typical Cross-section for Bituminous Pavement

- 1) Base treatment
- 2) Surfacing treatment

#### II. Standard of Quality Control for Bituminous Surfacing Treatment

- ① Spraying (priming)
- ② Surface dressing
- ③ Cold mix asphalt

#### III. General Issues

- ① Safety and health measures
- ② Miscellaneous works

#### < I. Formation of Typical Cross-section for Bituminous Pavement >

In terms of the “base treatment,” the compaction (standard specification: 98%) was not accepted because the percentage of compaction was out of range (93.03% at minimum and 96.25% at maximum). Also, regarding the “surfacing treatment,” the average width (standard specification: 6m) was not accepted since actual width was 5.5m for the sake of time constraint. This shall be rectified in the second field trial through proper time management during the construction period.

This is not a problem but a remark to be considered for the second field trial. Slow setting bitumen emulsion for surfacing treatment will be utilized this time instead of rapid setting which was adopted in the first field trial.

#### < II. Standard of Quality Control for Bituminous Surfacing Treatment >

With reference to the “surface dressing” and “cold mix asphalt,” effective use of light equipment was not partly accepted because 10-tone roller compactor (not light one) was used in the field trial. However, it is considered that heavy roller compactor is appropriate to achieve the desirable compaction. In the second field trial, therefore, 10-tone compactor will be used for desirable compaction as well as shorting of construction period. In connection with “mixing operation,” as “balling” was often observed, this operation was not accepted. Thus, this defect of balling shall be eliminated in the second field trial.

Regarding the light equipment for “cold mix asphalt,” furthermore, there is *the* important remark. Through the third country training in South Africa, counterpart observed the asphalt mixture production with the specific equipment called “pan mixer” at a private company. Originally, the Project tried to produce the “continuous mixer” by using their own design concept. However, counterpart requested to change continuous mixer into pan mixer, which is procurable in Ghana, from the perspectives of quality assurance and production efficiency through their experience in South Africa. Since the DFR could learn new concepts and approaches through the Third Country Training in South Africa, it is crucial to effectively apply the knowledge and experiences to the second field trial.

**< III. General Issues >**

Concerning “safety and health measures,” as a road worker was injured during the field trial, the DFR seeks the situation where no one gets injured in the second field trial. Safety and health awareness shall be intensified to avoid any accidents.

In the second field trial, therefore, those problems indicated from I to III above shall be overcome to meet LBST construction standard. There is a prospect that this indicator will be achieved after the completion of the second field trial.

Lastly, since the Form 3 influences the perfection level of road construction works, it is significant to confirm the construction progress in line with the Form 3. That is why filling in the checklist is greatly meaningful.

**(2) Task rates:**

Task rates are composed of two (2) types of labour-based bituminous surfacing operations, *i.e.*, “chip seal operation” and “cold mix asphalt operation.” With reference to “chip seal operation,” there are four (4) main activities as follows: (i) primer sealing (bitumen emulsion); (ii) spreading of 14mm chipping; (iii) spraying of bitumen for seal; and (iv) spreading of 10mm chipping.

On the other hand, “cold mix asphalt operation” includes three (3) main activities, such as (i) priming; (ii) tack coat (bitumen and water); and (iii) placing of cold mix asphalt.

As shown in the Table 1 and 2, unit rates are extracted from sub-activities corresponding to each main activity, and the rates indicate the costs (GH¢) for respective main activities per unit amount (ℓ, m<sup>2</sup>, or m<sup>3</sup>). Sub-activities under respective main activities are shown in the Attachment 7 (Task Rate Summary).

**Table 1: Chip Seal Operation** **January 2018**

Main Activity	Unit Rate
1. Primer Sealing (bitumen emulsion)	7.57 GHC/L
2. Spreading of 14mm chipping	643 GHC/m <sup>3</sup>
3. Spraying of bitumen for seal	6.91 GHC/L
4. Spreading of 10mm chipping	541 GHC/m <sup>3</sup>

**Table 2: Cold Mix Asphalt Operation** **January 2018**

Main Activity	Unit Rate
1. Priming	7.05 GHC/L
2. Tack Coat –Bitumen	6.77 GHC/L
Tack Coat- Water	1.46 GHC/L
3. Placing Cold Mix Asphalt	15.60 GHC/m <sup>2</sup>

**1-3-3 Achievement of the Output 3**

It is not ready to measure the achievement of Output 3 at this moment because the guidelines development is

still ongoing.

#### **1-4 Achievement of the Project Purpose**

##### **(1) Development of labour-based bituminous surfacing technology (LBST):**

There are two (2) indicators in the Project Purpose. In terms of the indicator 1, there is a prospect that LBST monitored along the checklist (Form 1) will be developed through the first and second field trials. The specific items defined in the Form 1 are indicated below.

##### **【Preparation Phase】**

- ① Work planning (work program, method statement, cash flow)
- ② Construction materials (chippings and bitumen)
- ③ Requisite equipment (tractor, trailer, pedestrian roller, water bowser, plate compactor, bitumen sprayer, chippy)

##### **【Implementation Phase (Base Treatment)】**

- ① Compaction of base course
- ② Traffic management
- ③ Quality assurance
- ④ Quality control
- ⑤ Construction method with labour procedure

##### **【Implementation Phase (Surface Treatment)】**

- ① Pre-coating of chippings
- ② Spotting and spreading of aggregates
- ③ Priming operation
- ④ Primer seal operation
- ⑤ Quality assurance
- ⑥ Quality control
- ⑦ Spraying operation
- ⑧ Seal operation
- ⑨ Cold mix asphalt operation

##### **【Inspection Phase (Immediately after the completion of construction)】**

- ① Road furniture
- ② Surface texture
- ③ Smoothness of road surface

The Project Team confirmed the above items from the following aspects, such as “actual achievements filled by DFR officials,” “acceptance & its comments by JICA experts,” and the “responses/undertakings by DFR officials.” This is a communication tool between DFR officials and JICA experts.

At this moment, since the “method statement” and “cash flow” of work planning during the “Preparation

Phase” were not submitted to DFR, the “actual achievements” and “acceptance by JICA experts” were not endorsed as described in the Result of the Form 1 (refer to Attachment 8). Other than those two items, there are fruitful advice and instructions from JICA experts to be fed back into the second field trial. Therefore, those clues shall be scrutinized by DFR for the improvement of the second field trial.

**(2) Self-evaluation of DFR officials, including Eastern Region, for acquiring LBST:**

The indicator 2 is the self-evaluation of DFR officials for acquiring LBST, and the target value was set in 65.0% since the baseline value was 44.7%. In order to confirm the progress of their understandings, the fourth questionnaire survey was conducted on the basis of the question items as follows:

- ① Planning skills and knowledge of road works;
- ② Road structure design and/or drawing;
- ③ Contents of Bill of Quantities (BOQ);
- ④ Cost estimation;
- ⑤ Road inspection tasks;
- ⑥ Safety practice for workers and road users during road works;
- ⑦ Technical advice and supports for a contractor;
- ⑧ Time management of road works during the execution periods;
- ⑨ Monitoring of road works; and
- ⑩ Standard specification of the labour-based bituminous surfacing technology.

DFR officials assessed themselves along the above question items by five-point scale with “5” in full-scale points. As the results of their self-evaluation on the LBST indicate the strength and weakness of DFR officials objectively, the technical assistance for DFR officials will efficiently be provided by focusing on the specific items.

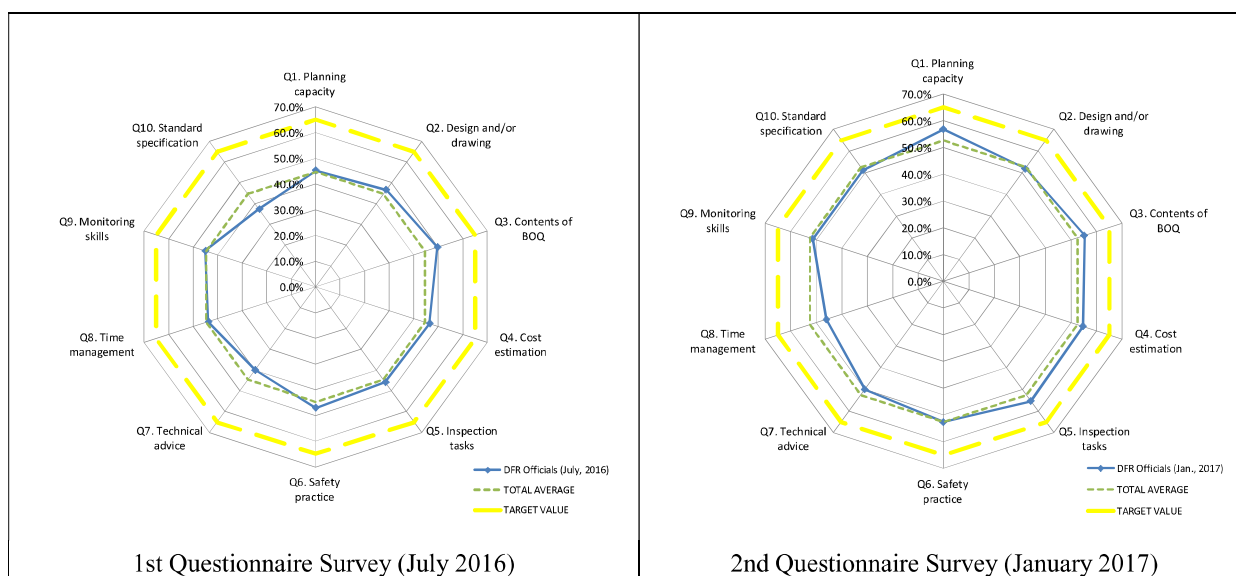
**Table 3: The self-rating results of DFR officials for acquiring LBST (Five-point scale)**

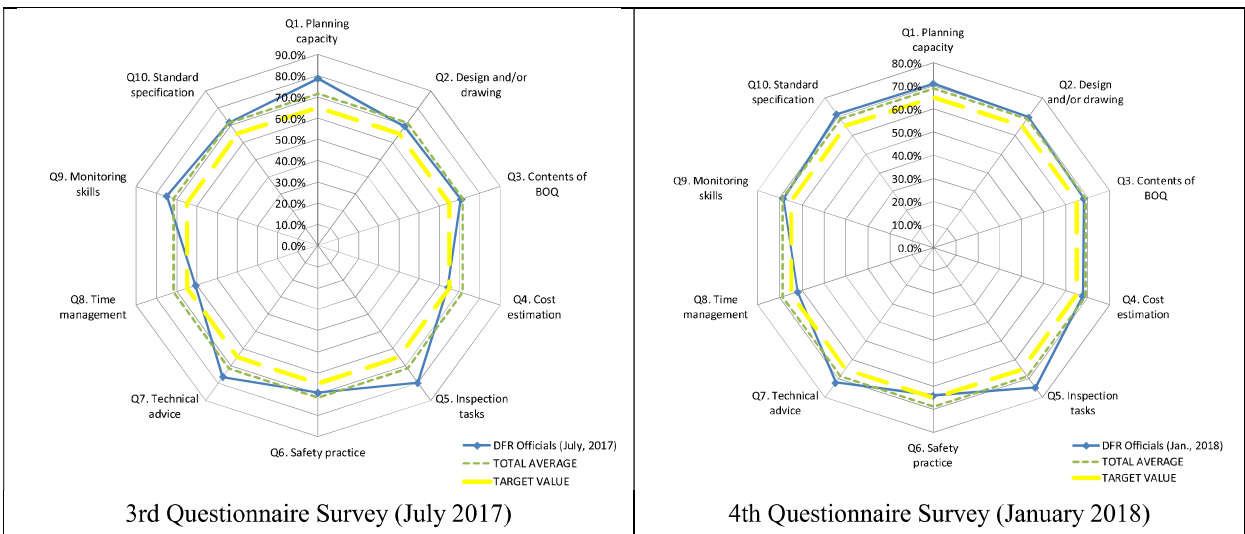
	1st Questionnaire (Jul 2016) 31 respondents	2nd Questionnaire (Jan 2017) 30 respondents	3rd Questionnaire (Jul 2017) 29 respondents	4th Questionnaire (Jan 2018) 31 respondents
<b>Q1. Planning skills and knowledge of road works</b>	45.2%	56.7%	78.5%	71.0%
<b>Q2. Road structure design and/or drawing</b>	46.5%	52.0%	69.3%	69.7%
<b>Q3. Contents of Bill of Quantities (BOQ)</b>	49.7%	55.3%	70.7%	68.4%
<b>Q4. Cost estimation</b>	46.5%	54.7%	64.3%	67.7%
<b>Q5. Road inspection tasks</b>	45.8%	55.3%	80.0%	74.8%

<b>Q6. Safety practice for workers and road users during road works</b>	47.1%	52.7%	69.3%	63.9%
<b>Q7. Technical advice and supports for a contractor</b>	40.0%	50.0%	76.4%	72.3%
<b>Q8. Time management of road works during the execution periods</b>	43.9%	46.0%	60.7%	61.9%
<b>Q9. Monitoring of road works</b>	45.2%	51.3%	75.0%	68.4%
<b>Q10. Standard specification of the labour-based bituminous surfacing technology</b>	37.4%	51.3%	71.4%	71.3%
<b>Total Rating on Average (Q1 – Q10)</b>	<b>44.7%</b>	<b>52.5%</b>	<b>71.5%</b>	<b>68.8%</b>
<b>Q11. Overall rating of the labour-based bituminous surfacing technology</b>	47.7%	52.0%	70.3%	72.3%

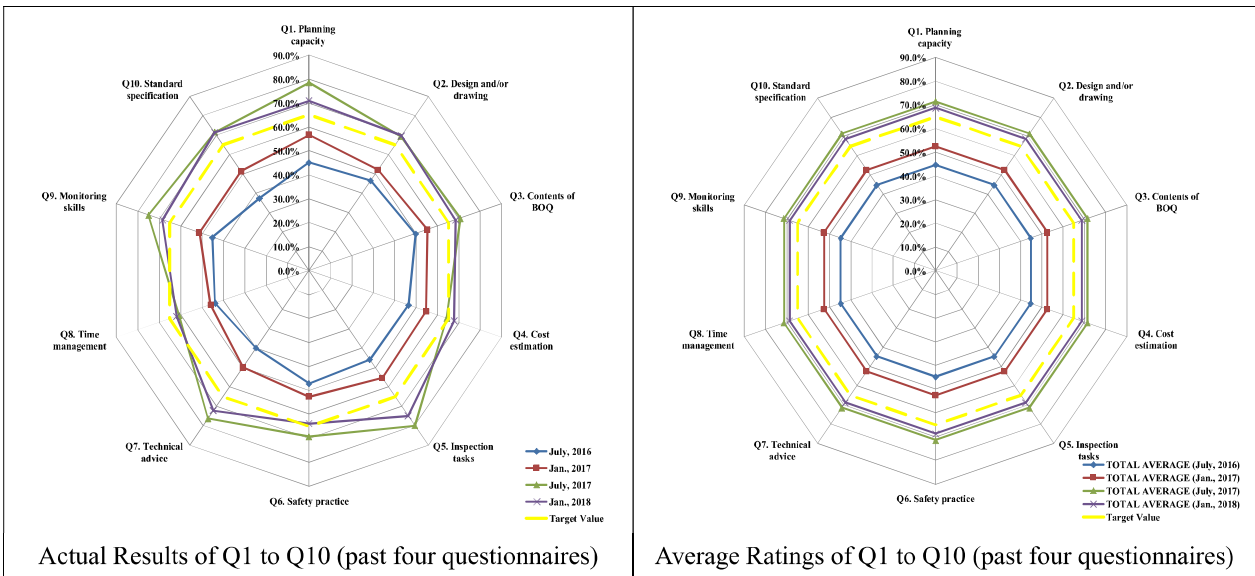
Source: Questionnaire survey through the Form 2 of the Monitoring System

DFR officials highly rated the “planning skills and knowledge (Q1: 71.0%)”, “road inspection tasks (Q5: 74.8%)”, “technical advice and supports for contractors (Q7: 72.3%)”, and “standard specification of LBST (Q10: 71.3%).” The ratings of those four items exceeded more than 5% of the target value. It is considered that first field trial in Koforidua as well as intensive workshop for guidelines development and overseas training in South Africa for the capacity enhancement of DFR officials were positively appreciated by DFR officials with the great supports of JICA experts. However, two items did not attain to the target, *i.e.*, the “safety practice for workers and road users (Q6: 63.9%)” and “time management of road works (Q8: 61.9%).” Thus, it is required to enhance safety practice and time management during the execution of second field trial through the technical advice and specific instructions by JICA experts.





**Figure 1: Self-rating results of DFR officials, including Eastern Region (Rader Chart)**



**Figure 2: Tendency of past self-rating results of DFR officials (“Actual Results” and “Average Ratings” of each question item from July 2016 to January 2018)**

**1-5 Changes of Risks and Actions for Mitigation**

In terms of the Important Assumptions, the Project shall pay attention to those conditions for the achievement of the Outputs and Project Purpose during the cooperation period. It seems that there are no risks to be found for those conditions at this moment.

**(1) Important Assumption for the achievement of the Outputs:**

DFR is able to utilize and mobilize available resources related to LBST in Ghana for the implementation of the Project. For example, KTC was involved in the first field trial, 2nd JCC, 1st Technical Seminar (convened



at KTC), and third country training in South Africa and Ethiopia to acquire the knowledge and experiences of LBST. The initiative of KTC is also indispensable to feed back them into the training courses at KTC for the achievement of the Overall Goal in the future. Moreover, KNUST provided the Project with the professional advice on LBST through the Technical Seminar, and GHA Central Lab conducted material tests for the first field trial.

**(2) Important Assumption for the achievement of the Project Purpose:**

Although Dr. Ampadu, Dy. Director (Planning) of DFR as well as Project Manager, retired on 11th December 2017, it is considered that this condition does not severely affect to the achievement of the Project Purpose. This is because his candidate successor, who is likely to be assigned from February 2018 will be able to work with the project members almost for a year before the project completion and go through the second field trial. Apart from this, there are no significant changes in C/P assignment.

**1-6 Progress of Actions undertaken by JICA**

N/A.

**1-7 Progress of Actions undertaken by Government of Ghana**

In regard to the trial construction, the subgrade, subbase and water drainage facility is allocated as part of the Government of Ghana's responsibility. The Project would take over above the sub-base and construct the base course and bituminous wearing course. The target section of the trial will be from 2+700 to 4+400 and the Contractor, which is Bend-Key Limited as same as the Project's contractor, has been in its position and has started their works since November 2017. Furthermore, it was agreed between DFR and the Project that the GoG part shall give contribution to the Project to implement the trial section in prior to the others. Therefore it is predicted that the GoG part would complete their necessary works before the Project part commence.

**1-8 Progress of Environmental and Social Considerations**

At section 0+400 of the target roads, there is a house that has to be demolished to complete the road since the building is blocking the half part of the road. The house owner has agreed GoG that he would vacate with proper compensation, and DFR has given report to Land Valuation Board to implement the land acquisition procedure. Currently, DFR is in stand by for the final approval from the Land Valuation Board and as soon as the light turns green, DFR would procure the land and do preparation to construct the missing part of the road.

**3 Modification of the Project Implementation Plan**

**3-1 PDM**

Based on discussions of the revision of PDM<sub>3</sub> between DFR and the JICA expert team, both sides are likely to agree on the change of target value in the Project Purpose by the end of February. After the agreement, the Project will be implemented according to the revised PDM<sub>3,1</sub>.

To be more precise, the target value in the indicator 2 of Project Purpose will be modified at **70%** from 65%.

**The Indicator 2 of Project Purpose (revised description):**

The self-rating of DFR officials and the officials concerned in Eastern Region for acquiring labour-based bituminous surfacing technology exceeds **70%** on average.

The rating results have gradually been increased from July 2016 to January 2018 as indicated in the Table 4. In the 3rd questionnaire survey in July 2017, it was considered that the rating result was drastically increased since the first field trial had just been completed at the time.

In any event, it is an appropriate timing to change the target value one year before the completion of the Project because the rating results of the last two surveys continuously exceeded the target value. The revised target (70%) shall be achieved by the end of the Project, *i.e.*, December 2018.

**Table 4: Rating results Modification of the PDM**

	1st Questionnaire (Jul 2016)	2nd Questionnaire (Jan 2017)	3rd Questionnaire (Jul 2017)	4th Questionnaire (Jan 2018)
Average Ratings	44.7%	52.5%	71.5%	68.8%

**4. Preparation of the Government of Ghana toward after the completion of the Project**

After the completion of the Project, DFR shall sustain its efforts to make LBST adopted as a viable surface treatment of feeder roads in Ghana, *i.e.*, Overall Goal which will be accomplished three years after the completion. In order to achieve this, it is crucial for DFR (1) to officially adopt LBST for feeder road surface treatment; (2) to conduct field trials in different climate and traffic conditions; and (3) to set up training course on LBST at KTC as defined in the indicators of the Overall Goal.

If the guidelines for LBST is properly developed and well recognized by DFR, there is a prospect that official approval of LBST will be obtained within three years. Thus, it is important to develop LBST guideline applicable to different road, climate, and traffic conditions across the country.

Most importantly, DFR shall allocate the budget to conduct field trials along the LBST construction standard, which is also described in the Important Assumption for the achievement of the Overall Goal. The Project encourages DFR to allocate the budget for the field trials in different road, climate, and traffic conditions from next financial year, FY 2019. Furthermore, it is crucial for DFR to find appropriate producers of bitumen emulsion with quality materials and reasonable price as well as steady supply since bitumen emulsion with a certain amount is indispensable for LBST construction works for the nationwide expansion.

Last but not least, DFR shall cooperate with KTC to set up training course along the guidelines. In order to disseminate LBST across the country, DFR officials, contractors, community representatives, and persons concerned need to receive the training course on LBST at KTC. During the cooperation period, the Project arranges the Technical Seminars to link between the guidelines and field trials in Koforidua. After the completion, however, DFR shall frequently communicate with KTC to develop training course along the guidelines.

## II. Project Monitoring Sheet I & II

### II-1. Project Monitoring Sheet I (PDM 3)

<b>II-1. Project Monitoring Sheet I (Version 5: 31st January, 2018)</b>					
<b>Project Design Matrix (PDM)</b>		Version No. 3 Date: 31st January, 2017			
<b>Project Title:</b> Project for Developing Labour Based Bituminous Surfacing Technology (LBST) in the Republic of Ghana					
<b>Implementing Agency in Ghana:</b> Department of Feeder Roads (DFR), Ministry of Roads and Highways (MRH)					
<b>Target Groups:</b> DFR officials and the officials concerned in Eastern Region					
<b>Project Sites:</b> Accra (capital) and feeder roads in Eastern Region					
Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions	Achievements	Remarks
<p><b>Overall Goal</b></p> <p>Measures are taken to make labour-based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.</p>	<p>1. Field trials along the LBST construction standard are conducted for further improvement and additional validation of labour-based bituminous surfacing technology in different climate and traffic conditions.</p> <p>2. Labour-based bituminous surfacing technology is officially adopted by DFR for feeder road surfacing.</p> <p>3. Training course for labour-based bituminous surfacing technology is set up according to the guidelines at the Koforidua Training Centre (KTC).</p>	<p>1. Field trial records, including the checklist of the LBST construction standard, prepared by DFR</p> <p>2. Approved guidelines by DFR</p> <p>3. Training records at KTC</p>		N/A	N/A
<p><b>Project Purpose</b></p> <p>The methodology and application of labour-based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.</p>	<p>1. Labour-based bituminous surfacing technology fulfilling the criteria defined in the monitoring checklist is developed through the field trials.</p> <p>2. The self-rating of DFR officials and the officials concerned in Eastern Region for acquiring labour-based bituminous surfacing technology exceeds 65% on average.</p>	<p>1. Monitoring checklist filled out by JICA experts</p> <p>2. Questionnaire surveys to DFR officials and the officials concerned in Eastern Region</p>	<p>1. There is no significant change for the activities of DFR for feeder road services.</p> <p>2. There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road.</p> <p>3. The budget for the measures necessary for the labour-based bituminous surfacing technology is secured.</p>	<p>The LBST is likely to be developed after the second field trial.</p> <p>Refer to the PMS Summary in detail.</p>	<p>As the self-rating results exceeded the target in the past two surveys, the target will be changed from 65% to 70%.</p>
<p><b>Outputs</b></p> <p>1. Current conditions and issues for labour-based bituminous surfacing technology in Ghana are identified.</p> <p>2. Field trials of labour-based bituminous surfacing technology are carried out.</p> <p>3. Guidelines for labour-based bituminous surfacing technology are prepared.</p>	<p>1-1. Issues and results analysed by the experts and counterparts are indicated in the Project Monitoring Sheet (Summary).</p> <p>2-1. Lab tests of materials are conducted in accordance with the material standard.</p> <p>2-2. The field trials are conducted in line with the construction standard for labour-based bituminous surfacing technology (LBST construction standard).</p> <p>2-3. Task rates for labour-based bituminous surfacing technology are defined.</p> <p>3-1. Draft guidelines for labour-based bituminous surfacing technology is completed.</p>	<p>1-1. Project Monitoring Sheet (Summary)</p> <p>2-1. Certificate ("Results") of the lab tests</p> <p>2-2. Checklist of the LBST construction standard</p> <p>2-3. Summary table of task rates</p> <p>3-1. Draft guidelines for labour-based bituminous surfacing technology</p>	<p>There is no significant change in C/P assignment</p>	<p>This Output was achieved as scheduled.</p> <p>First field trial was completed.</p> <p>Refer to the PMS Summary in detail.</p> <p>Guidelines preparation is still ongoing.</p>	N/A

<p><b>Activities</b></p> <p>1-1 Collect and analyse information on the counterparts (C/Ps) organisational capacity (e.g., personnel, budget, experiences, etc.).</p> <p>1-2 Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana.</p> <p>1-3 Review and evaluate the similar technical standards and manuals prepared by such organisations as Department for International Development (DFID), South African Department of Public Works, etc.</p> <p>1-4 Confirm the procurement and cost of materials (e.g., gravels, etc.).</p> <p>1-5 Test and evaluate characteristics of the materials as stipulated by respective technical standards.</p> <p>1-6 Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana.</p> <p>1-7 Check the quality control systems and the procedures of road pavement work in Ghana.</p> <p>1-8 Check the maintenance management systems of feeder roads in Ghana.</p> <p>1-9 Compile and report the analysis on issues on labour-based bituminous surfacing technology in Ghana.</p> <hr/> <p>2-1 Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials).</p> <p>2-2 Conduct necessary lab tests to assess the characteristics of materials.</p> <p>2-3 Identify technical requirements (e.g., materials, methodology and process, quality control, etc.) through the field trials.</p> <p>2-4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials.</p> <p>2-5 Collect information on task rates.</p> <p>2-6 Identify the applicable conditions of the labour-based bituminous surfacing technology.</p> <p>2-7 Identify the safeguard issues.</p> <p>2-8 Prepare a report on above.</p> <p>2-9 Carry out on-the-job training (OJT) through above activities.</p> <hr/> <p>3-1 Determine the contents of the guidelines by reviewing the result of the first field trials.</p> <p>3-2 Prepare and agree with the outline of the guidelines by both sides.</p> <p>3-3 Draft the guidelines.</p> <p>3-4 Carry out the second field trial following the guidelines.</p> <p>3-5 Revise the draft based on the result of the second field trials as necessary.</p> <p>3-6 Carry out OJT through above activities.</p>	<p><b>Inputs</b></p> <p><b>Japanese side</b></p> <ol style="list-style-type: none"> <li>Experts <ul style="list-style-type: none"> <li>Chief Advisor Feeder Road Development</li> <li>Road Pavement Technology</li> <li>LBT Guideline</li> <li>Cost Estimate Safe Guard</li> <li>Site Supervisor</li> <li>Maintenance of Machinery and Equipment</li> <li>Environment</li> <li>Project Coordination/Training Planning</li> <li>Monitoring and Evaluation</li> <li>Project Review</li> </ul> </li> <li>Provision of machinery and equipment <ul style="list-style-type: none"> <li>Compactor</li> <li>Asphalt sprayer</li> <li>Asphalt heater</li> <li>Tractor</li> <li>Trailer</li> <li>Impact tamping rammer</li> <li>Equipment for Dynamic Cone Penetrometer (DCP) testing</li> </ul> </li> <li>Transportation for the experts</li> <li>Provision of third country training (e.g., South Africa)</li> <li>Costs for the field trials <ul style="list-style-type: none"> <li>Base and bituminous surface treatment</li> <li>Supervisors</li> <li>Workers</li> <li>Others as necessary</li> </ul> </li> </ol>	<p><b>Ghanaian side</b></p> <ol style="list-style-type: none"> <li>Personnel <ul style="list-style-type: none"> <li>Project Director (DFR Director)</li> <li>Project Manager (Dy. Director of Planning, DFR)</li> <li>C/P (Mainly Planning Section and Eastern Region Office of DFR)</li> </ul> </li> <li>Expenses necessary for the field trials <ul style="list-style-type: none"> <li>Transportation for C/P staff</li> <li>Material test conducted at DFR (equipment, cost, etc.)</li> <li>Hand tools for pavement</li> <li>Road preparation at sub-base level for the field trials</li> </ul> </li> <li>Office space</li> <li>Furniture (e.g., desks, etc.)</li> <li>Means of communication at the head office (e.g., internet connection)</li> </ol>	<p>DFR is able to utilize and mobilise available resources related to labour-based bituminous surfacing technology in Ghana (e.g., KTC, KNUST, GHA Central Lab and their expertise, etc.) for the implementation of the Project.</p>
			<p><b>Pre-conditions</b></p> <ol style="list-style-type: none"> <li>Ghanaian side provides technical documents on LBT.</li> <li>Laboratory testing of materials is available.</li> <li>The sites for field trials are ensured (these sites must be prepared with the road bed and filled with sub base course materials, etc.).</li> </ol>
			<p><b>&lt;Issues and Countermeasures&gt;</b></p> <p>N/A</p>



## **Attachments**

- 1: Japanese Experts Assignment**
  - 2: Equipment**
  - 3: Counterparts Designation**
  - 4: Local Operation Cost (Ghana side)**
  - 5: Progress of Activities**
  - 6: Form-3 (Indicator of Construction Standard)**
  - 7: Task Rate Summary**
  - 8: Form-1 (Indicator of Project Purpose)**
-



**Attachment-2: Equipment (as of 31<sup>st</sup> July, 2017)**

Attachment-2 List of equipment												
No	Date of registration	Description/Name of equipment/ Goods	Specification - Standard	QTY	Price	unit	Provider	User	Purpose of Use	Place of Use	Responsible Person	Hand Over
1	23-Jan-16	Projector	EPSON EB-S31	1	445.68	USD	(Electronic retail shop in Japan)	Expert	Workshop /Presentation	DFR	Expert	✓
2	12-Feb-16	Printer	Ricoh MPC2011	1	6,075.91	USD	IMPC Intercom Programming & Manufacturing Co. Ltd.	Expert	Means of Documentation	DFR	Expert	✓
3	3-Aug-16	Cold Bitumen Sprayer	1D10CB	2	5,950.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
4	3-Aug-16	Plate Compactor	Bell, PCX450	2	4,475.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
5	3-Aug-16	Mobile Concrete Mixer	Bell, 400D	1	2,987.50	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
6	18-Aug-16	Tractor	75 HP, Diesel Engine, Tools	2	73,000.00	USD	Agria Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	✓
7	18-Aug-16	Tractor	Towed Type, 5000kg capacity, Tools	2								
8	18-Aug-16	Spare parts for tractor and tractor	-	1	1,441.00	USD	Agria Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	✓
9	26-Aug-16	Duplex Roller	Atlas, LP750	2	32,373.18	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
10	26-Aug-16	Engine Suction Water Pump	Techmoole, KGP80D	2	1,297.48	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
11	26-Aug-16	Mechanical Tool Set	-	1	530.21	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
12	8-Nov-16	Water Bowser	ID5000L	1	8,850.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
13	8-Nov-16	Manual hand Asphalt Sprayer	1D10M	2	3,880.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
14	8-Nov-16	Chip Spreader	NCA, Chippy	4	27,580.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
15	8-Nov-16	Spare parts	-	1	3,143.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
16	8-Dec-16	TRL Dynamic Cone Penetrometer (DCP)	Code: 16-T0012/A, Weight, 86Kgs, Dims: 117x51x46cm	2	4,374.20	USD	Askia Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
17	8-Dec-16	Spare parts	-	1	10,613.94	USD	Askia Ltd	C/P	For Project Activities	KTC	KTC/DFR	✓
Total					187,017.10	USD						





## Attachment-4: Local Operation Cost (Ghana side)

Local Cost Allocated by Ghana Side		Local Cost			
Items	MS Ver. 2 Feb. 2016 to Jul. 2016	MS Ver. 3 Aug. 2016 to January 2017	MS Ver. 4 Feb. 2017 to July 2017	MS Ver. 5 Aug. 2017 to Jan. 2018	MS Ver. 6 *** 2018 to *** 2018
<b>1-1</b>	<b>Personals</b>				
	1 C/P Designation	Director DFR Deputy Director of Planning Principal Engineer (Coordinator) Mechanical Engineer Director of Eastern Region	Director DFR Deputy Director of Planning Principal Engineer / DFR Senior Engineer / DFR Mechanical Engineer / DFR Assis. Engineer / DFR Director of Eastern Region / DFR-E Principal QS / DFR-E Senior Engineer / DFR-E Senior Technician Engineer / DFR-E	Director DFR Deputy Director of Planning / DFR Principal Engineer/ DFR Senior Engineer / DFR Mechanical Engineer/ DFR Assis. Engineer / DFR Director of Eastern Region / DFR-E Principal QS / DFR-E Senior Engineer / DFR-E Senior Technician Engineer / DFR-E	
<b>1-2</b>	<b>Human Resources and expenses necessary for the field trials</b>				
	1 Supervisors	N/A	N/A	Principal Engineer/ DFR (Site MTG) Assis. Engineer / DFR (Site MTG) Principal QS / DFR-E Senior Engineer / DFR-E Senior Technician Engineer / DFR-E	
	2 Workers	N/A	N/A	inclusive at JICA-LBST contract	
	3 Transportations for C/P staff	Travel allowance and accommodation, fuel borne by DFR	N/A	Travel allowance and accommodation, fuel funded by both DFR/KICA-LBST occasionally	
	4 Material test conducted at DFR	N/A	N/A	N/A	
	5 Hand tools for pavement	N/A	N/A	N/A	
	6 Road preparation up to sub-based level	N/A	N/A	N/A	
<b>1-3</b>	<b>Office Space</b>				
	1 Office space	DFR prepared Room 106 at DFR head office for the Project			
<b>1-4</b>	<b>Furniture</b>				
	1 Office facilities	DFR provide desks, chairs, power, air conditioner and HP color printer for the Project			
<b>1-5</b>	<b>Means of communication at the head office</b>				
	1 Communication Tools	Internet WIFI and a land line prepared for the Project			
<b>1-6</b>	<b>Others</b>				

## Attachment-5: Progress of Achievement

### Attachment -5 Progress of Activities

#### Activity Performed (as of end of January, 2018)

OUTPUT-1 Current Conditions and issues for labour based bituminous surfacing technology in Ghana are identified.									
Activity 1-1 <b>Completed</b>	<p>&lt;Collect and analyze information on the counterparts (C/Ps) organizational capacity (e.g. personal, budget, experiences, etc.)&gt;</p> <ul style="list-style-type: none"> <li>• Origination, number of engineers, budget and experience on LBT of DFR as well as the eastern region office were surveyed</li> <li>• Visited KTC and surveyed the capacity maintaining equipment. It was confirmed that KTC will be the appropriate organization to place and do the maintenance for the equipment which the Project and JICA will procure.</li> </ul>								
Activity 1-2 <b>Completed</b>	<p>&lt;Collect information regarding technical standards and design guidelines for bituminous surface technology on Ghana&gt;</p> <ul style="list-style-type: none"> <li>• Technical standards and guideline relating to LBT works from African countries in particular were collected. Totally, 24 numbers of standards and guideline such as Ethiopian, Tanzanian, Kenyan, South African and others were collected and evaluated.</li> </ul>								
Activity 1-3 <b>Completed</b>	<p>&lt;Review and evaluate the similar technology standards and manual prepared by such organizations as Department for International Development (DFID), South African Department of Public Works, etc.&gt;</p> <ul style="list-style-type: none"> <li>• From discussion with DFR, it was determined to apply cold emulsion asphalt rather than heated asphalt from the research in the past as well as safety. KNUST has attempted applying Otta seal pavement which requires heated cutback asphalt and was found difficulty utilizing it in Ghana's condition. From this, it was recommended to choose cold asphalt pavement, Sand seal and single surface dressing in the trial construction.</li> <li>• Evaluation through the collected documents, it was found that technical manual of Ethiopia covers most of the target pavements mentioned above. From this, referring to the Ethiopian manual was considered.</li> <li>• KTC was implementing a road design training utilizing DCP by World Bank support. This training was following the contents of the Ethiopian Manual, and from this, it was decided refer to Ethiopian Manual dominant.</li> </ul>								
Activity 1-4 <b>Completed</b>	<p>&lt;Confirm the procurement and cost of materials (e.g. gravels, etc.)&gt;</p> <ul style="list-style-type: none"> <li>• From interview, following were found as a general price of materials to be used in the trial construction.</li> </ul> <table border="1" data-bbox="821 728 1018 1473"> <thead> <tr> <th>Materials</th> <th>General Unit Price from interview</th> </tr> </thead> <tbody> <tr> <td>Cold emulsion</td> <td>560 GHS /drum include transport to trial site (drum =200 liters)</td> </tr> <tr> <td>Chippings</td> <td>65 GHS /m<sup>3</sup> (20-25mm) 40 GHS/m<sup>3</sup> (Dust) 56 GHS/m<sup>3</sup> (0-40 mixed)</td> </tr> <tr> <td>Gravel</td> <td>33 GHS/m<sup>3</sup> incl. transport to trial site</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>• Price fluctuation were surveyed and it was found that unit price of local labour and chipping continuously increased over the pass 1.5 years, and conversely the price of bitumen easily get influence from the international market which means not stable.</li> <li>• From the record, it was found the unit price of labour grow double in 1.5 years from the baseline where chipping were 1.5 times higher as well. For bitumen, price has escalated 2.4 times higher tentatively and came down to the original price eventually. It can be said that price of the bitumen is quite difficult to predict compare with the chippings and labours.</li> </ul>	Materials	General Unit Price from interview	Cold emulsion	560 GHS /drum include transport to trial site (drum =200 liters)	Chippings	65 GHS /m <sup>3</sup> (20-25mm) 40 GHS/m <sup>3</sup> (Dust) 56 GHS/m <sup>3</sup> (0-40 mixed)	Gravel	33 GHS/m <sup>3</sup> incl. transport to trial site
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Activity 1-5 <b>Completed</b>	<p>&lt;Test and evaluate characteristics of the materials as stipulated by respective technical standards&gt;</p> <ul style="list-style-type: none"> <li>• Confirmed implementing material testing will be conducted at the central material laboratory. The Capacity and capability of the laboratory was confirmed by observing the tests actually and interview to the technicians.</li> <li>• Quality and general cost for chipping (aggregate), gravel and cold emulsion were confirmed through interview to suppliers, contractors and DFR engineers.</li> </ul>								
Activity 1-6 <b>Completed</b>	<p>&lt;Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana&gt;</p> <ul style="list-style-type: none"> <li>• From interview to counterparts, it was grasped that there is a roll between headquarter and regional office. Most of the field works such as inventory survey, designing</li> </ul>								

	<p>cost estimation, tendering and quality control are under jurisdiction of the regional office while the headquarter has roll to monitor and give approval to the planning as well as payment to the contractors. So, regarding the procedures for design and procurement, the system is established appropriately.</p> <ul style="list-style-type: none"> <li>Most of the feeder roads in Ghana are gravel surface and bituminous surface is very little. The design of the surface is done by following the MRH standards. The design of the single surface is indicated in the MRH design manual and although this manual is based in EBT method, since the structure itself doesn't have difference between LBT, it can be understood still valid applying on feeder roads. From the above-mentioned discussion, the necessity of creating a new guideline for LBT in use of bitumen, which is the major output of this Project, was re-confirmed.</li> </ul> <p>&lt;Check the quality control systems and the procedures of road pavement work in Ghana&gt;</p> <ul style="list-style-type: none"> <li>Quality control in actual construction is a roll of the regional office. The regional office does the quality control followed by the MRH standard.</li> </ul> <p>&lt;Check the maintenance management systems of feeder roads in Ghana&gt;</p> <ul style="list-style-type: none"> <li>It was grasped that DFR has system which names RPM (Road Prioritisation Methodology), GIS (Database and Geographical Information System) and MPBS (Maintenance Performance Budgeting System). So, most of the DFR's activities from selecting the annual target road to making BOQ of it is systemized and confirmed working under the solid total system.</li> </ul> <p>&lt;Compile and report the analysis on issues on labour-based bituminous surfacing technology in Ghana&gt;</p> <ul style="list-style-type: none"> <li>Contents of the activity 1-1 to activity 1-9 have been compiled in a report including the results of the materials which was the missing item in MS2.</li> </ul>												
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<b>OUTPUT-2 Field</b>	<b>Trials of labour-based bituminous surfacing technology are carried out.</b>												
Activity 2-1 <b>Completed</b>	<ul style="list-style-type: none"> <li>The technical workshop was conducted as follows</li> </ul> <table border="1"> <thead> <tr> <th>S/N</th> <th>Date</th> <th>Participants</th> <th>Major discussion and Conclusion</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>27<sup>th</sup> July, 2016</td> <td>DFR, Eastern Region, JICA, LBST</td> <td> <ul style="list-style-type: none"> <li>Basic contents of the trial construction plan were confirmed.</li> <li>Cold Bitumen, Sand Seal and Single Surface were chosen as a target pavement type to be incorporated in the guideline.</li> <li>A contractor shall be hired by DFR to conduct the trial construction while the materials shall be provided by the Project.</li> <li>A private consultant shall be hired by the Project to collect data from the trial construction.</li> <li>The essence of utilizing LBT is the construction cost and durability.</li> </ul> </td> </tr> <tr> <td>2</td> <td>14<sup>th</sup> Sep., 2016</td> <td>DFR, Eastern Region, JICA, LBST</td> <td> <ul style="list-style-type: none"> <li>The objective of implementing the trial construction was defined as 1) determined the appropriate construction method to apply LBT on bituminous works, 2) confirm the balance between both labour and equipment based constructions, 3) record the spray and consumption rate of materials, 4) found findings related to safety and environment, and 5) reflect the lesson obtained to the Guideline.</li> <li>Target road and section of the trial construction was chosen between Ohomofo Densua-Atoke villages at Suhun, Municipal, and Eastern Region near KTC. The distance was approx. 3.2 km</li> <li>Since the construction of sub-base is now implemented by LBT, it was discussed and approved that the procurement of the labour which is the responsibility of DFR according to the PDM<sub>2</sub> shall be made with the same contractor by amending the current contract.</li> <li>Based on the submitted current status report, it was discussed and approved that the work items method should be single chip seal and cold mix asphalt. However,</li> </ul> </td> </tr> </tbody> </table>	S/N	Date	Participants	Major discussion and Conclusion	1	27 <sup>th</sup> July, 2016	DFR, Eastern Region, JICA, LBST	<ul style="list-style-type: none"> <li>Basic contents of the trial construction plan were confirmed.</li> <li>Cold Bitumen, Sand Seal and Single Surface were chosen as a target pavement type to be incorporated in the guideline.</li> <li>A contractor shall be hired by DFR to conduct the trial construction while the materials shall be provided by the Project.</li> <li>A private consultant shall be hired by the Project to collect data from the trial construction.</li> <li>The essence of utilizing LBT is the construction cost and durability.</li> </ul>	2	14 <sup>th</sup> Sep., 2016	DFR, Eastern Region, JICA, LBST	<ul style="list-style-type: none"> <li>The objective of implementing the trial construction was defined as 1) determined the appropriate construction method to apply LBT on bituminous works, 2) confirm the balance between both labour and equipment based constructions, 3) record the spray and consumption rate of materials, 4) found findings related to safety and environment, and 5) reflect the lesson obtained to the Guideline.</li> <li>Target road and section of the trial construction was chosen between Ohomofo Densua-Atoke villages at Suhun, Municipal, and Eastern Region near KTC. The distance was approx. 3.2 km</li> <li>Since the construction of sub-base is now implemented by LBT, it was discussed and approved that the procurement of the labour which is the responsibility of DFR according to the PDM<sub>2</sub> shall be made with the same contractor by amending the current contract.</li> <li>Based on the submitted current status report, it was discussed and approved that the work items method should be single chip seal and cold mix asphalt. However,</li> </ul>
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	3	DFR, Eastern Region, JICA, LBST, KNUST, ILO	<p>it was also confirmed that the standard structure of single chip seal in Ghana means 2 layers which applies 14mm chip on first and 9mm chip on second layer.</p> <ul style="list-style-type: none"> <li>Based on the conclusion of 2<sup>nd</sup> TW, BoQ applying single chip seal and cold mix asphalt was reported and due to budgetary reasons, it was recommended to adjust the construction length to meet the fixed sealing price. However, it was also discussed the necessity of having practice of spraying and spreading prior to actual construction for lesson obtained from the equipment operation training conducted at KTC.</li> <li>It was reported from the Chief Consultant that demarcation between the Project and DFR, the Project shall bear the labour and the contractor which it is the responsibility of DFR currently. From this, the PDM should be amended at the next Monitoring Sheet accordingly.</li> <li>Since the Ethiopian manual covers most of the area which this project aims, it was discussed and approved to refer this manual to build technical specification of the tendering documents. Relate to technical matters, the thickness of cold mix asphalt was discussed and approved to apply 14mm which is stated as the standard according to the Ethiopia manual.</li> <li>The Chief Consultant explained the further schedule that the tendering shall be implemented by restrict tendering and pre-tendering around begging of December, and tendering on 24<sup>th</sup> January tentatively. With collaboration of DFR and the Project, the tendering documents shall be made before end of November.</li> </ul>
<p>Activity 2-2 <b>Completed</b></p>	<p>From discussion made above, preparation of tendering documents which includes agreement and technical specification was completed by end of November. In the technical specification, both objective and methodology of implementing the trial construction was clearly mentioned. This tendering documents were sold to contractors who show the interest and passed the criteria of restrict tendering. Pre-tendering meeting was held on 6<sup>th</sup> December and tendering on 24<sup>th</sup> of January, 2017 as scheduled. A. Niggesten Ltd. presented the lowest price and expect have signing between Eight-Japan Engineering Consultants Inc. on early February.</p> <p>&lt;Conduct necessary lab tests to assess the characteristics of materials&gt;</p> <ul style="list-style-type: none"> <li>In the first trial construction, following lab test were carried out to confirm the quality of the materials and construction <ul style="list-style-type: none"> <li>Sieve test for gravel and aggregates, MDD and OMC test for gravels, Fl, ACV, LAA and ALD tests for aggregates, Sand replacement test for base course</li> </ul> </li> </ul> <p>&lt;Identify technical requirements (e.g., materials, methodology and process, quality control, etc.) through the field trials&gt;</p> <ul style="list-style-type: none"> <li>From the first trial construction, following knowledge was observed. Details are given in Activity 3-1 below. <ul style="list-style-type: none"> <li>Pre-coating the aggregate will seal the aggregate with emulsion and dust which adhere on the surface. For this, it was observed that pre-coating will prevent the aggregate comes off from the surface on surface dressing</li> <li>One layer of base course should be less than 150mm on doing compaction by LBT.</li> <li>Camber shall be attempted to be 3% for bituminous surface</li> <li>Emulsion needs proper storage method to keep the quality</li> <li>For spread rate of aggregate, more trials are needed to get closer to design rate</li> <li>For cold mix asphalt, how to remove dust balls was the one of the largest issue</li> </ul> </li> </ul>		

<p>Activity 2-4 <b>Completed</b></p>	<p>&lt;Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials&gt;</p> <ul style="list-style-type: none"> <li>From the first trial construction, following knowledge was observed. Details are given in Activity 3-1 below. <ul style="list-style-type: none"> <li>Rainy season is not appropriate for bituminous work since water affects the asphalt adhere on aggregate</li> <li>Since labour start farming in rainy seasons, it is desirable to finish works before that</li> <li>One month preparation was needed for the contractor and labour to understand the works. For this, training manual /guideline is needed for dissemination</li> <li>Currently, the contractors do not have chippy or tow grader which is an equipment needed for bituminous surface works by LBT. Strategy and involvement in government level required.</li> </ul> </li> </ul>								
<p>Activity 2-5 <b>Completed</b></p>	<p>&lt;Collect information on task rates&gt;</p> <ul style="list-style-type: none"> <li>Information to prepare the task rates are collected through the first trial construction and now under analysis.</li> </ul>								
<p>Activity 2-6 <b>Completed</b></p>	<p>&lt;Identify the applicable conditions of the labour-based bituminous surfacing technology&gt;</p> <ul style="list-style-type: none"> <li>Area where the terrain is heavy and steep is not applicable for LBT works</li> <li>Area where doesn't have basic access road to carry the equipment is not applicable for LBT works</li> <li>Area where difficult to hire labour or no residents are not applicable for LBT Works</li> <li>Area where difficult to carry bituminous materials is not applicable for bituminous LBT works since the production is made only at the greater Accra region.</li> </ul>								
<p>Activity 2-7 <b>Completed</b></p>	<p>&lt;Identify the safeguard issues&gt;</p> <ul style="list-style-type: none"> <li>Guidance of how to do bituminous sealing works by LBT to the labours was carried out.</li> <li>Guidance of HIV/AIDS and pre-cautions during construction was carried out.</li> </ul>								
<p>Activity 2-8 <b>Completed</b></p>	<p>&lt;Prepare a report on above&gt;</p> <ul style="list-style-type: none"> <li>Technical reports as follows were prepared. <ul style="list-style-type: none"> <li>Proportion of mixed aggregate</li> <li>Appropriate mixing rate of pre-coated aggregate</li> <li>Appropriate spray rate of emulsion</li> <li>Appropriate spread rate of aggregate</li> <li>Design mix of the cold mix asphalt</li> </ul> </li> <li>Comprehensive summary report was prepared.</li> <li>Discussion regarding the outline of the guideline was carried out and summarized in a table based on document submitted in the 3<sup>rd</sup> technical meeting</li> </ul>								
<p>Activity 2-9 <b>Completed</b></p>	<p>&lt;Carry out on-the-job training (OJT) through above activities&gt;</p> <ul style="list-style-type: none"> <li>All of the activities from Activity 1-1 to Activity 2-1 were carried out with collaboration between the DFR members and Japanese Experts.</li> <li>The DFR members with KTC and the contractors had an equipment operational training at KTC. The trainees had opportunity how to maintain the equipment as well as operation systemically. The JICA provided equipment was used for the training.</li> <li>All of the activities from Activities 2-2 to Activity 2-9 were carried out with collaboration between the DFR members and Japanese Experts</li> </ul>								
<p><b>OUTPUT-3 Guidelines for labour-based bituminous surfacing technology are prepared</b></p>									
<p>Activity 3-1 <b>Completed</b></p>	<p>&lt;Determine the contents of the guidelines by reviewing the result of the first field trials&gt;</p> <table border="1" data-bbox="1187 284 1347 1720"> <thead> <tr> <th data-bbox="1187 1630 1216 1720">S/N</th> <th data-bbox="1187 1500 1216 1630">Date</th> <th data-bbox="1187 1025 1216 1500">Participants</th> <th data-bbox="1187 284 1216 1025">Major discussion and Conclusion</th> </tr> </thead> <tbody> <tr> <td data-bbox="1216 1630 1238 1720">4</td> <td data-bbox="1216 1500 1276 1630">26<sup>th</sup> to 28<sup>th</sup> July, 2017 (The First Intensive</td> <td data-bbox="1216 1025 1347 1500"> <ul style="list-style-type: none"> <li><b>Dr. K. Osafo Ampadu</b> Deputy Director of Planning, DFR Head Office</li> <li><b>K. Omana-Brimpong</b> Principal Engineer, DFR Head Office</li> <li><b>Dr. Patrick Bekoe Amoah</b></li> </ul> </td> <td data-bbox="1216 284 1347 1025"> <p>The First Intensive Workshop was held in Pepeease, Eastern Region from 26 to 28<sup>th</sup>, July, 2017. The purpose of the workshop was to review the lesson learnt from the first trial construction and to discuss way forward for the preparation of the second trial construction. The outline of the review is given as follows; (a) Preparation</p> </td> </tr> </tbody> </table>	S/N	Date	Participants	Major discussion and Conclusion	4	26 <sup>th</sup> to 28 <sup>th</sup> July, 2017 (The First Intensive	<ul style="list-style-type: none"> <li><b>Dr. K. Osafo Ampadu</b> Deputy Director of Planning, DFR Head Office</li> <li><b>K. Omana-Brimpong</b> Principal Engineer, DFR Head Office</li> <li><b>Dr. Patrick Bekoe Amoah</b></li> </ul>	<p>The First Intensive Workshop was held in Pepeease, Eastern Region from 26 to 28<sup>th</sup>, July, 2017. The purpose of the workshop was to review the lesson learnt from the first trial construction and to discuss way forward for the preparation of the second trial construction. The outline of the review is given as follows; (a) Preparation</p>
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	Workshop in Pepease)	<ul style="list-style-type: none"> <li>• Senior Engineer, DFR Head Office</li> <li>• <b>Bernard William Amoah</b> Mechanical Engineer, DFR Head Office</li> <li>• <b>Frank Amofa Agyemen</b> Assistant Engineer, DFR Head Office</li> <li>• <b>Joseph Mauwusi Adekponya</b> Assistant Engineer, DFR Head Office</li> <li>• <b>Isaac Mensah</b> Principal Quality Surveyor, DFR Eastern region</li> <li>• <b>Frederick Addison</b> Senior Engineer, DFR Eastern region</li> <li>• <b>Christopher Ampah Essel</b> Senior Technician, Engineer, DFR Eastern region</li> <li>• <b>Motoki Ogawa</b> Team Leader, JICA-LBST</li> <li>• <b>Takaaki Hirakawa</b> Monitoring, JICA-LBST</li> <li>• <b>Yumiko Takeda</b> Training/Coordinator, JICA-LBST</li> <li>• <b>Tomoe Iehisa</b> Coordinator, JICA-LBST</li> <li>• <b>Anthony Mensah</b> Resident Eng., JICA-LBST</li> <li>• <b>Gifty Gbenyo</b> Secretary, JICA-LBST</li> </ul>	<ul style="list-style-type: none"> <li>• Cut back asphalt is usually applied to prepare pre-coated aggregate. However, considering the characteristics of LBT that the works shall be done by labour, emulsion has a high privilege that it doesn't use heat. For this, using emulsion for both pre-coating and priming was decided and design was made by existing manuals and trial test at field.</li> <li>(b) Base Course <ul style="list-style-type: none"> <li>• MDD96% was achieved where 98% is required under the MRH specification for base course. It is figured out that this shortage is caused by 150mm thickness of single layer to compact by pedestrian roller, and by adjusting the moisture content after and not before the compaction.</li> <li>• Undulation was observed on surface after compaction. Although the range of deviation was acceptable for gravel surface; for bituminous surface, it is desirable to secure higher evenness. For this, it is advised to utilize tow-grader before compaction.</li> <li>• The camber was made in 8% for the usual amount of gravel surface. However, 3% is usually applied in bituminous pavement roads and hence both gradients should be compared at the next trial construction. By lowering the gradient, matter of sprayed extra emulsion flow out to the shoulder is expected to be solved and appropriate spray rate should be considered as well.</li> <li>• Constructing a 6m width surface on the 6m width base course is difficult to ensure the required density and eventually the shoulder become loose. It is difficult to achieve sufficient compaction density unless the compaction width is wider than the design and cutting the edge and reforming the slope. Although the volume of emulsion that has flowed out was less than the primer coat, the same tendency was observed on the seal coat also.</li> </ul> </li> <li>(c) Surface Dressing <ul style="list-style-type: none"> <li>• Since water affects the adhesion of emulsion to the aggregate, appropriate curing measures after pre-coating the aggregate is required.</li> <li>• Regarding hauling and storage of the emulsion, initially contractor used empty drums to fill at the plant and convey to the site. However, to reduce times of hauling, the contractor changed to convey emulsion by using 5,000 liter tank. The emulsion was poured from the tank to buckets and then to drums every day. After this method was applied, clog in the asphalt distributor pipes was observed. This was considered because the viscosity of the emulsion has changed for it has stored in the tank for a long time than before and the emulsion has decomposed. To solve this matter, truck asphalt distributor was applied to storage the emulsion. This equipment will circulate the emulsion in the distributor and will avoid the emulsion to be decomposed.</li> <li>• Controlling the spray rate of emulsion was made by measuring the area sprayed and consumed volume, and its spraying speed. This method worked very well</li> </ul> </li> </ul>
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	<p>and even practical. It was able to adjust the area to be sprayed and its speed by observing the works.</p> <ul style="list-style-type: none"> <li>• Chippy was applied to spread aggregates. However, approx. 15% beyond the designed spread rate was observed.</li> </ul> <p>(d) Cold Mix Asphalt</p> <ul style="list-style-type: none"> <li>• A lot of dust balls came out during producing cold mix. According to the exiting LBT manuals, it says that proper moisture control of the materials is required that excessively moist or dry will be the cause making the dust balls. For our case, since the construction was carried out during the rainy season, it is considered that the quarry dust had too much moisture. For this, the quarry dust was dried under the sun before mixture, and then it had an improvement extremely.</li> <li>• During the construction it was found that the number of particular tools for cold mix such as guide rail will become the control of the construction speed. The maximum construction length of a section is about 50 m. Guide rail to construction 50m will be 2 lines (100 m) of thickness 20 mm rail ,and 1 line (50 m) of thickness 6 mm rail. This will be a set for one section and at least tools for 2 sections is desired be prepared for smooth implementation.</li> <li>• Waste material stick on the surface inside the concrete mixer and this affects the quality of the next cold mix. For this, sufficient amount of diesel oil, strong Kelen stick to remove sticky asphalt and cleaning at the end of every work was required.</li> </ul> <p>(e) Others</p> <ul style="list-style-type: none"> <li>• At least one month was needed to train and let understand the works to the contractor and labours. Training manual needed separately to the technical guideline.</li> <li>• The contractor did not possess any LBT equipment except concrete mixer and compactor. However, for the bituminous surface works, other equipment such as engine sprayer, chippy, tractor and tow grader are needed. Considering the dissemination of the guideline, strong involvement and strategy of the government for solution is needed.</li> </ul> <p>The contents discussed above were reflected to the table which describes the chapter and its outline of the guideline that was prepared at the 3<sup>rd</sup> technical meeting held on 9<sup>th</sup> November. This table shall be updated and more information shall be added as project progress obtained. After the lesson of the second trial construction incorporated in this table, it is expected that this shall be the source of the Guideline.</p> <p>Also, under the discussion, the contents to be incorporated in the second trial were given as follows;</p>
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	2-5 Application of Binder <b>Chapter-3 Quality Assurance and Control</b>	4-3/4-4	3-2 General Cross Section 3-3 Design of Bituminous Surface Treatment <b>Chapter-4 Construction</b>	
	3-1 Definitions	5-1	4-1 Work Planning	<b>Client, Contractor</b>
	3-2 Quality Assurance	5-2	4-2 laying the Base	
	3-3 Quality Control	5-3	4-3 Chip Sealing	
	<b>Chapter-4 Sealing Operation</b>		4-4 Cold Mix Asphalt	
	4-1 General	N/A	4-5 Traffic Control	<b>Client, Contractor</b>
	4-2 Site Preparations	4-3,4-3,4-4	4-6 Occupational Health and Safety	
	4-3 Chip Sealing	4-3	4-7 Environment Protection	
	4-4 Cold Mix Asphalt	4-4	<b>Chapter-5 Quality Assurance and Control</b>	
	4-5 Traffic Control	4-5	5-1 Definitions	<b>Client</b>
	4-6 Quality Control	5-2	5-2 QA and QC for laying the base	
	4-7 Quality Assurance	5-3	5-3 QA and QC for Chip Seal	
	4-8 Occupation Health and Safety	4-6	5-4 QA and QC for Cold Mix Asphalt	
	4-9 Environment Protection	4-7	<b>Chapter-6 Maintenance</b>	
	<b>Chapter-5 Maintenance</b>		6-1 Definitions	<b>Client</b>
	5-1 Definitions	6-1	6-2 Routine Maintenance	
	5-2 Routine Maintenance	6-2	6-3 Periodic Maintenance	
	5-3 Periodic Maintenance	6-3	<b>Chapter-7 Productivity Guide</b>	<b>Client, Contractor</b>
	<b>Chapter-6 Productivity Guide</b>		7-1 Production Rate	
	6-1 Production Rate	7-1	7-2 Unit Rate	
	6-2 Reference	7-2	Reference	
Activity 3-3 <b>Under Implementation</b>	<Draft the guidelines> The intensive workshop is scheduled at least three more times at following occasions. As of 31 <sup>st</sup> January, the draft guideline is scheduled to be revised under discussion in the intensive workshop scheduled on Feb. 2018.			
	6 Scheduled on Feb. 2018	-	-	
	7 Scheduled on Jun. 2018	-	-	
	8 Scheduled on Sep. 2018	-	-	
Activity 3-4 <b>Under Implementation</b>	<Carry out the second field trial following the guidelines> The tendering for the second trial was made on 13 <sup>th</sup> December, 2017, and Bend-Key Limit has taken the lowest price. Evaluation of the tendering was carried out and approval was made from the director on January, 2018. For this, it is expected that contract signing shall be made in early February, 2018.			

Activity 3-5	<Revise the draft based on the result of the second field trials as necessary>		
Activity 3-6	<Carry out OJT through above activities>		
<b>Under Implementation</b>	<ul style="list-style-type: none"> <li>The activities from Activity 3-1 to Activity 3-4 were carried out with collaboration between the DFR members and Japanese Experts.</li> <li>The DFR members has intensive workshop 2 times and technical seminar once with JCC.</li> <li>The DFR members have built the draft guideline to start concrete discussions. This draft guideline is expected to be revised under discussion with major members in the intensive workshop scheduled on Feb. 2018.</li> </ul>		
<b>OTHER OUTPUTS</b>			
Procurement of equipment	<ul style="list-style-type: none"> <li>All equipment was delivered and inspected properly by the Japanese Experts. For details, refer to Attachment-2.</li> </ul>		
<b>Under Implementation</b>	<ul style="list-style-type: none"> <li>Equipment operational training was conducted from 21<sup>st</sup> to 24<sup>th</sup> November, 2016 at KTC.</li> <li>Extra equipment such as tow grader, level and pan mixer is under delivery, and expected to be delivered at site by mid-March, 2018.</li> </ul>		
<b>Implementation</b>	<ul style="list-style-type: none"> <li>From 5<sup>th</sup> to 18<sup>th</sup> of November, 2018, the third country training was conducted with 10 members from DFR-HQ, DFR Eastern region and KLC. Following gives the outline of the activities and its results.</li> </ul>		
The third country Training			
<b>Completed</b>	<b>Date</b>	<b>County /location</b>	<b>Major Activities</b>
	6 <sup>th</sup> , Nov.	South Africa /Johannesburg	The first country to visit was South Africa and courtesy called the National Department of Public Works with ILO. There the delegation team had lecture from the Department about governance structure and national policy of public works.
	7 <sup>th</sup> , Nov.	South Africa /Cost Yard	The Team visited village name Tshwane located approx. 30km apart from Coast Yard. Actual construction works were observed out and many useful lessons were obtained. Use of pan mixer instead of concrete mixer to produce cold mix and control of moisture to avoid balling was the highlight of this activity since these two were the largest issues which were difficult to solve in the first trial.
	8 <sup>th</sup> , Nov.	South Africa /Johannesburg	With escort of the Municipal Engineer from the Johannesburg Municipality, the Team visited village name Stellenbosch which the road was constructed three years ago by LBT. Also the Team visited village name Ceres, and there, actual bituminous works were observed. From these sites, the Team obtained importance of training the contractor as well as the planner and designer not limited to technology but with financial and leadership skills.
	9 <sup>th</sup> , Nov.	South Africa /Johannesburg	The Team visited a factory which produces road material stabilizer. There the Team had change to demonstration how to produce cold mix asphalt by using pan mixer.
	9 <sup>th</sup> , Nov.	South Africa /Johannesburg	The Team visited Council of Scientific and Industrial Research (CSIR). Here the Team obtained lesson that the significant investment should be made into laboratory test for durable and sustainable asphalt construction. In this respect the roads and highway should as a matter priority collaborate with BRRI and the universities into researching the use of local material for asphalt pavement.
	10 <sup>th</sup> , Nov.	South Africa /Johannesburg	The Team visited the office of Expanded Public Works Programme (EPWP) and shared experience. It was found the importance of training and contractor for the employment generation, and therefore the role and mandate of KTC shall be lightened.

	13th to 17th, Nov.	Ethiopia /Addis Ababa	Join the ILO Regional Seminar	The Team joined the ILO Regional Seminar and presented the outline of this program and current achievement. Through joining the seminar, the Team member created personal relationship with almost all LBT related organization throughout Africa continent.
<p>Technical Seminar</p> <p><b>Under Preparation</b></p>	<p>Technical Seminar is an activity to present and discuss the contents of the Guideline to share its knowledge among organization/person relates. The outline of the discussion and result is given as follows.</p>			
<p><b>Under Preparation</b></p>	S/N	Date	Participants	Major discussion and Conclusion
1		On 17th August, 2017	MRH, GHIA, DUR, DFR, DFR-Eastern Region, KNUST and JICA	<p>DFR, DUR, KTC,</p>
				<p>Technical Seminar was carried out on 17<sup>th</sup> August, 2017 at KTC conference hall in Koforidua. The Major objective of this seminar was to present and discuss the lesson learnt from the first trial construction to build the draft guideline. The outlines achieved were presented by each person in charge. Following is the outline of the discussion and its results.</p>
				<p>Secure Safety</p> <ul style="list-style-type: none"> <li>• Basically, need more care to labours safety</li> <li>• Paying attention to environment is also required</li> <li>• Should indicate about protection of health of labours</li> </ul>
				<p>Economic Analysis</p> <ul style="list-style-type: none"> <li>• Needs comparison between EBT and LBT</li> <li>• Needs cements about maintenance cost and make comparison of LCC as well</li> <li>• Needs to indicate the actual required number of labours from the trial</li> </ul>
				<p>Application of local characteristic</p> <ul style="list-style-type: none"> <li>• Some areas in north is difficult to find good gravel</li> <li>• Needs to indicate the local characteristic on application</li> </ul>
				<p>Technical evaluation</p> <ul style="list-style-type: none"> <li>• Needs more clear source to explain the superiority of CMA, in particular about thickness</li> <li>• Environment is also should be consider on comparison of thickness</li> <li>• On evaluation of duration, taking photo of before-after is considered to be equipment</li> </ul>
				<p>Design</p> <ul style="list-style-type: none"> <li>• Needs to mention about the selection of pavement type – advantage and disadvantage, criteria to compare</li> </ul>
				<p>Equipment</p> <ul style="list-style-type: none"> <li>• Needs definition which machinery belongs to LBT –Definition of LBT works</li> <li>• Needs to mention the machinery's required basic specification.</li> <li>• Needs definition of times of passes – in which condition requires 2 time passes or 4 time passes.</li> </ul>
2		Scheduled on Aug. 2018	-	-
3		Scheduled on Dec. 2018	-	-

**Attachment-6: Form-3 (Indicator of Construction Standard)**

Ver. 1

**Attachment 6: Result of Form 3**  
**Form 3 (Checklist of the LBST Construction Standard)**  
 Road Section: Akote-Obomofodensua-Asiedu Feeder Road  
 Date: 09/02/2018  
 Person in charge: Eng. K. OMANE Brimpong

No.	Items	Actual Achievements		Acceptance <sup>*2</sup> (YES:1, NO:2)	Issues/Problems (If "NO: 2" in the Acceptance)
		Response <sup>*1</sup>	Evidence/Reasons		
<b>I. Formation of Typical Cross-section for Bituminous Pavement</b>					
<b>1. Base</b>					
(1)	What is the gradient of the camber? (3-5 %)	3%	Check with camber boards and Photographs of Base Construction dated 24/04/17 - 25/07/17	1	
(2)	What is the average width? (6 m)	6m	By measurement	1	
(3)	What is the thickness? (150 mm)	150mm	By levels	1	
(4)	Is the base well compacted? (98 %)	93.03 - 96.25%	Field Density Results of DFR/RML Team indicated 93.03% min. and 96.25 max. (See Form 1)	2	2nd field trial will be compacted in layers of 75mm each to achieve the specification of 98% MDD.
<b>2. Surfacing treatment</b>					
(1)	What is the average width? (6 m)	5.5 m	By measurement	2	Time constraint. This will be rectified in 2nd field trial.
(2)	Does the flatness of road surface meet specification? (Y/N)	YES	By checks with the camber board	1	RI and GPS needed for verification.
(3)	Does the aggregate meet specification? (Y/N)	YES	14mm Chippings: Test Results:DFR/RML report-14/03/17 10mm Chippings: Test Results:DFR/RMLreport-21/03/17	1	Supplier produced rapid setting instead of slow setting bitumen emulsion. Slow setting will be used for the 2nd field trial subject to laboratory test.
(4)	Does the emulsion meet specification? (Y/N)	YES	Bitumen Test: GHA Central Lab Report dated 18/04/17.	1	Pre-coating was achieved through the reduction of dust from the aggregates.
(5)	Are the aggregates properly pre-coated? (Y/N)	YES	Photographs of the period dated 22/04/17 - 20/08/17.	1	

**Note**

\*1: You can put figures or Yes/No based on the instruction in parentheses.

\*2: If it is acceptable, you can put "1" as your agreement. If unacceptable, you can do "2" as your disagreement.

No.	Items	Actual Achievements		Acceptance <sup>*2</sup> (YES:1, NO:2)	Issues/Problems (If "NO: 2" in the Acceptance)
		Response <sup>*1</sup>	Evidence/Reasons		
<b>II. Standard of Quality Control for Bituminous Surfacing Treatment</b>					
<b>1. Spraying (priming)</b>					
(1)	What is the spray rate? (1.0 lit/m <sup>2</sup> )	1.0 lit/m <sup>2</sup>	Prime Coat for Cold Mix Asphalt	1	
<b>2. Surface dressing</b>					
(1)	Is the surface properly primed? (Y/N)	YES	Daily Work Execution Records dated 27/05/17-19/08/17	1	
(2)	What is the spread rate of chippings for primer seal? (0.01 m <sup>3</sup> /m <sup>2</sup> )	0.01 m <sup>3</sup> /m <sup>2</sup>	Daily Work Execution Records dated 23/05/17-19/08/17	1	
(3)	What is the spread rate of chippings for seal? (0.005 m <sup>3</sup> /m <sup>2</sup> )	0.005 m <sup>3</sup> /m <sup>2</sup>	Daily Work Execution Records dated 17/06/17-19/08/17	1	
(4)	What is the spray rate of bitumen for primer seal? (1.6-2.0 lit/m <sup>2</sup> )	2.0 lit/m <sup>2</sup> 1.8 lit/m <sup>2</sup>	Case 1 Primer Seal Case 2 Primer Seal	1	
(5)	What is the spray rate of bitumen for seal? (1.6-1.8 l/m <sup>2</sup> )	1.7 lit/m <sup>2</sup> 1.6 lit/m <sup>2</sup>	Case 1 Seal Coat Case 2 Seal Coat	1	
(6)	How many labourers were used? (persons)	29	Daily Work Records dated 23/05/17-19/08/17	1	The number of labourers will be observed whether or not the number is appropriate through the 2nd field trial.
(7)	Were road construction works fully completed with the light equipment? (Y/N)	No Yes	For base course work - 10 tonne roller was used. Light Equipment used for the rest of activities.	2 1	To achieve the desired compaction, heavy roller compactor is appropriate. 10 tonne compactor will be used for the 2nd field trial.

**Note**

\*1: You can put figures or Yes/No based on the instruction in parentheses.

\*2: If it is acceptable, you can put "1" as your agreement. If unacceptable, you can do "2" as your disagreement.

No.	Items	Actual Achievements		Acceptance <sup>*2</sup> (YES:1, NO:2)	Issues/Problems (If "NO: 2" in the Acceptance)
		Response <sup>*1</sup>	Evidence/Reasons		
<b>3. Cold mix asphalt</b>					
(1)	Is the surface properly primed? (Y/N)	YES	Daily Work Execution Records dated 27/05/17-19/08/17	1	
(2)	Does the tack coat meet the prescribed specification? (Y/N)	YES	Daily Work Execution Records dated 27/05/17-19/08/17	1	
(3)	Is the tack coat sprayed properly? (Y/N)	YES	Daily Work Execution Records dated 27/05/17-19/08/17 Photographs dated 27/05/17-19/08/17	1	
(4)	Was the mixing operation carried out properly? (Y/N)	YES No	Visual inspection at times look good (Photographs) Problem of 'balling' observed often (Photographs)	1 2	The problem of balling will be eliminated in the 2nd field trial.
(5)	What is the average thickness? (14 mm for compaction, 20 mm for loose)	20mm 14mm	Loose volume when laid before compaction. After compaction.	1	
(6)	How many labourers were used? (persons)	25	Daily Work Execution Records dated 27/05/17-19/08/17	1	The number of labourers will be observed whether or not the number is appropriate through the 2nd field trial.
(7)	Were road construction works fully completed with the light equipment? (Y/N)	No Yes	Base work (10 ton roller) Light equipment for the rest of activities	2 1	To achieve the desired compaction, heavy roller compactor is appropriate. 10 tonne compactor will be used for the 2nd field trial.
<b>III. General Issues</b>					
<b>I. Safety and health measures</b>					
(1)	Were the workers wearing safety vest? (Y/N)	YES	Project Photographs dated 17/02/28-17/08/30	1	
(2)	Were the workers wearing safety boots? (Y/N)	YES	Project Photographs dated 17/02/28-17/08/30	1	
(3)	Were the workers wearing dust mask? (Y/N)	YES	Project Photographs dated 17/02/28-17/08/30	1	
(4)	Were the workers wearing gloves and goggles? (Y/N)	YES	Project Photographs dated 17/02/28-17/08/30	1	
(5)	Were the workers provided with clean drinking water? (Y/N)	YES	Project Photographs dated 17/05/23-17/08/30	1	

Note

\*1: You can put figures or Yes/No based on the instruction in parentheses.

\*2: If it is acceptable, you can put "1" as your agreement. If unacceptable, you can do "2" as your disagreement.

No.	Items	Actual Achievements		Acceptance <sup>*2</sup> (YES:1, NO:2)	Issues/Problems (If "NO: 2" in the Acceptance)
		Response <sup>*1</sup>	Evidence/Reasons		
(6)	Have first aid kits been provided? (Y/N)	YES	Photograph	1	
(7)	Were the workers provided with a good place of convenience? (Y/N)	YES	Photograph	1	
(8)	How many injuries were recorded? (persons)	YES	One (1) worker	2	Hope to record no injuries in the 2nd field trial. Health and safety awareness will be intensified to avoid accidents.
(9)	How many casualties were recorded? (persons)	Nil	N/A	1	
(10)	How many fatalities were recorded? (persons)	Nil	N/A	1	
<b>2. Miscellaneous works</b>					
(1)	Were the locations of the sign boards appropriate? (Y/N)	YES	Project Photograph dated 27/03/17	1	
(2)	Was the project name clearly indicated? (Y/N)	YES	Project Photograph dated 27/03/17	1	
(3)	Was the road name clearly indicated? (Y/N)	YES	Project Photograph dated 27/03/17	1	
(4)	Was the chainage clearly indicated? (Y/N)	YES	Project Photograph dated 27/03/17	1	
(5)	Was the client name clearly indicated? (Y/N)	YES	Project Photograph dated 27/03/17	1	
(6)	Was the contractor name clearly indicated? (Y/N)	YES	Project Photograph dated 27/03/17	1	
(7)	Was the financier name clearly indicated? (Y/N)	YES	Project Photograph dated 27/03/17	1	

**Note**

\*1: You can put figures or Yes/No based on the instruction in parentheses.

\*2: If it is acceptable, you can put "1" as your agreement. If unacceptable, you can do "2" as your disagreement.



## Attachment-7: Task Rate Summary

### Attachment 7: Task Rate Summary Chip Seal Operation

Main Activity	January 2018 Unit Rate
1. Primer sealing (bitumen emulsion)	7.56 GH¢/ℓ
2. Spreading of 14 mm chipping	643 GH¢/m <sup>3</sup>
3. Spraying of bitumen for seal	6.91 GH¢/ℓ
4. Spreading of 10 mm chipping	541 GH¢/m <sup>3</sup>

### Main Activity 1: Primer Sealing (bitumen emulsion)

Sub-activities	Labourers	total	Light Equipment	Materials	Productivity (Unit)
1-1. Brooming of base	4 labourers	4	-	-	2,006 m <sup>2</sup> /day
1-2. Watering	1 operator 1 labourer	2	1 tractor	Water	3,786 m <sup>2</sup> /day
1-3. Bitumen spraying	1 operator 1 mechanic 7 labourers	9	1 bitumen sprayer	Bitumen emulsion	662 m <sup>2</sup> /day

### Main Activity 2: Spreading of 14 mm Chipping

Sub-activities	Labourers	total	Light Equipment	Materials	Productivity (Unit)
2-1. Pre-coating 14 mm chippings	1 operator 2 labourers	3	1 loader		49 m <sup>3</sup> /day
2-2. Loading and unloading	1 operator 6 labourers	7	1 tractor (capacity of	14mm chippings, Bitumen emulsion,	9 m <sup>3</sup> /day
2-3. Chipping spreading	6 chippy 2 labourers	8	2 chippies	Diesel and water	662 m <sup>2</sup> /day
2-4. Compaction	1 operator	1	1 pedestrian roller		662 m <sup>2</sup> /day

### Main Activity 3: Spraying of bitumen for seal

Sub-activities	Labourers	total	Light Equipment	Materials	Productivity (Unit)
3-1. Brooming of primed surface	4 labourers	4	-	-	1,731 m <sup>2</sup> /day
3-2. Bitumen spraying	1 operator 1 mechanic 7 labourers	9	1 bitumen sprayer	Bitumen emulsion	1,697 m <sup>2</sup> /day

### Main Activity 4: Spreading of 10 mm chipping

Sub-activities	Labourers	total	Light Equipment	Materials	Productivity (Unit)
4-1. Pre-coating 10mm chippings	1 operator 2 labourers	3	1 loader		47 m <sup>3</sup> /day
4-2. Loading and unloading	1 operator 6 labourers	7	1 tractor (capacity of	10mm chippings, Bitumen emulsion,	10 m <sup>3</sup> /day
4-3. Chip spreading	6 chippy spreader 2 labourers	8	2 chippies	Diesel and water	1,697 m <sup>2</sup> /day
4-4. Compaction	1 operator	1	1 pedestrian roller		1,697 m <sup>2</sup> /day

Cold Mix Asphalt Operation		January 2018
Main Activity	Unit Rate	
1. Priming	7.05 GH¢/ℓ	
2. Tack coat - bitumen Tack coat - water	6.77 GH¢/ℓ 1.46 GH¢/ℓ	
3. Placing of cold mix asphalt	15.60 GH¢/m <sup>2</sup>	

**Main Activity 1: Priming**

Sub-activities	Labourers	Light Equipment	Materials	Productivity (Unit)
1-1. Brooming of base	4 labourers	-	-	2,006 m <sup>2</sup> /day
1-2. Watering	1 operator 1 labourer	1 tractor	Water	3,786 m <sup>2</sup> /day
1-3. Bitumen spraying	1 operator 1 mechanic 7 labourers	1 bitumen sprayer	Bitumen emulsion	3,162 m <sup>2</sup> /day
1-4. Loading and unloading quarry dust	4 labourers	wheel barrows & shovels	Quarry dust	26 m <sup>3</sup> /day
1-5. Spreading of quarry dust	4 labourers	-	-	2,271 m <sup>2</sup> /day

**Main Activity 2: Tack coat (bitumen and water)**

Sub-activities	Labourers	Light Equipment	Materials	Productivity (Unit)
2-1. Brooming of primed surface	5 labourers	-	-	1,854 m <sup>2</sup> /day
2-2. Spraying of tack coat	2 labourers	Water can and brushes	Bitumen emulsion	1,384 m <sup>2</sup> /day

**Main Activity 3: Placing of cold mix asphalt**

Sub-activities	Labourers	Light Equipment	Materials	Productivity (Unit)
3-1. Batching & mixing of asphalt	2 operators 8 labourers	2 concrete mixers	10mm chippings, Quarry dust,	5.77 m <sup>3</sup> /day
3-2. Placing of asphalt	8 labourers	1 plate compactor	Bitumen emulsion, Water	217 m <sup>2</sup> /day
3-3. Compaction	1 operator 1 labourer	1 roller		433 m <sup>2</sup> /day

## Attachment-8: Form-1 (Indicator of Project Purpose)

Ver. 1

**Attachment 8: Result of Form 1**  
**Form 1 (Monitoring Checklist for the Development of LBT Bituminous Surfacing Technology)**  
 Road Section: Akote-Obomofodensua-Asiedu Feeder Road      Name of JICA Expert: Motoki OGAWA      Date: 09/02/2018

No.	Items	Actual Achievements filled by DFR Officials		Acceptance <sup>1)</sup> by JICA Experts (YES:1, NO:2)	Comments by JICA Experts	Responses/Undertakings by DFR Officials
		Response	Evidence/Reasons			
<b>Preparation Phase ⇒ "Chapter 4: Construction" in the Guidelines</b>						
		YES	WP: submitted by ANL on 10/04/17.	1	Contents Written in the WP was acceptable and desired to continued in the next trial	Instruction would be given to the next contractor
1	Has the work planning (work program, method statement, and cash flow) been done properly? (Y/N)	NO	MS: Not submitted because DFR did not ask for it.	2	DFR should lecture to the next contractor of lesson we have from the first trial and let them prepare the documents for further confirmation as well as understanding.	Instruction would be given to the next contractor
		NO	CF: Not submitted by ANL.	2	CF is a document to understand the appropriateness of the task rate and methodology. Therefore, it is strongly expected that DFR would give proper instructions to the next contractor	Instruction would be given to the next contractor
2	Do construction materials (chippings and bitumen) meet standard specification? (Y/N)	YES	Bitumen: GHA Central Lab report- 18/04/17 14mm Chippings: DFR/RML report-14/03/17 10mm * RML: Regional Material Laboratory	1	No problem observed except usage of slow setting emulsion was more recommendable rather than rapid setting. However, it is understandable that slow setting is difficult to procure due to market reason.	New company producing slow setting was found in Kumasi, and would be applied as test case in the next trial.
3	Are the requisite equipment (tractor, trailer, pedestrian roller, water bowser, plate compactor, bitumen sprayer, chippy) available? (Y/N)	YES	Release of equipment to ANL: Notes of Site Meeting-17/03/13. Project Photographs of the period dated 17/04-03-17/08/13.	1	All equipment need for operation was delivered by the Project before commencement of the first trial.	All equipment would be made available to the next contractor.

No.	Items	Actual Achievements filled by DFR Officials		Acceptance <sup>1</sup> by JICA Experts (YES:1, NO:2)	Comments by JICA Experts	Responses/Undertakings by DFR Officials
		Response	Evidence/Reasons			
<b>Implementation Phase (Base Treatment) ⇒ "Chapter 4: Construction" in the Guidelines</b>						
1	Is base course well compacted? (Y/N)	YES	<p><b>Compaction test results:</b>            DFR/RML Reports:            Dated 18/05/17 (95.98min-96.25max);            Dated 05/07/17 (95.03min-95.04max) etc.  <b>DCP test results:</b>            N/A- applied on sub-base</p>	1	The average of the compaction achieved only up to 96% MDD (maximum dry density) where the requirement of the standard was 98% MDD. For this, it is recommended to compact the base course in two times and easily confirm the result by using DCP. Also, you have to be careful not crushing the aggregate by compacting in so thin thickness.	Basically it would try to separate the layers in two in the next trial. However, if time is limited, then we might decide to use large machinery to save the time.
2	Is there proper traffic management? (Y/N)	YES	<p><b>Photograph check:</b>            Project Photographs dated 17/03/31-17/08/31.</p>	1	No Problem observed. Keep record properly and reflect to the guideline as typical shift for safety.	Monitoring continued at the next trial
3	Is there an appropriate quality assurance mechanism in place? (Y/N)	YES	<p><b>Daily Record Sheet (DRS):</b>            Daily Work Execution records of the period dated 23/05/17 - 19/08/17.</p>	1	No problem observed. The client did preparation and give proper instructions to the contractor to achieve the standard.	There was not enough communication between the contractor and DFR because the contractor compacted the base course using small equipment. The contractor was allowed to use the 10 tone roller to achieve the desired results. This experience shall be taken to the next trial.
4	Is there an appropriate quality control mechanism in place? (Y/N)	YES	<p><b>Laboratory Test:</b>            DFR/RML Sieve Analysis Test for 14mm &amp; 10mm chippings dated 11/04/17 &amp; 21/03/17 and Compaction Test Results</p>	1	All materials were confirmed its quality before construction.	Continued to the next trial
5	Does construction method follow labour procedure? (Y/N)	YES	<p><b>Photograph check:</b>            Project Photographs dated 17/03/31 - 17/08/31.  <b>DRS:</b>            Daily Work Reports dated 20/02/17 - 23/08/31.</p>	1	Most of the works including hauling and spreading materials, watering and compaction was done by LBT. However, in compaction of the base, it was difficult to achieve the required density which is 98%/MDD. This is considered to caused by compacting 150mm thickness by the pedestrian roller. For this, we obtained a lesson that in case of using the pedestrian roll, the maximum thickness of base shall be lower than 150mm or divide in 2 layers.	Basically, it would try to separate the layers in two in the next trial. However, if time is limited, then we might decide to use large machinery to save the time.

No.	Items	Actual Achievements filled by DFR Officials		Acceptance <sup>1</sup> by JICA Experts (YES:1, NO:2)	Comments by JICA Experts	Responses/Undertakings by DFR Officials
		Response	Evidence/Reasons			
<b>Implementation Phase (Surface Treatment) ⇒ "Chapter 4: Construction" in the Guidelines</b>						
1	Are chippings pre-coated? (Y/N)	YES	<b>Photograph check:</b> Project Photographs dated 22/04/17 - 20/08/17. <b>DRS:</b> Daily Work Reports, Material Storage and Consumption Records & ANL Progress Reports (April-August 2017)	1	It was found that pre-coating the aggregate is a useful method in this country since a lot of dust adhere to surface of the aggregate and the dust which remain even after screening would behave together with the aggregate, and this would cause emanating deterioration of the bituminous surface.	Instruction would be given to the next contractor.
2	Are the spotting and spreading of aggregates carried out properly? (Y/N)	YES	<b>Photograph check:</b> Project Photographs dated 23/05/17 - 19/08/17. <b>DRS:</b> Daily Work Execution Records dated 23/05/17 - 19/08/17.	1	It was observed that usage of chippy is very useful that it would contribute spreading the material equally.	Chippy would be used at the next trial continuously and collect more data for more effective use.
3	Is the priming operation carried out properly? (Y/N)	YES	<b>DRS:</b> Daily Work Execution Records dated 27/05/17 - 19/08/17.	1	Have training for both the operator and labor before actual construction is very effective and recommended to continue in the next trial also.	Training for contractor including supervisor and operator shall be continuously carried out in the next trial.
4	Is the primer seal operation carried out properly? (Y/N)	YES	<b>DRS:</b> Daily Work Execution Records dated 23/05/17 - 19/08/17.	1	Have training for both the operator and labor before actual construction is very effective and recommended to continue in the next trial also.	Training for contractor including supervisor and operator shall be continuously carried out in the next trial.
5	Is there an appropriate quality assurance mechanism in place? (Y/N)	YES	Tray Test conducted by DFR/RML Team dated 26/05/17. Daily Work Execution Record dated 23/05/17 - 19/08/17.	1	No problem observed. The client did preparation properly and gave proper instructions to the contractor to achieve the standard.	Instruction would be given to the next contractor.
6	Is there an appropriate quality control mechanism in place? (Y/N)	YES	<b>Laboratory Test:</b> Bitumen: GHA Central Lab report - 18/04/17 14mm Chippings: DFR/RML report - 14/03/17 10mm Chippings: DFR/RML report - 21/03/17	1	All qualities of the materials were tested at Regional and Central Material Laboratory. It might be difficult for Category C contractors to do material testing by themselves. However, it should be considered to establish a system asking contractors to do basic testing by their own for self-management. And the client shall focus more on inspection.	Continued in the next trial. Testing by procuring testing machine by their own will take time for them to prepare. However, we understand the training to contractor is needed to raise their competency. Also, cooperation with the universities might be another solution in long term.
7	Is the spraying operation carried out properly? (Y/N)	YES	<b>DRS:</b> Daily Work Execution Records dated 23/05/17- 19/08/17.	1	No problem observed except maintenance of the spraying machine. The spraying machine should be maintained daily or it would start clogging the pipe.	Lesson observed will be reflected in the next trial.

No.	Items	Actual Achievements filled by DFR Officials		Acceptance <sup>1</sup> by JICA Experts (YES:1, NO:2)	Comments by JICA Experts	Responses/Undertakings by DFR Officials
		Response	Evidence/Reasons			
8	Is the seal operation carried out properly? (Y/N)	YES	DRS: Daily Work Execution Records dated 23/05/17-19/08/17.	1	No problem observed..	Chippy was very useful equipment to achieve evenness of the spread rate even though the labour did not have enough experience.
9	Is the cold mix asphalt operation carried out properly? (Y/N)	YES	DRS: Daily Work Execution Records dated 27/05/17-23/08/17.	1	No problem was observed except procedure of producing the pre-mix asphalt using the concrete mixer. A lot of balling emanated and it was difficult to find the exact reason. However, we had lesson in South Africa for this ball that the problem comes from the moisture contents of the aggregate. So, it is expected that this lesson shall be reflected to the second trial.	It is expected that newly-procured equipment, pan mixer, would solve the balling problem by increasing moisture content.

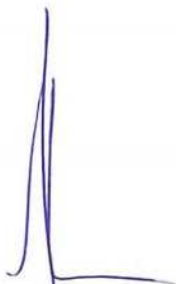
TO CHIEF REPRESENTATIVE JICA GHANA OFFICE

## PROJECT MONITORING SHEET

Project Title: JICA Project for Developing Labour Based Bituminous Surfacing Technology  
(LBST)

Version of the sheet: Ver. 6 (July-2018)

Submission Date: 31th August 2018



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Mr. E. Duncan-Williams  
Director  
Department of Feeder Roads  
Ministry of Roads and Highways



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Motoki Ogawa  
Chief Advisor /Rural Road Development  
Eight-Japan Engineering Consultants Inc.

## I. Summary

### 1. Progress

#### 1-1. Progress of Inputs

##### (1) Japanese Side Input

Item	Achievement (as of 31 <sup>st</sup> July)					
Japanese Experts	Following 13 experts in total have been dispatched to the Project, under the position below. The total Man/Month of these experts was 40.30 MM up to 31 <sup>st</sup> July. Details are given in <b>Attachment-1</b> .					
	Expert		Position		Man/Month (MM)	
	Motoki Ogawa		Chief Adviser / Rural Road Development		7.67	
	Seiji Kadooka		Deputy Chief Advisor / Road Pavement technology		5.23	
	Hiroaki Takahashi		LBT Guidelines		2.87	
	Kazunori Kobayashi		Cost Estimation/ Safety Gard		2.50	
	Tetsuo Sakamoto		Site Supervisor		5.33	
	Ikumasa Kawasaki		Site Supervisor		3.00	
	Masanori Takeishi		Maintenance and Machinery Equipment		2.50	
	Naoko Sasaki		Environment Considerations		2.00	
	Yumiko Takeda		Project Coodination1 / Training Plan		2.17	
	Takaaki Hirakawa		Monitoring and Evaluation 1		4.43	
	Mayumi Shoji		Project Coordination 2 / Monitoring and Evaluation 2		1.13	
	Tatsumi Tokunaga		Project Review		0.30	
	Tomoe Iehisa		Project Coordination 2		1.17	
Total (by the end of 31 <sup>st</sup> July, 2018)				40.30		
Local Operation Cost	Local operation cost was mainly utilized for the following items					
	No.	Items	US\$	No.	Items	US\$
	1	Transport Cost (domestic)	68,971	6	Allowance and Accommodation	10,378
	2	Communication Cost	2,066	7	Local Consultants/ Advisor	54,742
	3	Equipment Purchased	209,959	8	Others	17,033
	4	Third Country Training	55,742	9	Sub-Contract (1 <sup>st</sup> Construction) Trial	239,744
	5	Meeting, Workshop and JCC	27,959	10	Sub-Contract (2 <sup>st</sup> Construction) Trial	108,448
Equipment	Copy machine, projector and construction machinery were provided. Details are					



	given in <b>Attachment-2</b> .																								
Study tour in the Third country	<p>The study tour to the third country, titled “The study tour for developing guideline of bituminous sealing technology” was implemented from 5<sup>th</sup> to 18<sup>th</sup> November, 2017 in South Africa and Ethiopia. The name and position of the Ghanaian counterparts are given in the following table.</p> <table border="1"> <thead> <tr> <th>Name of Participants</th> <th>Position /Organization</th> </tr> </thead> <tbody> <tr> <td>Mr. Ibrahim Seidu (Only for Ethiopia)</td> <td>Director, RSIM/MRH</td> </tr> <tr> <td>Dr. K. Osafo Ampadu</td> <td>Deputy Director of Planning/DFR</td> </tr> <tr> <td>Eng. K. Omane-Brimpong</td> <td>Principal Engineer/DFR</td> </tr> <tr> <td>Dr. Patrick Bekoe Amoah</td> <td>Senior Engineer/DFR</td> </tr> <tr> <td>Eng. Bernard Williams Amoah</td> <td>Mechanical Engineer/DFR</td> </tr> <tr> <td>Eng. Frank Amofa Agyemang</td> <td>Assistant Engineer/DFR</td> </tr> <tr> <td>Eng. Joseph Mawusi Adekponya</td> <td>Assistant Engineer/DFR</td> </tr> <tr> <td>Dr. Issac Mensah</td> <td>Principal Quality Surveyor/DFR</td> </tr> <tr> <td>Eng. Frederick Addison</td> <td>Senior Engineer/DFR</td> </tr> <tr> <td>Eng. Christopher Ampah Essel</td> <td>Senior Technician Engineer/DFR</td> </tr> <tr> <td>Eng. Emmanuel Opoku-Adusei</td> <td>Assistant Engineer/KTC</td> </tr> </tbody> </table> <p>The outline of the activities is given in <b>Attachment-5</b>.</p>	Name of Participants	Position /Organization	Mr. Ibrahim Seidu (Only for Ethiopia)	Director, RSIM/MRH	Dr. K. Osafo Ampadu	Deputy Director of Planning/DFR	Eng. K. Omane-Brimpong	Principal Engineer/DFR	Dr. Patrick Bekoe Amoah	Senior Engineer/DFR	Eng. Bernard Williams Amoah	Mechanical Engineer/DFR	Eng. Frank Amofa Agyemang	Assistant Engineer/DFR	Eng. Joseph Mawusi Adekponya	Assistant Engineer/DFR	Dr. Issac Mensah	Principal Quality Surveyor/DFR	Eng. Frederick Addison	Senior Engineer/DFR	Eng. Christopher Ampah Essel	Senior Technician Engineer/DFR	Eng. Emmanuel Opoku-Adusei	Assistant Engineer/KTC
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## (2) Ghana Side Input

Item	Achievement (as of 31 <sup>st</sup> July)				
Counterparts	<p>The following Counterparts have been assigned for the project.</p> <table border="1"> <tbody> <tr> <td>DFR Head Office</td> <td>           Director            Deputy Director of Planning            Principal Engineer            Senior Engineer            Mechanical Engineer            Assistant Engineer         </td> </tr> <tr> <td>DFR Eastern Region</td> <td>           Regional Manager            Principal Quality Surveyor            Senior Engineer            Senior Technician Engineer         </td> </tr> </tbody> </table> <p>Details are given in <b>Attachment-3</b>.</p>	DFR Head Office	Director Deputy Director of Planning Principal Engineer Senior Engineer Mechanical Engineer Assistant Engineer	DFR Eastern Region	Regional Manager Principal Quality Surveyor Senior Engineer Senior Technician Engineer
DFR Head Office	Director Deputy Director of Planning Principal Engineer Senior Engineer Mechanical Engineer Assistant Engineer				
DFR Eastern Region	Regional Manager Principal Quality Surveyor Senior Engineer Senior Technician Engineer				
Local Operation Cost	<p>Operation cost for the Project funded by Ghana side includes the running office cost, the material test, and road preparation up to sub-based level of the 1<sup>st</sup> Trial Construction. Details are given in <b>Attachment-4</b>.</p>				

### 1-2 Progress of Activities

Details are given in **Attachment-5**.

### 1-3 Achievement of the Outputs

#### 1-3-1 Achievement of the Output 2

##### (1) Lab test of materials

There were 6 lab tests of materials for 2nd field trial. The findings indicate that all 6 test results were “acceptable.” During the field trial, only acceptable materials are used for the construction works.

**Table 1: Results of the lab tests during 2nd field trial**

No.	Date	Test Item	Test Result	Ref. No
1	14th Mar., 2018	Gravel at Obomofodensua Borrow Pit 1 (Sub-base)	Acceptable	DFR/ER/RML/ GOG/SB/01/2018
2	9th April., 2018	Gravel at Obomofodensua Borrow Pit 2 (Sub-base)	Acceptable	DFR/ER/RML/ GOG/SB/02/2018
3	17th April. 2018	Bitumen Emulsion K3-70	Acceptable	GHA/CML/TF.13/ 604
4	17th April.,2018	Bitumen Emulsion K2-70	Acceptable	GHA/CML/TF.13/ 605
5	25th April.2018	Gravel at Obomofodensua Borrow Pit 3 (Base)	Acceptable	DFR/ER/RML/ JICA/BS/03/2018
6	2nd May, 2018	Gravel at Obomofodensua Borrow Pit 4 (Base)	Acceptable	DFR/ER/RML/ JICA/BS/04/2018

Note 1

Acceptable: Lab test of materials was passed and fully utilized.

Note 2

BS: Base

CML: Central Material Laboratory

DFR: Department of Feeder Roads - Koforidua

ER: Eastern Region

GHA: Ghana Highway Authority, Accra

GOG: Government of Ghana

RML: Regional Material Laboratory

SB: Sub-base

**(2) LBST construction standard (Form 3)**

It is not ready to complete the Form 3 because 2nd field trial is still ongoing at the end of July. However, as there were several challenges during 1st field trial, the following points shall be monitored to prevent them from occurring again in 2nd field trial:

- Base treatment;
- Road width;
- Dust balls; and
- Worker's injury.

In terms of the base treatment, the compaction (standard specification: 98%) was not accepted because the percentage of compaction was out of range (93.03% at minimum and 96.25% at maximum). Also, the road width (standard specification: 6m) was 5.5m for the sake of time constraint. In connection with dust balls, as they were often observed in concrete mixers, a new type of mixer, *pan mixer*, is used at site on a trial basis. Although concrete mixer caused material loss due to dust balls, there are prospects that the loss will be reduced because pan mixers can stir more efficiently than concrete mixers. Lastly, concerning "worker's injury," as a road worker was injured

in 1st field trial, zero injuries are sought to be achieved.

Other than the points explained above, as a toilet facility for workers has not been established yet, it is necessary for workers to be able to use the facility during construction works.

### (3) Task rates

It is not ready to prepare the task rate since 2nd field trial is still ongoing at the end of July. With reference to cold mix asphalt, the data extracted from K1-70 (rapid-setting)/K3-70 (slow-setting), with/without fillers, and pan mixer/concrete mixer will be compared to make sure the materials are properly and efficiently utilized for LBT road works.

### 1-3-2 Achievement of the Output 3

It is not ready to measure the achievement of Output 3 at this moment because the guideline development is still ongoing. Also, the guideline directly links to the Form 1 and Form 3 which are the checklists of the LBST development and construction standard respectively.

### 1-4 Achievement of the Project Purpose

#### (1) Development of labour-based bituminous surfacing technology (LBST: Form 1)

There are two (2) indicators in the Project Purpose. In terms of the indicator 1, it is not ready to complete the Form 1 to check the development of LBST because 2nd field trial is still ongoing.

During 1st field trial, as the “method statement” and “cash flow” of work planning were not submitted to DFR, the project team shall observe those documents to be submitted by the contractor in 2nd field trial.

#### (2) Self-evaluation of DFR officials, including Eastern Region, for acquiring LBST:

The indicator 2 is the self-evaluation of DFR officials for acquiring LBST, and the target value was reestablished in 70.0% since the initial target (65.0%) had consecutively been achieved by January 2018. In order to confirm the progress of their understandings, therefore, the fifth questionnaire survey was conducted again on the basis of the question items (Q1 – 10) as indicated in the table below.

**Table 2: The self-rating results of DFR officials for acquiring LBST (Five-point scale)**

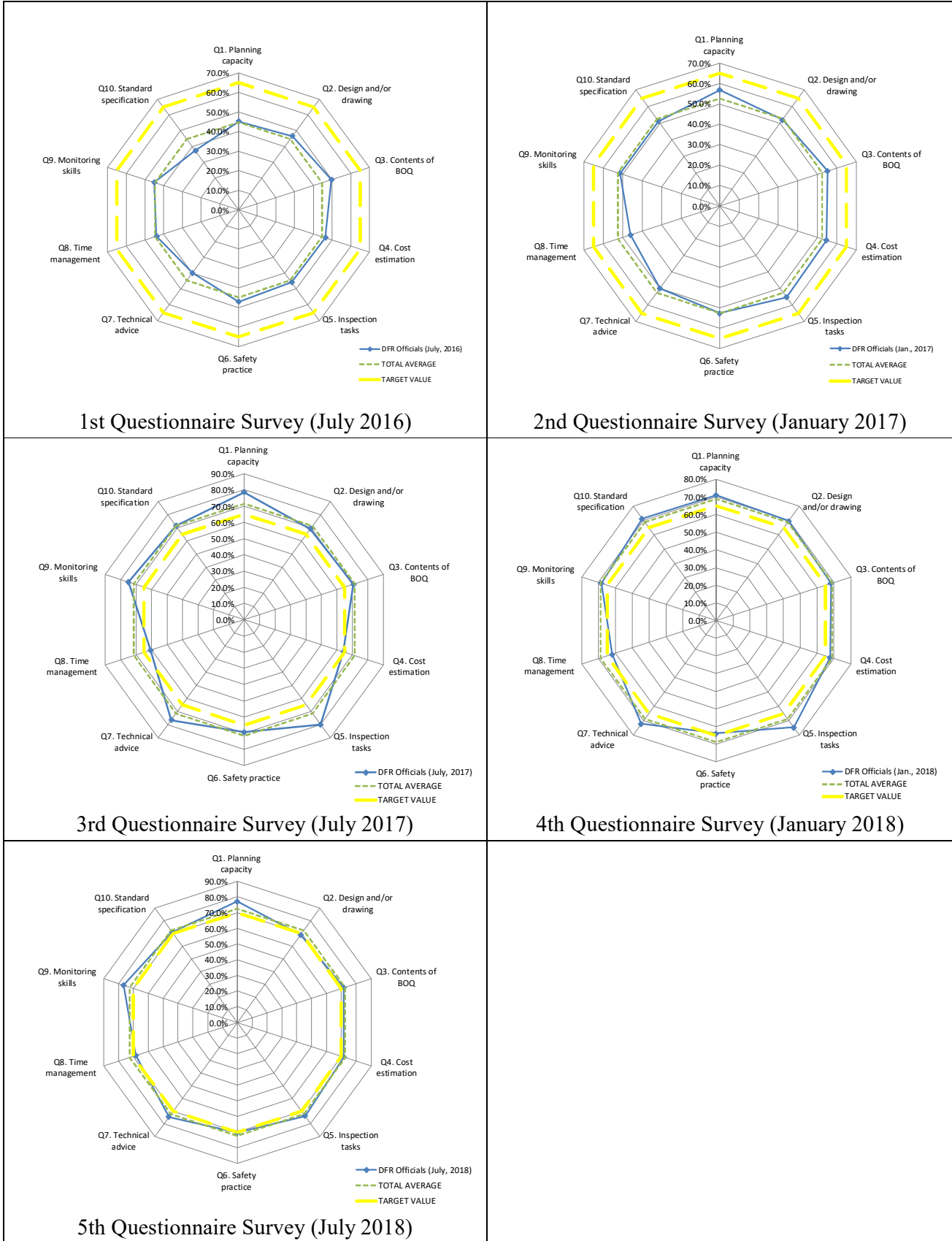
	1st Ques. (Jul 2016) 31 respondents	2nd Ques. (Jan 2017) 30 respondents	3rd Ques. (Jul 2017) 29 respondents	4th Ques. (Jan 2018) 31 respondents	5th Ques. (Jul 2018) 29 respondents
<b>Q1. Planning skills and knowledge of road works</b>	45.2%	56.7%	78.5%	71.0%	77.2%
<b>Q2. Road structure design and/or drawing</b>	46.5%	52.0%	69.3%	69.7%	69.0%
<b>Q3. Contents of Bill of Quantities (BOQ)</b>	49.7%	55.3%	70.7%	68.4%	71.7%

<b>Q4. Cost estimation</b>	46.5%	54.7%	64.3%	67.7%	71.7%
<b>Q5. Road inspection tasks</b>	45.8%	55.3%	80.0%	74.8%	73.8%
<b>Q6. Safety practice for workers and road users during road works</b>	47.1%	52.7%	69.3%	63.9%	70.3%
<b>Q7. Technical advice and supports for a contractor</b>	40.0%	50.0%	76.4%	72.3%	74.5%
<b>Q8. Time management of road works during the execution periods</b>	43.9%	46.0%	60.7%	61.9%	68.3%
<b>Q9. Monitoring of road works</b>	45.2%	51.3%	75.0%	68.4%	76.6%
<b>Q10. Standard specification of the LBST</b>	37.4%	51.3%	71.4%	71.3%	71.0%
<b>Total Rating on Average (Q1 – Q10)</b>	<b>44.7%</b>	<b>52.5%</b>	<b>71.5%</b>	<b>68.8%</b>	<b>72.4%</b>

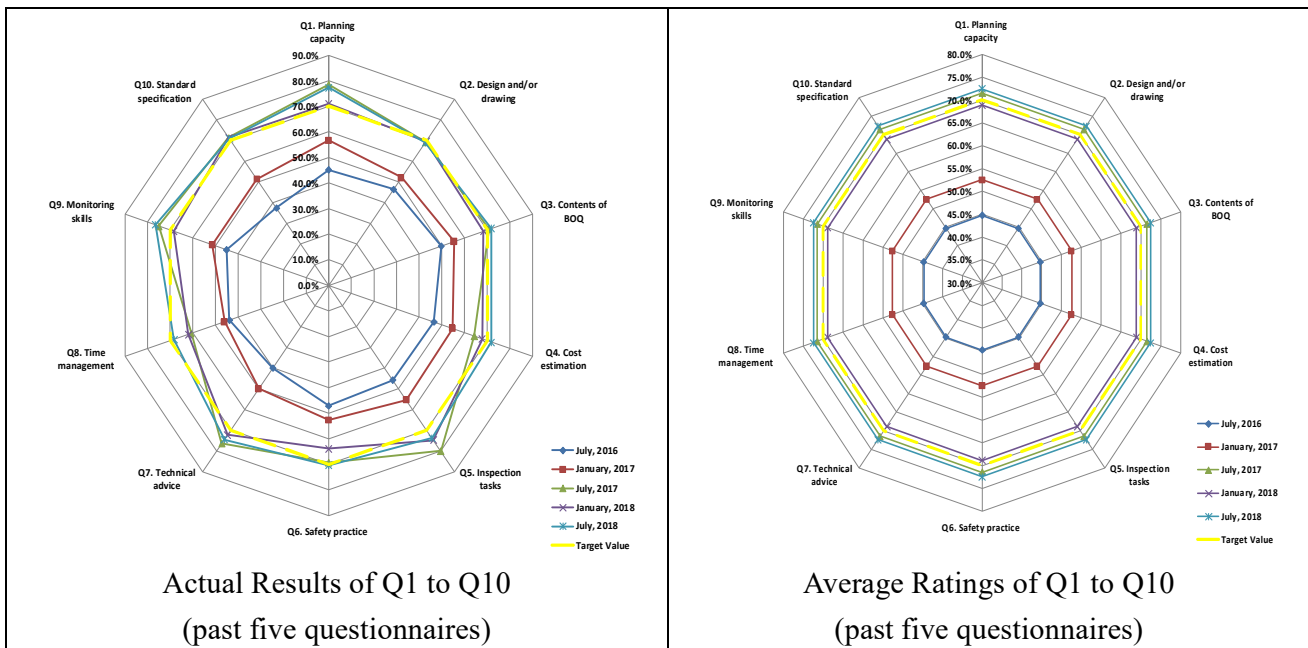
Source: Questionnaire survey through the Form 2 of the Monitoring System

The self-rating of DFR officials exceeded the target value because the total rating from Q1 to Q10 on average was **72.4%**. Also, DFR officials are confident of the “planning skills and knowledge (Q1: 77%)”, “technical advice and supports for contractors (Q7: 75%)”, and “monitoring of road works (Q9: 77%)” as indicated in the figures below. The ratings of those three items attained to 75% or higher. Through two field trials in Koforidua, C/P came to understand the work planning and provide technical advice for contractors as well as conduct monitoring operations.

On the other hand, two items did not attain to 70%, *i.e.*, the “road structure design and/or drawing (Q2: 69%)” and “time management of road works (Q8: 68%).” Thus, it is required to enhance road structure design and time management of work progress. In terms of time management, however, as disbursement delay influences the road works by contractors, it cannot be simply concluded that “time management” did not attain to 70% in case of 2nd field trial.



**Figure 1: Self-rating results of DFR officials, including Eastern Region (Rader Chart)**



**Figure 2: Tendency of past self-rating results of DFR officials (“Actual Results” and “Average Ratings” of each question item from July 2016 to July 2018)**

### 1-5 Changes of Risks and Actions for Mitigation

In terms of the Important Assumptions, the Project shall pay attention to those conditions for the achievement of the Project Purpose and Overall Goal during the cooperation period. Regarding the budget issue after the termination of the Project, especially, there are some concerns to be explained below.

#### (1) Important Assumption for the achievement of the Project Purpose:

*“There is no significant change in C/P assignment.”*

Although Dr. Ampadu, Dy. Director (Planning) of DFR as well as Project Manager, retired on 11th December 2017, it is considered that this condition does not severely affect to the achievement of the Project Purpose. This is because his successor, Mr. K.N. Akosah-Koduah assigned from 19th April 2018, had been involved in the Project as a chief engineer in the past and is working for the Project more intensively than ever before. Apart from this, there are no significant changes in C/P assignment.

#### (2) Important Assumption for the achievement of the Overall Goal:

*“The budget for the measures necessary for the labour-based bituminous surfacing technology is secured.”*

Although the budget for the GOG portions in 2nd field trial was allocated, the payment to contractor was not executed on time when it was necessary. Under this emergent circumstance,

the contractor in 2nd field trial has endeavored to keep the construction works without interruption. Thus, even if the budget is allocated for the LBST measures after the project termination, it is crucial for DFR officials to monitor the budget disbursement from the Road Funds secretariat so as to achieve the Overall Goal. It is the most important remark as an undertaking of DFR after the termination of the Project because contractors are not able to apply LBST to feeder roads in Ghana without getting paid from GOG for the nationwide expansion.

## **2 Delay of Work Schedule and/or Problems (if any)**

### **2-1 Detail and Cause**

By the end of July 2018, the work progress is around 73.5% (the work delay is 11.5% against the planned target 85%). The cause of this delay is the interruption of interim payment to the contractors by GOG. Because the sub-base and concrete ditch construction from the 3.9km to 4.4km section could not be completed as scheduled, the base construction which was planned to be executed was not launched on time. On the other hand, although the JICA team strongly requested DFR to proceed with the payment procedure promptly, the interim payment was not made by the end of July. Thus, the contractor requested for the postpone of contract for one month, by 20th August 2018.

### **2-2 Action to be taken**

The delay of DFR disbursement severely affected the project progress and outcome. Therefore, JICA Ghana Office submitted the letter to the Director of DFR in July 2018. It was difficult to execute the LBT construction works as planned during 2nd field trial because GOG was not able to disburse the budget for the sub-base construction through the Road Fund.

### **2-3 Roles of Responsible Persons/Organization**

It is necessary for DFR to put in the maximum efforts to disburse the budget as scheduled for the achievement of the Project Purpose. Also, the Project Team needs the supports from JICA Ghana Office to complete 2nd field trial within the contract period, 20th August 2018, without the disbursement delay by GOG.

### **1-6 Progress of Actions undertaken by JICA**

N/A.

### **1-7 Progress of Actions undertaken by Government of Ghana**

In regard to the trial construction, the subgrade, subbase and water drainage facility is allocated as part of the Government of Ghana's responsibility. The Project would take over above the sub-base and construct the base course and bituminous wearing course. The target section of the trial will be from 2+700 to 5+550 and the Contractor, which is Bend-Kay Limited as same as the

Project's contractor, has been in its position and has started their works since November 2017.

### **1-8 Progress of Environmental and Social Considerations**

At section 0+400 of the target roads, there is a building that has to be demolished to complete the road since the building is blocking the half part of the road. The building owner has agreed GoG that he would vacate with proper compensation, and DFR has given report to Land Valuation Board to implement the land acquisition procedure.

## **3 Modification of the Project Implementation Plan**

### **3-1 PDM**

There is no modification on the Project Implementation Plan for Ver 6.0.

## **4. Preparation of the Government of Ghana toward after the completion of the Project**

It is considered that there are three items need to be focused for the dissemination and sustainability of the LBST after completion of the Project. The first is to establish the base of the engineering technology of which the output of this Project would answer to its request. Second is a continuous production of demand of the work based on LBST and Government of Ghana is highly expected to be in charge of this field. The last is provision of training to engineers not only from the client but also the contractors. KTC is strongly expected to be the only agency who has the mandate. Following gives more closer view of the above three items.

### **1) Establishment of engineering base**

The guideline prepared by this project would be the first version and to maintain guideline as useful, it is extremely crucial to keep updating the contents frequently to incorporate the latest knowledge. Also, considering the overall goal which will be accomplished in three years after the completion of the Project, it is expected to have a review and update in the third year after the Project completion. Following contents are expected to incorporate in the next update.

- a. Study the deterioration of the surface frequently on the trial section by monitoring frequently.
- b. Conduct further economic research and analysis to study the impact of LBST
- c. Conduct field trials in different climate, terrain and traffic conditions for dissemination
- d. Collect further actual construction data to make numbers in the guideline more precisely.

### **2) Continuous production of demand**

Producing demand of LBST by the GoG is extremely crucial in terms of sustainability, and



for this, it is necessary to nationally adopt LBST as feeder road surface treatment as well the Guideline. The official statement of the Government is strongly expected to enhance the investment of the private sector to prepare LBST works.

### **3) Provision of training**

Setting up training course on LBST is also a crucial matter for the dissemination of LBST, and KTC is considered to be the most appropriate agency to take over this issue. DFR shall cooperate with KTC to set up training course along the guidelines. To disseminate LBST across the country, the target of the training shall be not only the client side but also contractors, community representatives, and persons concerned need to receive the training. Most importantly, it is expected that GoG would allocate budget for the training.

## II. Project Monitoring Sheet I & II

### II-1. Project Monitoring Sheet I (PDM 3)

#### II-1. Project Monitoring Sheet I (Version 6: 31st July, 2018)

Project Design Matrix (PDM <sub>3.1</sub> )		Version No. 3-1 Date: 15th February, 2018	
Project Title: Project for Developing Labour Based Bituminous Surfacing Technology (LBST) in the Republic of Ghana Implementation Agency in Ghana: Department of Feeder Roads (DFR), Ministry of Roads and Highways (MRH) Target Groups: DFR officials and the officials concerned in Eastern Region		Project Period: February, 2016 – December, 2018 Project Sites: Accra (capital) and feeder roads in Eastern Region	
Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p><b>Overall Goal</b> Measures are taken to make labour-based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.</p>	<ol style="list-style-type: none"> <li>Field trials along the LBST construction standard are conducted for further improvement and additional validation of labour-based bituminous surfacing technology in different climate and traffic conditions.</li> <li>Labour-based bituminous surfacing technology is officially adopted by DFR for feeder road surfacing.</li> <li>Training course for labour-based bituminous surfacing technology is set up according to the guidelines at the Koforidua Training Centre (KTC).</li> </ol>	<ol style="list-style-type: none"> <li>Field trial records, including the checklist of the LBST construction standard, prepared by DFR</li> <li>Approved guidelines by DFR</li> <li>Training records at KTC</li> </ol>	N/A
<p><b>Project Purpose</b> The methodology and application of labour-based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.</p>	<ol style="list-style-type: none"> <li>Labour-based bituminous surfacing technology fulfilling the criteria defined in the monitoring checklist is developed through the field trials.</li> <li>The self-rating of DFR officials and the officials concerned in Eastern Region for acquiring labour-based bituminous surfacing technology exceeds 70% on average.</li> </ol>	<ol style="list-style-type: none"> <li>Monitoring checklist filled out by JICA experts</li> <li>Questionnaire surveys to DFR officials and the officials concerned in Eastern Region</li> </ol>	<ol style="list-style-type: none"> <li>There is no significant change for the activities of DFR for feeder road services.</li> <li>There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road.</li> <li>The budget for the measures necessary for the labour-based bituminous surfacing technology is secured.</li> </ol>
<p><b>Outputs</b></p> <ol style="list-style-type: none"> <li>Current conditions and issues for labour-based bituminous surfacing technology in Ghana are identified.</li> <li>Field trials of labour-based bituminous surfacing technology are carried out.</li> <li>Guidelines for labour-based bituminous surfacing technology are prepared.</li> </ol>	<ol style="list-style-type: none"> <li>1-1. Issues and results analysed by the experts and counterparts are indicated in the Project Monitoring Sheet (Summary).</li> <li>2-1. Lab tests of materials are conducted in accordance with the material standard.</li> <li>2-2. The field trials are conducted in line with the construction standard for labour-based bituminous surfacing technology (LBST construction standard).</li> <li>2-3. Task rates for labour-based bituminous surfacing technology are defined.</li> <li>3-1. Draft guidelines for labour-based bituminous surfacing technology is completed.</li> </ol>	<ol style="list-style-type: none"> <li>1-1. Project Monitoring Sheet (Summary)</li> <li>2-1. Certificate ("Results") of the lab tests</li> <li>2-2. Checklist of the LBST construction standard</li> <li>2-3. Summary table of task rates</li> <li>3-1. Draft guidelines for labour-based bituminous surfacing technology</li> </ol>	<p>This Output was achieved as scheduled. Second field trial is still ongoing. Refer to the PMS Summary in detail.</p> <p>Guidelines preparation is still ongoing.</p>
			<p>As the self-rating results exceeded the target in the past two surveys, the target will be changed from 65% to 70%.</p>
			N/A
			N/A
			N/A

<p><b>Activities</b></p> <p>1-1 Collect and analyse information on the counterparts (C/Ps) organisational capacity (e.g., personnel, budget, experiences, etc.).</p> <p>1-2 Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana.</p> <p>1-3 Review and evaluate the similar technical standards and manuals prepared by such organisations as Department for International Development (DFID), South African Department of Public Works, etc.</p> <p>1-4 Confirm the procurement and cost of materials (e.g., gravels, etc.).</p> <p>1-5 Test and evaluate characteristics of the materials as stipulated by respective technical standards.</p> <p>1-6 Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana.</p> <p>1-7 Check the quality control systems and the procedures of road pavement work in Ghana.</p> <p>1-8 Check the maintenance management systems of feeder roads in Ghana.</p> <p>1-9 Compile and report the analysis on issues on labour-based bituminous surfacing technology in Ghana.</p> <hr/> <p>2-1 Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials).</p> <p>2-2 Conduct necessary lab tests to assess the characteristics of materials.</p> <p>2-3 Identify technical requirements (e.g., materials, methodology and process, quality control, etc.) through the field trials.</p> <p>2-4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials.</p> <p>2-5 Collect information on task rates.</p> <p>2-6 Identify the applicable conditions of the labour-based bituminous surfacing technology.</p> <p>2-7 Identify the safeguard issues.</p> <p>2-8 Prepare a report on above.</p> <p>2-9 Carry out on-the-job training (OJT) through above activities.</p> <hr/> <p>3-1 Determine the contents of the guidelines by reviewing the result of the first field trials.</p> <p>3-2 Prepare and agree with the outline of the guidelines by both sides.</p> <p>3-3 Draft the guidelines.</p> <p>3-4 Carry out the second field trial following the guidelines.</p> <p>3-5 Revise the draft based on the result of the second field trials as necessary.</p> <p>3-6 Carry out OJT through above activities.</p>	<p><b>Inputs</b></p> <p><b>Japanese side</b></p> <ol style="list-style-type: none"> <li>Experts <ul style="list-style-type: none"> <li>Chief Advisor/Feeder Road Development</li> <li>Road Pavement Technology</li> <li>LBT Guideline</li> <li>Cost Estimate/Safe Guard</li> <li>Site Supervisor</li> <li>Maintenance of Machinery and Equipment</li> <li>Environment</li> <li>Project Coordination/Training Planning</li> <li>Monitoring and Evaluation</li> <li>Project Review</li> </ul> </li> <li>Provision of machinery and equipment <ul style="list-style-type: none"> <li>Compactor</li> <li>Asphalt sprayer</li> <li>Asphalt heater</li> <li>Tractor</li> <li>Trailer</li> <li>Impact tamping rammer</li> <li>Equipment for Dynamic Cone Penetrometer (DCP) testing</li> </ul> </li> <li>Transportation for the experts</li> <li>Provision of third country training (e.g., South Africa)</li> <li>Costs for the field trials <ul style="list-style-type: none"> <li>Base and bituminous surface treatment</li> <li>Supervisors</li> <li>Workers</li> <li>Others as necessary</li> </ul> </li> </ol>	<p><b>Ghanaian side</b></p> <ol style="list-style-type: none"> <li>Personnel <ul style="list-style-type: none"> <li>Project Director (DFR Director)</li> <li>Project Manager (Dy. Director of Planning, DFR)</li> <li>C/P (Mainly Planning Section and Eastern Region Office of DFR)</li> </ul> </li> <li>Expenses necessary for the field trials <ul style="list-style-type: none"> <li>Transportation for C/P staff</li> <li>Material test conducted at DFR (equipment, cost, etc.)</li> <li>Hand tools for pavement</li> <li>Road preparation at sub-base level for the field trials</li> </ul> </li> <li>Office space</li> <li>Furniture (e.g., desks, etc.)</li> <li>Means of communication at the head office (e.g., internet connection)</li> </ol>	<p>DFR is able to utilize and mobilise available resources related to labour-based bituminous surfacing technology in Ghana (e.g., KTC, KNUST, GHA Central Lab and their expertise, etc.) for the implementation of the Project.</p>
		<p><b>Pre-conditions</b></p> <ol style="list-style-type: none"> <li>Ghanaian side provides technical documents on LBT.</li> <li>Laboratory testing of materials is available.</li> <li>The sites for field trials are ensured (these sites must be prepared with the road bed and filled with sub base course materials, etc.).</li> </ol>	
		<p><b>&lt;Issues and Countermeasures&gt;</b></p> <p>N/A</p>	



## **Attachments**

- 1: Japanese Experts Assignment**
  - 2: Equipment**
  - 3: Counterparts Designation**
  - 4: Local Operation Cost (Ghana side)**
  - 5: Progress of Activities**
-



## Attachment-2: Equipment (as of 31<sup>st</sup> July, 2018)

No	Date of registration	Description/Name of equipment / Goods	Specification /Standard	QTY	Price	unit	Provider	User	Purpose of Use	Place of Use	Responsible Person	Hand Over
1	23-Jan-16	Projector	EPSON EB-S31	1	445.68	USD	(Electronic retail shop in Japan)	Expert	Workshop /Presentation	DFR	DFR	
2	12-Feb-16	Printer	Ricoh MPC2011	1	6,075.91	USD	IMPC Intercom Programming & Manufacturing Co. Ltd.	Expert	Means of Documentation	DFR	DFR	
3	3-Aug-16	Cold Bitumen Sprayer	1D10CB	2	5,950.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
4	3-Aug-16	Plate Compactor	Bell, PCX450	2	4,475.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
5	3-Aug-16	Mobile Concrete Mixer	Bell, 400D	1	2,987.50	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
6	18-Aug-16	Tractor	75 HP, Diesel Engine, Tools	2	73,000.00	USD	Afgrl Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	
7	18-Aug-16	Tractor	Towed Type, 5000kg capacity, Tools	2			Afgrl Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	
8	18-Aug-16	Spare parts for tractor and tractor	-	1	1,441.00	USD	Afgrl Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	
9	26-Aug-16	Duplex Roller	Atlas, LP750	2	32,373.18	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	
10	26-Aug-16	Engine Suction Water Pump	Technoele, KGP80D	2	1,297.48	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	
11	26-Aug-16	Mechanical Tool Set	-	1	530.21	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	
12	8-Nov-16	Water Bowser	ID5000L	1	8,850.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
13	8-Nov-16	Manual hand Asphalt Sprayer	1D10M	2	3,880.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
14	8-Nov-16	Chip Spreader	NCA, Chippy	4	27,580.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
15	8-Nov-16	Spare parts	-	1	3,143.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
16	8-Dec-16	TRL Dynamic Cone Penetrometer (DCP)	Code: 16-T0012/A, Weight, 86Kgs, Dims: 117x51x40cm	2	4,374.20	USD	Askia Ltd	C/P	For Project Activities	KTC	KTC/DFR	
17	8-Dec-16	Spare parts	-	1	10,613.94	USD	Askia Ltd	C/P	For Project Activities	KTC	KTC/DFR	
18	16-Feb-18	Level	Automatic Level	1	1,345.88	USD	Deng	C/P	For Project Activities	KTC	KTC/DFR	
19	4-May-18	Tow Grader	GT9354-18 SN RMS18001G2165	1	14,188.00	USD	Afgrl Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	
20	25-Jul-18	Pan Mixer		2	7,407.79	USD	Kosamo Ltd.	C/P	For Project Activities	KTC	KTC/DFR	
	TOTAL				209,958.77	USD						





## Attachment-4: Local Operation Cost (Ghana Side)

		Local Cost			
Items	MS Ver. 2 Feb. 2016 to Jul. 2016	MS Ver. 3 Aug. 2016 to January 2017	MS Ver. 4 Feb. 2017 to July 2017	MS Ver. 5 Aug. 2017 to Jan. 2018	MS Ver. 6 Feb. 2018 to July 2018
<b>1-1</b>	<b>Personals</b>				
	1 C/P Designation	Director DFR Deputy Director of Planning Principal Engineer (Coordinator) Principal Engineer (Technical Workshop) Mechanical Engineer Director of Eastern Region	Director DFR Deputy Director of Planning / DFR Principal Engineer/ DFR Senior Engineer /DFR Mechanical Engineer/DFR Assis. Engineer /DFR Director of Eastern Region / DFR-E Principal QS / DFR-E Senior Engineer / DFR-E Senior Technician Engineer / DFR-E	Director DFR Deputy Director of Planning / DFR Principal Engineer/ DFR Senior Engineer /DFR Mechanical Engineer/DFR Assis. Engineer /DFR Director of Eastern Region / DFR-E Principal QS / DFR-E Senior Engineer / DFR-E Senior Technician Engineer / DFR-E	Director DFR Deputy Director of Planning / DFR Principal Engineer/ DFR Senior Engineer /DFR Mechanical Engineer/DFR Assis. Engineer /DFR Director of Eastern Region / DFR-E Principal QS / DFR-E Senior Engineer / DFR-E Senior Technician Engineer / DFR-E
<b>1-2</b>	<b>Human Resources and expenses necessary for the field trials</b>				
	N/A	N/A	N/A	N/A	N/A
	1 Supervisors	N/A	Principal Engineer/ DFR (Site MTG) Assis. Engineer /DFR (Site MTG) Principal QS / DFR-E Senior Engineer / DFR-E Senior Technician Engineer / DFR-E	Principal Engineer/ DFR (Site MTG) Assis. Engineer /DFR (Site MTG) Principal QS / DFR-E Senior Engineer / DFR-E Senior Technician Engineer / DFR-E	Principal Engineer/ DFR (Site MTG) Assis. Engineer /DFR (Site MTG) Principal QS / DFR-E Senior Engineer / DFR-E Senior Technician Engineer / DFR-E
	2 Workers	N/A	inclusive at JICA-LBST contract	inclusive at JICA-LBST contract	inclusive at JICA-LBST contract
	3 Transportations for C/P staff	Travel allowance and accommodation, fuel borne by DFR	Travel allowance and accommodation, fuel funded by both DFR/KICA-LBST occasionally	Travel allowance and accommodation, fuel funded by both DFR/KICA-LBST occasionally	Travel allowance and accommodation, fuel funded by both DFR/KICA-LBST occasionally
	4 DFR	N/A	N/A	N/A	1,280 GHS
	5 Hand tools for pavement	N/A	N/A	N/A	N/A
	6 Road preparation up to Sub-base level and construction for the extension 4.4 to 5.5 km	N/A	N/A	N/A	661,462 GHS (Certificate issued)
<b>1-3</b>	<b>Office Space</b>				
	1 Office space	DFR prepared Room 106 at DFR head office for the Project			
<b>1-4</b>	<b>Furniture</b>				
	1 office facilities	DFR provide desks, chairs, power, air conditioner and HP color printer for the Project			
<b>1-5</b>	<b>Means of communication at the head office</b>				
	1 Communication Tools	Internet WiFi and a land line prepared for the Project			
<b>1-6</b>	<b>Others</b>				
	1				

**Attachment-5: Progress of Achievement**

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## Activity Performed (as of end of July 2018)

OUTPUT-1 Current Conditions and issues for labour based bituminous surfacing technology in Ghana are identified.									
Activity 1-1 <b>Completed</b>	<p>&lt;Collect and analyze information on the counterparts (C/P's) organizational capacity (e.g. personal, budget, experiences, etc.)&gt;</p> <ul style="list-style-type: none"> <li>• Origination, number of engineers, budget and experience on LBT of DFR as well as the eastern region office were surveyed</li> <li>• Visited KTC and surveyed the capacity maintaining equipment. It was confirmed that KTC will be the appropriate organization to place and do the maintenance for the equipment which the Project and JICA will procure.</li> </ul>								
Activity 1-2 <b>Completed</b>	<p>&lt;Collect information regarding technical standards and design guidelines for bituminous surface technology on Ghana&gt;</p> <ul style="list-style-type: none"> <li>• Technical standards and guideline relating to LBT works from African countries in particular were collected. Totally, 24 numbers of standards and guideline such as Ethiopian, Tanzanian, Kenyan, South African and others were collected and evaluated.</li> </ul>								
Activity 1-3 <b>Completed</b>	<p>&lt;Review and evaluate the similar technology standards and manual prepared by such organizations as Department for International Development (DFID), South African Department of Public Works, etc.&gt;</p> <ul style="list-style-type: none"> <li>• From discussion with DFR, it was determined to apply cold emulsion asphalt rather than heated asphalt from the research in the past as well as safety. KNUST has attempted applying Otta seal pavement which requires heated cutback asphalt and was found difficulty utilizing it in Ghana's condition. From this, it was recommended to choose cold asphalt pavement, Sand seal and single surface dressing in the trial construction.</li> <li>• Evaluation through the collected documents, it was found that technical manual of Ethiopia covers most of the target pavements mentioned above. From this, referring to the Ethiopian manual was considered.</li> <li>• KTC was implementing a road design training utilizing DCP by World Bank support. This training was following the contents of the Ethiopian Manual, and from this, it was decided refer to Ethiopian Manual dominant.</li> </ul>								
Activity 1-4 <b>Completed</b>	<p>&lt;Confirm the procurement and cost of materials (e.g. gravels, etc.)&gt;</p> <ul style="list-style-type: none"> <li>• From interview, following were found as a general price of materials to be used in the trial construction.</li> </ul> <table border="1" data-bbox="853 689 1077 1534"> <thead> <tr> <th>Materials</th> <th>General Unit Price from interview</th> </tr> </thead> <tbody> <tr> <td>Cold emulsion</td> <td>560 GHS /drum include transport to trial site (drum =200 liters)</td> </tr> <tr> <td>Chippings</td> <td>65 GHS /m<sup>3</sup> (20-25mm) 40 GHS/m<sup>3</sup> (Dust) 56 GHS/m<sup>3</sup>(0-40 mixed)</td> </tr> <tr> <td>Gravel</td> <td>33 GHS/m<sup>3</sup> incl. transport to trial site</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>• Price fluctuation were surveyed and it was found that unit price of local labour and chipping continuously increased over the pass 1.5 years, and conversely the price of bitumen easily get influence from the international market which means not stable.</li> <li>• From the record, it was found the unit price of labour grow double in 1.5 years from the baseline where chipping were 1.5 times higher as well. For bitumen, price has escalated 2.4 times higher tentatively and came down to the original price eventually. It can be said that price of the bitumen is quite difficult to predict compare with the chippings and labours.</li> </ul>	Materials	General Unit Price from interview	Cold emulsion	560 GHS /drum include transport to trial site (drum =200 liters)	Chippings	65 GHS /m <sup>3</sup> (20-25mm) 40 GHS/m <sup>3</sup> (Dust) 56 GHS/m <sup>3</sup> (0-40 mixed)	Gravel	33 GHS/m <sup>3</sup> incl. transport to trial site
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Activity 1-5 <b>Completed</b>	<p>&lt;Test and evaluate characteristics of the materials as stipulated by respective technical standards&gt;</p> <ul style="list-style-type: none"> <li>• Confirmed implementing material testing will be conducted at the central material laboratory. The Capacity and capability of the laboratory was confirmed by observing the tests actually and interview to the technicians.</li> <li>• Quality and general cost for chipping (aggregate), gravel and cold emulsion were confirmed through interview to suppliers, contractors and DFR engineers.</li> </ul>								

<p>Activity 1-6 <b>Completed</b></p>	<p>&lt;Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana&gt;</p> <ul style="list-style-type: none"> <li>From interview to counterparts, it was grasped that there is a roll between headquarter and regional office. Most of the field works such as inventory survey, designing cost estimation, tendering and quality control are under jurisdiction of the regional office while the headquarter has roll to monitor and give approval to the planning as well as payment to the contractors. So, regarding the procedures for design and procurement, the system is established appropriately.</li> <li>Most of the feeder roads in Ghana are gravel surface and bituminous surface is very little. The design of the surface is done by following the MRH standards. The design of the single surface is indicated in the MRH design manual and although this manual is based in EBT method, since the structure itself doesn't have difference between LBT, it can be understood still valid applying on feeder roads. From the above-mentioned discussion, the necessity of creating a new guideline for LBT in use of bitumen, which is the major output of this Project, was re-confirmed.</li> </ul>												
<p>Activity 1-7 <b>Completed</b></p>	<p>&lt;Check the quality control systems and the procedures of road pavement work in Ghana&gt;</p> <ul style="list-style-type: none"> <li>Quality control in actual construction is a roll of the regional office. The regional office does the quality control followed by the MRH standard.</li> </ul>												
<p>Activity 1-8 <b>Completed</b></p>	<p>&lt;Check the maintenance management systems of feeder roads in Ghana&gt;</p> <ul style="list-style-type: none"> <li>It was grasped that DFR has system which names RPM (Road Prioritisation Methodology), GIS (Database and Geographical Information System) and MPBS (Maintenance Performance Budgeting System). So, most of the DFR's activities from selecting the annual target road to making BOQ of it is systemized and confirmed working under the solid total system.</li> </ul>												
<p>Activity 1-9 <b>Completed</b></p>	<p>&lt;Compile and report the analysis on labour-based bituminous surfacing technology in Ghana&gt;</p> <ul style="list-style-type: none"> <li>Contents of the activity 1-1 to activity 1-9 have been compiled in a report including the results of the materials which was the missing item in MS2.</li> </ul>												
<p><b>OUTPUT-2 Field Trials of labour-based bituminous surfacing technology are carried out.</b></p>													
<p>Activity 2-1 <b>Completed</b></p>	<p>&lt;Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials)&gt;</p> <ul style="list-style-type: none"> <li>The technical workshop was conducted as follows</li> </ul>												
	<table border="1"> <thead> <tr> <th data-bbox="770 1749 794 1827">S/N</th> <th data-bbox="770 1480 794 1749">Date</th> <th data-bbox="770 1088 794 1480">Participants</th> <th data-bbox="770 262 794 1088">Major discussion and Conclusion</th> </tr> </thead> <tbody> <tr> <td data-bbox="802 1749 826 1827">1</td> <td data-bbox="802 1480 826 1749">27<sup>th</sup> July, 2016</td> <td data-bbox="802 1088 826 1480">DFR, Eastern Region, JICA, LBST</td> <td data-bbox="802 262 1042 1088"> <ul style="list-style-type: none"> <li>Basic contents of the trial construction plan were confirmed.</li> <li>Cold Bitumen, Sand Seal and Single Surface were chosen as a target pavement type to be incorporated in the guideline.</li> <li>A contractor shall be hired by DFR to conduct the trial construction while the materials shall be provided by the Project.</li> <li>A private consultant shall be hired by the Project to collect data from the trial construction.</li> <li>The essence of utilizing LBT is the construction cost and durability.</li> </ul> </td> </tr> <tr> <td data-bbox="1050 1749 1074 1827">2</td> <td data-bbox="1050 1480 1074 1749">14<sup>th</sup> Sep., 2016</td> <td data-bbox="1050 1088 1074 1480">DFR, Eastern Region, JICA, LBST</td> <td data-bbox="1050 262 1343 1088"> <ul style="list-style-type: none"> <li>The objective of implementing the trial construction was defined as 1) determined the appropriate construction method to apply LBT on bituminous works, 2) confirm the balance between both labour and equipment based constructions, 3) record the spray and consumption rate of materials, 4) found findings related to safety and environment, and 5) reflect the lesson obtained to the Guideline.</li> <li>Target road and section of the trial construction was chosen between Obomfo Densua-Akote villages at Suhun, Municipal, and Eastern Region near KTC. The distance was approx. 3.2 km</li> <li>Since the construction of sub-base is now implemented by LBT, it was discussed and approved that the procurement of the labour which is the responsibility of</li> </ul> </td> </tr> </tbody> </table>	S/N	Date	Participants	Major discussion and Conclusion	1	27 <sup>th</sup> July, 2016	DFR, Eastern Region, JICA, LBST	<ul style="list-style-type: none"> <li>Basic contents of the trial construction plan were confirmed.</li> <li>Cold Bitumen, Sand Seal and Single Surface were chosen as a target pavement type to be incorporated in the guideline.</li> <li>A contractor shall be hired by DFR to conduct the trial construction while the materials shall be provided by the Project.</li> <li>A private consultant shall be hired by the Project to collect data from the trial construction.</li> <li>The essence of utilizing LBT is the construction cost and durability.</li> </ul>	2	14 <sup>th</sup> Sep., 2016	DFR, Eastern Region, JICA, LBST	<ul style="list-style-type: none"> <li>The objective of implementing the trial construction was defined as 1) determined the appropriate construction method to apply LBT on bituminous works, 2) confirm the balance between both labour and equipment based constructions, 3) record the spray and consumption rate of materials, 4) found findings related to safety and environment, and 5) reflect the lesson obtained to the Guideline.</li> <li>Target road and section of the trial construction was chosen between Obomfo Densua-Akote villages at Suhun, Municipal, and Eastern Region near KTC. The distance was approx. 3.2 km</li> <li>Since the construction of sub-base is now implemented by LBT, it was discussed and approved that the procurement of the labour which is the responsibility of</li> </ul>
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			<p>DFR according to the PDM2, shall be made with the same contractor by amending the current contract.</p> <ul style="list-style-type: none"> <li>Based on the submitted current status report, it was discussed and approved that the work items method should be single chip seal and cold mix asphalt. However, it was also confirmed that the standard structure of single chip seal in Ghana means 2 layers which applies 14mm chip on first and 9mm chip on second layer.</li> </ul>
3	9 <sup>th</sup> Nov., 2016	DFR, Eastern Region, JICA, LBST, KNUST, ILO	<ul style="list-style-type: none"> <li>Based on the conclusion of 2<sup>nd</sup> TW, BoQ applying single chip seal and cold mix asphalt was reported and due to budgetary reasons, it was recommended to adjust the construction length to meet the fixed sealing price. However, it was also discussed the necessity of having practice of spraying and spreading prior to actual construction for lesson obtained from the equipment operation training conducted at KTC.</li> <li>It was reported from the Chief Consultant that demarcation between the Project and DFR, the Project shall bear the labour and the contractor which it is the responsibility of DFR currently. From this, the PDM should be amended at the next Monitoring Sheet accordingly.</li> <li>Since the Ethiopian manual covers most of the area which this project aims, it was discussed and approved to refer this manual to build technical specification of the tendering documents. Relate to technical matters, the thickness of cold mix asphalt was discussed and approved to apply 14mm which is stated as the standard according to the Ethiopia manual.</li> <li>The Chief Consultant explained the further schedule that the tendering shall be implemented by restrict tendering and pre-tendering around begging of December, and tendering on 24<sup>th</sup> January tentatively. With collaboration of DFR and the Project, the tendering documents shall be made before end of November.</li> </ul>
Activity 2-2 <b>Completed</b>	<ul style="list-style-type: none"> <li>From discussion made above, preparation of tendering documents which includes agreement and technical specification was completed by end of November. In the technical specification, both objective and methodology of implementing the trial construction was clearly mentioned. This tendering documents were sold to contractors who show the interest and passed the criteria of restrict tendering. Pre-tendering meeting was held on 6<sup>th</sup> December and tendering on 24<sup>th</sup> of January, 2017 as scheduled. A. Naggesten Ltd. presented the lowest price and expect have signing between Eight-Japan Engineering Consultants Inc. on early February.</li> </ul>		
Activity 2-3 <b>Completed</b>	<p>&lt;Conduct necessary lab tests to assess the characteristics of materials&gt;</p> <ul style="list-style-type: none"> <li>In the first trial construction, following lab test were carried out to confirm the quality of the materials and construction <ul style="list-style-type: none"> <li>➢ Sieve test for gravel and aggregates, MDD and OMC test for gravels, FI, ACV, LAA and ALD tests for aggregates, Sand replacement test for base course</li> </ul> </li> </ul> <p>&lt;Identify technical requirements (e.g., materials, methodology and process, quality control, etc.) through the field trials&gt;</p> <ul style="list-style-type: none"> <li>From the first trial construction, following knowledge was observed. Details are given in Activity 3-1 below. <ul style="list-style-type: none"> <li>➢ Pre-coating the aggregate will seal the aggregate with emulsion and dust which adhere on the surface. For this, it was observed that pre-coating will prevent the aggregate comes off from the surface on surface dressing</li> <li>➢ One layer of base course should be less than 150mm on doing compaction by LBT.</li> </ul> </li> </ul>		

	<ul style="list-style-type: none"> <li>➢ Camber shall be attempted to be 3% for bituminous surface</li> <li>➢ Emulsion needs proper storage method to keep the quality</li> <li>➢ For spread rate of aggregate, more trials are needed to get closer to design rate</li> <li>➢ For cold mix asphalt, how to remove dust balls was the one of the largest issue</li> </ul>
Activity 2-4 <b>Completed</b>	<p>&lt;Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials&gt;</p> <ul style="list-style-type: none"> <li>• From the first trial construction, following knowledge was observed. Details are given in Activity 3-1 below. <ul style="list-style-type: none"> <li>➢ Rainy season is not appreciate for bituminous work since water affects the asphalt adhere on aggregate</li> <li>➢ Since labour start farming in rainy seasons, it is desirable to finish works before that</li> <li>➢ One month preparation was needed for the contractor and labour to understand the works. For this, training manual /guideline is needed for dissemination</li> <li>➢ Currently, the contractors do not have chippy or tow grader which is an equipment needed for bituminous surface works by LBT. Strategy and involvement in government level required.</li> </ul> </li> </ul>
Activity 2-5 <b>Completed</b>	<p>&lt;Collect information on task rates&gt;</p> <ul style="list-style-type: none"> <li>• Information to preparer the task rates are collected through the first trial construction and now under analysis.</li> </ul>
Activity 2-6 <b>Completed</b>	<p>&lt;Identify the applicable conditions of the labour-based bituminous surfacing technology&gt;</p> <ul style="list-style-type: none"> <li>• Area where the terrain is heavy and steep is not applicable for LBT works</li> <li>• Area where doesn't have basic access road to carry the equipment is not applicable for LBT works</li> <li>• Area where difficult to hire labour or no residents are not applicable for LBT Works</li> <li>• Area where difficult to carry bituminous materials is not applicable for bituminous LBT works since the production is made only at the grater Accra region.</li> </ul>
Activity 2-7 <b>Completed</b>	<p>&lt;Identify the safeguard issues&gt;</p> <ul style="list-style-type: none"> <li>• Guidance of how to do bituminous sealing works by LBT to the labours was carried out.</li> <li>• Guidance of HIV/AIDS and pre-cautions during construction was carried out.</li> </ul>
Activity 2-8 <b>Completed</b>	<p>&lt;Prepare a report on above&gt;</p> <ul style="list-style-type: none"> <li>• Technical reports as follows were prepared. <ul style="list-style-type: none"> <li>➢ Proportion of mixed aggregate</li> <li>➢ Appropriate mixing rate of pre-coated aggregate</li> <li>➢ Appropriate spray rate of emulation</li> <li>➢ Appropriate spread rate of aggregate</li> <li>➢ Design mix of the cold mix asphalt</li> </ul> </li> <li>• Comprehensive summary report was prepared.</li> <li>• Discussion regarding the outline of the guideline was carried out and summarized in a table based on document submitted in the 3<sup>rd</sup> technical meeting</li> </ul>
Activity 2-9 <b>Completed</b>	<p>&lt;Carry out on-the-job training (OJT) through above activities&gt;</p> <ul style="list-style-type: none"> <li>• All of the activities from Activity 1-1 to Activity 2-1 were carried out with collaboration between the DFR members and Japanese Experts.</li> <li>• The DFR members with KTC and the contractors had an equipment operational training at KTC. The trainees had opportunity how to maintain the equipment as well as operation systemically. The JICA provided equipment was used for the training.</li> <li>• All of the activities from Activities 2-2 to Activity 2-9 were carried out with collaboration between the DFR members and Japanese Experts</li> </ul>

**OUTPUT-3 Guidelines for labour-based bituminous surfacing technology are prepared**

Activity 3-1

**Completed**

<Determine the contents of the guidelines by reviewing the result of the first field trials>

S/N	Date	Participants	Major discussion and Conclusion
4	26 <sup>th</sup> to 28 <sup>th</sup> July, 2017  (The First Intensive Workshop in Pepease)	<ul style="list-style-type: none"> <li>• <b>Dr. K. Osafo Ampadu</b> Deputy Director of Planning, DFR Head Office</li> <li>• <b>K. Omane-Brimpong</b> Principal Engineer, DFR Head Office</li> <li>• <b>Dr. Patrick Bekoe Amoah</b> Senior Engineer, DFR Head Office</li> <li>• <b>Bernard William Amoah</b> Mechanical Engineer, DFR Head Office</li> <li>• <b>Frank Amofa Agyemen</b> Assistant Engineer, DFR Head Office</li> <li>• <b>Joseph Mauwusi Adekponya</b> Assistant Engineer, DFR Head Office</li> <li>• <b>Issac Mensah</b> Principal Quality Surveyor, DFR Eastern region</li> <li>• <b>Frederick Addison</b> Senior Engineer, DFR Eastern region</li> <li>• <b>Christopher Ampah Essel</b> Senior Technician, Engineer, DFR Eastern region</li> <li>• <b>Motoki Ogawa</b> Team Leader, JICA-LBST</li> <li>• <b>Takaaki Hirakawa</b> Monitoring, JICA-LBST</li> <li>• <b>Yumiko Takeda</b> Training/Coordinator, JICA-LBST</li> <li>• <b>Tomoe Iehisa</b> Coordinator, JICA-LBST</li> <li>• <b>Anthony Mensah</b> Resident Eng., JICA-LBST</li> <li>• <b>Gifty Gbenyo</b> Secretary, JICA-LBST</li> </ul>	<p>The First Intensive Workshop was held in Pepease, Eastern Region from 26 to 28<sup>th</sup>, July, 2017. The purpose of the workshop was to review the lesson learnt from the first trial construction and to discuss way forward for the preparation of the second trial construction. The outline of the review is given as follows;</p> <p>(a) Preparation</p> <ul style="list-style-type: none"> <li>• Cut back asphalt is usually applied to prepare pre-coated aggregate. However, considering the characteristics of LBT that the works shall be done by labour, emulsion has a high privilege that it doesn't use heat. For this, using emulsion for both pre-coating and priming was decided and design was made by existing manuals and trial test at field.</li> </ul> <p>(b) Base Course</p> <ul style="list-style-type: none"> <li>• MDD96% was achieved where 98% is required under the MRH specification for base course. It is figured out that this shortage is caused by 150mm thickness of single layer to compact by pedestrian roller, and by adjusting the moisture content after and not before the compaction.</li> <li>• Undulation was observed on surface after compaction. Although the range of deviation was acceptable for gravel surface; for bituminous surface, it is desirable to secure higher evenness. For this, it is advised to utilize tow-grader before compaction.</li> <li>• The camber was made in 8% for the usual amount of gravel surface. However, 3% is usually applied in bituminous pavement roads and hence both gradients should be compared at the next trial construction. By lowering the gradient, matter of sprayed extra emulsion flow out to the shoulder is expected to be solved and appropriate spray rate should be considered as well.</li> <li>• Constructing a 6m width surface on the 6m width base course is difficult to ensure the required density and eventually the shoulder become loose. It is difficult to achieve sufficient compaction density unless the compaction width is wider than the design and cutting the edge and reforming the slope. Although the volume of emulsion that has flowed out was less than the primer coat, the same tendency was observed on the seal coat also.</li> </ul> <p>(c) Surface Dressing</p> <ul style="list-style-type: none"> <li>• Since water affects the adhesion of emulsion to the aggregate, appropriate curing measures after pre-coating the aggregate is required.</li> <li>• Regarding hauling and storage of the emulsion, initially contractor used empty drums to fills at the plant and convey to the site. However, to reduce times of</li> </ul>

				<p>hauling, the contractor changed to convey emulsion by using 5,000 liter tank. The emulsion was poured from the tank to buckets and then to drums every day. After this method was applied, clog in the asphalt distributor pipes was observed. This was considered because the viscosity of the emulsion has changed for it has stored in the tank for a long time than before and the emulsion has decomposed. To solve this matter, truck asphalt distributor was applied to storage the emulsion. This equipment will circulate the emulsion in the distributor and will avoid the emulsion to be decomposed.</p> <ul style="list-style-type: none"> <li>• Controlling the spray rate of emulsion was made by measuring the area sprayed and consumed volume, and its spraying speed. This method worked very well and even practical. It was able to adjust the area to be sprayed and its speed by observing the works.</li> <li>• Chippy was applied to spread aggregates. However, approx. 15% beyond the designed spread rate was observed.</li> </ul> <p>(d) Cold Mix Asphalt</p> <ul style="list-style-type: none"> <li>• A lot of dust balls came out during producing cold mix. According to the exiting LBT manuals, it says that proper moisture control of the materials is required that excessively moist or dry will be the cause making the dust balls. For our case, since the construction was carried out during the rainy season, it is considered that the quarry dust had too much moisture. For this, the quarry dust was dried under the sun before mixture, and then it had an improvement extremely.</li> <li>• During the construction it was found that the number of particular tools for cold mix such as guide rail will become the control of the construction speed. The maximum construction length of a section is about 50 m. Guide rail to construction 50m will be 2 lines (100 m) of thickness 20 mm rail ,and 1 line (50 m) of thickness 6 mm rail. This will be a set for one section and at least tools for 2 sections is desired be prepared for smooth implementation.</li> <li>• Waste material stick on the surface inside the concrete mixer and this affects the quality of the next cold mix. For this, sufficient amount of diesel oil, strong Kelen stick to remove sticky asphalt and cleaning at the end of every work was required.</li> </ul> <p>(e) Others</p> <ul style="list-style-type: none"> <li>• At least one month was needed to train and let understand the works to the contractor and labours. Training manual needed separately to the technical guideline.</li> <li>• The contractor did not possess any LBT equipment except concrete mixer and compactor. However, for the bituminous surface works, other equipment such</li> </ul>
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			<p>as engine sprayer, chipper, tractor and tow grader are needed. Considering the dissemination of the guideline, strong involvement and strategy of the government for solution is needed.</p> <p>The contents discussed above were reflected to the table which describes the chapter and its outline of the guideline that was prepared at the 3<sup>rd</sup> technical meeting held on 9<sup>th</sup> November. This table shall be updated and more information shall be added as project progress obtained. After the lesson of the second trial construction incorporated in this table, it is expected that this shall be the source of the Guideline.</p> <p>Also, under the discussion, the contents to be incorporated in the second trial were given as follows;</p> <ul style="list-style-type: none"> <li>(a) Another contractor shall be hired to compare the performance (however same route and labours)</li> <li>(b) To confirm the strength of the cold mix asphalt academically, Marshall tests shall be carried out in several test cases</li> <li>(c) Do trial by changing spray rate of primer coat and seal coat</li> <li>(d) Observe the behaviour of the sprayed emulsion by changing the camber of the base course.</li> <li>(e) Do trial of spread rate of the Chippy by adjusting the guide.</li> <li>(f) Improvement of surface dressing methodology to get closer to the design spread rate.</li> <li>(g) Other production rates such as brooming, watering, mixing asphalt, Spreading, Spraying, Compaction and etc. shall be recorded.</li> </ul>		
<p>Activity 3-2 <b>Completed</b></p>	<p>5</p>	<p>Ditto as the first intensive workshop except Ms. Takeda and Ms. Ieshisa</p>	<p>The first and second day of the discussion was spent for creating the draft of the technical paper which should be submitted to the ILO regional seminar by end of August. On the third day, presentation material for the coming technical seminar was carried out. Since the technical point was very clear from the discussion made in Peduase, the participants were separated in groups to focus more in their specialities.</p>		
<p>&lt;Prepare and agree with the outline of the guidelines by both sides&gt; From the result of the first trial construction, the content of the guideline was agreed to amend to the following from what was concluded in the previous technical meetings. This amendment was made to clear the target of each chapter.</p>					
		<p><b>Original</b></p>	<p><b>Second Version</b></p>	<p><b>Target</b></p>	
<p><b>Chapter-1 Introduction to Bituminous Sealing</b></p>		<p><b>Chapter-1 Introduction</b></p>			<p><b>All</b></p>
<p>1-1 Purpose of the Sealing</p>		<p>1-1 Purpose of the Sealing</p>			
<p>1-2 Construction Quality Standards</p>		<p>1-2 Construction Quality Standards</p>			

Activity 3-3	<p>1-3 Construction Methods</p> <p>1-4 Labour Based Sealing Operations</p> <p>1-5 Choice of Seals</p> <p>1-6 Bituminous Binders</p> <p>1-7 Aggregates</p> <p>1-8 Testing of Materials</p> <p>1-9 Use of Marginal Materials</p> <p>1-10 Design of Bituminous Surface Treatment</p> <p><b>Chapter-2 Preparation for Sealing Operation</b></p> <p>2-1 laying the base</p> <p>2-2 Working planning and preparations</p> <p>2-3 Operation of Bitumen Sprayer</p> <p>2-4 The Spray Procedure</p> <p>2-5 Application of Binder</p> <p><b>Chapter-3 Quality Assurance and Control</b></p> <p>3-1 Definitions</p> <p>3-2 Quality Assurance</p> <p>3-3 Quality Control</p> <p><b>Chapter-4 Sealing Operation</b></p> <p>4-1 General</p> <p>4-2 Site Preparations</p> <p>4-3 Chip Sealing</p> <p>4-4 Cold Mix Asphalt</p> <p>4-5 Traffic Control</p> <p>4-6 Quality Control</p> <p>4-7 Quality Assurance</p> <p>4-8 Occupation Health and Safety</p> <p>4-9 Environment Protection</p> <p><b>Chapter-5 Maintenance</b></p> <p>5-1 Definitions</p> <p>5-2 Routine Maintenance</p> <p>5-3 Periodic Maintenance</p> <p><b>Chapter-6 Productivity Guide</b></p> <p>6-1 Production Rate</p> <p>6-2 Reference</p>	<p>2-3</p> <p>1-3</p> <p>2-4</p> <p>3-1-1</p> <p>3-1-2</p> <p>5</p> <p>5</p> <p>3-3</p> <p>4-2</p> <p>4-1</p> <p>4-3/4-4</p> <p>4-3/4-4</p> <p>4-3/4-4</p> <p>5-1</p> <p>5-2</p> <p>5-3</p> <p>N/A</p> <p>4-3,4-3,4-4</p> <p>4-3</p> <p>4-4</p> <p>4-5</p> <p>5-2</p> <p>5-3</p> <p>4-6</p> <p>4-7</p> <p>6-1</p> <p>6-2</p> <p>6-3</p> <p>7-1</p> <p>7-2</p>	<p>1-3 Labour Based Sealing Options</p> <p><b>Chapter-2 Planning</b></p> <p><b>Chapter-2 Planning</b></p> <p>2-1 Reconnaissance</p> <p>2-2- Selection of Surface Type (Paved or Unpaved)</p> <p>2-3 Selection of LBT and EBT</p> <p>2-4 Selection of Sealing</p> <p>2-5 Equipment</p> <p>2-6 Implementation of Structure</p> <p>Chapter-3 Design</p> <p><b>Chapter-3 Materials</b></p> <p>3-1-1 Bituminous binders</p> <p>3-2-2 Aggregates</p> <p>3-2 General Cross Section</p> <p>3-3 Design of Bituminous Surface Treatment</p> <p><b>Chapter-4 Construction</b></p> <p>4-1 Work Planning</p> <p>4-2 laying the Base</p> <p>4-3 Chip Sealing</p> <p>4-4 Cold Mix Asphalt</p> <p>4-5 Traffic Control</p> <p>4-6 Occupational Health and Safety</p> <p>4-7 Environment Protection</p> <p><b>Chapter-5 Quality Assurance and Control</b></p> <p>5-1 Definitions</p> <p>5-2 QA and QC for laying the base</p> <p>5-3 QA and QC for Chip Seal</p> <p>5-4 QA and QC for Cold Mix Asphalt</p> <p><b>Chapter-6 Maintenance</b></p> <p>6-1 Definitions</p> <p>6-2 Routine Maintenance</p> <p>6-3 Periodic Maintenance</p> <p><b>Chapter-7 Productivity Guide</b></p> <p>7-1 Production Rate</p> <p>7-2 Unit Rate</p> <p>Reference</p>	<p><b>Client, Consultant</b></p> <p><b>Client, Consultant</b></p> <p><b>Client, Contractor</b></p> <p><b>Client, Contractor</b></p> <p><b>Client</b></p> <p><b>Client, Contractor</b></p>
<Draft the guidelines>				

Completed		Intensive workshop as given below was carried out to build the first draft of the guideline		Major Discussion and Conclusion
S/N	Date	Participants		
6	On 12th to 14th Feb. 2018 at Peduase	<p>&lt;DFR-HQ&gt;            Dr. K. Osafu Ampadu /Former Deputy Director of Planning            Eng. K. Omane-Brimpong/ Principal Engineer            Dr. Patrick Bekoe Amoah / Senior Engineer            Eng. Bernard Williams Amoah/ Mechanical Engineer/            Eng. Frank Amofa Agyemen /Assistant Engineer            Eng. Joseph Mawusi Adekponya /Assistant Engineer            &lt;DFR-Eastern-Region&gt;            Dr. Issac Mensah /Principal Quality Surveyor            Eng. Frederick Addison /Senior Engineer            Eng. Christopher Ampah Essel /Senior Technician Engineer            &lt;KTC&gt;            Eng. Emmanuel Opoku-Adusei /Assistant Engineer            &lt;JICA&gt;            Prince Bio /Local Consultant Engineer            &lt;The Project&gt;            Motoki Ogawa /Chief Engineer            Ikumasa Kawasaki /Supervisor            Takaaki Hirakawa /Monitoring and Evaluation            Mensah Anthony Senyo / Assit. Site Supervisor            Gifty Gbenyo /Secretary</p>	<p>Discussion was made base on the chapters indicated in Activity 2-2 above. Outline of the discussion is given as follows.</p> <ul style="list-style-type: none"> <li>Reflecting lesson/knowledge obtained from the first trial is inadequate. Materials which Mr. Sakamoto has left shall be reviewed more carefully and attempt to incorporate to one of the chapters of the Guideline. Or shall attach as an appendix after the main part.</li> <li>Actual experience from the trial shall be given in the Guideline. This expects readers not just tracing the established technical standards but also help understanding its background. For instance, how you tackled with the dust balls, maintenance of the equipment, trial of mixing proportion of the bitumen and the aggregates shall be attractive to present. (refer to the First intensive workshop (S/N 4) above)</li> <li>Subject of environment and safety shall be more incorporated.</li> <li>Since calibration of the unit rate by each region is considered for further dissemination of the guideline, the source of the unit rate shall be explained in more detail and easy understandings as well.</li> <li>Refer to and incorporate the writing material which Mr. Takeishi /Mechanical Expert has left.</li> </ul> <p>The first draft guideline was built based on discussion done in this intensive workshop.</p>	
Activity 3-4 <b>Under Implementation</b>			<p>&lt;Carry out the second field trial following the guidelines&gt;</p> <ul style="list-style-type: none"> <li>The tendering for the second trail was made on 13<sup>th</sup> December 2017, and Bend-Key Limit has taken the lowest price. Evaluation of the tendering was carried out and approval was made from the director on January 2018 and followed to make signing to the contract on 2<sup>nd</sup> February 2018.</li> <li>The construction started from 20<sup>th</sup> of February after receiving and issuing the necessary documents under the contract. The construction duration was stipulated for 5 months which means 20th July 2018 is the end of the contract.</li> <li>The construction started from the GoG portion since the Project's portion would be constructed on the sub-base course which the GoG portion has built. Since same Bend-Key has taken the business of the GoG portion, the works taken over smoothly without time gap.</li> <li>Additional machine such as level, tow grader and pan mixer were delivered to the site and applied in the actual construction works. The result are under data collection and incorporated in the Guideline.</li> <li>Economic research was conducted on February before the commencement of the construction becomes busy.</li> <li>The progress of the works was achieved up to 73.5% at end of July where the schedule was 85%. The delay happened due to payment of the GoG portion. The Project and DFR have taken action time by time to disburse budget from the Road Fund even asking JICA's support writing letter to the Minister directly asking his understanding and urgent action, the payment is still not been made at 31<sup>st</sup> July 2018 present. Therefore, the contract was amended to extend one month from the initial.</li> </ul>	

<p>Activity 3-5 <b><u>Under Implementation</u></b></p>	<p>&lt;Revise the draft based on the result of the second field trials as necessary&gt;</p> <ul style="list-style-type: none"> <li>• Since the second trial is still under implementation as of 31st June 2018, the data collection is expected to be around August to October since the data would be collected and analyzed after the completion of the construction. The construction period has been extended to 20<sup>th</sup> Aug. 2018 at present.</li> <li>• The collection for the economic analysis is scheduled to be held in September after the completion of the construction.</li> <li>• Review and proofreading shall be conducted in October to November by the DFR members and the academic researchers as well. After this procedure, the draft shall be final and be the manuscript for the editing process which comes next.</li> <li>• Editing which means digitizing and decorating the material is scheduled to be done around mid of November.</li> </ul>																				
<p>Activity 3-6 <b><u>Under Implementation</u></b></p>	<p>&lt;Carry out OJT through above activities&gt;</p> <ul style="list-style-type: none"> <li>• The activities from Activity 3-3 to Activity 3-5 were carried out with collaboration between the DFR members and Japanese Experts.</li> <li>• The DFR members have intensive workshop 3 times and technical seminar once with JCC.</li> <li>• The DFR members have built the first draft guideline (Activity 3-3) to start concrete discussions.</li> </ul>																				
<p><b>OTHER OUTPUTS</b></p>																					
<p>Procurement of equipment <b><u>Completed</u></b></p>	<ul style="list-style-type: none"> <li>• All equipment was delivered and inspected properly by the Japanese Experts. For details, refer to Attachment-2.</li> <li>• Equipment operational training was conducted from 21<sup>st</sup> to 24<sup>th</sup> November 2016 at KTC.</li> <li>• Extra equipment such as tow grader, level and pan mixer were delivered on March to July 2018 at KTC.</li> </ul>																				
<p>The third country Training <b><u>Completed</u></b></p>	<p>From 5<sup>th</sup> to 18<sup>th</sup> of November 2018, the third country training was conducted with 10 members from DFR-HQ, DFR Eastern region and KLC. Following gives the outline of the activities and its results.</p> <table border="1" data-bbox="887 250 1351 1830"> <thead> <tr> <th>Date</th> <th>County /location</th> <th>Major Activities</th> <th>Lesson Learnt</th> </tr> </thead> <tbody> <tr> <td>6<sup>th</sup>, Nov.</td> <td>South Africa /Johannesburg</td> <td>Visiting EPWP with ILO</td> <td>The first country to visit was South Africa and courtesy called the National Department of Public Works with ILO. There the delegation team had lecture from the Department about governance structure and national policy of public works.</td> </tr> <tr> <td>7<sup>th</sup>, Nov.</td> <td>South Africa /Cost Yard</td> <td>Visiting village name Tshwane</td> <td>The Team visited village name Tshwane located approx. 30km apart from Coast Yard. Actual construction works were observed out and many useful lessons were obtained. Use of pan mixer instead of concrete mixer to produce cold mix and control of moisture to avoid balling was the highlight of this activity since since these two were the largest issues which were difficult to solve in the first trial.</td> </tr> <tr> <td>8<sup>th</sup>, Nov.</td> <td>South Africa /Johannesburg</td> <td>Visiting village name Stellenbosch and Ceres</td> <td>With escort of the Municipal Engineer from the Johannesburg Municipality, the Team visited village name Stellenbosch which the road was constructed three years ago by LBT. Also, the Team visited village name Ceres, and there, actual bituminous works were observed. From these sites, the Team obtained importance of training the contractor as well as the planner and designer not limited to technology but with financial and leadership skills.</td> </tr> <tr> <td>9<sup>th</sup>, Nov.</td> <td>South Africa</td> <td>Visiting</td> <td>The Team visited a factory which produces road material stabilizer. There the Team had change to</td> </tr> </tbody> </table>	Date	County /location	Major Activities	Lesson Learnt	6 <sup>th</sup> , Nov.	South Africa /Johannesburg	Visiting EPWP with ILO	The first country to visit was South Africa and courtesy called the National Department of Public Works with ILO. There the delegation team had lecture from the Department about governance structure and national policy of public works.	7 <sup>th</sup> , Nov.	South Africa /Cost Yard	Visiting village name Tshwane	The Team visited village name Tshwane located approx. 30km apart from Coast Yard. Actual construction works were observed out and many useful lessons were obtained. Use of pan mixer instead of concrete mixer to produce cold mix and control of moisture to avoid balling was the highlight of this activity since since these two were the largest issues which were difficult to solve in the first trial.	8 <sup>th</sup> , Nov.	South Africa /Johannesburg	Visiting village name Stellenbosch and Ceres	With escort of the Municipal Engineer from the Johannesburg Municipality, the Team visited village name Stellenbosch which the road was constructed three years ago by LBT. Also, the Team visited village name Ceres, and there, actual bituminous works were observed. From these sites, the Team obtained importance of training the contractor as well as the planner and designer not limited to technology but with financial and leadership skills.	9 <sup>th</sup> , Nov.	South Africa	Visiting	The Team visited a factory which produces road material stabilizer. There the Team had change to
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					demonstration how to produce cold mix asphalt by using pan mixer.
				manufacturing firm	The Team visited Council of Scientific and Industrial Research (CSIR). Here the Team obtained lesson that the significant investment should be made into laboratory test for durable and sustainable asphalt construction. In this respect the roads and highway should as a matter priority collaborate with BRRl and the universities into researching the use of local material for asphalt pavement.
9 <sup>th</sup> , Nov.	South Africa /Johannesburg	Visiting CSIR			The Team visited the office of Expanded Public Works Programme (EPWP) and shared experience. It was found the importance of training and contractor for the employment generation, and therefore the role and mandate of KTC shall be lightened.
10 <sup>th</sup> , Nov.	South Africa /Johannesburg	Visiting EPWP office			The Team joined the ILO Regional Seminar and presented the outline of this program and current achievement. Through joining the seminar, the Team member created personal relationship with almost all LBT related organization throughout Africa continent.
13 <sup>th</sup> to 17 <sup>th</sup> , Nov.	Ethiopia /Addis Ababa	Join the ILO Regional Seminar			

Technical Seminar is an activity to present and discuss the contents of the Guideline to share its knowledge among organization/person relates. The outline of the discussion and result is given as follows.

**Technical Seminar Under Implementation**

S/N	Date	Participants	Major discussion and Conclusion												
1	On 17th August, 2017	MRH, GH, DUR, DFR, DFR-Eastern Region, KTC, KNUST and JICA	<ul style="list-style-type: none"> <li>Technical Seminar was carried out on 17<sup>th</sup> August, 2017 at KTC conference hall in Koforidua. The Major objective of this seminar was to present and discuss the lesson learnt from the first trial construction to build the draft guideline. The outlines achieved were presented by each person in charge. Following is the outline of the discussion and its results.</li> </ul> <table border="1"> <tr> <td>Secure Safety</td> <td> <ul style="list-style-type: none"> <li>Basically, need more care to labours safety</li> <li>Paying attention to environment is also required</li> <li>Should indicate about protection of health of labours</li> </ul> </td> </tr> <tr> <td>Economic Analysis</td> <td> <ul style="list-style-type: none"> <li>Needs comparison between EBT and LBT</li> <li>Needs cements about maintenance cost and make comparison of LCC as well</li> <li>Needs to indicate the actual required number of labours from the trial</li> </ul> </td> </tr> <tr> <td>Application of local characteristic</td> <td> <ul style="list-style-type: none"> <li>Some areas in north is difficult to find good gravel</li> <li>Needs to indicate the local characteristic on application</li> </ul> </td> </tr> <tr> <td>Technical evaluation</td> <td> <ul style="list-style-type: none"> <li>Needs clearer source to explain the superiority of CMA, in particular about thickness</li> <li>Environment is also should be consider on comparison of thickness</li> <li>On evaluation of duration, taking photo of before-after is considered to be equipment</li> </ul> </td> </tr> <tr> <td>Design</td> <td> <ul style="list-style-type: none"> <li>Needs to mention about the selection of pavement type – advantage and disadvantage, criteria to compare</li> </ul> </td> </tr> <tr> <td>Equipment</td> <td> <ul style="list-style-type: none"> <li>Needs definition which machinery belongs to LBT –Definition of LBT works</li> <li>Needs to mention the machinery's required basic specification.</li> <li>Needs definition of times of passes – in which condition requires 2 time passes or 4 time passes.</li> </ul> </td> </tr> </table>	Secure Safety	<ul style="list-style-type: none"> <li>Basically, need more care to labours safety</li> <li>Paying attention to environment is also required</li> <li>Should indicate about protection of health of labours</li> </ul>	Economic Analysis	<ul style="list-style-type: none"> <li>Needs comparison between EBT and LBT</li> <li>Needs cements about maintenance cost and make comparison of LCC as well</li> <li>Needs to indicate the actual required number of labours from the trial</li> </ul>	Application of local characteristic	<ul style="list-style-type: none"> <li>Some areas in north is difficult to find good gravel</li> <li>Needs to indicate the local characteristic on application</li> </ul>	Technical evaluation	<ul style="list-style-type: none"> <li>Needs clearer source to explain the superiority of CMA, in particular about thickness</li> <li>Environment is also should be consider on comparison of thickness</li> <li>On evaluation of duration, taking photo of before-after is considered to be equipment</li> </ul>	Design	<ul style="list-style-type: none"> <li>Needs to mention about the selection of pavement type – advantage and disadvantage, criteria to compare</li> </ul>	Equipment	<ul style="list-style-type: none"> <li>Needs definition which machinery belongs to LBT –Definition of LBT works</li> <li>Needs to mention the machinery's required basic specification.</li> <li>Needs definition of times of passes – in which condition requires 2 time passes or 4 time passes.</li> </ul>
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