THE REPUBLIC OF GHANA
MINISTRY OF ROADS AND HIGHWAYS
DEPARTMENT OF FEEDER ROADS

THE REPUBLIC OF GHANA
THE PROJECT FOR
DEVELOPING LABOUR BASED
BITUMINOUS SURFACING TECHNOLOGY

PROJECT COMPLETION REPORT

JANUARY 2019

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

EIGHT-JAPAN ENGINEERING CONSULTANTS INC.
PADECO CO., LTD.

EI
JR
19-020

Contents

I. Basic Information of the Project

1. Country

Republic of Ghana

2. Title of the Project

The Project for Developing Labour Based Bituminous Surfacing Technology (LBST) in the Republic of Ghana

3. Duration of the Project (Planned and Actual)

Three (3) Years

4. Background

Labour-based Technology (hereinafter referred to as "LBT") has been utilized for road maintenance and rehabilitation, especially for low-volume road in the developing countries. LBT road construction in the Republic of Ghana was introduced during the mid-1980s with supports from World Bank and Danish International Development Agency (DANIDA), and it is now a viable alternative technology for road construction.

LBT for road maintenance and rehabilitation up to a sub-based level is well established in Ghana. However, LBT for bituminous surfacing had not been developed. The Department of Feeder Roads (hereinafter referred to as "DFR") is now trying to introduce the Labour-based Bituminous Surfacing Technology (LBST) as one of technologies which optimizes the maintenance cost of feeder roads.

Given the backgrounds mentioned above, the Government of the Republic of Ghana requested the Government of Japan to conduct a technical cooperation for developing Labour-based Bituminous Surfacing Technology (LBST).

5. Overall Goal and Project Purpose

Overall Goal

Measures are taken to make labour-based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.

Project Purpose

The methodology and application of labour-based bituminous surfacing technology (LBST) is established through the field trials in Eastern Region of Ghana.

6. Implementing Agency

Department of Feeder Roads (DFR), Ministry of Roads and Highways (MRH)

II. Results of the Project

1. Results of the Project

1-1 Input by the Japanese side (Planned and Actual)

<table>
<tr><th>Item</th><th>Achievement</th></tr>
<tr><td>Japanese Experts</td><td>Following 13 experts in total have been dispatched to the Project, under the position below. The total Man/Month of these experts was 45.97 MM where the plan was also 45.97 MM. Details are given in Attachment-1.
<table>
<tr><th rowspan="2">Expert</th><th rowspan="2">Position</th><th>Plan</th><th>Actual</th></tr>
<tr><th colspan="2">Man-Month</th></tr>
<tr><td>Motoki Ogawa</td><td>Chief Adviser / Rural Road Development</td><td>9.50</td><td>9.94</td></tr>
<tr><td>Seiji Kadooka</td><td>Deputy Chief Advisor /Road Pavement technology</td><td>6.77</td><td>6.73</td></tr>
<tr><td>Hiroaki Takahashi</td><td>LBT Guidelines</td><td>4.50</td><td>3.00</td></tr>
<tr><td>Kazunori Kobayashi</td><td>Cost Estimation/ Safety Gard</td><td>6.00</td><td>2.50</td></tr>
<tr><td>Tetsuo Sakamoto</td><td>Site Supervisor</td><td>5.50</td><td>5.33</td></tr>
<tr><td>Ikumasa Kawasaki</td><td>Site Supervisor</td><td>0.00</td><td>3.00</td></tr>
<tr><td>Masanori Takeishi</td><td>Maintenance and Machinery Equipment</td><td>3.20</td><td>2.50</td></tr>
<tr><td>Naoko Sasaki</td><td>Environment Considerations</td><td>2.00</td><td>3.00</td></tr>
<tr><td>Yumiko Takeda</td><td>Project Coodination1 /Training Plan</td><td>1.50</td><td>2.17</td></tr>
<tr><td>Takaaki Hirakawa</td><td>Monitoring and Evaluation 1</td><td>4.10</td><td>5.20</td></tr>
<tr><td>Mayumi Shoji</td><td>Project Coordination 2 /Monitoring and Evaluation 2</td><td>2.20</td><td>1.13</td></tr>
<tr><td>Tatsumi Tokunaga</td><td>Project Review</td><td>0.70</td><td>0.30</td></tr>
<tr><td>Tomoe Iehisa</td><td>Project Coordination 2</td><td>0.00</td><td>1.17</td></tr>
<tr><td colspan="2">Total</td><td>45.97</td><td>45.97</td></tr>
</table>
</td></tr>
<tr><td>Local Operation Cost</td><td>Local operation cost was mainly utilized for the following items
<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Items</th><th>Plan</th><th>Actual</th></tr>
<tr><th colspan="2">US$</th></tr>
<tr><td>1</td><td>Transport Cost (domestic)</td><td>158,581</td><td>79,931</td></tr>
<tr><td>2</td><td>Communication Cost</td><td>460</td><td>2,590</td></tr>
</table>
</td></tr>
</table>

	3	Equipment Purchased	126,326	121,971
	4	Third Country Training	27,413	55,742
	5	Meeting, Workshop and JCC	217	4,905
	6	Allowance and Accommodation	46,355	81,196
	7	Local Consultants/Advisor	80,721	80,815
	8	Others (incl. Guideline Printing)	44,554	48,650
	9	Sub-Contract (1st Trial Construction)	277,381	239.744
	10	Sub-Contract (2st Trial Construction)	147,328	127,152

Equipment

Copy machine, projector and construction machinery were provided. Details are given in **Annex 1-4**.

Study tour in the Third country

The study tour to the third country, titled "The study tour for developing guideline of bituminous sealing technology" was implemented from 5th to 18th November 2017 in South Africa and Ethiopia. The name and position of the Ghanaian counterparts are given in the following table.

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

The outline of the activities is given in **Annex 1-7.**

1-2 Input by the Ghanaian side (Planned and Actual)

Item	Achievement	
Counterparts	The following Counterparts have been assigned for the project.	
	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 Details are given in **Annex 1-5**.
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 1st Trial Construction. Details are given in **Annex 1-2.**

1-3 Activities (Planned and Actual)

Details are given in **Annex 1-7**.

2. Achievements of the Project

In order to confirm the progresses of the Outputs and Project Purpose achieved, C/P and Japanese experts monitored the progresses based on the Monitoring System (MS: refer to the **Annex 1-8**). The specific contents of the MS are as follows:

(1) Components of PDM (narrative summary, indicators, means of verification);
(2) Monitoring method (persons/organizations in charge, frequency, remarks);
(3) Target value (baseline value, target value); and
(4) Achievements of each financial year (FY 2016, 2017, and 2018).

The project activities were monitored according to the above items, and the achievements were filled out in the MS on the basis of the progress.

2-1 Outputs and indicators

2-1-1 Output 1

(1) Indicator 1: Clarification of current conditions and issues

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 **Annex 2-1**)," 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 was approved.

2-1-2 Output 2

(1) Indicator 1: Lab test of materials

1st Field Trial and its Pre-test

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

During the 1st field trial, acceptable materials (partly satisfactory ones) were used for the construction works, and the unacceptable ones were eliminated from construction works.

Table 1: Results of the lab tests during the 1st field trial

No.	Date	Test Item	Test Result	Ref. No
Pre-tests of materials (before 1st 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)	*Unacceptable*	GHA/CML/FT13/ 2388
5	14th Sep., 2016	Gravel (Base material)	*Unacceptable*	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 1st 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	*Unacceptable*	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 K1-70	Acceptable	GHA/CML/TF13/ 1471
18	22nd May, 2017	Aggregate	*Unacceptable*	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

2nd Field Trial

There were 15 lab tests of materials during the 2nd field trial. The findings indicate that all 14 test results were "acceptable." During the 2nd field trial, only acceptable materials were used for the construction works.

Table 2: Results of the lab tests during the 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
7	24th Oct., 2018	CMA Design Mix- Base Case	Acceptable	GHA/CML/TF.13/103
8	24th Oct., 2018	CMA Design Mix # 1	Acceptable	GHA/CML/TF.13/103
9	24th Oct., 2018	CMA Design Mix # 2	Acceptable	GHA/CML/TF.13/103
10	24th Oct., 2018	CMA Design Mix # 3	Acceptable	GHA/CML/TF.13/103
11	24th Oct., 2018	CMA Design Mix # 4	Acceptable	GHA/CML/TF.13/103
12	24th Oct., 2018	CMA Design Mix # 5	Unacceptable	GHA/CML/TF.13/103
13	24th Oct., 2018	CMA Design Mix # 6	Acceptable	GHA/CML/TF.13/103
14	24th Oct., 2018	CMA Design Mix # 7	Acceptable	GHA/CML/TF.13/103
15	24th Oct., 2018	CMA Design Mix # 8	Acceptable	GHA/CML/TF.13/103

Note 1
Acceptable: Lab test of materials was passed and fully utilized.
Unacceptable: Design mix failed and not used (Only Base Case, Case 6 & 8 were used)
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) Indicator 2: Implementation status based on LBST construction standard

The field trials have 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 **Annex 1-9**).

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 (CMA)

III. General Issues

① Safety and health measures

② Miscellaneous works

1st Field Trial

< 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 2nd field trial through proper time management during the construction period.

< 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 2nd field trial, therefore, 10-tone compactor will be used for desirable compaction as well as shorting of construction period. In connection with "mixing operation," this operation was not accepted because "dust ball" was often observed. Thus, this defect of dust ball shall be eliminated in the 2nd 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 2nd 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 2nd field trial. Safety and health awareness shall be intensified to avoid any accidents.

2nd Field Trial

As there were some adjustments to be taken in the 2nd field trial, those problems indicated above from I to III were technically overcome to meet LBST construction standard. For instance, the compaction (standard specification: 98%) and average road width (standard specification: 6m) were accepted. Also, “dust ball” was not observed by using pan mixers, and no labourers got injured in the 2nd field trial. Other than the points explained above, a toilet facility for workers was established.

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

(3) Indicator 3: Task rate[1]

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 3**, 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^2, or m^3). Sub-activities under respective main activities are shown in the **Annex 1-10** (Task Rate Summary).

The results of field trials show that the unit rates in the 2nd field trial became cheaper than the previous trial, except for the spreading of 10mm chippings[2] in the chip seal operation. On top of that, it implies the pan mixer efficiently functioned to produce materials for construction works in comparison with the concrete mixer to be used in

[1] As the task rates are not generalized at this moment, they are used for the reference purpose only.
[2] During the operation of the chippy for the spreading of 10mm chippings, there were problems with the chippy to reduce the equipment efficiency.

the 1st field trial.

Table 3: Unit rates for chip seal and cold mix asphalt in the 1st and 2nd field trials

1st Field Trial

Chip Seal

Main Activity	Unit Rate
1. Primer sealing (bitumen emulsion)	7.56 GH¢/ℓ
2. Spreading of 14 mm chipping	643.00 GH¢/m^3
3. Spraying of bitumen for seal	6.91 GH¢/ℓ
4. Spreading of 10 mm chipping	541.00 GH¢/m^3

Cold Mix Asphalt

Main Activity	Unit Rate
1. Priming	7.05 GH¢/ℓ
2. Tack coat - bitumen	6.77 GH¢/ℓ
Tack coat - water	1.46 GH¢/ℓ
3. Placing of cold mix asphalt	32.67 GH¢/m^2

2nd Field Trial

Chip Seal

Main Activity	Unit Rate
1. Primer sealing (bitumen emulsion)	7.14 GH¢/ℓ
2. Spreading of 14 mm chipping	566.94 GH¢/m^3
3. Spraying of bitumen for seal	6.66 GH¢/ℓ
4. Spreading of 10 mm chipping	619.77 GH¢/m^3

Cold Mix Asphalt

Main Activity	Unit Rate
1. Priming	6.87 GH¢/ℓ
2. Tack coat - bitumen	6.65 GH¢/ℓ
Tack coat - water	1.33 GH¢/ℓ
3. Placing of cold mix asphalt	31.49 GH¢/m^2

2-1-3 Output 3

(1) Indicator 1: Completion of draft guidelines for LBST

The draft LBST Guideline was completed with the appendixes of Operation Guide on Chip Seal and Cold Mix Asphalt. Thus, there are prospects that the Guideline will be approved by DFR in the near future and used for the LBST construction works across the country from now on.

2-2 Project Purpose and indicators

The Project Purpose was achieved as explained in the indicator 1 and 2 below. Because the LBST was developed through the field trials (indicator 1) and DFR officials acquired the LBST according to the self-rating results (indicator 2), the Project concluded that the Project Purpose was achieved, *i.e.*, establishing the LBST methodology and application.

(1) Indicator 1: Development of LBST

In terms of the indictor 1, there is a prospect that LBST monitored along the checklist (Form 1: refer to **Annex 1-11**) will be developed through the 1st and 2nd 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.

1st Field Trial

During the 1st field trial, 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. Other than those two items, there are fruitful advice and instructions from JICA experts to be fed back into the 2nd field trial.

2nd Field Trial

As the clues extracted from the 1st field trial were effectively applied to the implementation of the 2nd field trial, it was not found any unacceptance. Specifically, the contractor submitted the method statement and cash flow of work planning to DFR. Also, dust balls were not found because of the use of pan mixer, and the road surface became smooth by using the newly-procured towed grader. Thus, it concludes that LBST methodology was developed with the successful completion of physical construction works although there were some challenges for the disbursement delay to contractors and the miscalculation of unit rate.

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

The indicator 2 was achieved because it exceeded the target value (70.0%). This 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 measure the achievement of the Project Purpose, the questionnaire surveys were conducted according to the following question items (refer to **Annex 1-12** Questionnaire on LBST (Form 2) for details):

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 indicated the strength and weakness of DFR officials objectively, the technical assistance for DFR officials were efficiently carried out by focusing on the specific items.

Table 4: The self-rating results of DFR officials for acquiring LBST (Five-point scale)

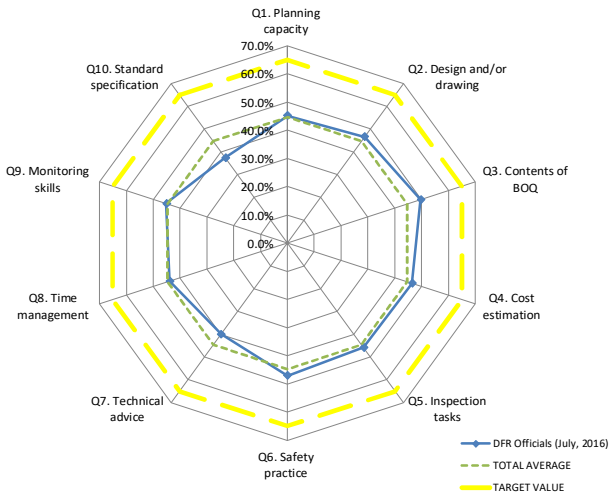
	1st Ques. (Jul 2016) 31 respondents	2nd Ques. (Jan 2017) 30 respondents	3rd Ques. (Jul 2017) 29 respondents	4th Ques. (Jan 2018) 31 respondents	5th Ques. (Jul 2018) 29 respondents	6th Ques. (Nov 2018) 31 respondents
Q1. Planning skills and knowledge of road works	45.2%	56.7%	78.5%	71.0%	77.2%	76.1%
Q2. Road structure design and/or drawing	46.5%	52.0%	69.3%	69.7%	69.0%	72.9%
Q3. Contents of Bill of Quantities (BOQ)	49.7%	55.3%	70.7%	68.4%	71.7%	75.5%
Q4. Cost estimation	46.5%	54.7%	64.3%	67.7%	71.7%	72.3%
Q5. Road inspection tasks	45.8%	55.3%	80.0%	74.8%	73.8%	80.6%
Q6. Safety practice for workers and road users during road works	47.1%	52.7%	69.3%	63.9%	70.3%	72.9%
Q7. Technical advice and supports for a contractor	40.0%	50.0%	76.4%	72.3%	74.5%	77.4%
Q8. Time management of road works during the execution periods	43.9%	46.0%	60.7%	61.9%	68.3%	64.5%
Q9. Monitoring of road works	45.2%	51.3%	75.0%	68.4%	76.6%	76.8%
Q10. Standard specification of the LBST	37.4%	51.3%	71.4%	71.3%	71.0%	76.8%
Total Rating on Average (Q1 – Q10)	**44.7%**	**52.5%**	**71.5%**	**68.8%**	**72.4%**	**74.6%**

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

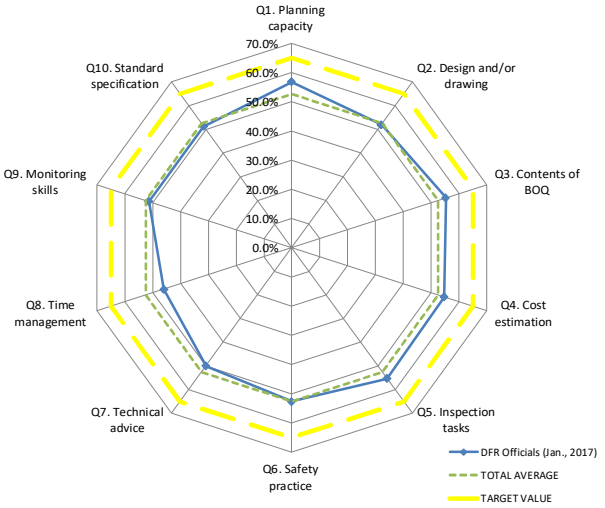
The self-rating of DFR officials exceeded the target value because the total rating from Q1 to Q10 on average was **74.6%**. DFR officials were highly confident of the "road inspection tasks (Q5: 80.6%)" and "technical advice and supports for contractors (Q7: 77.4%)." Six (6) items out of 10 attained to more than 75% which were 5% higher than the target (70%). Through two field trials in Koforidua, C/P came to be able to understand the road inspection tasks and provide technical advice for contractors. Moreover, it is considered that two field trials in Koforidua as well as overseas training in South Africa and intensive workshop for guidelines development were positively appreciated by DFR officials with the great supports of JICA experts for their capacity enhancement.

On the other hand, one item did not attain to 70%, *i.e.*, the "time management

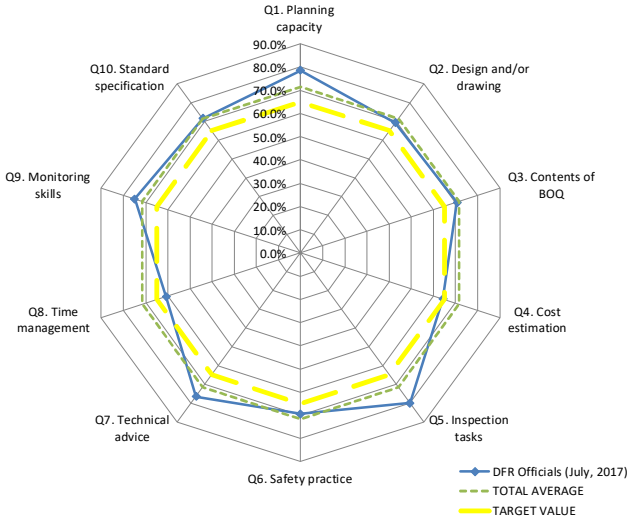
of road works (Q8: 64.5%).” Thus, this shall be remarked to enhance the time management of road works for other field trials in different areas implemented by DFR after the termination of the Project.



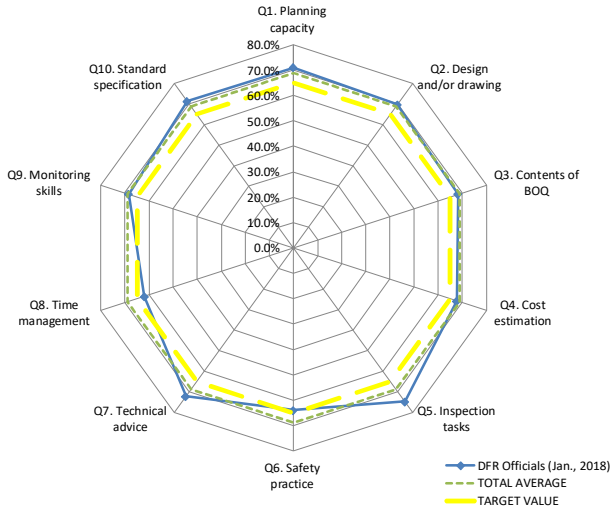
1st Questionnaire Survey (July 2016)



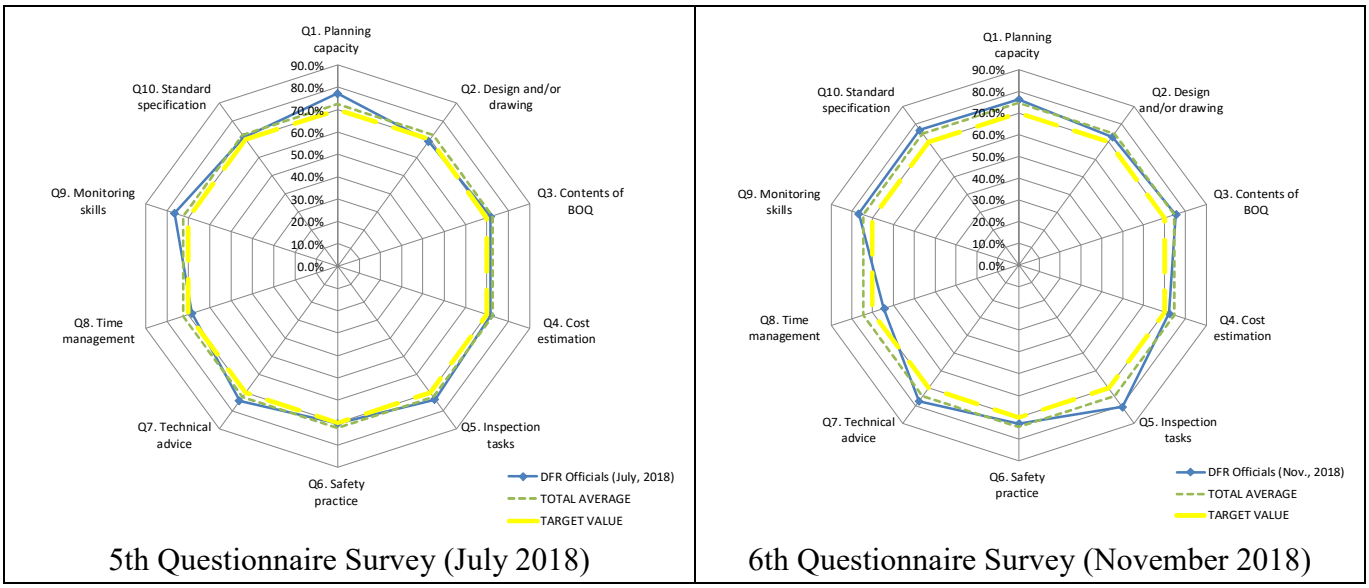
2nd Questionnaire Survey (January 2017)



3rd Questionnaire Survey (July 2017)

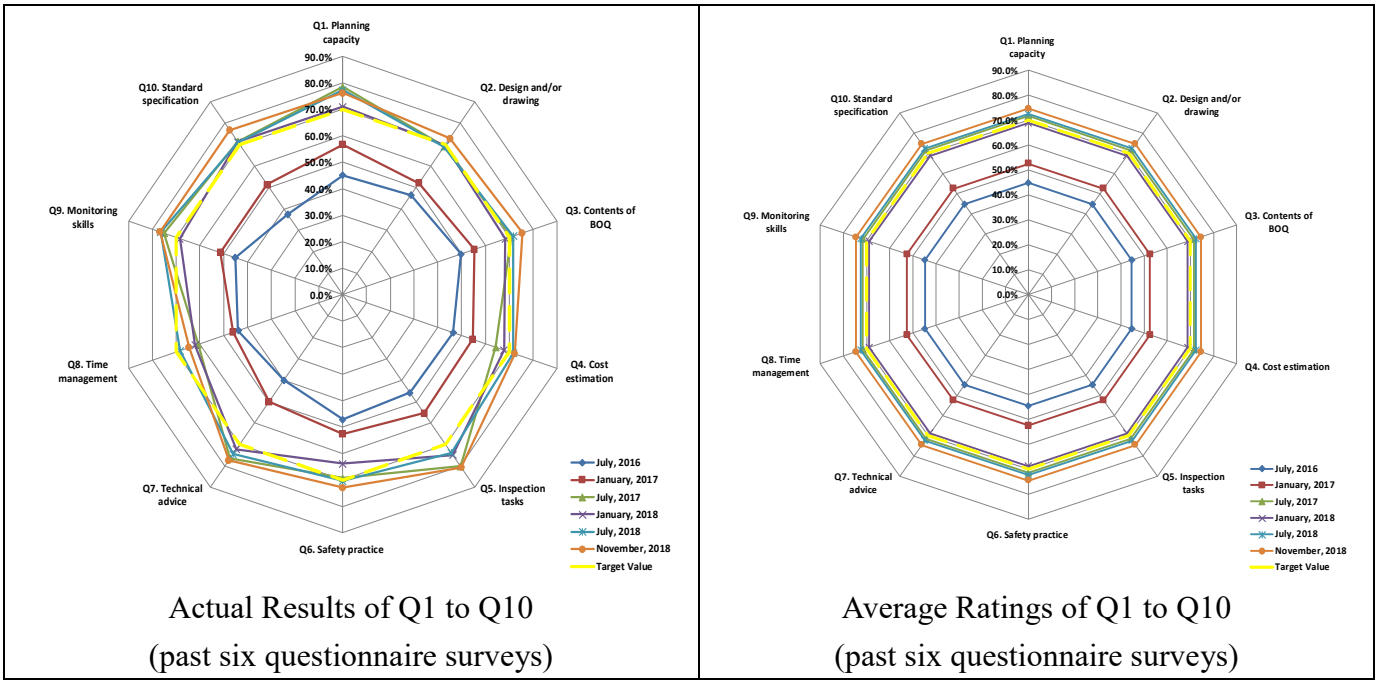


4th Questionnaire Survey (January 2018)



5th Questionnaire Survey (July 2018) | 6th Questionnaire Survey (November 2018)

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



Actual Results of Q1 to Q10 (past six questionnaire surveys)

Average Ratings of Q1 to Q10 (past six questionnaire surveys)

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

3. History of PDM Modification

3-1 Transition of PDM_1 to PDM_2

In order to effectively utilize PDM, the indicators and means of verification as well as the important assumptions of PDM_1 were mainly modified as shown in the

Table 5, and PDM_2 was prepared. Also, the activities and inputs were rephrased more understandably without changing those meanings.

Table 5: Modification of the PDM_1 to PDM_2

Components of the PDM		Corrections
Activities	General	Parts of the activities were modified so as to start from the verb.
	Activity 3-1	The first and second field trials were clearly distinguished.
Indicators	General	The expressions of indicators at each level of the PDM were clarified, such as labour-based bituminous surfacing technology, etc.
	Project Purpose	The expression of the indicator 1 was modified in the way to develop the labour-based bituminous surfacing technology based on the criteria of the monitoring checklist. In terms of the acquisition of the technology in the indicator 2, the achievement of the technology development is grasped through the self-evaluation of the DFR officials, including Eastern Region. The target value has been set at 65.0% because the baseline value was 44.7% (July 2016).
	Output 2	The indicator 2-1 was modified in the way to carry out the lab tests in accordance with the material standard.
		Regarding the indicator 2-2, the field trials came to be carried out in line with the LBST construction standard. With reference to the implementation of field trials, moreover, the word of “first” was deleted because the second field trials should also be included.
Means of Verification	Project Purpose	As a tool for confirming the development of the labour-based bituminous surfacing technology in the indicator 1, the Project prepared the monitoring checklist filled out by JICA experts and objectively observes the achievements according to the

		checklist.
		In the indicator 2, the Project prepared the questionnaire and came to use the one for the self-evaluation of the DFR officials in order to observe their acquisition status of the LBT bituminous surfacing technology.
	Output 2	As the means of verification of the indicator 2-1, the Project utilizes the certificate (“Results”) of the lab tests based on the material standard.
		As a tool for confirming the progress of field trials in the indicator 2-2, the Project prepared the checklist of the LBST construction standard and objectively observes the achievements in line with the checklist.
		In the means of verification of the indicator 2-3, the Project will prepare the summary table of task rates and fill out the unit cost of each work item.
Inputs	Japanese side	JICA experts, *i.e.*, “Monitoring and Evaluation” and “Project Review”, were added in the Japanese side.
	Ghanaian side	The layer of counterpart personnel and persons in charge were clarified in the Ghanaian side.
		The component of field trials was rearranged, and parts of expression were modified in the Ghanaian side.
Important Assumptions	For the achievements of the Outputs	As available resources related to the LBT bituminous surfacing technology, the KTC and KNUST were added to GHA Central Lab.
	For the achievement of the Project Purpose	The “assignment” after the C/P was added.
		Although the PDM_1 described that the draft guidelines was adopted as its official rule or regulation, the achievement of the Project Purpose would not be accepted if the draft was not adopted before the termination of the Project. Because the official adoption is acceptable even after the termination of the Project, the description was

		deleted. Thus, the trial operations will be carried out in line with the draft guidelines in this Project.
	For the achievement of the Overall Goal	Although this condition was originally placed in the same line of the Overall Goal, this has been replaced at one-rank lower level, *i.e.*, for the achievement of the Overall Goal because the budgetary condition shall be fulfilled for *the* achievement.
	In the same line of the Overall Goal	Because the Super Goal, above the Overall Goal, is not described in the PDM_1, those important assumptions except the "budgetary condition" were deleted. There were no corresponding parts of those important assumptions for the achievements of the objectives at other levels.

3-2 Transition of PDM_2 to PDM_{3-1}

PDM_3 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 6** because Japanese side mainly came to be responsible for the operational cost of the field trials, including labour forces, through subcontracting agreement with the awarded contractor.

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

Table 6: Modification of the PDM_2 to PDM_3

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.

Moreover, since the rating results had gradually been increased from July 2016 to January 2018 as indicated in the **Table 7**, the target value was modified at **70%** from 65%. Based on discussions of the revision of PDM_3 between DFR and the JICA expert

team, both sides agreed on the change of target value in the Project Purpose in February 2018, and the Project was implemented according to the revised PDM3-1 since then.

Table 7: Rating results from 1st to 4th questionnaire surveys

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

4. Others

4-1 Results of Environmental and Social Considerations (if applicable)

In the environment plan of DFR, it is indicated clearly that the emulsion should be kept in an appropriate condition to prevent from pouring off to the grand which would permeate and contaminate the underground water. In case of emulsion poured off from the container, it is indicated to rip off all the polluted soil to a harmless one. Since the emulsion was observed kept in an inadequate condition, this part was given in the Guideline. Also, subject which is particular to labour based method such as safety and health was reflected as well.

4-2 Results of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

N/A

III. Results of Joint Review

1. Results of Review based on DAC Evaluation Criteria

1-1 Relevance

[Government Policy in Ghana]

"An Agenda for Jobs: Creating Prosperity and Equal Opportunity for All (2018-2021)" is the Medium-term National Development Policy Framework in Ghana. There are several points which directly connect to the concept of the LBST Project. For the attainment of the Social Development Goal, the employment and decent work are one of medium-term policy interventions in which labor-intensive methods are strongly recommended and highlighted as specific government involvements. In order to achieve the medium-term goal for "Environment, Infrastructure, and Human Settlement," rural

[3] In the 3rd questionnaire survey in July 2017, it was considered that the rating result was drastically increased since the 1st field trial had just been completed at that time.

development and management is one of priorities for a government intervention. Moreover, the medium-term strategies include local economic development and provision of basic infrastructure, such as roads, electricity, *etc.*, to enhance the quality of life in rural areas. In this way, as GOG emphasizes labor-intensive methods and infrastructure development, including roads, the LBST Project is consistent with the direction of the GOG policy.

[Government Policy in Japan]

"Economic Infrastructure (Electric Power and Transportation)" is one of the priority areas of the "Rolling Plan for Ghana (April 2017)" and undertakes the development of basic infrastructure and road network for regional economic growth in the transportation area. Also, transportation improvement, including road network development in the eastern region, is emphasized to promote the country's economy and comprehensive growth. There is the "Economic Infrastructure Development Program" in the priority area which broadly assists basic infrastructure development of the local community, and the LBST Project is also positioned within the framework of this Program. Therefore, the Project is in line with the direction of the Government of Japan.

[Needs of the Project]

Since the majority of domestic transportation in Ghana relies on roads, the development of road network supporting basic infrastructure of local communities is an urgent issue. As the domestic transportation network development in Ghana is also beneficial for the development in West Africa, it is crucial to improve transportation infrastructure for the economic growth in Ghana from the broad-based perspective.

In addition, the surface layer of gravel and earth roads has been easily washed away by rain, which requires large-scale maintenance after every rainy season. In response to this situation, GOG plans to improve the durability against rainfall and reduce life-cycle costs by applying bituminous surface treatment to the road surface layer. Moreover, GOG incorporates LBT as a means of actively promoting road network improvement and job creation as mentioned in the government policy of Ghana. Under this circumstance, therefore, the development needs of GOG are considerably high, and the Project fulfills the needs of people in Ghana in terms of road development and job creation for local community.

1-2 Effectiveness

The effectiveness of the Project is ***high*** because the Project Purpose was

achieved in line with the indicators and through the accomplishments of three (3) Outputs before the end of the Project.

The main purpose of the Project is to establish the labour-based bituminous surfacing technology (LBST) together with the Guideline which contributes to the dissemination of LBST application. To achieve this purpose, field trials were carried out twice to collect the data necessary for the LBST and its Guideline through actual construction works in Koforidua, Eastern Region. Ultimately, LBST was developed and incorporated into the Guideline.

In terms of indicators, the first indicator explains that LBST has been developed according to the checklist (Form 1) prepared by the Project. As Form 1 shows all the LBST criteria accepted, the indicator 1 was achieved. Also, since the indicator 2 explains that the self-rating of DFR officials on LBST exceeds target value (70%), the indicator 2 was accomplished, too.

Furthermore, the Outputs contributed to the achievement of the Project Purpose through (1) the analysis of current conditions and issues in Ghana, (2) implementation of field trials, and (3) guideline development.

1-3 Efficiency

In general, the Inputs were favorably transferred into the Outputs although JICA road section was shortened because of road construction where partly wider than the original design for bus parking, curve of the intersections and access roads. However, GOG undertook the remaining section on behalf of JICA.

Regarding the third country training in South Africa, C/P obtained the ideas of pan mixer to efficiently prevent material loss from producing dust balls as shown in **Figure 3**. After the training, C/P tried to design the pan mixer and ordered it to a domestic manufacturer, and it has gradually been improved for the smooth mixture by re-examining stirring capacity, engine stability, gearbox, etc. Thus, this Input was effectively utilized for the accomplishments of the Outputs in terms of the implementation of 2nd field trial and the development of LBST Guideline.

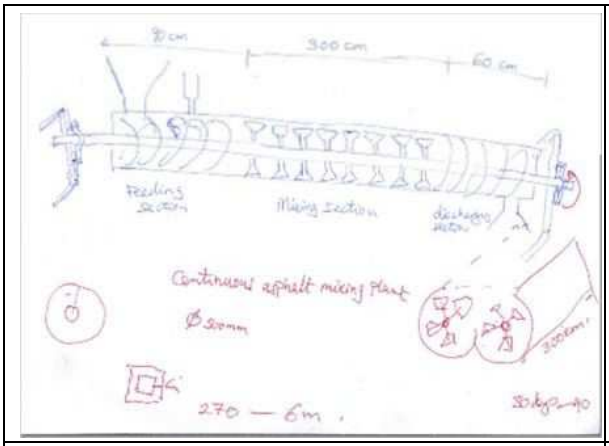
	
Continuous Mixer (Original design before visiting South Africa)	Pan Mixer used by Road Material Stabilizer (PTY) Ltd. in South Africa

Figure 3: Comparison between the original design (Continuous Mixer) and Pan Mixer

On the other hand, although this Project planned to construct the section from 2.70 to 4.40 km during the 2nd field trial, the section was shortened to 4.02 km because the road with CMA was partly constructed wider than the original design (6.0m). As a result, GOG took the responsibility for remaining section from 4.02 to 4.40km. Moreover, GOG is responsible for the section from 4.40 to 5.55 km with EBT and K3-70 for CMA portion.

Lastly, as the project period was only 46.0M/M (15M/M per year on average) for three (3) years, the assignments of JICA experts were dispersed and diluted to do operations. Under this constraint, even though the assignments of JICA experts were extremely limited, project activities were sufficiently carried out.

1-4 Impact

Although it is too early to assess the accomplishment of the Overall Goal at this moment, there are prospects that the Overall Goal will be achieved three years after the termination of the Project (refer to IV. 1 “Prospects to achieve Overall Goal” for more detail). Additionally, the following impacts are recognizable from the implementation process of the Project.

[Pan Mixer]

The pan mixer was newly manufactured by Ghanaian side through the third country training in South Africa. The knowledge extracted from this experience contributes to the production of pan mixer in Ghana, and the effects and advantages of pan mixer are described in the LBST Guideline for the nationwide expansion. Hence,

there are prospects that the pan mixer will be utilized for LBST construction works across the country in the future. This is a significant impact of the Project, and it is desirable to covey this fact through the PR activities by DFR. In any way, the Pan Mixer is high-potential equipment in consideration of nationwide expansion in the future.

[Role of trial construction site as a showcase in Ghana]

Trial site has the role as a showcase of LBST construction works in Ghana. In the past, several engineers from Burkina Faso visited the trial construction site and observed the LBST construction works through on-site program of KTC. Also, a delegation from Tanzania and students from KNUST came to observe LBST trial construction. Moreover, a delegation from Kenya will visit the site since they have interests in LBST construction. This showcase shall be utilized more effectively for PR activities of the Project to let Ghanaian people know of the LBST construction for the future's nationwide expansion.

[Gender Issue]

As for gender issues, the LBST Project contributes to the involvement of women in the labour-based activities for road construction. Women's involvement is 19.6%[4] (19 women of 97 workers) in the 1st field trial and 16.2%[5] in the 2nd field trial (11 women of 68 workers). It is a good opportunity for women in village to generate additional incomes through LBST activities.

[Collaboration with the MELR]

In terms of job creation with the labor-intensive methods, the Ministry of Employment and Labour Relations (MELR) is one of key stakeholders to promote LBST construction works. Thus, it is crucial for DFR to collaborate with the MELR for the smooth implementation of LBST operations for next three years toward the achievement of the Overall Goal.

1-5 Sustainability

The sustainability of the Project is ***moderate*** because the involvement of KTC and financial disbursement of Road Funds for the LBST operations are not firmly ensured for the LBST movement at the end of the Project. However, there are prospects

[4] This percentage is calculated from the women's headcount, and the one in total worker-day is 21.1%.
[5] This percentage is calculated from the women's headcount, and the one in total worker-day is 18.3%.

that DFR will continuously promote LBST construction works with reference to the Guideline.

[Policy aspects]

As mentioned in the Relevance, labor-intensive methods are strongly recommended for the purpose of the employment and decent works explained in "An Agenda for Jobs: Creating Prosperity and Equal Opportunity for All (2018-2021)." Thus, if the policy is retained for the future, the LBST construction works will be sustained because of the governmental policy framework by 2021 at minimum.

[Operational aspects]

During the 1st and 2nd field trials, JICA experts supervised the construction works in a certain period. However, as JICA experts do not supervise the construction works after the termination of the Project, DFR and contractors shall execute the LBST construction works by themselves with reference to the Guideline. Needless to say, it is important for KTC to establish the LBST training program through the adoption of the Guideline.

In order to keep the Guideline to be used continuously from now on, the most reasonable approach is to regularly update the Guideline with new data and information. Thus, it is necessary to set up a platform to deliver the updated version of LBST Guideline, which will be a motivation of C/P to improve it. Under this circumstance, the annual general meeting for engineers and ILO seminar (every two years) are an appropriate platform to deliver the updated version. Next question is who will update the LBST Guideline after the end of the Project. In response to this question, the taskforce of LBST Guideline shall be established for this purpose. If this mechanism is set up, the Guideline will continuously be updated with their ownership towards the guideline improvement. Most importantly, it is necessary for DFR to secure the budget for the taskforce operations to improve the Guideline.

In terms of on-site manual for LBST contractors and labourers, the appendixes on "A: Chip Seal Operation Guide" and "B: Cold Mix Asphalt Operation Guide" are attached to the Guideline. Those appendixes fully adopt easy-to-understand illustrations and pictures for the front-line workers on sites. As the appendixes are user-friendly contents, they shall broadly be used and referred in a proactive manner.

[Financial aspect]

As mentioned in the Efficiency, GOG took the responsibility for remaining

section from 4.02 to 4.40km as well as from 4.40 to 5.55 km with EBT and K3-70 for CMA portion. Although the Project did not put additional budget for the 2nd field trial, it would be a good sign to have its ownership towards the project activities by GOG side from the sustainable aspect.

On the other hand, budget disbursement from Road Fund (RF) is one of anxieties to be solved after the termination of the Project. In case of the 2nd field trial, because the disbursement from RF was delayed, DFR was not able to pay contractors for their construction works. It is crucial for DFR officials to monitor the budget disbursement from RF even if the budget is allocated for the LBST measures. If it is difficult for DFR to share the work progress and its interim payment with RF, the visualized comparative table shall be prepared to recognize actual work and disbursement progress based on the planned target by due date as proposed in the **Table 8.**

Table 8: Comparative table of actual work progress and financial progress (proposed)

Time schedule	31/1/2019	28/2/2019	31/3/2019	30/4/2019
Planned target to be completed (%)				
Actual work progress (%)				
Actual disbursement progress (%)				

Also, the DFR budget from RF was almost triply increased in FY2017 from previous financial year because fuel levy changed into 0.43GHC/litter from 0.07 GHC/litter in 2016. Thus, there is a prospect that DFR budget for road construction, including LBST construction works, will be secured in a certain degree. According to DFR, furthermore, 10% of DFR budget shall be allocated for the purpose of LBST works at minimum.

Table 9: DFR Budget (Road Fund portion) from FY 2016 to FY 2018

Unit: GH ₵ (Million)

	FY 2015	FY 2016	FY 2017
DFR Budget (Road Fund portion)	86.63	63.72	180.00

Source: DFR

[Technical aspect]

・ LBST construction standard (Form 3)

The field trials were carried out along the LBST construction standard (Form 3) established by the Project. Form 3 is expected to be the standard specification of the LBST in Ghana eventually. Hence, the field trials in different climate and traffic conditions will continuously be conducted in line with the Form 3 even after the termination of the Project.

・ Pan mixer

The pan mixer was newly manufactured by Ghanaian side through the third country training in South Africa. Since the technology for pan mixer development is owned by the Ghanaian side, the pan mixer will continuously be utilized for LBST construction works from now on.

・ Adoption of slow-setting emulsion (K3-70) for bituminous surface treatment

As K3-70 is appropriate for LBST works due to construction speed, it would be recommended to utilize it. Thus, it is crucial for DFR to find appropriate producers of K3-70 with steady supply because certain amounts of K3-70 is indispensable for the nationwide expansion in the near future.

2. Key Factors Affecting Implementation and Outcomes

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 labour-based bituminous surfacing technology in Ghana (e.g., KTC, KNUST, GHA Central Lab and their expertise, etc.) for the implementation of the Project.*

DFR could utilize and mobilize available resources related to LBST in Ghana for the implementation of the Project. For example, KTC was involved in the field trials, JCC, technical seminar 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 program at KTC for the achievement of the Overall Goal in the future. Moreover, KNUST provided the Project with the professional advice for the preparation of LBST Guideline, and

GHA Central Lab conducted material tests for the field trials.

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

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

The position of DFR Director, Project Director, was changed from Mr. F.O.M. Digber to Mr. Duncan Williams in April 2017 and to Mr. Bernard Badu in October 2018.

Also, Dy. Director (Planning), Project Manager, was changed from Mr. Asiedu to Dr. Ampadu in April 2016 and to Mr. K.N. Akosah-Koduah in April 2018.

Mr. Seth Osei Nketia was assigned as the Regional Manager of Eastern Region in June 2017. Moreover, there were two (2) officials in DFR additionally assigned in April 2017.

As a conclusion, it is considered that this condition does not severely affect to the achievement of the Project Purpose because C/P could share the project concept with new members through the meetings and seminars convened by the Project.

(3) Important Assumptions for the achievement of the Overall Goal:

- *There is no significant change for the activities of DFR for feeder road services.*
- *There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road.*

At this moment, there are no possibilities to change the feeder road services by DFR as well as its institutional arrangement for the maintenance and management of feeder roads.

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

Although the budget for the GOG portions in the 2nd field trial was definitely allocated, the payment to the contractor was not disbursed on time when it was necessary. Thus, even if the budget is allocated for the LBST measures, it is crucial for the DFR officials to monitor the budget disbursement from RF by reference to the monitoring format (Table 7) as indicated in the Sustainability. That is the most important remark for the attainment of the Overall Goal.

3. Evaluation on the Results of the Project Risk Management

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 2nd field trial as planned because DFR was not able to disburse the budget for the sub-base construction through the RF. Ultimately, although the budget was disbursed for the sub-base course and their own portions of the road construction, it is necessary for DFR to continuously put in the maximum efforts to disburse the budget as scheduled for the continuation of the field trials in different climate and traffic conditions for the achievement of the Overall Goal.

According to the lesson learned of the Ex-ante Evaluation Summary, it highlights that the dispatch of JICA experts should be designed to spread their assignments to cover whole duration of the Project to minimize their absence. The Project followed this lesson and communicated with other JICA experts through the internal meetings in Tokyo, email exchanges, monthly reports, etc. With the limited assignments of JICA experts, *i.e.*, 46.0M/M for three (3) years, the Project tactically focused on the development of LBST Guideline through two field trials and training components (third country training and technical seminars). Under this constraint, the project activities were sufficiently carried out with appropriate management.

4. Lessons Learned

The third country training is a good opportunity to obtain some ideas, skills, knowledge, etc. It is crucial for the C/P to feed back this experience into their actual practices. Therefore, the visiting sites shall be selected carefully to make the training meaningful. For instance, the C/P visited a contractor to exchange opinions and observed the equipment and materials to be used for construction works, which connected to the production of pan mixer for the 2nd field trial. In this way, it is important for C/P to visit the similar organizations/groups and model sites to get innovative ideas in order to apply the experiences in the third country into the actual practices in their home country.

IV. For the Achievement of Overall Goals after the Project Completion

1. Prospects to achieve Overall Goal

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 project termination. In order to achieve this, it is crucial for DFR (a) to officially adopt LBST for feeder road surface treatment; (b) to conduct field trials in different climate and traffic conditions; and (c) to set up training program on LBST at KTC as defined in the indicators of the Overall Goal.

If the LBST Guideline is properly developed and well recognized, it could be said that LBST is officially adopted by DFR through the approval of LBST Guideline. This is because LBST construction works are going to be carried out based on the Guideline across the country. In that sense, there is a prospect that official approval of LBST will be obtained after the project completion. It is important to develop the Guideline applicable to different road, climate, and traffic conditions in Ghana.

Most importantly, DFR shall allocate the budget to conduct field trials along the LBST construction standard (Form 3), 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. Moreover, it is crucial for DFR to find appropriate producers of bitumen emulsion (slow-setting) 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 implementation of field trials.

Lastly, DFR shall cooperate with KTC to set up training program along the LBST Guideline. In order to disseminate LBST countrywide, DFR officials, contractors, community representatives, and persons concerned need to receive the LBST training at KTC. During the cooperation period, the Project arranged the technical seminars to link between the Guideline and field trials in Koforidua. After the completion, furthermore, DFR shall frequently communicate with KTC to develop LBST training program along the Guideline for the achievement of the Overall Goal.

2. Plan of Operations and Implementation Structure of the Ghanaian side to achieve Overall Goal

The following operations shall be implemented after the completion of the LBST Project. The operation schedule is shown in the **Table 10.**

(1) DFR establishes the taskforce of LBST Guideline.
(2) The taskforce member delivers a presentation of the LBST Guideline updated during annual general meetings for engineers and ILO regional seminars.
(3) DFR officially approves the LBST Guideline.
(4) DFR conducts field trials along the LBST construction standard (Form 3) in different climate and traffic conditions.
(5) LBST Guideline is regularly updated and improved by the LBST taskforce.
(6) LBST training program is established at KTC in collaboration with DFR.

Ultimately, the Overall Goal will be achieved three (3) years after the

termination of the Project, and ex-post evaluation survey will be executed by the consultant hired by JICA Headquarters.

Table 10: The operation schedule to achieve the Overall Goal

Activities	Responsible organizations	2019												2020												2021											
		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) Establishment of LBST Guideline taskforce	DFR																																				
(2) Presentation delivery of LBST Guideline at annual general meetings for engineers and ILO regional seminars (■)	LBST Guideline Taskforce																																				
(3) Official approval of the LBST Guideline	DFR																																				
(4) Implementation of field trials in different climate and traffic conditions	DFR																																				
(5) Update of LBST Guideline	LBST Guideline Taskforce																																				
(6) Establishment of LBST training program at KTC	KTC																																				
Ex-post evaluation survey	DFR, Taskforce, KTC																																				

3. Recommendations for the Ghanaian side

The recommendations are separately extracted from the analysis results as explained above.

To MRH:

It was observed in the second trial construction that the payment to the contractor in the GoG part was delayed, and it has given a large influence on the contractor such as losing its motivation maintaining schedule as planned or worsen the condition of its management. Hence, it is required to re-build a system which could release the payment as soon as the certificate issues. Improvement of this condition is necessary for dissemination of the LBST method.

Also, MRH should prepare a LBST market to facilitate the embedment and extend use of LBST nationwide, which is one of the targets of the overall goal in the PDM. And it is extremely necessary that MRH should make an official announcement that the government would continuously disburse budget for LBST market to encourage contractors investing procuring equipment positively in use of LBST construction.

Furthermore, the Guideline built in this project can be said a tool for the embedment of the technology and achievement of overall goal, and for this, it requires KTC's intervention to prepare a training material to implement training under MRH's

support.

To DFR:

Regarding the task rate, there are some challenges to modify the calculation procedure. At this moment, only particular official(s) can intervene into the calculation of task rate. In fact, since the breakdowns of task rate are hidden by a group of main or sub-main activities, it is difficult for other DFR officials to find fundamental errors in the current structure. As the checking function does not work properly, it is necessary for other officials to detect fundamental human errors by enhancing the transparency of task rate mechanism. Therefore, it shall be considered to reform the structure of task rate. Task rate shall be scrutinized by several persons to check and lessen the possibility of human errors. This will contribute to make precise comparison between LBT and EBT which is necessary to build annual development (action) plan.

Because of the delay of the payment to the contractors, it was observed that the GoG section of the Project which is mainly the EBT construction did not completed within the project duration. It is necessary to collect data at the same route or section to do analysis for precise and reliable comparison between LBT and EBT. Therefore, DFR is requested to continue collecting data for such section after the Project completes. From this, area where LBST has the superiority will become clear and this will contribute taking measures for LBST to be adopted as a viable alternative in feeder roads in Ghana. It is also expected that this lesson will be reflected in the next update of the Guideline.

Furthermore, to facilitate the use of the built guideline, it is requested to indicate clear condition where to apply LBST in the DFR's annual plan. Lessons were found from the trial construction practically as follows;

1) Construction cost between LBT and EBT becomes almost equal in extension of 2 to 3 km. From this, although it depends on its side condition, it could be said that there would be an advantage in LBT in case of less than this distance
2) There should be and village or settlement in such distance to provide necessary number of labour force.
3) Since there are varieties of tasks which some of them are difficult to evaluate equally, there should be a reliability and culture to help each other among the labours

It is expected that DFR would develop an official guide (rule) how/where to apply LBST by referring the above lessons observed. Enactment of sections where to be constructed in that year by LBST from its' characteristic, or consideration of several contract methods as allowing investment from the community adding to the government fund will be given as an idea as a reference.

DFR shall establish a taskforce of LBST Guideline to update and improve the LBST Guideline. In the first place, DFR shall assign the taskforce members and allocate the budget for the taskforce operations. The taskforce revises the LBST Guideline in terms of policy change, data adjustment, material and method change, etc. Also, the Guideline will be updated and improved on a regular basis for its continuous utilization. It will be a good opportunity for the taskforce members to perform presentations at annual general meetings for engineers (conference held annually reporting its activity for engineers in Ghana) and ILO regional seminars since giving such occasion presenting their efforts and results officially would encourage C/P to tackle with the guideline seriously.

Job creation is one of the most important policies of the GOG, DFR budget for feeder road maintenance from RF shall be allocated for the LBST construction works in a certain percentage. In order to enhance the job creation in rural area, since the LBST works are the most appropriate approach to achieve the governmental goal, 10% of DFR budget for an example shall be allocated for the purpose of LBST works at minimum. Also, the budget for the LBST training program at KTC shall be considered thoroughly.

For the achievement of the overall goal, it is requested to refer the lesson observed from the trial construction as follows;

1) Since there are no practical experiences of using bitumen in LBT among the local contractors in Ghana, it is necessary to carry out a few days training before actual commencement of the construction for the labours and the operators of the equipment. From this, the construction site should be located at where trainers from KTC are able to dispatch.

2) Since the number of equipment for bitumen is limited in Ghana, currently the contractors have to rent from KTC. So, the location of the construction site should be where able to convey these machineries from Koforidua.

3) Since proportion of the labour cost in the construction budget is respectively high than that of EBT, the price of wage provided will control the superiority of LBT. Although the minimum wage is enacted in the law, in practical, it depends on the economic level of the area. So, it is requested to conduct study to understand area where LBT has its superiority from the personal wages.

4) Regarding 3) above, most of the labours hired from the area were farmers. These people become busy in the rainy seasons, and at this season, the personal wages tend to become higher than others. So, season should be considered well when to do the public notice to avoid rising of the construction cost which comes to the efficiency of the construction directly as well.

To KTC:

The LBST Guideline is not only for DFR but also for contractors because they execute actual road works. As it is indispensable for contractors in Ghana to acquire the skills and knowledge of the LBST for the nationwide expansion, the role of KTC is crucial to provide them with the instructions of LBST in collaboration with the DFR. As mentioned above, therefore, it is expected that KTC incorporates LBST Guideline into its training curriculum and program after the termination of the Project. According to the operation schedule in the **Table 10**, KTC shall establish LBST training program in 2019 and launch this from January 2020. Also, the training program shall be reviewed before the end of 2021.

Since it is understood that the equipment provided in the Project shall be used in the above-mentioned training, it is necessary for DFR to maintain this equipment in good condition.

4. Monitoring Plan from the End of the Project to Ex-post Evaluation

By the time of the ex-post evaluation which will be executed three (3) years after the termination of the Project, the operation schedule to achieve the Overall Goal shown in the **Table 10** shall be monitored annually by JICA Ghana Office.

Furthermore, although the delay of DFR disbursement severely affected the project progress, the budget was ultimately disbursed for the project continuation since JICA Ghana Office took action to submit the letter to the DFR Director in July 2018. Although it is considered that DFR continuously puts in its maximum efforts to disburse

the budget as scheduled for the field trials, JICA Ghana Office shall monitor the budget disbursement to make sure LBST construction works are smoothly carried out without any incidents.

ANNEX 1: Results of the Project

Annex 1-1: List of Dispatched Experts
Annex 1-2: Operational Expenses
Annex 1-3: List of Training
Annex 1-4: List of Equipment
Annex 1-5: List of Counterparts
Annex 1-6: Revised Plan of Operations, etc.
Annex 1-7: Achievements of Activities
Annex 1-8: Monitoring System
Annex 1-9: Checklist of the LBST Construction Standard (Form 3)
Annex 1-10: Task Rate Summary
Annex 1-11: Monitoring Checklist for the LBST Development (Form 1)
Annex 1-12: Questionnaire on LBST (Form 2)

ANNEX 2: List of Products (Guidelines, etc.) produced by the Project

Annex 2-1: Report on Analysis of Current Status for Labour-Based Bituminous Surfacing Technology
Annex 2-2: Guideline for Labour-based Bituminous Surfacing Technology (LBST Guideline)

ANNEX 3: PDM (All versions of PDM)

ANNEX 4: R/D, M/M, Minutes of JCC (copy) (*)

ANNEX 5: Monitoring Sheet (copy) (*)

ANNEX-1: RESULTS OF THE PROJECT

Annex 1-1: List of Dispatched Experts

List of dispatched experts are given in the next table.

【Activity in Ghana】

Name	in charge of	Plan /Actual	Num. of Trips	2016 2	3	4	5	6	7	8	9	10	11	12	2017 1	2	3	4	5	6	7	8	9	10	11	12	2018 1	2	3	4	5	6	7	8	9	10	11	12	2019 1	2	Plan/Actual Days	MM
Motoki OGAWA 小川基樹	Chief Adviser /Rural Road Development	Plan	9	45					30				30		30				30			30					30						30				30				285	9.50
		Actual	6	45 1 16						42 27 7			38 8 14		19 9 16 3 11 19				30 11 9			14 22 4				33 15 16							31 5 4				37 5 11 15				298	9.93
Seiji KADOOKA 角岡正嗣	Road Pavement Technology	Plan	6				45			30										30		38								30						30					203	6.77
		Actual	4				37 18 24				30 21 19											30 7 5		30 2 31						30 16 15						30 1 30					187	6.23
Hiroaki TAKAHASHI 高橋宏明	LBT Guidelines	Plan	3										45											45										45							135	4.50
		Actual	1																					52 25 15								38 28 5									90	3.00
Kazunori KOBAYASHI 小林一典	Cost Estimation /Safety Gard	Plan	5					45							30				45								30				30										180	6.00
		Actual	2				45 10 23								30 12 13																										75	2.50
Tetsuo SAKAMOTO 坂本哲夫	Site Supervisor	Plan	3									45				60												60														165	5.50
		Actual	3										27 2 28		88 1 29				45 12 25																						160	5.33
Ikumasa KAWASAKI 川崎育将	Site Supervisor	Plan	0																																							0	0.00
		Actual	0																								60 30 9 9 28 26															90	3.00
Masanori TAKEISHI 銀石正典	Maintenace and Machinary and Equipment	Plan	3		45						30				21																										96	3.20
		Actual	2	45 22 6														30 17 16																								75	2.50
Naoko SASAKI 佐々木直子	Environment Considerations	Plan	2												30												30															60	2.00
		Actual	1												30 27 28													30 1 30							30 1 30						90	3.00
Yumiko TAKEDA 武田由美子	Project Coordination 1/ Training Plan	Plan	3			15																15																	15		45	1.50
		Actual	2						21 12 2													44 8 20																			65	2.17
Takaaki HIRAKAWA 平川貴章	Evaluation & Monitoring 1	Plan	5				30			24					15							24																	30		123	4.10
		Actual	4			25 6 30				25 5 29					17 4 20							23 19 10				23 24 15						20 12 8					23 17 8			156	5.20
Mayumi SHOJI 庄子真由美	Project Coordination 2 /Evaluation Monitoring 2	Plan	4	21											15												15						15								66	2.20
		Actual	2	21 1 21											13 8 20																										34	1.13
Tatsumi TOKUNAGA 徳永達己	Project Review	Plan	2																			12												9								21	0.70
		Actual	1																			9 12 20																				9	0.30
Tomoe IEHISA 家久 冬萌	Project Coordination 2	Plan	0																																							0	0.00
		Actual	1																			35 15 20																				35	1.17

	PLANNED	ACTUAL
Days	1,379	1,364
MM	45.97	45.47

ASSIGNED FINISHED SCHEDULED COMPANIE'S EXPENSE

【Activity in Japan】

Name	in charge of	Plan /Actual	Num. of Trips	2016 2	3	4	5	6	7	8	9	10	11	12	2017 1	2	3	4	5	6	7	8	9	10	11	12	2018 1	2	3	4	5	6	7	8	9	10	11	12	2019 1	2	Plan/Actual Days	MM
Seiji KADOOKA 角岡正嗣	Road Pavement Technology	Plan																																							0	0.00
		Actual																																	10 15 30						10	0.50

	PLANNED	ACTUAL
Days	0	0
MM	0.00	0.50

【Reports】

	2016 2	3	4	5	6	7	8	9	10	11	12	2017 1	2	3	4	5	6	7	8	9	10	11	12	2018 1	2	3	4	5	6	7	8	9	10	11	12
Report	▼Workplan		▼PMS-1				▼PMS-2			▼Current Status Report		▼PMS-3 ▼第一回中間進捗報告書(和文)First Interim Report (Japanese)							▼PMS-4					▼PMS-5 ▼第二回中間進捗報告書(和文)Second Interim Report (Japanese)					▼PMS-6					POR▼	

Annex-1-2: Operational Expense

Operational expense of Ghana side is given in the following table and Japanese side is given in “1-1 Input of the Japanese Side” above.

Annex 1-2 Operational Expenses

			Local Cost					
		Items	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 Aug. 2017 to Jan. 2018	MS Ver. 6 Feb. 2018 to July 2018	PCR Feb. 2016 to December 2018
1-1			**Personals**					
	1	C/P Designation	Director DFR Deputy Director of Planning Principal Engineer (Cooridinator) Principal Engineer (Techinial Workshop) Mechanical Engineer Director of Eastern Region	Director DFR Deputy Director of Planning Principal Engineer (Cooridinator) Principal Engineer (Techinial 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	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
1-2	**Human Resources and expenses necessary for the field trials**							
	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	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	N/A	inclusive at JICA-LBST contract	inclusive at JICA-LBST contract	inclusive at JICA-LBST contract	inclusive at JICA-LBST contract
	3	Transporatations for C/P staff	Travel allowance and accomodation, fuel borne by DFR	N/A	Travel allowance and accomodation, fuel funded by both DFR/KICA-LBST occadionally	Travel allowance and accomodation, fuel funded by both DFR/KICA-LBST occadionally	Travel allowance and accomodation, fuel funded by both DFR/KICA-LBST occadionally	Travel allowance and accomodation, fuel funded by both DFR/KICA-LBST occadionally
	4	Material test conducted at DFR	N/A	N/A	3,840 GHS	N/A	N/A	Totally 7,040 GHS
	5	Hand tools for pavement	N/A	N/A	N/A	N/A	N/A	N/A
	6	Road preparation up to Sub-base level	N/A	N/A	740,240 GHS	N/A	661,462 GHS (Certificate Issued)	Totally 1,401,702 GHS
1-3	**Office Space**							
	1	Office space	DFR prepared Room 106 at DFR head office for the Project					
1-4	**Furniture**							
	1	office facilities	DFR provide desks, chairs, power, air conditioner and HP color printer for the Project					
1-5	**Means of communication at the head office**							
	1	Communication Tools	Internet WIFi and a land line preprared for the Project					
1-6			**Others**					
	1							

Annex 1-3: List of Training

Annex 1-3: List of Training

Following trainings were implemented in the Project.

1. Training to learn how to use the provided LBT equipment

The training was made to understand the maintenance method of the equipment which was provided by the Project for the trial construction, and to obtain practical construction skills utilizing this equipment. The training was conducted 4 days from 21th Nov. to 24th Nov. 2016 at KTC. Following table gives the detail of the program. Totally, 144 persons from DFR, KTC and contractors participated to the training.

Table-1 Time table of the training for utilizing the provided equipment

DATE		TIME	CONTENTS	METHOD	PERSON IN CHARGE
21st Nov.	M	13:30 - 13:45	Registration.	Classroom	Director
		13:45 - 14:00	Opening Remarks.	Classroom	KTC
		14:00 - 14:20	Orientation of the Training.	Classroom	AFGRI
		14:20 - 15:30	General guidance for tractors and trailers.	Field	AFGRI
		15:30	Practical guidance and training for tractors and trailers.	Field	DFR & KTC
		15:30 - 17:00	Closed Training session.		
			Preparation for the training fields for 22nd Nov.		DFR&KTC
22nd Nov.	T	9:15 -10:30	General guidance for equipment supplied i.e. asphalt distributors for manual & engine types, chip speeders for manual type etc.	Classroom	AGRIA / Ian Dickie
		10:30 - 12:10	Practical guidance for asphalt distributors for manual & engine types, chip speeders for manual type, concrete mixer and compaction plates.	Field	AGRIA / Ian Dickie
		12:10 - 13:30	Lunch break.		
		13:30 - 15:30	Practical training by using of equipment supplied. Splayed emulation by both manual & engine sprayers, spread aggregate by manual chip spreaders and then compacted by plate compactors.	Field	AGRIA / Ian Dickie
		15:30	Closed Training session.		
		15:30 - 17:00	Preparation for the training fields for 23rd Nov.	Field	DFR & KTC
23rd Nov.	W	8:45 - 9:15	Preparation for the training field.	Field	DFR & KTC
		9:15 - 12:00	Practical training by using of	Field	AGRIA /

			equipment supplied. Splayed emulation by both manual & engine sprayers, spread aggregate by manual chip spreaders and then compacted by		Ian Dickie
		12:00 - 13:30	plate compactors.		
		13:30 - 14:30	Lunch break.		
			Repeated and continued the practical	Field	AGRIA /
		14:30	training.		Ian Dickie
		15:00 - 15:30	Closed Trail session due to heavy rain.	Field	
					KNUST
			Inspected by Prof. Ampadu for the equipment supplied to DFR and area the field trail was carried out.		
24th Nov.	T	8:45 - 9:15	Preparation for the training field.	Field	DFR & KTC
		9:30 - 10:30	General guidance for pedestrian compactors	Classroom	CEMIX
		10:30 - 12:30	Practical guidance for pedestrian compactors and engine pumps.	Field	CEMIX
		12:30 - 13:30	Lunch break.		
		13:30 - 15:30	Practical training by using of equipment supplied. Splayed emulation by both manual & engine sprayers, spread aggregate by manual spreaders and then compacted by	Field	DFR & KTC
		15:30	pedestrian compactors Closed Training session.		
		15:30 - 16:00	Cleaned the field used for the practical training and returned all equipment for storing.	Field	DFR & KTC

2. The Third Country Training

A third country training was conducted for 14 days from 5th Nov. to 18th Nov. 2018 in South Africa and Ethiopia. The objective of the training was 1) to obtain the necessary information and lessons learned that shall be essential to develop the LBT Guidelines from the advanced experience in South Africa and Ethiopia, and 2) to create the close relationship between the LBT relating organizations in other African Countries.

To achieve the mentioned objective, program was incorporate to visit the authorities to have lesson and the practical construction site in South Africa, and in Ethiopia, it was decided to participate to the 17th ILO regional seminar in Addis Ababa with submitting report for presentation. Following table gives the detail of the programme. Totally 12 members which belongs to one from MRH ,6 from DFR headquarters, 3 from DFR eastern region, one from KTC and one from the Japanese expert participated the training.

Table-2: Time Table of the Third Country Training Tour

Date		AM	PM	Stay at
5-Nov-17	Sun	AM 9:00 Flight from Accra to Johannesburg/SA	PM: 4:45 Arriving at Johannesburg	Johannesburg/SA
6-Nov-17	Mon	JICA South Africa Office/ Courtesy call and Briefing on Safety Management	Expanded Public Works Programme (EPWP) National Department of Public Works / Courtesy Call, Experience of LBT and and Technical Issues in SA	Pretoria/SA
7-Nov-17	Tue	ILO South Africa Office / Courtesy Call, Best Practices of LBT Surface Treatment	Discussion	Pretoria/SA
8-Nov-17	Wed	NCA (National Cold Asphalt/ Private Company): Practice of Best Chippy Utilization for LBT Works	Move to Demonstration / Site Visit at Eastern Cape Region or Western Cape Region	Eastern or Western Cape Region
9-Nov-17	Thu	Site Visit at Eastern Cape Region or Westen Cape Region	Site Visit at Eastern Cape Region or Westen Cape Region	Eastern or Western Cape Region
10-Nov-17	Fri	Move to Johannesburg		Johannesburg/SA
11-Nov-17	Sat		PM: 2:10 Flight to Addis Ababa PM: 8:25 Arriving at Addis Ababa	Addis Ababa
12-Nov-17	Sun	Preparation for ILO Seminar	Preparation for ILO Seminar PM 12:10 Flight from Accra to Adis Ababa PM 20:50 Arrive at Addis Ababa	Addis Ababa
13-Nov-17	Mon	JICA Ethiopia Office/ Courtesy call and Briefing on Safety Management ILO Regional Seminar	ILO Regional Seminar	Addis Ababa
14-Nov-17	Tue	ILO Regional Seminar	ILO Regional Seminar	Addis Ababa
15-Nov-17	Wed	ILO Regional Seminar	ILO Regional Seminar	Addis Ababa
16-Nov-17	Thu	ILO Regional Seminar / Ethiopian Roads Authority	ILO Regional Seminar / Ethiopian Roads Authority	Addis Ababa
17-Nov-17	Fri	ILO Regional Seminar / Ethiopian Roads Authority	Site Visit	Addis Ababa
18-Nov-17	Sat	AM: 8:30 Flight to Accra AM: 11:10 Arriving at Accra		Accra

The achievement from the training shall be conclude as follows.

SOUTH AFRICA

- ✓ We have learned from the South African policy and organizational structure that supports LBT (including responsibility of the organization, supportive policy,

implementation and monitoring system and budget).

- ✓ To a large extent, we have identified issues and factors that contributes to enhance and disseminate LBT. This will aid us in the Development of LBT guidelines, functions of LBT related research/training centre and selection of construction method.
- ✓ We have also learned the utilization and maintenance of LBT equipment and the practice of safety management at site.

ETHIOPIA (ILO Regional Seminar)

- ✓ We have learnt from the International Labour Organization (ILO) conference the various technologies implored by countries to create employment using labour based technologies.
- ✓ We have learnt the impact of policies on socio-economic growth and development.
- ✓ We have learnt that greening is not the end of industrialization but a means to foster a clean and green economy.
- ✓ We have learnt innovations and technological options for pro-employ mentand sustainable infrastructure delivery.
- ✓ The key to complete and smooth development of labour based technology is by sensitizing the populace and through training.

Annex: 1-4 List of Equipment

Annex 1-4 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	DFR	3-Spe. 2018
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-Spe. 2018
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	3-Spe. 2018
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	3-Spe. 2018
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	3-Spe. 2018
6	18-Aug-16	Spare parts for tractor and tralor	-	1	1,441.00	USD	Afgri Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	3-Spe. 2018
7	26-Aug-16	Duplex Roller	Atlas, LP750	2	32,373.18	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	3-Spe. 2018
8	26-Aug-16	Engine Suction Water Pump	Technoele, KGP80D	2	1,297.48	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	3-Spe. 2018
9	26-Aug-16	Mechanical Tool Set	-	1	530.21	USD	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	3-Spe. 2018
10	8-Nov-16	Water Bowser	ID5000L	1	8,850.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	3-Spe. 2018
11	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	3-Spe. 2018
12	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	3-Spe. 2018
13	8-Nov-16	Spare parts	-	1	3,143.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	3-Spe. 2018
14	16-Feb-18	Level	Automatic Level	1	1,345.88	USD	Deng	C/P	For Project Activities	KTC	KTC/DFR	3-Spe. 2018
15	4-May-18	Tow Grader	GT9354-18 SN RMS18001G2165	1	14,188.00	USD	Afgri Ghana Company LTD.	C/P	For Project Activities	KTC	KTC/DFR	3-Spe. 2018
16	25-Jul-18	Pan Mixer		2	7,407.79	USD	Kosamo Ltd.	C/P	For Project Activities	KTC	KTC/DFR	3-Spe. 2018
TOTAL					121,970.63	USD						

Annex: 1-5 List of Counter Parts

Annex 1-5 List of Counterparts

Name	Position	Organization	2016											2017											2018											2019	
			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
Mr. F. O. M. Digber	DFR Director	DFR																																				
Mr. Duncan Williams																																						
Mr. Bernard Bidu																																						
Mr. John Obeng Asiedu	Deputy Director of Planning	DFR																																				
Dr. Kwasi Osafo Ampadu																																						
Mr. K.N. Akosah-Koduah																																						
Mr. K . Omane Brimpong	Principal Engineer	DFR																																				
Dr. Patric Amoah Betoe	Senior Enginee	DFR																																				
Mr. Bernard Williams Amoah	Mechanical Engineer	DFR																																				
Mr. Frank Amofa Agyemen	Assistant Engineer	DFR																																				
Mr. Joseph Mauwusi Adekponya	Assistant Engineer	DFR																																				
Mr. Bernard Afari Kuma	Regional Director	DFR-Eastern Region																																				
Mr. Seth Osei Nketia	Regional Manager	DFR-Eastern Region																																				
Dr. Isaac Mensah	Principal Quality Surveyor	DFR-Eastern Region																																				
Mr. Frederick Addison	Senior Engineer	DFR-Eastern Region																																				
Mr. Christopher Ampah Essel	Senior Technician Engineer	DFR-Eastern Region																																				

Annex: 1-6 Revised Plan of Operations

Activities / Sub-Activities	Plan / Actual	2016 I	2016 II	2016 III	2016 IV	2017 I	2017 II	2017 III	2017 IV	2018 I	2018 II	2018 III	2018 IV	Responsible Organization: GOG	Achievements	Issue & Countermeasures
Output 1: Current Conditions and issues of labour based bituminous surfacing technology in Ghana ara identified																
1.1 Collect and analysis information on the counterparts (C/Ps) organisational capacity (e.g. personal, budget, experience, etc.)	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
1.2 Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana.	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
1.3 Review and evaluate the similar technical standards and manuals prepared by such organizations as DFID, South African Development of Public Works, etc.	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
1.4 Confirm the procurement and cost of materials (e.g. gravels)	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
1.5 Test and evaluate characteristics of the materials as stipulated by respective technical standards.	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
1.6 Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana.	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
1.7 Check the quality control systems and the procedures of road pavement work in Ghana	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
1.8 Check the maintenance management systems of feeder roads in Ghana	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
1.9 Compile and report the analysis on issues on labour-based bituminous surfacing technology in Ghana.	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
Output 2:Field trails of labour based bituminous surfacing technology are carried out																
2.1 Prepare a plan for the fields trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials)	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
2.2 Conduct necessary lab tests to assess the characteristics of materials	Plan													Same as above Material Eng., ER	Completed	—
	Actual															
2.3 Identify technical requirements (e.g. materials, methodology and process, quality control, etc.) through the field trials	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
2.4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
2.5 Collect information on task rates	Plan													Same as above Contract Manager, ER	Completed	—
	Actual															
2.6 Identify the applicable conditions of the labour-based bituminous surfacing technology	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
2.7 Identify the safeguard issues	Plan													Same as above Environmentalist	Completed	—
	Actual															
2.8 Prepare a report on above	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
2.9 Carry out on-the-job training(OJT) through above activities	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
Output 3: Guidelines for labour based bituminous surfacing technology are prepared																
3.1 Determine the contents of the guidelines by reviewing the result of the first field trials.	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
3.2 Prepare and agree with the outline of the guidelines by both sides.	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
3.3 Draft the guidelines	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
3.4 Carry out the second field trial following the guidelines	Plan													Principal Eng. & Eng. Planning Div., DFR	Delayed because of GOG budget disbursement	Eventually completed
	Actual															
3.5 Revise the draft based on the result of the second field trials as necessary.	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
3.6 Carry out OJT through above activities	Plan													Principal Eng. & Eng. Planning Div., DFR	Completed	—
	Actual															
Duration / Phasing	Plan															
	Actual															

Monitoring Plan	Plan / Actual	2016 I	2016 II	2016 III	2016 IV	2017 I	2017 II	2017 III	2017 IV	2018 I	2018 II	2018 III	2018 IV	Remarks	Issue	Solution
Monitoring																
Joint Coordinating Committee (JCC)	Plan														N/A	—
	Actual															
Set-up the indicators and means of verification	Plan														N/A	—
	Actual															
Submission of Monitoring Sheet	Plan														N/A	—
	Actual															
Reports/Documents																
Project Progress Report	Plan														N/A	—
	Actual															
Project Completion Report	Plan														N/A	—
	Actual															
Public Relations																
Project news	Plan														N/A	—
	Actual															

Annex: 1-7 Achievements of Activements

Annex: 1-7 Achievements of Activements

<table>
<tr><td colspan="2">OUTPUT-1 Current Conditions and issues for labour based bituminous surfacing technology in Ghana are identified.</td></tr>
<tr><td>Activity 1-1
<u>Completed</u></td><td><u><Collect and analyze information on the counterparts (C/P's) organizational capacity (e.g. personal, budget, experiences, etc.)></u>
・ Origination, number of engineers, budget and experience on LBT of DFR as well as the eastern region office were surveyed
・ 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.</td></tr>
<tr><td>Activity 1-2
<u>Completed</u></td><td><u><Collect information regarding technical standards and design guidelines for bituminous surface technology on Ghana></u>
・ 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.</td></tr>
<tr><td>Activity 1-3
<u>Completed</u></td><td><u><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.></u>
・ 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.
・ 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.
・ 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.</td></tr>
<tr><td>Activity 1-4
<u>Completed</u></td><td><u><Confirm the procurement and cost of materials (e.g. gravels, etc.)></u>
・ From interview, following were found as a general price of materials to be used in the trial construction.
<table>
<tr><th>Materials</th><th>General Unit Price from interview</th></tr>
<tr><td>Cold emulsion</td><td>560 GHS /drum include transport to trial site
(drum =200 litters)</td></tr>
<tr><td>Chippings</td><td>65 GHS /m^3 (20-25mm)
40 GHS/m^3 (Dust)
56 GHS/m^3(0-40 mixed)</td></tr>
<tr><td>Gravel</td><td>33 GHS/m3 incl. transport to trial site</td></tr>
</table>
・ 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.
・ 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.</td></tr>
<tr><td>Activity 1-5
<u>Completed</u></td><td><u><Test and evaluate characteristics of the materials as stipulated by respective technical standards></u>
・ 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.
・ Quality and general cost for chipping (aggregate), gravel and cold emulsion were confirmed though interview to suppliers, contractors and DFR engineers.</td></tr>
</table>

<table>
<tr><td>Activity 1-6
<u>Completed</u></td><td><u><Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana></u>
・ 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.
・ 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.</td></tr>
<tr><td>Activity 1-7
<u>Completed</u></td><td><u><Check the quality control systems and the procedures of road pavement work in Ghana></u>
・ Quality control in actual construction is a roll of the regional office. The regional office does the quality control followed by the MRH standard.</td></tr>
<tr><td>Activity 1-8
<u>Completed</u></td><td><u><Check the maintenance management systems of feeder roads in Ghana></u>
・ 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.</td></tr>
<tr><td>Activity 1-9
<u>Completed</u></td><td><u><Compile and report the analysis on issues on labour-based bituminous surfacing technology in Ghana></u>
・ 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.</td></tr>
<tr><td colspan="2">OUTPUT-2 Field Trials of labour-based bituminous surfacing technology are carried out.</td></tr>
<tr><td>Activity 2-1
<u>Completed</u></td><td><u><Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials></u>
・ The technical workshop was conducted as follows
<table>
<tr><th>S/N</th><th>Date</th><th>Participants</th><th>Major discussion and Conclusion</th></tr>
<tr><td>1</td><td>27th July, 2016</td><td>DFR, Eastern Region, JICA, LBST</td><td>・ Basic contents of the trial construction plan were confirmed.
・ Cold Bitumen, Sand Seal and Single Surface were chosen as a target pavement type to be incorporated in the guideline.
・ A contractor shall be hired by DFR to conduct the trial construction while the materials shall be provided by the Project.
・ A private consultant shall be hired by the Project to collect data from the trial construction.
・ The essence of utilizing LBT is the construction cost and durability.</td></tr>
<tr><td>2</td><td>14th Sep., 2016</td><td>DFR, Eastern Region, JICA, LBST</td><td>・ The objective of implementing the trial construction was defied 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 Guidline.
・ Target road and section of the trial construction was chosen between Obomofo Densua-Akote villages at Suhun, Municipal, and Eastern Region near KTC. The distance was approx. 3.2 km</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td></td><td></td><td></td><td>・ 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 PDM2, shall be made with the same contractor by amending the current contract.
・ 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.</td></tr>
<tr><td>3</td><td>9th Nov., 2016</td><td>DFR, Eastern Region, JICA, LBST, KNUST. ILO</td><td>・ Based on the conclusion of 2nd 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.
・ 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.
・ 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.
・ 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 24th January tentatively. With collaboration of DFR and the Project, the tendering documents shall be made before end of November.</td></tr>
</table>
・ 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 6th December and tendering on 24th 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.
</td></tr>
<tr><td>Activity 2-2
<u>Completed</u></td><td><u><Conduct necessary lab tests to assess the characteristics of materials></u>
・ In the first trial construction, following lab test were carried out to confirm the quality of the materials and construction
➢ 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</td></tr>
<tr><td>Activity 2-3</td><td><Identify technical requirements (e.g., materials, methodology and process, quality control, etc.) through the field trials></td></tr>
</table>

Completed	・ From the first trial construction, following knowledge was observed. Details are given in Activity 3-1 bellow. ➢ 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 ➢ One layer of base course should be less that 150mm on doing compaction by LBT. ➢ Camber shall be attempted to be 3% for bituminous surface ➢ Emulsion needs proper storage method to keep the quality ➢ For spread rate of aggregate, more trials are needed to get closer to design rate ➢ For cold mix asphalt, how to remove dust balls was the one of the largest issue
Activity 2-4 **Completed**	<*Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials*> ・ From the first trial construction, following knowledge was observed. Details are given in Activity 3-1 bellow. ➢ Rainy season is not appreciate for bituminous work since water affects the asphalt adhere on aggregate ➢ Since labour start farming in rainy seasons, it is desirable to finish works before that ➢ One month preparation was needed for the contractor and labour to understand the works. For this, training manual /guideline is needed for dissemination ➢ 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.
Activity 2-5 **Completed**	<*Collect information on task rates*> ・ Information to preparer the task rates are collected through the first trial construction and now under analysis.
Activity 2-6 **Completed**	<*Identify the applicable conditions of the labour-based bituminous surfacing technology*> ・ Area where the terrain is heavy and steep is not applicable for LBT works ・ Area where doesn't have basic access road to carry the equipment is not applicable for LBT works ・ Area where difficult to hire labour or no residents are not applicable for LBT Works ・ 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.
Activity 2-7 **Completed**	<*Identify the safeguard issues*> ・ Guidance of how to do bituminous sealing works by LBT to the labours was carried out. ・ Guidance of HIV/AIDS and pre-cautions during construction was carried out.
Activity 2-8 **Completed**	<*Prepare a report on above*> ・ Technical reports as follows were prepared. ➢ Proportion of mixed aggregate ➢ Appropriate mixing rate of pre-coated aggregate ➢ Appropriate spray rate of emulation ➢ Appropriate spread rate of aggregate ➢ Design mix of the cold mix asphalt ・ Comprehensive summary report was prepared.

<table>
<tr><td></td><td>・ Discussion regarding the outline of the guideline was carried out and summarized in a table based on document submitted in the 3rd technical meeting</td></tr>
<tr><td>Activity 2-9
<u>Completed</u></td><td><u><Carry out on-the-job training (OJT) through above activities></u>
・ All of the activities from Activity 1-1 to Activity 2-1 were carried out with collaboration between the DFR members and Japanese Experts.
・ 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.
・ All of the activities from Activities 2-2 to Activity 2-9 were carried out with collaboration between the DFR members and Japanese Experts</td></tr>
<tr><td colspan="2">OUTPUT-3 Guidelines for labour-based bituminous surfacing technology are prepared</td></tr>
<tr><td>Activity 3-1
<u>Competed</u></td><td><Determine the contents of the guidelines by reviewing the result of the first field trials>
<table>
<tr><th>S/N</th><th>Date</th><th>Participants</th><th>Major discussion and Conclusion</th></tr>
<tr><td>4</td><td>26th to 28th July, 2017

(The First Intensive Workshop in Pepease)</td><td>・ Dr. K. Osafo Ampadu
Deputy Director of Planning, DFR Head Office
・ K. Omane-Brimpong
Principal Engineer, DFR Head Office
・ Dr. Patrick Bekoe Amoah
Senior Engineer, DFR Head Office
・ Bernard William Amoah
Mechanical Engineer, DFR Head Office
・ Frank Amofa Agyemen
Assistant Engineer, DFR Head Office
・ Joseph Mauwusi Adekponya
Assistant Engineer, DFR Head Office
・ Issac Mensah
Principal Quality Surveyor, DFR Eastern region
・ Frederick Addison
Senior Engineer, DFR Eastern region
・ Christopher Ampah Essel
Senior Technician, Engineer,DFR Eastern region
・ Motoki Ogawa
Team Leader, JICA-LBST
・ Takaaki Hirakawa
Monitoring, JICA-LBST
・ Yumiko Takeda
Training/Coordinator, JICA-LBST
・ Tomoe Iehisa
Coordinator, JICA-LBST
・ Anthony Mensah</td><td>The Fist Intensive Workshop was held in Pepease, Eastern Region from 26 to 28th, 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, 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.
(b) Base Course
・ 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.
・ 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.
・ 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.
・ 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</td></tr>
</table></td></tr>
</table>

				Resident Eng.,JICA-LBST ・ **Gifty Gbenyo** Secretary, JICA-LBST	is wider than the design and cutting the edge and reforming the slope. Although the volume of emulsion that has flowed out was less that the primer coat, the same tendency was observed on the seal coat also. (c) Surface Dressing ・ Since water affects the adhesion of emulsion to the aggregate, appropriate curing measures after pre-coating the aggregate is required. ・ 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 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 distributer 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 discomposed. 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 discomposed. ・ 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. ・ Chippy was applied to spread aggregates. However, approx. 15% beyond the designed spread rate was observed. (d) Cold Mix Asphalt ・ 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. ・ 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. ・ 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. (e) Others ・ 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. ・ 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. The contents discussed above were reflected to the table which describes the chapter and its outline of the guideline that was prepared at the 3rd technical meeting held on 9th 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. Also, under the discussion, the contents to be incorporated in the second trial were given as follows; (a) Another contractor shall be hired to compare the performance (however same 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	9th to 11th Aug., 2017 (The Second	Ditto as the first intensive workshop except Ms. Takeda and Ms. Ieshisa	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

	Intensive Workshop in Peduase)		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 specialties.

Activity 3-2
Completed

<Prepare and agree with the outline of the guidelines by both sides>

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.

Original	Move to	Second Version	Target
Chapter-1 Introduction to Bituminous Sealing		**Chapter-1 Introduction**	**All**
1-1 Purpose of the Sealing	1-1	1-1 Purpose of the Sealing	
1-2 Construction Quality Standards	1-2	1-2 Construction Quality Standards	
1-3 Construction Methods	2-3	1-3 Labour Based Sealing Options	
1-4 Labour Based Sealing Operations	1-3	Chapter-2 Planning	
1-5 Choice of Seals	2-4	**Chapter-2 Planning**	**Client, Consultant**
1-6 Bituminous Binders	3-1-1	2-1 Reconnaissance	
1-7 Aggregates	3-1-2	2-2- Selection of Surface Type (Paved or Unpaved)	
1-8 Testing of Materials	5	2-3 Selection of LBT and EBT	
1-9 Use of Marginal Materials	5	2-4 Selection of Sealing	
1-10 Design of Bituminous Surface Treatment	3-3	2-5 Equipment	
Chapter-2 Preparation for Sealing Operation		2-6 Implementation of Structure	
2-1 laying the base	4-2	Chapter-3 Design	
2-2 Working planning and preparations	4-1	**Chapter-3 Materials**	**Client, Consultant**
2-3 Operation of Bitumen Sprayer	4-3/4-4	3-1-1 Bituminous binders	
2-4 The Spray Procedure	4-3/4-4	3-2-2 Aggregates	
2-5 Application of Binder	4-3/4-4	3-2 General Cross Section	
Chapter-3 Quality Assurance and Control		3-3 Design of Bituminous Surface Treatment	
3-1 Definitions	5-1	**Chapter-4 Construction**	**Client, Contractor**
3-2 Quality Assurance	5-2	4-1 Work Planning	
3-3 Quality Control	5-3	4-2 laying the Base	
Chapter-4 Sealing Operation		4-3 Chip Sealing	
4-1 General	N/A	4-4 Cold Mix Asphalt	
4-2 Site Preparations	4-3,4-3,4-4	4-5 Traffic Control	
4-3 Chip Sealing	4-3	4-6 Occupational Health and Safety	
4-4 Cold Mix Asphalt	4-4	4-7 Environment Protection	
4-5 Traffic Control	4-5	**Chapter-5 Quality Assurance and Control**	**Client, Contractor**
4-6 Quality Control	5-2	5-1 Definitions	

	4-7 Quality Assurance 4-8 Occupation Health and Safety 4-9 Environment Protection	5-3 4-6 4-7	5-2 QA and QC for laying the base 5-3 QA and QC for Chip Seal 5-4 QA and QC for Cold Mix Asphalt	
	Chapter-5 Maintenance		**Chapter-6 Maintenance**	**Client**
	5-1 Definitions 5-2 Routine Maintenance 5-3 Periodic Maintenance	6-1 6-2 6-3	6-1 Definitions 6-2 Routine Maintenance 6-3 Periodic Maintenance	
	Chapter-6 Productivity Guide		**Chapter-7 Productivity Guide**	**Client, Contractor**
	6-1 Production Rate 6-2 Reference	7-1 7-2	7-1 Production Rate 7-2 Unit Rate Reference	

Activity 3-3
Completed

<Draft the guidelines>

・ Intensive workshop as given bellow was carried out to build the first draft of the guideline

S/N	Date	Participants	Major Discussion and Conclusion
6	On 12th to 14th Feb. 2018 at Peduase	**<DFR-HQ>** Dr. K. Osafo 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 **<DFR-Eastern-Region>** Dr. Issac Mensah /Principal Quality Surveyor Eng. Frederick Addison /Senior Engineer Eng. Christopher Ampah Essel /Senior Technician Engineer **<KTC>** Eng. Emmanuel Opoku-Adusei /Assistant Engineer **<JICA>** Prince Bio /Local Consultant Engineer **<The Project>** Motoki Ogawa /Chief Engineer Ikumasa Kawasaki /Supervisor Takaaki Hirakawa /Monitoring and Evaluation Mensah Anthony Senyo /Assist. Site Supervisor Gifty Gbenyo /Secretary	Discussion was made base on the chapters indicated in Activity 2-2 above. Outline of the discussion is given as follows. ・ 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. ・ 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) ・ Subject of environment and safety shall be more incorporated. ・ 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. ・ Refer to and incorporate the writing material which Mr. Takeishi /Mechanical Expert has left. The first draft guideline was built based on discussion done in this intensive workshop.

Activity 3-4 **Completed**	<*Carry out the second field trial following the guidelines*> ・ The tendering for the second trail was made on 13th 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 2nd February 2018. ・ The construction started from 20th 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. ・ 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. ・ 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. ・ Economic research was conducted on February before the commencement of the construction becomes busy. ・ 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 31st July 2018 present. Therefore, the contract was amended to extend one month from the initial. ・ Finally, the disbursement was made on late September and the construction for the JICA section was completed on end of October. The construction done for the second trial was totally 1,320m between 2+700 to 4+20 where it was initially designed up to 4+400. This reduction of the distance was caused due to excess of the construction area such as corner of the intersection, bus parking bay and access roads. However, the DFR announced that the remain section would be taken by the GoG, and the GoG completed up to 4+400 in CMA by end of November. ・ Following section from 4+400 to 5+250 shall be the Chip Seal constructed by Equipment base. The completion of this section was not made by the end of the Project, hence it is strongly expected to collect the data for comparison and reflected in the next update of the Guideline.
Activity 3-5 **Completed**	<*Revise the draft based on the result of the second field trials as necessary*> ・ The data from the second trial was collected after re-commencement in October and reflected to the Guideline. ・ The economic analysis which become the Appendix-H was completed in end of October and the report was submitted in mid-November. ・ Reviewed by Prof. Amadu /KNUST and also Dr. Ampadu who is the former deputy director of planning of DFR. ・ Proofreading by editorial board of newspaper was hired. ・ Editing done at the publishing company and the 100 copies of printing completed in 10th December 2018.
Activity 3-6 **Completed**	<*Carry out OJT through above activities*> ・ The activities from Activity 3-3 to Activity 3-5 were carried out with collaboration between the DFR members and Japanese Experts. ・ The DFR members has intensive workshop 3 times and technical seminar once with JCC. ・ The DFR members have built the first draft guideline (Activity 3-3) to start concrete discussions. ・ The DFR members have built the guideline in December 2018.
OTHER OUTPUTS	
Procurement of	・ All equipment was delivered and inspected properly by the Japanese Experts. For details, refer to Attachment-2.

<table>
<tr><td>equipment

<u>Completed</u></td><td>・ Equipment operational training was conducted from 21st to 24th November 2016 at KTC.
・ Extra equipment such as tow grader, level and pan mixer were delivered on March to July 2018 at KTC</td></tr>
<tr><td>The third country Training

<u>Completed</u></td><td>・ From 5th to 18th 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.
<table>
<tr><th>Date</th><th>County /location</th><th>Major Activities</th><th>Lesson Learnt</th></tr>
<tr><td>6th, 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>7th, 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 concreate 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>8th, 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>9th, Nov.</td><td>South Africa /Johannesburg</td><td>Visiting manufacturing firm</td><td>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.</td></tr>
<tr><td>9th, Nov.</td><td>South Africa /Johannesburg</td><td>Visiting CSIR</td><td>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.</td></tr>
<tr><td>10th, Nov.</td><td>South Africa /Johannesburg</td><td>Visiting EPWP office</td><td>The Team visited the office of Expanded Public Works Programmee (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.</td></tr>
<tr><td>13th to 17th, Nov.</td><td>Ethiopia /Addis Ababa</td><td>Join the ILO Regional Seminar</td><td>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.</td></tr>
</table></td></tr>
</table>

Technical Seminar

Completed

- 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.

S/N	Date	Participants	Major discussion and Conclusion
1	On 17th August, 2017	MRH, GHA, DUR, DFR, DFR-Eastern Region, KTC, KNUST and JICA	• Technical Seminar was carried out on 17th 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.

Secure Safety	• Basically, need more care to labours safety • Paying attention to environment is also required • Should indicate about protection of health of labours
Economic Analysis	• Needs comparison between EBT and LBT • Needs cements about maintenance cost and make comparison of LCC as well • Needs to indicate the actual required number of labours from the trial
Application of local characteristic	• Some areas in north is difficult to find good gravel • Needs to indicate the local characteristic on application
Technical evaluation	• Needs clearer source to explain the superiority of CMA, in particular about thickness • Environment is also should be consider on comparison of thickness • On evaluation of duration, taking photo of before-after is considered to be equipment
Design	• Needs to mention about the selection of pavement type –advantage and disadvantage, criteria to compare
Equipment	• Needs definition which machinery belongs to LBT –Definition of LBT works • Needs to mention the machinery's required basic specification. • Needs definition of times of passes – in which condition requires 2 time passes or 4 time passes.

	2	On 30th Aug. 2018	MRH, GHA, DUR, DFR, DFR-Eastern Region, KTC and JICA	• Technical Seminar was carried out on 30th August 2018 at DFR conference room. Progress of trial construction was reported, and outline of the Guideline was presented.		
				Progress of the trial construction		• Most problems which was observed in the first trial such as achievement of the density, emanation of dust balls, securing the road width was solved. • Building at 0+175 to be demolish is under preparation. • GoG sections progress is 22% • Non-payment issue was sent to MRH from DFR
				Presentation of the outline of the Guideline	Chapter-1 Introduction to sealing	• It was confirmed that objective of applying LBT is mainly for the employment • There was comment that the Guideline should be targeted to other agencies under MRH as well as DFR.
					Chapter-2 &3 Planning /Design	• Compaction density of 98% of base course was achieved by using the 10-ton roller. In the first trial, the pedestrian roller was applied for compaction, and it was observed that dividing the layers is necessary to achieve the required density. At the second trial due to limited time the 10-ton roller was applied to buy time. • The dust ball was drastically reduced during the second trial by using pan-mixer. The availability of locally manufacturing pan-mixer and chippy was discussed and concluded it might be possible. • Slow setting emulsion K3-70 shall be used in the GoG section as trial. In the GoG section, other methods such as adding cement or hush ash in the cold pre-mix would be applied. • How to secure required quantity of aggregate which fits with the specification was discussed. Some ideas such as blending with other quarry products and relaxation of the standard in use of marginal materials in local community • Other topics such as use of emulsion rather than cut back asphalt, testing materials before production was discussed. These ideas given through discussion would be reflected to the guideline.
					Chapter 4 Construction	• There was a request to consider specifying the “compacted camber” and “non-compacted camber”

						• The use of steel rollers instead of pneumatic rollers for compaction of spreading chipping was discussed, and it was concluded that pedestrian rollers can be used to compact chippings since it does not crash the aggregate.
					Chapter 5 Quality Assurance	• The issue to the difficulty in meeting required standards was discussed with suggestions made to consider alternatives instead of relaxation of standards. Emphasis was laid on QA focusing on process while QC focus on the end product.
					Chapter 6 Maintenance	• Maintenance of CMA should be included in the Guideline
					Chapter 7 production Rate	• It was presented that LBT comes more expensive that EBT. Discussion was made on how to check and control the right payment of daily wages to the workers. • The need to implement the social impact study was mentioned. The Project explained that baseline survey and post construction survey is now under implementation. However, the team leader mentioned that the post construction survey was desirable to be conducted a few months later, however, due to delay of the construction the survey has to be done at same month of its completion.
					Appendix	• The difference between the operation manual and design manual. • Clean construction site was also discussed • Suggestion was made on developing a “Pocket Book” for site supervisors
				There were further comments as follows; • Involvement of KTC as a training organization of the guideline is crucial. • Comparative cost analysis between EBT and LBT is necessary for selection of the construction method • Involvement of other stakeholders who have high interest in this kind of technology should be intervened. • Reflection of not only the results but also what people have learnt from the trial to the Guideline is a vital factor for its dissemination • Since this technology would contribute to the socio-economic development as well as the development of the infrastructure, publicity becomes the key after the project completion.		

	3	On 11th December, 2018	MRH, GHA, DUR, DFR, DFR-Eastern Region, KTC, Central lab. KNUST, association of the contractors, Media and JICA	• The final technical seminar was carried out on 11th December 2018 at Engineers Centre in Accra. Outline of the prepared guideline was explained. Following comments were given to the established Guideline. ➢ There was question whether there is any time lack between the Primer Seal and the Seal Coat in respect of the unit rates build up. DFR responded that, the time lack has no influence on the unit rate build up. ➢ There was question about the funding of the programme. Members agreed that, there will be the need to set aside some funds for the programme by government. ➢ There was an inquiry about preparations being made by the Ministry for future training. He also inquired about the use of other materials for sealing since chippings may not be readily available in some areas of the country. He suggested the use of natural gravel as an alternative for sealing works. ➢ The Director of KTC suggested the allocation of funds to KTC and other agencies for future trainings. He mentioned that, some funds need to be made available to contractor on time for the sustainability of labour-based works. ➢ Engineer from GHA inquired about the design criteria for the Cold Mix Asphalt and testing. She also suggested that, the pre-coating design used for the trial construction can be owned as the Ghana Specification for LBST works where bitumen emulsion is used. Mr. Omane Brimpong responded that, a test was conducted at the GHA Central Lab in Accra for the various Cold Mix Asphalt design mix proportion with a very good results; however, the Project Team could not in cooperate the results into the Guideline due to time constraint. ➢ The Director of DFR appealed to JICA for further assistance in the training and dissemination of the LBST in Ghana. ➢ One of the members given a view of that, the country can plan and begin the process first before asking for foreign assistance. ➢ A participant mentioned that, the labour content of the cost estimation was about 22% from his calculation and suggested if this could be moved to 30% to make it attractive. DFR however disagreed with the figures, mentioned that, using the direct cot, the labour content is rather 30% for the Trial Construction. ➢ A participant asked whether the Contractors were trained before the Trial Construction and DFR replied they were trained. ➢ GHA asked whether the equipment used for the Trial Construction is available in our local market. Mr. Omane said that currently we don't have some of the equipment i.e the chippy and the bitumen sprayers in the local market but the Gratis Foundation Centers in the country can manufacture this equipment for the local market. ➢ Prof. Ampadu /KNUST commented on the life circle cost of the chip seal and the cold mix asphalt. He suggested that 10% difference in cost established between the chip seal and the cold mix asphalt may offset in the maintenance cost of the cold mix asphalt rather than the initial cost. He requested the Ministry to check this as the two surfacing types used is being monitored. He suggested the use of the	

					LBST in the 'Zongo Development' initiative by the current government to create employment opportunities using the local dwellers in the 'Zongo' communities for the construction of their roads. He urged the Ministry to consider this suggestion. He also considered the labour content of the cost estimation in comparison with the conventional asphalt roads suggesting that the LBST cold mix asphalt can be a viable alternative in that case. ➢ A participant suggested the involvement of Local Government in the LBST programme. ➢ Environment /DFR inquired about road safety measures in respect of speed calming measures used in the Trial Construction. DFR mentioned that these measures are already in place. She also suggested the involvement of the Environmental Protection Agency in the LBST programme. ➢ A participant suggested the involvement of the Ghana Standards Authority in the LBST programme to ensure standards are guaranteed since light equipment for construction is going to be manufactured locally. He also commented on the need to involve the Ghana Standards Authority citing examples of some local building materials not meeting the required standard.	

Annex: 1-8 Monitoring System

Annex 1-8: Monitoring System (M/S) for the DFR from FY 2016 to FY 2018 **Ver. 6 (11/12/2018)**

Components of the PDM			Monitoring Method			Target Value		Achievements of Each Financial Year		
Narrative Summary	Indicators	Means of Verification	Person/Organization in Charge	Frequency	Remarks	Baseline	Target Value*[1]	FY 2016	FY 2017	FY 2018
Project Purpose: **The methodology and application of labour-based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.**	(1) Labour-based bituminous surfacing technology fulfilling the criteria defined in the monitoring checklist is developed through the field trials.	Monitoring checklist filled out by DFR officials and JICA experts (Refer to ***Form 1***)	Principal Engineer of the Planning Division, DFR	Annually (during and/or after field trials)		N/A	All the criteria in the monitoring checklist (Form 1) shall be acceptable.	N/A	The 1st field trial has been completed in line with the monitoring checklist (Form 1) with some defects. Please refer to the result of Form 1.	LBST was eventually developed through the 1st and 2nd field trials in line with Form 1. Please refer to the result of Form 1.
	(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.	Questionnaire surveys to DFR officials and the officials concerned in Eastern Region (Refer to ***Form 2***)	Engineer of the Planning Division, DFR	Semi-annually	DFR officials include the Development, Maintenance, and Planning Divisions as well as Eastern Region Office.	44.7 % (July 2016)	**65% => 70% from Feb 2018**	44.7% (in July) 52.5% (in January, 2017)	71.5% (in July) 68.8% (in January, 2018)	72.4% (in July) 74.6% (in November)
Output 1: **Current conditions and issues for labour-based bituminous surfacing technology in Ghana are identified.**	(1) Issues and results analysed by the experts and counterparts are indicated in the Project Monitoring Sheet (Summary).	Project Monitoring Sheet (Summary)	Principal Engineer of the Planning Division, DFR	1st year only		N/A	To contain all necessary issues and results based on the contents of the Report.	The Report contains all necessary issues and results, and it has been approved.	N/A	N/A
Output 2: **Field trials of labour-based bituminous surfacing technology are carried out.**	(1) Lab tests of materials are conducted in accordance with the material standard.	Certificate ("Results") of the lab tests	Principal Engineer of the Planning Division, DFR	Annually (before and during field trials carried out from February to May in FY2017 and FY2018)		N/A	All the materials (gravel, bitumen, chip, etc.) utilized for the field trials are passed as indicated in the "Results" of the lab tests.	N/A	Acceptable materials (partly satisfactory ones) are used in the 1st field trial. Unacceptable ones were not used.	Acceptable materials are used in the 2st field trial.
	(2) The field trials are conducted in line with the construction standard for labour-based bituminous surfacing technology (LBST construction standard).	Checklist of the LBST construction standard (Refer to ***Form 3***)	Principal Engineer of the Planning Division, DFR	Annually (during field trials carried out from February to May in FY2017 and FY2018)	DFR officials and the officials concerned in Eastern Region fill out the monitoring checklist.	N/A	All the standards in the checklist (Form 3) shall be acceptable.	N/A	The 1st field trial has been completed in line with the checklist of LBST construction standard (Form 3) with some defects. Please refer to the result of Form 3.	The 2nd field trial has been completed in line with Form 3 without any incidents. Please refer to the result of Form 3.
	(3) Task rates for labour-based bituminous surfacing technology are defined.	Summary table of task rates	Quantity Surveyor of Planning Division, DFR	Annually (around July or August in FY2017 and FY2018)		N/A	To contain all necessary information (unit cost) of each work item indicated in the summary table.	N/A	Unit costs of each work item are indicated in the task rate for the 1st field trial. Please refer to the task rate summary in detail.	Unit costs of each work item are indicated in the task rate for the 2nd field trial. Please refer to the task rate summary in detail.
Output 3: **Guidelines for labour-based bituminous surfacing technology are prepared.**	(1) Draft guidelines for labour-based bituminous surfacing technology is completed.	Draft guidelines for labour-based bituminous surfacing technology	Dy. Director of Planning, DFR	Final year only		N/A	Completion of draft guidelines	N/A	N/A	Draft LBST Guideline was completed.

NOTE:

Annex 1-8: Monitoring System (2) Status of the Important Assumptions (IAs) Ver. 3 (11/12/18)

Important Assumptions for the achievement of the Outputs	Person(s) in charge	FY 2016 (End of the 1st FY: by December 2016)	FY 2017 (End of the 2nd FY: by December 2017)	FY 2018 (End of the 3rd FY: by December 2018)	Measures and undertakings by the Project
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.	Deputy (Dy.) Director (Planning) of Department of Feeder Roads (DFR), Ministry of Roads and Highways (MRH)	· Fulfilled or unfulfilled: Fulfilled · Its cause(s): N/A · Influence(s) to the Project: N/A	· Fulfilled or unfulfilled: Fulfilled · Its cause(s): N/A · Influence(s) to the Project: N/A	· Fulfilled or unfulfilled: Fulfilled · Its cause(s): N/A · Influence(s) to the Project: N/A	· 1st year: N/A · 2nd year: N/A · 3rd year: N/A
Important Assumptions for the achievement of the Project Purpose	**Person(s) in charge**	**FY 2016 (End of the 1st FY: by December 2016)**	**FY 2017 (End of the 2nd FY: by December 2017)**	**FY 2018 (End of the 3rd FY: by December 2018)**	**Measures and undertakings by the Project**
There is no significant change in C/P assignment.	Dy. Director (Planning) of DFR, MRH	· Fulfilled or unfulfilled: Fulfilled · Its cause(s): N/A · Influence(s) to the Project: N/A **Note:** 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.	· Fulfilled or unfulfilled: Fulfilled · Its cause(s): N/A · Influence(s) to the Project: N/A **Note:** 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, has 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.	· Fulfilled or unfulfilled: Fulfilled · Its cause(s): N/A · Influence(s) to the Project: N/A **Note:** Although DFR Director was changed from Mr. Duncan Williams to Mr. Benard Badu in October 2018, it is considered that this condition does not severely affect to the achievement of the Project Purpose. This is because C/P shared the project concept with the DFR Director through the meeting convened by the Project.	· 1st year: N/A · 2nd year: N/A · 3rd year: N/A

Important Assumptions for the achievement of the Overall Goal	Person(s) in charge	FY 2016 (End of the 1st FY: by December 2016)	FY 2017 (End of the 2nd FY: by December 2017)	FY 2018 (End of the 3rd FY: by December 2018)	Measures and undertakings by the Project
There is no significant change for the activities of DFR for feeder road services.	DFR Director, MRH	N/A at this moment	N/A at this moment	Refer to the PCR	· 1st year: N/A · 2nd year: N/A · 3rd year: Refer to PCR
There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road.	DFR Director, MRH	N/A at this moment	N/A at this moment	Refer to the PCR	· 1st year: N/A · 2nd year: N/A · 3rd year: Refer to PCR
The budget for the measures necessary for the labour-based bituminous surfacing technology is secured.	DFR Director, MRH	N/A at this moment	N/A at this moment	Refer to the PCR	· 1st year: N/A · 2nd year: N/A · 3rd year: Refer to PCR

Annex: 1-9 Checklist of the LBST Constuction Standard (Form-3)

Annex 1-9: Checklist of the LBST Construction Standard (Form 3: 1st Field Trial) **Ver. 1**

Form 3: Checklist of the LBST Construction Standard **Date: 09/02/2018**

Road Section: Akote-Obomofodensua-Asiedu Feeder Road **Person in charge: Eng. K. OMANE Brimpong**

No.	Items	Actual Achievements		Acceptance*2 (YES:1, NO:2)	Issues/Problems (If "NO: 2" in the *Acceptance*)
		Response*1	Evidence/Reasons		
I. Formation of Typical Cross-section for Bituminous Pavement					
1. Base					
(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.
2. Surfacing treatment					
(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 repot-14/03/17 10mm Chippings: Test Results:DFR/RMLreport-21/03/17	1	
(4)	Does the emulsion meet specification? (Y/N)	YES	Bitumen Test: GHA Central Lab Report dated 18/04/17.	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.
(5)	Are the aggregates properly pre-coated? (Y/N)	YES	Photographs of the period dated 22/04/17 - 20/08/17.	1	Pre-coating was achieved through the reduction of dust from the aggregates.

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*2 (YES:1, NO:2)	Issues/Problems (If "NO: 2" in the *Acceptance*)
		Response*1	Evidence/Reasons		
II. Standard of Quality Control for Bituminous Surfacing Treatment					
1. Spraying (priming)					
(1)	What is the spray rate? (1.0 lit/m^2)	1.0 lit/m²	Prime Coat for Cold Mix Asphalt	1	
2. Surface dressing					
(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^3/m^2)	0.01m³/m²	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^3/m^2)	0.005m³/m²	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^2)	2.0lit/m² 1.8lit/m²	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^2)	1.7 lit/m² 1.6 lit/m²	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*2 (YES:1, NO:2)	Issues/Problems (If "NO: 2" in the *Acceptance*)
		Response*1	Evidence/Reasons		
3. Cold mix asphalt					
(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.
III. General Issues					
1. Safety and health measures					
(1)	Were the workers wearing safety vest? (Y/N)	YES	Project Photograths dated 17/02/28-17/08/30	1	
(2)	Were the workers wearing safety boots? (Y/N)	YES	Project Photograths dated 17/02/28-17/08/30	1	
(3)	Were the workers wearing dust mask? (Y/N)	YES	Project Photograths dated 17/02/28-17/08/30	1	
(4)	Were the workers wearing gloves and goggles? (Y/N)	YES	Project Photograths dated 17/02/28-17/08/30	1	
(5)	Were the workers provided with clean drinking water? (Y/N)	YES	Project Photograths 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*2 (YES:1, NO:2)	Issues/Problems (If "NO: 2" in the *Acceptance*)
		Response*1	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	
2. Miscellaneous works					
(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.

Annex 1-9: Checklist of the LBST Construction Standard (Form 3: 2nd Field Trial) **Ver. 1**

Form 3: Checklist of the LBST Construction Standard **Date: 26/10/2018**

Road Section: Akote-Obomofodensua-Asiedu Feeder Road **Person in charge: Eng Omane Brimpong**

No.	Items	Actual Achievements		Acceptance*2 (YES:1, NO:2)	Issues/Problems (If "NO: 2" in the *Acceptance*)
		Response*1	Evidence/Reasons		
I. Formation of Typical Cross-section for Bituminous Pavement					
1. Base					
(1)	What is the gradient of the camber? (3-5 %)	3%	Check with camber boards (See photographs of Base Construction dated 29/03/18 - 26/08/18) √	YES	
(2)	What is the average width? (6 m)	6.3m	By measurement √	YES	
(3)	What is the thickness? (150 mm)	150mm	By levels and DFR Lab. Reports √	YES	
(4)	Is the base well compacted? (98 %)	98.17 - 99.47%	Field Density Results of DFR/RML Team indicated 98.17% min. and 99.47 max.√	YES	
2. Surfacing treatment					
(1)	What is the average width? (6 m)	6.3m	By measurement √	YES	
(2)	Does the flatness of road surface meet specification? (Y/N)	YES	By checks with the camber board and visual inspection √	YES	
(3)	Does the aggregate meet specification? (Y/N)	YES	14mm Chippings: Test Results:DFR/RML report √ 10mm Chippings: Test Results:DFR/RML report √	YES	
(4)	Does the emulsion meet specification? (Y/N)	YES	Bitumen Test: GHA Central Lab Report dated 17/04/18. √	YES	
(5)	Are the aggregates properly pre-coated? (Y/N)	YES	Photographs of the period dated 31/05/18 - 12/06/18. √	YES	

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*2 (YES:1, NO:2)	Issues/Problems (If "NO: 2" in the *Acceptance*)
		Response*1	Evidence/Reasons		
II. Standard of Quality Control for Bituminous Surfacing Treatment					
1. Spraying (priming)					
(1)	What is the spray rate? (1.0 lit/m^2)	1.0 lit/m²	Prime Coat for Cold Mix Asphalt √	YES	
2. Surface dressing					
(1)	Is the surface properly primed? (Y/N)	YES	Daily Work Execution Records dated 20/07/18-03/10/18 √	YES	
(2)	What is the spread rate of chippings for primer seal? (0.01 m^3/m^2)	0.01m³/m²	Daily Work Execution Records dated 05/06/18-14/06/18 √	YES	
(3)	What is the spread rate of chippings for seal? (0.005 m^3/m^2)	0.005m³/m²	Daily Work Execution Records dated 13/06/18-11/09/18 √	YES	
(4)	What is the spray rate of bitumen for primer seal? (1.6-2.0 lit/m^2)	1.8lit/m²	Daily Work Execution Records dated 05/06/18-14/06/18 √	YES	
(5)	What is the spray rate of bitumen for seal? (1.6-1.8 l/m^2)	1.6 lit/m²	Daily Work Execution Record dated 13/06/18-11/09/18 √	YES	
(6)	How many labourers were used? (persons)	26	Daily Work Records dated 06/06/18-11/09/18 √	YES	
(7)	Were road construction works fully completed with the light equipment except base course work? (Y/N)	Yes	For base course work - 10 tonne roller was used. √ Light Equipment was used for the surface dressing works. √	YES	

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*2 (YES:1, NO:2)	Issues/Problems (If "NO: 2" in the *Acceptance*)
		Response*1	Evidence/Reasons		
3. Cold mix asphalt					
(1)	Is the surface properly primed? (Y/N)	YES	Daily Work Execution Records dated 20/07/18-03/10/18 Photographs taken on 20/07/18-03/10/18 √	YES	
(2)	Does the tack coat meet the prescribed specification? (Y/N)	YES	Daily Work Execution Records dated 24/07/18-24/09/18 √	YES	
(3)	Is the tack coat sprayed properly? (Y/N)	YES	Photographs dated 24/07/18-24/10/18 √	YES	
(4)	Was the mixing operation carried out properly? (Y/N)	YES	Visual inspection of mixture look good (Photographs) and the problem of 'balling' has reduced (Photographs) √	YES	
(5)	What is the average thickness? (14 mm for compaction, 20 mm for loose)	20mm 14mm	Loose volume when laid before compaction. √ After compaction. √	YES	
(6)	How many labourers were used? (persons)	28	Daily Records dated 24/07/18-24/10/18 √	YES	
(7)	Were road construction works fully completed with the light equipment except base course work? (Y/N)	Yes	Light equipment were used for cold mix asphalt. √	YES	
III. General Issues					
1. Safety and health measures					
(1)	Were the workers wearing safety vest? (Y/N)	YES	Project Photograths dated 04/04/18-24/10/18 √	YES	
(2)	Were the workers wearing safety boots? (Y/N)	YES	Project Photograths dated 04/04/18-24/10/18 √	YES	
(3)	Were the workers wearing dust mask? (Y/N)	YES	Project Photograths dated 05/06/18-24/10/18. √	YES	
(4)	Were the workers wearing gloves and goggles? (Y/N)	YES	Project Photograths dated 05/06/18-24/10/18. √	YES	
(5)	Were the workers provided with clean drinking water? (Y/N)	YES	EJEC site supervisors can confirm the provision of clean drinking water to workers from 07/03/18-29/09/18. √	YES	

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[*2] (YES:1, NO:2)	Issues/Problems (If "NO: 2" in the *Acceptance*)
		Response[*1]	Evidence/Reasons		
(6)	Have first aid kits been provided? (Y/N)	YES	Photograph √	YES	
(7)	Were the workers provided with a good place of convenience? (Y/N)	YES	Pit latrine provided for the workers as recorded in the 'Notes of Site Meeting & photograph dated 24/09/18. √	YES	
(8)	How many injuries were recorded? (persons)	NIL	N/A √	YES	
(9)	How many casualties were recorded? (persons)	NIL	N/A √	YES	
(10)	How many fatalities were recorded? (persons)	NIL	N/A √	YES	
2. Miscellaneous works					
(1)	Were the locations of the sign boards appropriate? (Y/N)	YES	Erected at CH 2+700 & CH 5+555 at project site. √	YES	
(2)	Was the project name clearly indicated? (Y/N)	YES	Photograph of project sign board at CH 2+700 & 5+555. √	YES	
(3)	Was the road name clearly indicated? (Y/N)	YES	Photograph of project sign board at CH 2+700 & 5+555. √	YES	
(4)	Was the chainage clearly indicated? (Y/N)	YES	Photograph of project sign board at CH 2+700 & 5+555. √	YES	
(5)	Was the client name clearly indicated? (Y/N)	YES	Photograph of project sign board at CH 2+700 & 5+555. √	YES	
(6)	Was the contractor name clearly indicated? (Y/N)	YES	Photograph of project sign board at CH 2+700 & 5+555. √	YES	
(7)	Was the financier name clearly indicated? (Y/N)	YES	Photograph of project sign board at CH 2+700 & 5+555. √	YES	

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.

Annex: 1-10 Task Rate Summary

Annex 1-10: Task Rate Summary (1st Field Trial)

Chip Seal Operation January 2018

Main Activity	Unit Rate
1. Primer sealing (bitumen emulsion)	7.56 GH¢/ℓ
2. Spreading of 14 mm chipping	643.00 GH¢/m^3
3. Spraying of bitumen for seal	6.91 GH¢/ℓ
4. Spreading of 10 mm chipping	541.00 GH¢/m^3

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^2/day
1-2. Watering	1 operator 1 labourer	2	1 tractor	Water	3,786 m^2/day
1-3. Bitumen spraying	1 operator 1 mechanic 7 labourers	9	1 bitumen sprayer	Bitumen emulsion	662 m^2/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	14mm chippings, Bitumen emulsion, Diesel and water	49 m^3/day
2-2. Loading and unloading	1 operator 6 labourers	7	1 tractor (capacity of 2.6m^3)		9 m^3/day
2-3. Chipping spreading	6 chippy spreaders 2 labourers	8	2 chippies		662 m^2/day
2-4. Compaction	1 operator	1	1 pedestrian roller		662 m^2/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^2/day
3-2. Bitumen spraying	1 operator 1 mechanic 7 labourers	9	1 bitumen sprayer	Bitumen emulsion	1,697 m^2/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	10mm chippings, Bitumen emulsion, Diesel and water	47 m^3/day
4-2. Loading and unloading	1 operator 6 labourers	7	1 tractor (capacity of 2.6m^3)		10 m^3/day
4-3. Chip spreading	6 chippy spreaders 2 labourers	8	2 chippies		1,697 m^2/day
4-4. Compaction	1 operator	1	1 pedestrian roller		1,697 m^2/day

Cold Mix Asphalt Operation January 2018

Main Activity	Unit Rate
1. Priming	7.05 GH¢/ℓ
2. Tack coat - bitumen	6.77 GH¢/ℓ
Tack coat - water	1.46 GH¢/ℓ
3. Placing of cold mix asphalt	32.67 GH¢/m^2

Main Activity 1: Priming

Sub-activities	Labourers	total	Light Equipment	Materials	Productivity (Unit)
1-1. Brooming of base	4 labourers	4	-	-	2,006 m^2/day
1-2. Watering	1 operator 1 labourer	2	1 tractor	Water	3,786 m^2/day
1-3. Bitumen spraying	1 operator 1 mechanic 7 labourers	9	1 bitumen sprayer	Bitumen emulsion	3,162 m^2/day
1-4. Loading and unloading quarry dust	4 labourers	4	wheel barrows & shovels	Quarry dust	26 m^3/day
1-5. Spreading of quarry dust	4 labourers	4	-	-	2,271 m^2/day

Main Activity 2: Tack coat (bitumen and water)

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

Main Activity 3: Placing of cold mix asphalt

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

Annex 1-10: Task Rate Summary (2nd Field Trial)

Chip Seal October 2018

Main Activity	Unit Rate	
1. Primer sealing (bitumen emulsion)	7.14	GH¢/ ℓ
2. Spreading of 14 mm chipping	566.94	GH¢/m^3
3. Spraying of bitumen for seal	6.66	GH¢/ ℓ
4. Spreading of 10 mm chipping	619.77	GH¢/m^3

Main Activity 1: Primer Sealing (bitumen emulsion)

Sub-activities	Labourers	total	Light Equipment	Materials	Productivity (Unit)
1-1. Brooming of base	4 labourers	4	-	-	3,026 m^2/day
1-2. Watering	1 operator 1 labourer	2	1 tractor	Water	4,418 m^2/day
1-3. Bitumen spraying	1 operator 1 mechanic 7 labourers	9	1 bitumen sprayer	Bitumen emulsion	1,021 m^2/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	14mm chippings, Bitumen emulsion, Diesel and water	33 m^3/day
2-2. Loading and unloading	1 operator 6 labourers	7	1 tractor (capacity of 2.6m^3)		9 m^3/day
2-3. Chipping spreading	6 chippy spreaders 2 labourers	8	2 chippies		1,078 m^2/day
2-4. Compaction	1 operator	1	1 pedestrian roller		1,078 m^2/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	-	-	2,550 m^2/day
3-2. Bitumen spraying	1 operator 1 mechanic 7 labourers	9	1 bitumen sprayer	Bitumen emulsion	1,249 m^2/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	10mm chippings, Bitumen emulsion, Diesel and water	50 m^3/day
4-2. Loading and unloading	1 operator 6 labourers	7	1 tractor (capacity of 2.6m^3)		7 m^3/day
4-3. Chip spreading	6 chippy spreaders 2 labourers	8	2 chippies		1,471 m^2/day
4-4. Compaction	1 operator	1	1 pedestrian roller		1,471 m^2/day

Cold Mix Asphalt October 2018

Main Activity	Unit Rate
1. Priming	6.87 GH¢/ℓ
2. Tack coat - bitumen	6.65 GH¢/ℓ
Tack coat - water	1.33 GH¢/ℓ
3. Placing of cold mix asphalt	31.49 GH¢/m^2

Main Activity 1: Priming

Sub-activities	Labourers	total	Light Equipment	Materials	Productivity (Unit)
1-1. Brooming of base	4 labourers	4	-	-	3,026 m^2/day
1-2. Watering	1 operator 1 labourer	2	1 tractor	Water	4,418 m^2/day
1-3. Bitumen spraying	1 operator 1 mechanic 7 labourers	9	1 bitumen sprayer	Bitumen emulsion	4,164 m^2/day
1-4. Loading and unloading quarry dust	4 labourers	4	wheel barrows & shovels	Quarry dust	11 m^3/day
1-5. Spreading of quarry dust	4 labourers	4	-	-	2,416 m^2/day

Main Activity 2: Tack coat (bitumen and water)

Sub-activities	Labourers	total	Light Equipment	Materials	Productivity (Unit)
2-1. Brooming of primed surface	5 labourers	5	-	-	1,854 m^2/day
2-2. Spraying of tack coat	2 labourers	2	Water can and brushes	Bitumen emulsion	1,868 m^2/day

Main Activity 3: Placing of cold mix asphalt

Sub-activities	Labourers	total	Light Equipment	Materials	Productivity (Unit)
3-1. Batching & mixing of asphalt	2 operators 8 labourers	10	2 pan mixers	10mm chippings, Quarry dust, Bitumen emulsion, Water	7.22 m^3/day
3-2. Placing of asphalt	8 labourers	8			339 m^2/day
3-3. Compaction	1 operator 1 labourer	2	1 roller		357 m^2/day

Annex: 1-11 Monitoring Checklis for the LBST Development (Form-1)

Annex 1-11: Monitoring Checklist for the LBST Development (Form 1: 1st Field Trial) **Ver. 1**

Form 1: Monitoring Checklist for the Development of LBT Bituminous Surfacing Technology **Date: 09/02/2018**

Road Section: Akote-Obomofodensua-Asiedu Feeder Road **Name of JICA Expert: Motoki OGAWA**

No.	Items	Actual Achievements filled by DFR Officials		Acceptance*1 by JICA Experts (YES:1, NO:2)	Comments by JICA Experts	Responses/Undertakings by DFR Officials
		Response	Evidence/Reasons			
Preparation Phase ⇒ "Chapter 4: Construction" in the Guidelines						
1	Has the work planning (work program, method statement, and cash flow) been done properly? (Y/N)	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
		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 sumitted 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 repot-14/03/17 10mm Chippings: DFR/RML report-21/03/17 * 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 17/04/03-17/08/31.	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.

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

No.	Items	Actual Achievements filled by DFR Officials		Acceptance*1 by JICA Experts (YES:1, NO:2)	Comments by JICA Experts	Responses/Undertakings by DFR Officials
		Response	Evidence/Reasons			
Implementation Phase (Base Treatment) ⇒ "Chapter 4: Construction" in the Guidelines						
1	Is base course well compacted? (Y/N)	YES	**Compaction test results:** DFR/RML Reports: Dated 18/05/17 (93.98min-96.25max); Dated 05/07/17 (93.03min-95.04max) etc. **DCP test results:** N/A- applied on sub-base	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	**Photograph check:** Project Photographs dated 17/03/31-17/08/31.	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	**Daily Record Sheet (DRS):** Daily Work Execution records of the period dated 23/05/17 - 19/08/17.	1	No problem observed. The client did preparation and give proper instuctions 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	**Laboratory Test:** DFR/RML Sieve Analysis Test for 14mm & 10mm chippings dated 11/04/17 & 21/03/17 and Compaction Test Results	1	All materials were confirmed its quality before construction.	Continued to the next trial
5	Does construction method follow labour procedure? (Y/N)	YES	**Photograph check:** Project Photographs dated 17/03/31 - 17/08/31. **DRS:** Daily Work Reports dated 20/02/17 - 23/08/31.	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.

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

No.	Items	Actual Achievements filled by DFR Officials		Acceptance*1 by JICA Experts (YES:1, NO:2)	Comments by JICA Experts	Responses/Undertakings by DFR Officials
		Response	Evidence/Reasons			
Implementation Phase (Surface Treatment) ⇒ "Chapter 4: Construction" in the Guidelines						
1	Are chippings pre-coated? (Y/N)	YES	**Photograph check:** Project Photographs dated 22/04/17 - 20/08/17. **DRS:** 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 wound 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	**Photograph check:** Project Photographs dated 23/05/17 - 19/08/17. **DRS:** 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	**DRS:** 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	**DRS:** 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 instuctions 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	**Laboratory Test:** Bitumen: GHA Central Lab report - 18/04/17 14mm Chippings: DFR/RML repot - 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	**DRS:** 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.

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

No.	Items	Actual Achievements filled by DFR Officials		Acceptance*1 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 spead 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.

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

No.	Items	Actual Achievements filled by DFR Officials		Acceptance*1 by JICA Experts (YES:1, NO:2)	Comments by JICA Experts	Responses/Undertakings by DFR Officials
		Response	Evidence/Reasons			
Inspection Phase (immediately after the completion of construction) ⇒ "Chapter 5: Quality Assurance and Control" in the Guidelines						
1	Is there proper road furniture in place? (Y/N)	YES	**Visual inspection:** At the Project Site from CH 0+000 - CH 2+700. **Photographs:** Dated 19/08/17-23/08/17. **Visual inspection:** At the Project Site from CH 0+000 - CH 2+700.	1	Road marking, signboard and hump were placed at appropriate locations. It was a lesson that extra concrete slab is needed at both forwards and backwards of the hump that it could not bear the impact from the axels in this kind of bituminous surface could not bear the impact.	Continued at the next trial.
2	Is the texture of the surface acceptable? (Y/N)	YES	**Visual inspection:** At the Project Site from CH 0+000 - CH 2+700.	1	No problem observed	We feel there were no problem in texture. The texture is to be maintained in the second field trial.
3	Is the road surface smooth? (Y/N)	YES	**Visual inspection:** YES - Cold Mix Asphalt No - Chip Seal	1	It is much smoother than gravel surface. However, there was lesson that flatness on bituminous surface is a factor to pay more attention than gravel surface since the shape and undulation of the base course surface would directly come to the bituminous layer. Also, it was recorded that a labourer who was taking a rest near the truck injured when the container lost balance while it was being loaded on a truck. This lesson shall be reflected to the next trial.	Newly-procured equipment, towed grader, is expected to contribute to achieving more smoothness. Also, it is desirable to introduce system using simple machinery, such as tablet PC, to measure the RI value. RI value would be a index to evaluate the flatness of the surface.

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

Annex: 1-12 Questionaire on LBST (Form-2)

Annex 1-12: Questionnaire on LBST (Form 2)

Questionnaire on the Labour-based Bituminous Surfacing Technology

Organization (Division/Section): _____

Date (Day/Month/Year): ____ / ____ / 20____

Name: _____

(1) DFR Official (Head Quarters)	
(2) Official concerned in Eastern Region	

On a scale from "1" to "5" with "5" representing the highest possible rating, please indicate how you recognize the labour-based bituminous surfacing technology with each of the following statements (Q1 to Q11).

Q1. The planning skills and knowledge of road works with the labour-based bituminous surfacing technology are _____.

5	4	3	2	1
Excellent	Very good	Good	Fair	Poor

Q2. The road structure design and/or drawing of the labour-based bituminous surfacing technology are _____.

5	4	3	2	1
Excellent	Very good	Good	Fair	Poor

Q3. The contents of Bill of Quantities (BOQ) for the labour-based bituminous surfacing technology are _____.

5	4	3	2	1
Excellent	Very good	Good	Fair	Poor

Q4. The cost estimation in the labour-based bituminous surfacing technology is _____.

5	4	3	2	1
Excellent	Very good	Good	Fair	Poor

Annex 1-12: Questionnaire on LBST (Form 2)

Q5. The road inspection tasks on the labour-based bituminous surfacing technology are _____.

5	4	3	2	1
Excellent	Very good	Good	Fair	Poor

Q6. The safety practice for workers and road users during road works with the labour-based bituminous surfacing technology is _____.

5	4	3	2	1
Excellent	Very good	Good	Fair	Poor

Q7. The technical advice and supports of the labour-based bituminous surfacing technology for a contractor are _____.

5	4	3	2	1
Excellent	Very good	Good	Fair	Poor

Q8. The time management of road works with the labour-based bituminous surfacing technology during execution periods is _____.

5	4	3	2	1
Excellent	Very good	Good	Fair	Poor

Q9. The monitoring of road works with the labour-based bituminous surfacing technology is _____.

5	4	3	2	1
Excellent	Very good	Good	Fair	Poor

Q10. The standard specification of the labour-based bituminous surfacing technology is _____.

5	4	3	2	1
Excellent	Very good	Good	Fair	Poor

Q11. Indicate the overall rating on your level of understanding of the labour-based bituminous surfacing technology.

5	4	3	2	1
Excellent	Very good	Good	Fair	Poor

Thank you for your cooperation

ANNEX-2: LIST OF PRODUCTS (GUIDELINES, ETC) PRODUCED BY THE PROJECT

Annex 2-1: Report on Anaylysis of Current Status for Labour-Based Bituminous Surfacing Technology

Annex 2-2: Guideline for Labour-Based Bituminous Surfacing Technology

Note) Annex 2-2 Guideline shall be attached as a separate volume to this report.

Republic of Ghana

The Project for Developing

Labour-Based Bituminous Surfacing Technology

Report on Analysis of Current Status for Labour-Based Bituminous Surfacing Technology

September 2016

Department of Feeder Roads

Eight-Japan Engineering Consultants Inc.

PADECO Co., Ltd.

TABLES OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1 The Outline of the Project

Labour-Based Technology, in which labour (preferably local) is optimised, where technically feasible, to carry out works in a cost-effective manner to produce quality works[1] and contribute to generate employment especially in rural area, has been introduced in the Republic of Ghana as an alternative of upgrade or maintain unpaved roads led by the Department of Feeder Roads (DFR) under the Ministry of Roads and Highways (MRH). However, durability of unpaved road is low due to heavy rainfall in wet season and steep terrain in Ghana and consequently roads are deteriorated in short time. Thus, cost-effective road surface treatment method is required to improve service level of feeder roads.

In order to address the issue, DFR has conducted a field trial in collaboration with Kwame Nkrumah University of Science and Technology (KNUST) to examine the effectiveness of "otta-seal" which is one of bituminous surfacing technologies used in Kenya, Botswana and other countries. Following the trial, it is concluded that otta-seal is not appropriate as a labour-based surfacing method in Ghana due to lack of suitable materials for otta-seal and necessity of heated bitumen.

From the experience above, DFR has requested Japan International Cooperation Agency (JICA) to assist development of labour-based bituminous surfacing technology. The objective is to establish methodology and application of labour-based bituminous surfacing technology through the field trials in the Eastern region of Ghana.

Chapter 2 Department of Feeder Roads

Department of Feeder Roads (DFR) is the governmental organization responsible for management of feeder roads in Ghana as well as the counterpart organization for the project. The details of DFR are presented in this chapter.

2-1 Responsibilities

This section describes responsibilities performed by DFR with reference to a draft performance agreement for the Director of DFR.

(1) Vision

"To ensure that 80% of rural communities in Ghana can access a feeder road within 2km radius

[1] Local Resource-Based Approaches for Infrastructure Investment Source Book (2010) International Labour Office (ILO)

at optimum cost under a decentralized system by 2020."

(2) Mission

"The Department of Feeder Roads exists to ensure the provision of safe all weather accessible feeder roads at optimum cost to facilitate the movement of people, goods and services and to promote socio-economic development, in particular agriculture through the use of labour and capital intensive technologies."

(3) Objectives

1) To provide improved all year round access for the movement of people and goods to facilitate the promotion of economic activities and access to social services in rural communities.

2) To protect and preserve investments made on improved roads and bridges through adequate maintenance systems.

3) To provide employment opportunities for the rural poor by encouraging a greater use of labour-based road construction technology.

4) To use sound economic and technical criteria for feeder road investment for rehabilitation and construction activities.

5) To implement measures to mitigate the negative environmental impact of road schemes.

6) To assist in the development of the technical capacity of Municipal and District Assemblies (MDA's) to facilitate the decentralisation process and for the effective supervision and maintenance of feeder roads.

7) To ensure the safety, comfort and convenience of the travelling.

8) To minimize vehicle-operating cost

9) To assist the District and Municipal Assemblies in the prioritization and selection of roads for improvement using the Road Prioritization Methodology (RPM).

10) To put in place a sound monitoring system to ensure that work is executed as planned and to the right quality standard and specification.

11) To train contractors to enable them to carry out maintenance works

(4) Functions

DFR administrates the feeder road network and related bridges in the country. The functions are listed as follows;

1) Planning, development and maintenance of the feeder roads network and related bridges.
2) Usage of the following tools for planning, prioritisation and selection of Feeder Roads:
    - Road Prioritisation Methodology (RPM)
    - Database and Geographical Information System (GIS)
    - Maintenance Performance Budgeting System (MPBS)
3) Classification and setting up of design standards on different classes of feeder roads.
4) Undertaking of research with or without the collaboration of any research organization with a view to facilitate DFR's planning, development and maintenance activities.
5) Maintenance and .preservation of such records relating to DFR's functions as considered expedient.
6) Management of feeder road database.
7) Implementation of routine and periodic maintenance activities through the use of private contractors and consultants.
8) Carrying out route location and design studies
9) Procurement of feeder roads and related bridge works.
10) Ensure that labour standards, environmental, safety and health related issues are adhered to during execution of feeder roads contracts.
11) Capacity building for DFR staff, contractors, consultants and District Assemblies to attain efficiency in DFR's functions.
12) Collaboration with other MDAs on feeder road related issues

2-2 Organisational Structure

Organizational structures of DFR headquarters and regional office are presented in the section.

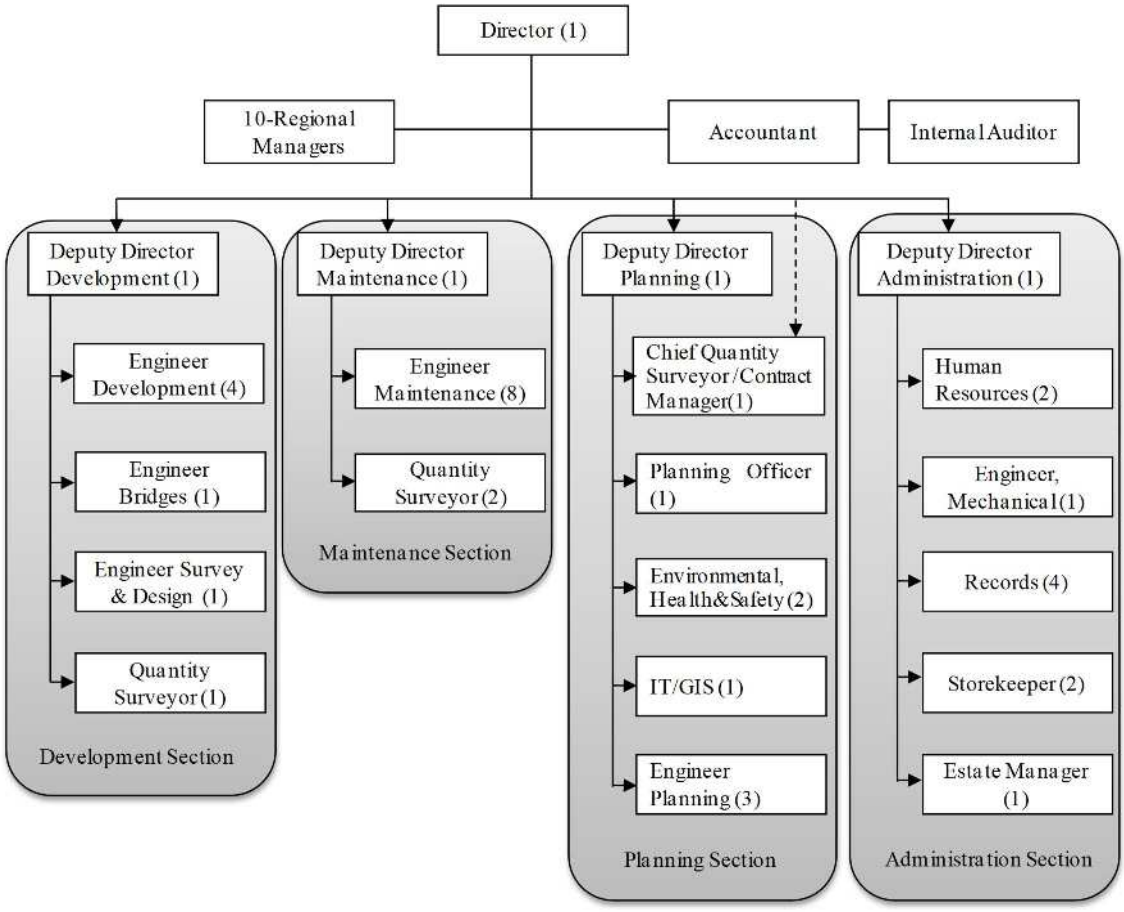
(1) DFR Headquarters

Figure 2-1 shows the organizational structure of DFR headquarters. Under the director of DFR, four deputy directors are assigned to manage each section. Under the deputy directors, a variety of engineers/technicians are allocated such as road and bridge engineers in the Development section, maintenance engineer and quantity surveyors in the Maintenance section, and planning engineer and IT/GIS Expert in the Planning section. The administration section mainly consists of management officials such as human resource and records keeper.

The development section, the maintenance section and the planning section individually have

their own projects to be implemented. In principal, the development section deals with larger projects such as new construction works, the maintenance section is in charge of small projects such as routine maintenance, and the planning section is responsible for study project. However, actual work demarcation does not always follow the principal and the director of DFR determines the allocation of respective projects in consideration of other factors such as current work load of each section.

The planning section is responsible for this project led by the deputy director planning, and the counterpart engineer has been assigned from planning engineers. Through the counterpart engineers, assistance from other sections will be acquired especially to implement field trials and preparation for this project.



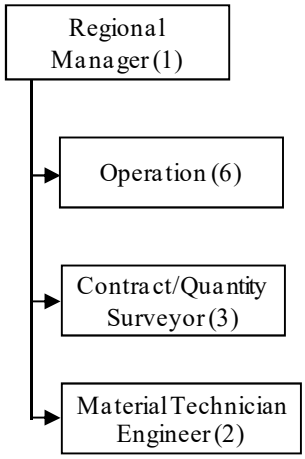
Note: Figures in parentheses express number of staff engaging the roles as of May 2016
Source: DFR

Figure 2-1: Organisational Structure of DFR Headquarters

(2) Regional Offices

The basic organisational chart of DFR regional offices is shown in Figure 2-2. Regional offices are managed by regional manager with the support from operation managers with technician

engineers, contract manager with assistant quantity surveyors, and material technician engineers. Regional offices are often responsible for supervision of projects except for the projects directly managed by the HQ. As field trials for the JICA project are expected to be conducted in the Eastern region, support from the Eastern regional office will be required for implementation.



Note: Figures in parentheses express number of staff engaging the roles as of May 2016
Source: DFR

Figure 2-2: Organizational Structure of DFR Regional Offices

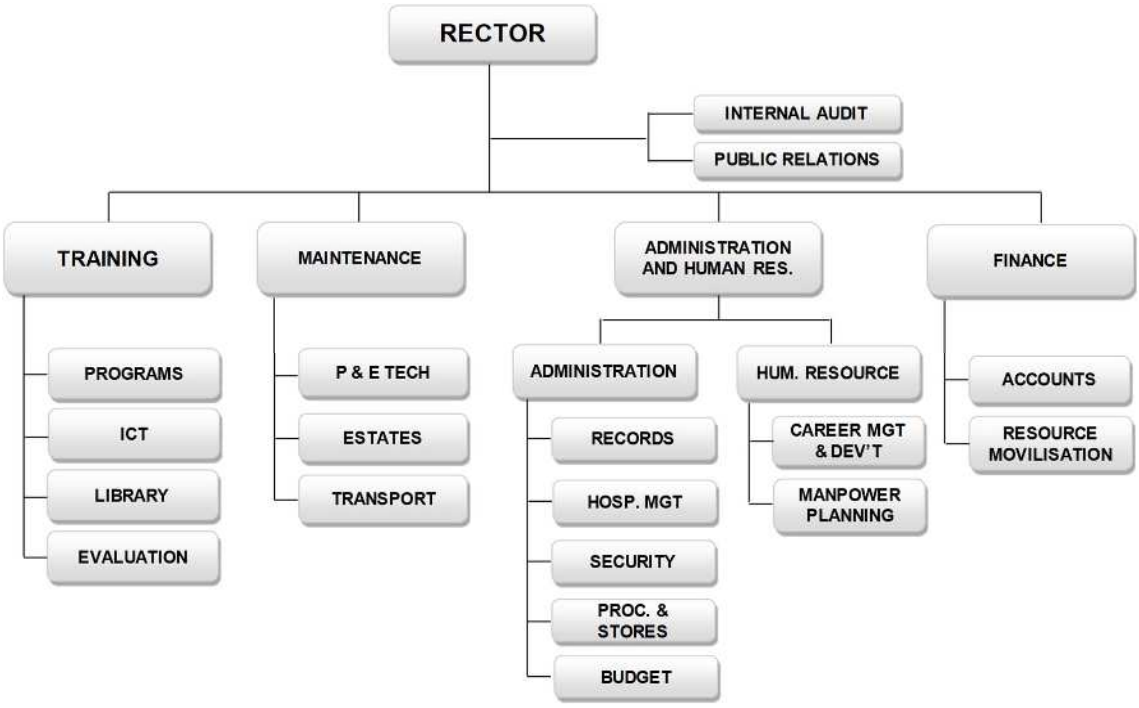
(3) Koforidua Training Centre (KTC)

Koforidua Training Centre (KTC) is an organisation directly under the Ministry of Roads and Highways, not belongs to DFR[2] at the moment. However, KTC is briefly described in this sub-section because KTC plays an important role for implementation of LBT in Ghana.

KTC was established to build capacity for road construction management for its agencies and stakeholders, consisting of 52 staff including 8 technical staff. The organisational structure is shown in Figure 2-3. In addition, visiting lecturers are dispatched by DFR to complement practical expertise. In particular, trainings for LBT have been conducted in KTC since the establishment and a number of contractors participated in to become a LBT contractor (see Table 2-3 for classification of contractor).

According to the rector, KTC has invited officials from other countries such as Burkina Faso and has conducted trainings for LBT. They have a prospect that KTC be a regional centre for LBT in the Western Africa.

[2] KTC was established as a part of DFR in 1996 and became an individual entity under MRH in 2006



Source: KTC Organisational Manual

Figure 2-3: Organisational Structure of Koforidua Training Centre

(4) Class of Engineers

A number of engineers working in DFR are categorised in 5 classes in accordance with the responsibilities and experience. Table 2-1 summarised respective classes of engineer. Note that responsibilities and experience are indicative only and actual situations may be different.

Table 2-1: Class of Engineers

Class	Responsibilities (Indicative)	Experiences (Indicative)
Chief Engineer	Assist the Deputy Director for management	23 ~ 38 years
Principal Engineer	Management of Project, Assist the Deputy Director	12 ~ 26 years
Senior Engineer	Assist the implementation of projects	6 ~ 16 years
Engineer	Address daily engineering issues	3 ~ 6 years
Assistant Engineer	Assist all engineers. Young engineer after graduation	1 ~ 3 years

Source: DFR

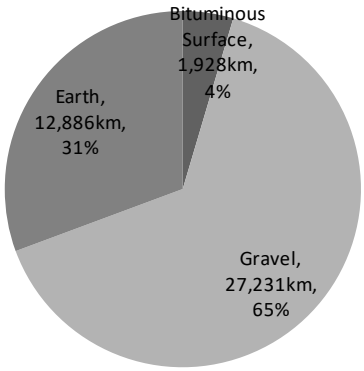
2-3 Road Network

The length of road network managed by DFR is 42,045 km in total. This is longer than the network under the Ghana Highway Authority (GHA), the length of which is approximately 14,000 km all

over the country[3]. Although approximately half of trunk roads managed by GHA are paved, the ratio of bituminous surfaced roads of DFR is only 4 % and 65 % of roads are gravel surface and the remaining 31 % are earth roads as shown in Figure 2-4. Consequently, the roads are deteriorated after rainfalls and frequent maintenance is required to keep the roads in good conditions.

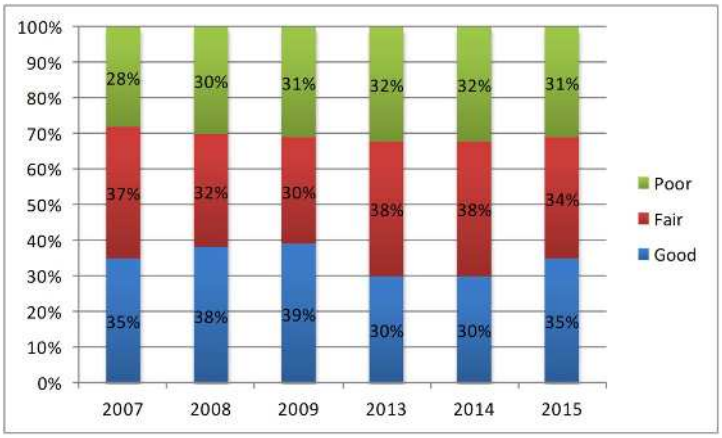
Under the harsh situation, DFR maintains the road conditions as shown in Figure 2-5. In general, road conditions worsen by time passing, however the conditions have been kept the same level as 35% of roads were maintained in good condition, 34% in fair, and 31% in poor condition. The proportions are almost same in the period of 2007 – 2015 due to continuous maintenance.

Labour-Based Surfacing Technology is expected to improve the road condition by its higher durability and require lower frequent maintenance.



Source: JICA Project Team based on DFR Annual Report for 2015

Figure 2-4: Road Length by Surface Type



Source: JICA Project Team based on DFR Annual Report for 2015

Figure 2-5: Road Conditions in 2007 - 2015

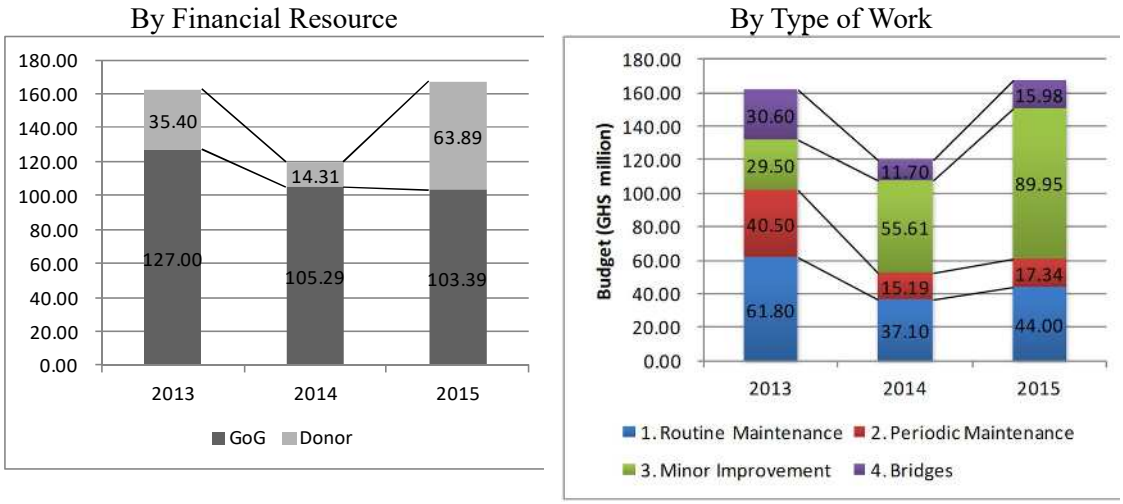
[3] Road Condition Report Year 2011 (2012) Ghana Highway Authority

2-4 Budget

The budget for DFR consists of two financial resources – fund by the Government of Ghana (GoG) and support from development partners. 10 – 40 % of the total budget is supported by development partners and the remaining is financed by GoG including the Road Fund, the financial resource of which is mainly fuel tax to be used for small-sized maintenance such as routine and period maintenance. As shown in Figure 2-6, fund from GoG has slightly reduced whilst financial infusion from development partners in 2015 was the largest amongst the three years.

Figure 2-6 presents that the total budgets of DFR were GHS 120 – 160 million in the past three years. The budgets are divided into 4 categories such as routine maintenance, periodic maintenance, minor improvement, and bridge works. In 2013, routine maintenance was the most major activity allocated 38 % of the total budget. However, the major activity was changed to minor improvement in 2014 and 2015, the shares of which were 46 % and 54 %, respectively.

Since minor improvement includes surfacing and rehabilitation of roads, the Labour-Based Surfacing Technology is expected to be utilised under the minor improvement budget upon the establishment of the technology.



Source: JICA Project Team based on DFR Annual Report 2013 - 2015

Figure 2-6: Budget 2013-2015

2-5 Approaches on Labour-Based Technology by DFR

(1) Policies

As a development policy in road sector, Sector Medium-Term Development Plan (SMTDP) 2014

– 2017 was issued by Ministry of Roads and Highways in 2015. SMTDP recognised LBT as a cost effective and an appropriate method of improving rural transportation, whilst addressing issues of economic development and poverty reduction.

The sector has revamped the LBT to improve upon the livelihood of rural Ghanaians by creating employment opportunities and facilitating access of the rural population, which is predominately poor access to markets, economic and social centres. This is in furtherance of the Government policy on job creation.

Two refresher training courses for DFR engineers and contractors' supervisors were completed at Koforidua Training Centre (KTC) in 2010 and 2011, respectively. Tenders have been received from trained labour-based contractors to start work using this approach. LBT contracts have been awarded in all regions.

(2) Introduction of LBT in Ghana

In the National Feeder Roads Rehabilitation and Maintenance Project (NFRRMP) since 1987, LBT along with Equipment-Based Technology (EBT) was introduced to rehabilitate the existing feeder roads of 12,000 km. Consequently, approximately 2,000 km had been developed by using LBT during the 10 years after implementation.

Although LBT had not been applied frequently in a certain period of time, the Ministry decided to revamp the LBT and many LBT projects were implemented in 2015 as listed in Table 2-2. Most of the regions conducted LBT projects and the total length was 430 km including ongoing projects.

Table 2-2: Summary of LBT Works in 2015

Region	Lot No.	District	Road Name	Length (km)	Activities	Progress (%)
Greater Accra Region	1A	Ga South	Ashalearnan - Fawotekose F/R	4.20	Spot Imp.	0
	1B	Ga South	Ashalearnan - Fawotekose, Mmampehia & Otaten - Fawotekose F/R	5.20	Spot Imp.	100
	2A	D/East	Talebanya Jnc - Talebanya & Nuhuale Jnc - Nuhuale F/R	6.00	Spot Imp.	13.6
	2B	D/East	Tehe Jnc – Tehe F/R	5.00	Spot Imp.	100
	3A	D/East	Ameyawkorpe - Safahukorpe F/R	5.00	Spot Imp.	72.4
	3B	D/East	Adonokorpe - Peterkorpe F/R	3.00	Spot Imp.	100
Volta	4	Ho	Adukorpe Jnc - Ziave	6.30	Rehab.	100
	5	Ho	Klepe - Demetse - Akrofu & Hoviekpe Jnc - Hoviekpe	9.30	Rehab.	100
	6	Ho	Abutia Sebekope Jnc - Sebekope	5.30	Spot Imp.	100
	7	Ho	Ho Soldier Barracks - Tokokoe Ph.2	9.80	Spot Imp.	100
E	8	Yilo Krobo	Huhunya - Torgodo & Others	9.40	Rehab.	35

Region	Lot No.	District	Road Name	Length (km)	Activities	Progress (%)
	9	Fanteakwa	Owusukrom – Asrebuso	10.00	Rehab.	30
	10	Upper Manya	Djomoh - Mensah	6.60	Rehab.	90
	11	Lower Manya	Ayemesu - Gbortsonya	9.30	Rehab.	28
	12	West Akin	Asamankese – Ametima & Others	12.35	Spot Imp.	52
	13	Akuapem North	Asamang - Lakpa	12.30	Spot Imp.	100
Central	14	Assin South	Mankata Jnc – Mankata	10.70	Rehab.	25
	15	Ajumako – Enyan - Essiam	Abaasa – Onyandze – Kokodo – Engo	7.10	Spot Imp.	40
	17	Assin North	Essiam – Kyeikrom – Adukweku	6.70	Spot Imp.	42
Western	19	SWDA	Bowobra – Apentemadi & Others	12.50	Spot Imp.	0
	20	JMDA	Anhwiafutu Jnc Kwabre & Others	11.40	Spot Imp.	0
	21	ADA	Akpafu Jnc – Akpafu & Others	9.30	Spot Imp.	46
Ashanti	22	Ashanti Akyem South	Asankare - Dampong	4.90	Rehab.	100
	23	Sekyere East	Ntumakunso	10.00	Rehab.	100
	24	Ashanti Akyem South	Adomfe - Brentuokrom	9.00	Rehab.	100
Northern	25	Asunafo North	Nfrekrom - Nyamebekyere	15.50	Spot Imp.	63
	29	Tonlum – Kumbu	Wantugu – Kasuliyilli	14.20	Spot Imp.	52
	30	East Gonja	Bamvim – Dalogyilli	11.10	Spot Imp.	48
	31	Tolon	Katindaa – Koblinahigu	2.65	Rehab.	30
	32	Central Gonja	Sankunyipale - Mahamuyilli	9.20	Rehab.	25
Upper East	33	Bongo	Feo - Aniakumkwa & Others	15.00	Spot Imp.	18
	34	Kassena – Nanakana West	Sandema - Katiu & Others	19.60	Spot Imp.	20
	35	Talensi – Nabdan	Tongo - Baare & Others	11.40	Spot Imp.	87
	36	Bawku West	Zebilla - Timonde & Others	12.30	Rehab.	57
Upper West	37	Sissala West	Kusale - Boti & Others	10.30	Spot Imp.	27
	38	Sissala East	Naabugubelle - Challu & Challu -Nmanduono - Jambugu - Yipanpu	10.00	Rehab.	29
	39	Sissala West	Kongo - Buo & Bamahu – Konpala	9.60	Rehab.	46
TOTAL LENGTH				430.0		

Source: Annual Report for 2015, DFR

(3) Contractors

As of April 2016, there are more than 5,000 contractors in Ghana[4]. The contractors are categorised

[4] Referring "List of contractors in good standing as at 08 April 2016" and "List of contractors not in good standing as at 08 April 2016" issued by Ministry of Roads and Highways
http://www.mrh.gov.gh/5/3/guidelines/contractor-classification

using two criteria – "Category" and "Class" as shown in Table 2-3. "Category" expresses type of infrastructure contractors can work on, which consists of; A) Roads, airports and related structures, B) bridges, culverts and other structures, C) Labour-based roadwork, and S) Steel bridges and structures for construction, rehabilitation and maintenance. "Class" represents the maximum amount of contract contactors can undertake. Contractors with lower number in class (i.e. "Class 1") are eligible to bid for larger amount of contract and contractors with higher number are allowed to bid only for small amount of contract. The limit amounts vary by category as shown in Table 2-3.

For road construction with Labour-Based Surfacing Technology (LBST), category C could be the minimum requirement, however, experience of category-A works may also be required to complement expertise on bituminous surfacing in addition to LBT gravelling works.

The contractors with "Category C" are listed in "List of contractors in good standing as at 08 April 2016" and "List of contractors not in good standing as at 08 April 2016" on the website of the Ministry of Roads and Highways. The number of contractors with category C is 64 all over the country, all of which have both category A and B as well. Almost half (28 firms) of the contractors are located in the Greater Accra region followed by the Ashanti region the number of which is 11 companies. In the Eastern region where field trials for this project are planned, 5 companies run their business as LBT contractor.

Table 2-3: Classification Table for Road Constructors by Category and Class

	CATEGORY A	CATEGORY B	CATEGORY C	CATEGORY S
CLASS	ROADS AIRPORTS & RELATED STRUCTURES	BRIDGES, CULVERTS & OTHER STRUCTURES	LABOUR BASED ROADWORKS	STEEL BRIDGES AND STRUCTURES: CONSTRUCTION, REHABILITATION AND MAINTENANCE
4	Spot improvement and reshaping, 80km and regravelling. 20km a. Tender figure up to cedi equivalent of US$ 250,000 b. Total value of work on hand up to cedi equivalent of US$ 400,000	Pipe culverts up to 1.2m diameters and non-reinforced concrete structures, drains 0.5km a. Tender figure up to cedi equivalent of US$ 100,000 b. Total value of work on hand up to cedi equivalent of US$ 150,000	ROAD CONSTRUCTION MAINTENANCE AND SPOT IMPROVEMENT USING LABOUR BASED METHODS AS TRAINED BY THE DEPARTMENT OF FEEDER ROADS	This Class not applicable
3	Work in Class 4 plus resealing up to 20km and resurfacing up to 10 km a. Tender figure up to	Work in Class 4 plus single box culverts and other minor reinforced concrete structures including short retaining walls.		Sand blasting, cleaning, jacking, changing of members and parts, tightening of bolts and nuts, other repairs including painting.

	CATEGORY A	CATEGORY B	CATEGORY C	CATEGORY S
CLASS	ROADS AIRPORTS & RELATED STRUCTURES	BRIDGES, CULVERTS & OTHER STRUCTURES	LABOUR BASED ROADWORKS	STEEL BRIDGES AND STRUCTURES: CONSTRUCTION, REHABILITATION AND MAINTENANCE
	cedi equivalent of US$ 650,000 b. Total value of work on hand up to cedi equivalent of US$ 1,000,000	a. Tender figure up to cedi equivalent of US$ 250,000 b. Total value of work on hand up to cedi equivalent of US$ 400,000		a. Tender figure up to cedi equivalent of US$ 250,000 b. Total value of work on hand up to cedi equivalent of US$ 400,000
2	Work in Class 3 ;plus improvements, rehabilitation and minor construction works a. Tender figure up to cedi equivalent of US$ 1,250,000 b. Total value of work on hand up to cedi equivalent of US$ 2,000,000	Work in Class 3 plus major box culverts or bridges and, reinforced concrete, steel or composite reinforced structures a. Tender figure up to cedi equivalent of US$ 500,000 b. Total value of work on hand up to cedi equivalent of US$ 750,000		Work in Class 3 plus minor Construction a. Tender figure up to cedi equivalent of US$ 500,000 b. Total value of work on hand up to cedi equivalent of US$ 750,000
1	Work in Class 2 plus major construction of roads and airports. No limit on tender	Work in Class 2 plus bridges and other major structures No limit on tender		Work in Class 2 plus major construction No limit on tender

Source: Guidelines for Classification of Contractors for Road and Bridge Works (2004) Ministry of Roads and Transport

(4) Field Trial for Otta Seal

Whilst LBT has been applied for gravel-surfaced roads in Ghana, DFR has tackled to develop bituminous surfacing technology by LBT prior to this project in order to increase the proportion of paved roads as well as to reduce life cycle costs for feeder roads. As a prospective alternative for surfacing technology, DFR has conducted a field trial for application of otta seal in collaboration with Professor Ampadu of Kwame Nkrumah University of Science and Technology (KNUST). This section describes the outline of field trial for otta seal.

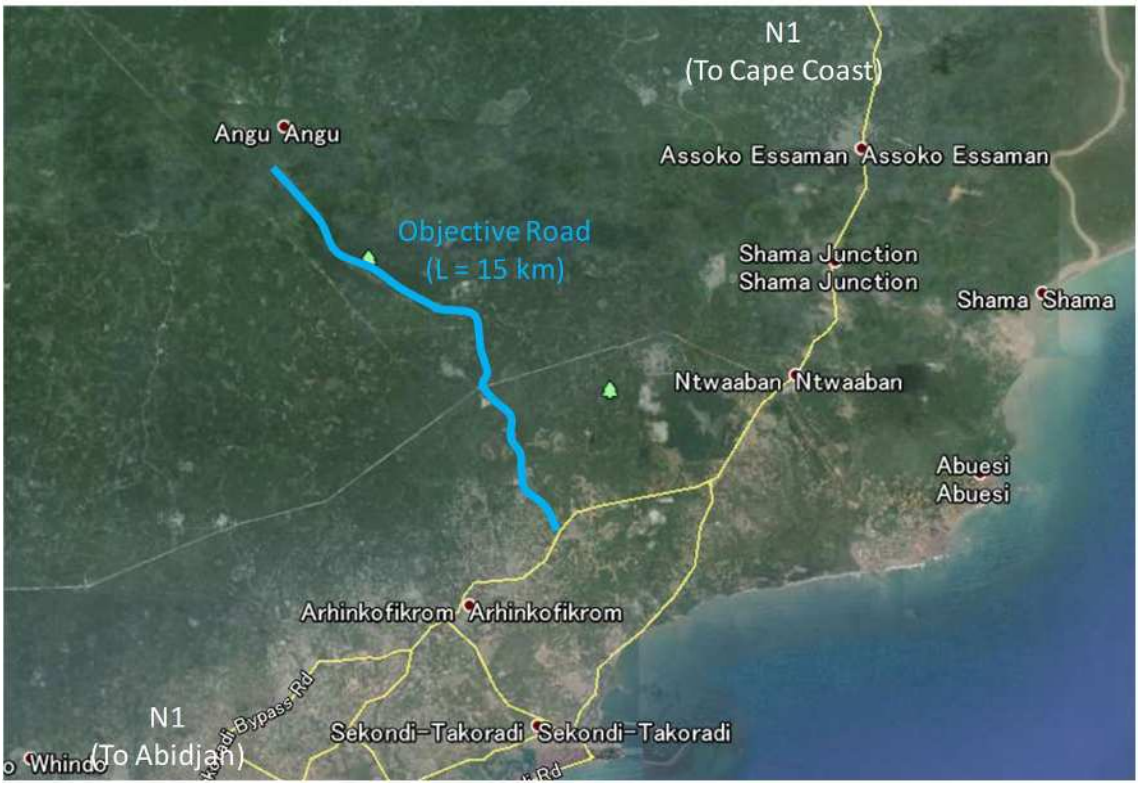
a) Objectives

"The objective of the investigation is to compare the performance and cost of otta seal with that

of conventional chip seal.[5]"

b) Location

The field trial was conducted on a feeder road connecting to coastal trunk road (N1) near Sekondi-Takoradi in the Western Region. As shown in Figure 2-7, the objective road continues to direction of inland, the length of which is approximately 15 km in total.



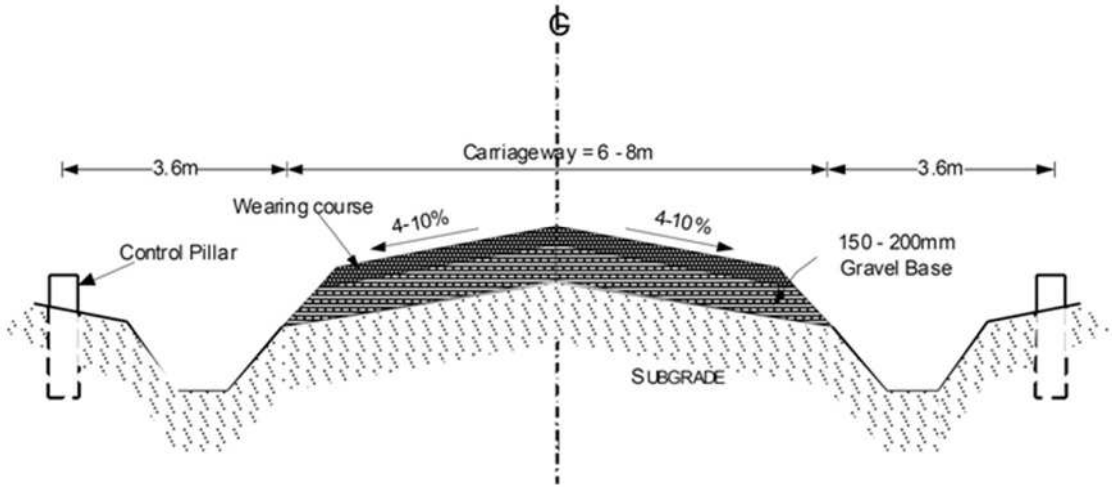
Source: JICA Project Team powered by Google Earth

Figure 2-7: Location of the Objective Road

c) Structure and Surfacing Type

Typical pavement structure for the field trial is shown in Figure 2-8. The objective road is a 2-lane road with carriageway of 6 – 8 m and the gradient of camber is generally 4 – 10 %. The pavement consists of 2 layers – base course of 150 – 200 mm with gravel on sub-grade and wearing course.

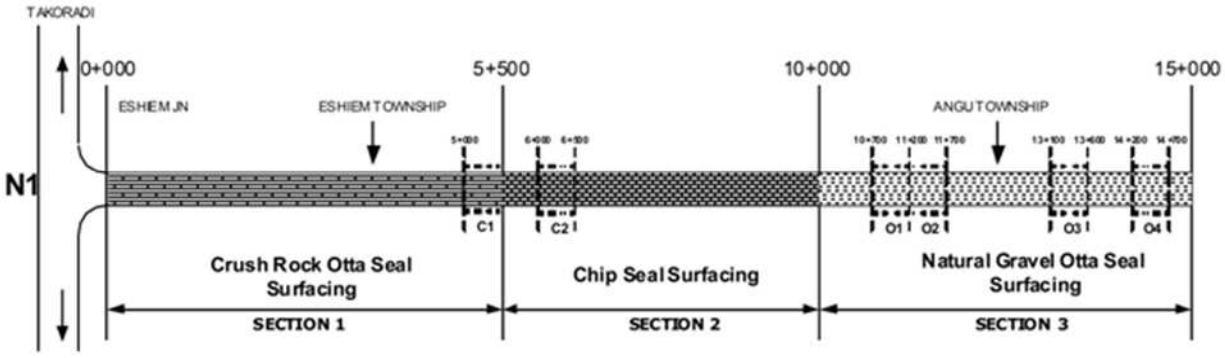
[5] Investigation into a Potentially Labour-Intensive Alternative Surfacing Technology for Feeder Roads in Ghana (2011) Ampadu et al.



Source: Ampadu et al. (2011)

Figure 2-8: Typical Cross Section for the Field Trial

As shown in Figure 2-9, the objective road of 15 km was divided into 3 sections with different surfacing – crush rock otta seal surfacing for section 1, chip seal surfacing for section 2, and natural gravel otta seal surfacing for section 3. Within respective sections, one or more subsections are selected as denoted in C1~2 and O1~4 in the figure for detailed investigation. The specifications for each subsection are shown in Table 2-4. In order to determine adequate spray rate of asphalt and proportion of fine in gravel for natural gravel otta seal, different rates were applied for comparison.



Source: Ampadu et al. (2011)

Figure 2-9: Pavement Type applied in the Field Trial

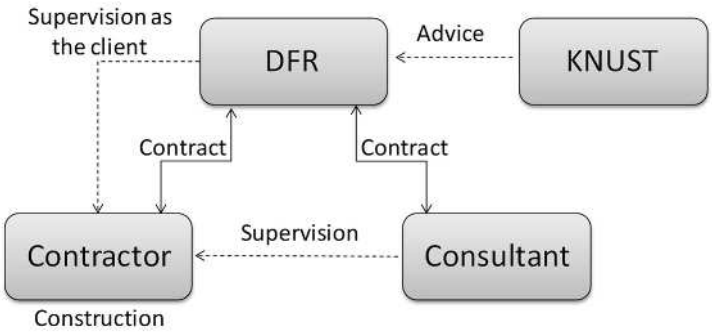
Table 2-4: Specifications for Subsections

Section	CH	Surface Type	Subsection		Variable	
					Spray Rate (L/m^2)	Aggregate Grading
Section 1	0+000 – 5+500	Crush Rock Otta Seal (AC-10)	C1 (5+000 – 5+500)		2.57	-
Section 2	5+500 – 10+000	Chip Seal (Emulsion)	C2 (6+000 – 6+500)		1.7 for primer seal, 1.5 for final seal	14 mm for primer seal, 10 mm for final seal
Section 3	10+000 – 15+000	Natural Gravel Otta Seal (AC-10)	O1 (10+700 – 11+200)	Block 1	1.97	Gravel + 11.53% fines
				Block 2	2.36	
				Block 3	1.8	
			O2 (11+200 – 11+700)	Block 1	2.1	Gravel + 14.76% fines
				Block 2	2.18	
				Block 3	1.94	
			O3 (13+100 – 13+600)	Block 1	2.1	Gravel + 11.1% fine
				Block 2	2.21	
				Block 3	2.48	
			O4 (14+200 – 14+700)	Block 1	2.1	Gravel + 20.41% fines
				Block 2	2.21	
				Block 3	2.48	

Source: Ampadu et al. (2011)

d) Implementation Method and Structure

Figure 2-10 presents the implementation structure of otta seal trial. DFR had a tender process to procure a contractor for constructing the bituminous surfacing road and a consultant for supervising the contractor. DFR also supervised the work as the implementation agency for the project. As the project required academic points of view, Professor Ampadu from Kwame Nkrumah University of Science and Technology (KNUST) participated in the project to provide advices.



Source: JICA Project Team based on the interview with the Regional Manager of DFR

Figure 2-10: Implementation Structure for Otta Seal Trial

The work procedures for both chip seal and otta seal, and workforces required for construction are shown in Table 2-5. The work procedures consist of three phases – aggregate preparation, construction and post-construction and each task are described in the table. The required equipment and the number of labours for respective surfacing are shown in right columns. Note

that the proportion of labour seems not necessarily high and adequate equipment were utilised for implementing the tasks in the trial. Some equipment might be replaced with more labour-intensive one to carry out the forthcoming field trials in this JICA project in the result of discussion among the stakeholders.

Table 2-5: Implementation Method and Resource Requirement by Contractor

CHIP SEAL Major Material: Bituminous Emulsion, Chippings				NATURAL GRAVEL OTTA SEAL Major Material: AC-10 Bitumen, Natural Gravel			
Tasks	Equipment	Labour		Tasks	Equipment	Labour	
		Type	No.			Type	No.
Aggregate Preparation							
Purchase chippings, haul to project site	Trucks	-	-	Natural Gravel is obtained from borrow pit	Excavator, Trucks	-	-
Pre-coating of chippings with dieselbitumen mixture	Payloader	Supervisor	1	Spreading, hand piking of debris, screening to reduce fines content	Screening machine	Supervisor	1
		Operator	1			Operator	1
		Labour	3			Labour	6
Stockpiling	Payloader	Operator	1	Stockpiling and covering to prevent wetting by rain	Payloader, Tarpaulins	Operator	1
						Labour	3
Construction							
Preparation to base level	-	-	-	Preparation to base level	-	-	-
Sweeping	Brooms	Supervisor	1	Sweeping	Brooms	Supervisor	1
		Labour	7			Labour	7
Watering	Water bowser	Operator	1	Watering	Water bowser	Operator	1
		Assistant	1			Assistant	1
Priming using bitumen emulsion	Bitumen Distributor	Operator	1	-	-	-	-
		Assistant	1				
Primer sealing	Truck-mounted Chip spreader	Operator	1	-	-	-	-
		Assistant	1				
Spray bitumen emulsion	Bitumen Distributor	Operator	1	Spray AC-10 bitumen	Bitumen Distributor	Operator	1
		Assistant	1			Assistant	1
		Labour	1			Labour	1
Spreading of aggregates	Truck-mounted Chip spreader	Operator	1	Spreading of aggregates	Truck-mounted Chip spreader	Operator	1
		Assistant	1			Assistant	1
		Labour	1			Labour	1
Compaction	Steel roller, Pneumatic roller	Operator	2	Compaction	Steel roller, Pneumatic roller	Operator	2
Sweeping aggregates	Brooms	Labour	4	Sweeping aggregates	Brooms	Labour	6
Post-construction							
-	-	-	-	Compaction	Pneumatic roller	Operator	1
-	-	-	-	Sweeping	Brooms	Labour	6

Source: Ampadu et al. (2011)

e) Present Condition of Surfacing

DFR and JICA Project Team visited the field trial site to observe the current condition of surfacing in May 2016, almost 5 years elapsed after the completion of construction. The photographs taken in the site visit are shown in Figure 2-11.

Crush Road Otta Seal (Sec 1)

Chip Seal (Sec 2)

Natural Gravel Otta (Sec 3)

Source: JICA Project Team

Figure 2-11: The Present Condition of Road Surface at 5 years after implementation

f) Lessons Learnt for the Project

Through the interviews with DFR officials and literature review, the lessons learnt from the field trial for otta seal were extracted as follows;

- All the types of sealing seem to have adequate durability in consideration of the average service life of 7 ~ 10 years[6]. The section with natural gravel otta seal was more deteriorated compared to the other surfacing in spite of lower traffic volume estimated.
- It was concluded that around 11 ~ 15% of fine particles is appropriate for natural gravel otta seal in terms of workmanship and durability.
- Preparation of aggregate for natural gravel otta seal required more workforces due to the necessity of adjustment of fine particles. This could be an obstacle for disseminating natural gravel otta seal as an alternative surfacing method.
- Adequate aggregates for natural gravel otta seal are reportedly available in the Northern parts of Ghana rather than the Southern parts. Application of otta seal in the North areas might be effective.
- There is possibility to increase the proportion of labour from the combination of workforce in the otta seal trial (i.e. from bitumen distributor to handy-sized bitumen sprayer). Further investigation for labour ratio is required.
- From the viewpoint of safety, it was found that hot bitumen (i.e. AC-10) posed a certain extent of risk for unskilled labour working for bitumen spreading and previous/latter work processes.
- The implementation structure for the otta seal trial may be applicable for JICA project. However, modification may be required in consideration of equipment to be utilised

[6] The Otta Seal Surfacing (2012) C. Overby, M.I. Pinard

Chapter 3 Standards and Manuals

This chapter reveals standards and manuals related to labour-based surfacing technology in Ghana and other countries.

3-1 Standards and Manuals used in Ghana

Standards and manuals in Ghana are listed in Table 3-1. The Handbook for Road Prioritisation Methodology (RPM) is the method mentioned in the objectives of DFR (refer to Chapter 2-1) and is utilised for prioritising roads to be maintained or rehabilitated on early planning stage. Following the selection of roads, road design is carried out by referring A2 ~ A5 in the list. In particular, the Standard Specification for Road and Bridge Works (2007) is the basic document to be referred in road design in Ghana. Chapter 16 and 17 describe bituminous surface treatment and bituminous asphalt including cold-mix.

Table 3-1: List of Standards and Manuals used in Ghana

A	Road Planning and Design
A1	Handbook for Road Prioritisation Methodology (RPM) (2005) DFR
A2	Standard Specification for Road and Bridge Works (2007) Ministry of Transportation
A3	Road Design Guide (1991) Ghana Highway Authority (GHA)
A4	Pavement Design Guide (1991) GHA
A5	Bitumen Surface Treatment Work Instruction Manual (2000) GHA
B	Material Testing
B1	GHA S1 ~ 9
B2	British Standards (BS, U.K.)
B3	ASTM Standards, AASHTO (U.S.)

Source: JICA Project Team

3-2 Relevant Standards and Manuals in Other Countries

From the technical points of view, the project contains the two aspects – bituminous surfacing for roads with low traffic volume and Labour-Based Technology. These technologies have been studied all over the world and a number of materials to be referred are available. The list of

relevant standards and manuals are shown in Table 3-2.

Table 3-2: List of Standards and Manuals in Other Countries

Country	Title
South Africa	Construction of low volume sealed roads – Good practice guide to labour-based methods (2013) ILO
	Labour enhanced construction for bituminous surfacing (1993) Southern African Bitumen Association (SABITA)
	CIDB practical manual /Manual-4 Bituminous Pavement Seals(2007)CIDB
	Local resource-based approaches for infrastructure investment (2010) ILO
Mozambique	Updating of manuals of work norms and specifications for low volume rural roads in Mozambique (2013) AFCAP
Botswana	Alternative Surfacing Technologies for Low-Volume Sealed Roads (LVSR) + Case Studies, Charles Overby
	The design, construction and maintenance of Otta seals /guideline No.1 (1999) Roads Department /RoB
	The use of silcrete and other marginal materials for road surfacing (2002) Roads Department /RoB
	Citizen contractor development and choice of technology, Roads Department /RoB
	The Otta Seal Surfacing –A practical and economic alternative to traditional bituminous surface treatment (2012) Roads Department /RoB
Tanzania	Manual for the provision of Low volume roads (2015) Ministry of Works
	Presentation material –The development of demonstration site on various technologies in road construction /rehabilitation (2015) PMO-RALG
Kenya	Low cost bitumen standard roads in Kenya (2010) Ministry of Roads
Ethiopia	Bituminous Sealing of low volume roads using labour based methods /Training manual (2013) ILO /Ethiopian Roads Authority (ERA)
	Design manual for low volume road (2011) ERA
	Review of surface dressing practice in Ethiopia (2009) ERA/AFCAP
DFID	Appropriate and efficient maintenance of low cost rural roads-Report II Assessment of maintenance manuals (2000) DFID
	Manual for the labour based construction of bituminous surfacing on low-volume roads (2003) DFID/TRL
	A guide to surface dressing in tropical and sub-tropical countries /ORN-3 (2000) DFID/TRL
	A guide to the pavement evaluation and maintenance of bitumen-surface roads in tropical and sub-tropical countries /ORN-18 (2000) DFID/TRL
	A guide to the structural design of bitumen-surfaced roads in tropical and sub-tropical counties /ORN-31 (2000) DFID/TRL
AFCAP	Alternative surfacing for low volume rural roads (2010) AFCAP
SATCC	Guideline low-volume sealed roads, SATCC
World Bank	Expanding labour-based methods for road works in Africa (1996) WB

Source: JICA Project Team

Chapter 4 Materials

Availability of materials is one of the key factors to determine type of surfacing, specifications and method of construction. This chapter reveals general situations on key materials for bituminous surfacing namely bituminous emulsion, chipping aggregate, and gravel.

4-1 Bituminous Emulsion

(1) Type of Bituminous Materials

Bituminous material is indispensable to construct bituminous paved road, which is the most prevalent pavement method in most countries. Bituminous materials used for road works are mainly categorised into 3 types such as i) asphalt for hot mix, ii) cutback bitumen, and iii) bituminous emulsion. The characteristics of respective materials are shown in Table 4-1. Requirements and properties for the respective materials are given in the Standard Specification for Road & Bridge Work (SSRBW) issued by Ministry of Transportation, Section 16, Bituminous Surface Treatment and Surface Dressing. For surface treatment, which is the objective pavement method in this project, cutback bitumen and bituminous emulsion are candidates as binder. However, the use of cutback bitumen for labour-based bituminous surfacing technology was rejected by the following reasons; i) negative effects in health of unskilled labours are expected because solvent (i.e. gasoline, kerosene) evaporates during solidification, and ii) heating the material may cause an accident by unskilled labours. Therefore, bituminous emulsion will be applied for the labour-based bituminous surfacing technology.

Table 4-1: Type of Major Bituminous Materials

Type	Components	General Heating Requirement[7]	Major Usage
Asphalt for hot mix	Asphalt[8]	Above 150 °C	Hot mix asphalt
Cutback bitumen	Asphalt, gasoline or kerosene or heavy oil	Above 100 °C	Cold mix asphalt, surface treatment, prime coat, tack coat
Bituminous emulsion	Asphalt, water and emulsifier	No heating[9]	Cold mix asphalt, surface treatment, prime coat, tack coat

Source: JICA Project Team based on "Bituminous Emulsion" by Japan Emulsified Asphalt Association, "Standard Specification for Road and Bridge Works in Ghana" by Ministry of Transportation, Wikipedia, etc.

[7] The required temperatures are based on the Standard Specification for Road and Bridge Works in Ghana. Actual temperature may be different by specific type of asphaltic material

[8] Asphalt consists of saturated hydrocarbon, naphthene aromatics, polar aromatics, and asphaltenes made of petroleum.

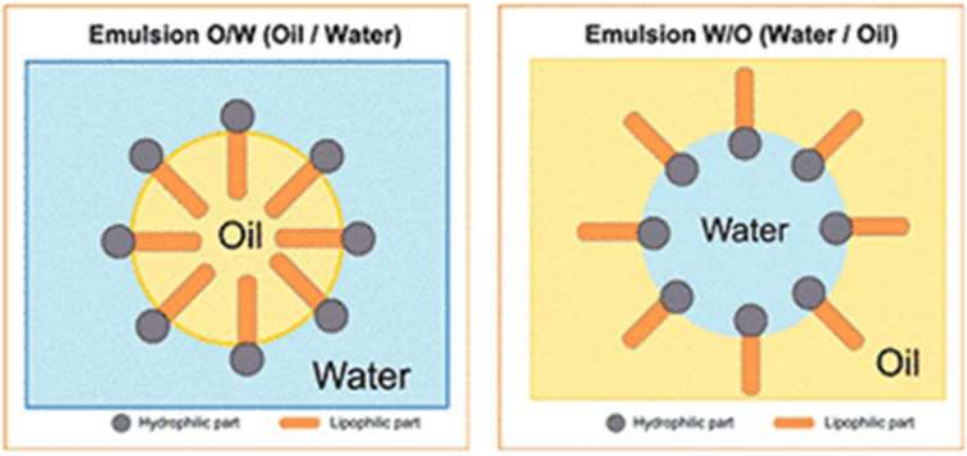
[9] Heating is required for some types of application

(2) Type of Bituminous Emulsion

Bituminous emulsions are categorised by 2 criteria – emulsifier and speed of setting. The differences are described in this section.

1) Emulsifier

As shown in Figure 4-1, emulsifier connects bitumen and water into emulsion by wrapping bitumen like mechanism of soap. By type of emulsifier, emulsions are categorised into 3 types, namely cationic, anionic, and nonionic emulsions. Cationic and anionic emulsions are used for surface treatment. Previously anionic emulsion was often applied due to the easiness of emulsification, however cationic emulsion recently becomes prevalent because of the faster solidification and better adhesion to aggregates.



Source: https://bakingmoleculargastronomy.wordpress.com/tag/emulsifier/

Figure 4-1: Mechanism of Emulsion

2) Speed of Setting

In addition to type of emulsifier, emulsions are classified by its setting/solidification speed. Types of emulsions by setting speed are shown in Table 4-2. Rapid setting emulsion contains high proportion of bitumen and is often sprayed for surface dressing. Medium setting emulsion is often applied to produce pre-mixed cold asphalt which is to be used within short term whilst slow setting emulsion is utilized for variety of purposes such as prime & tack coats, pre-mixed asphalt which is to be stockpiled for a while and binder for sand seal.

Table 4-2: Type of Emulsion by Setting Speed

Grade	Symbol	Bitumen Content	General Application
Rapid Setting	RS	High	Surface dressing
Medium Setting	MS	Medium	Pre-mixed (cold) asphalt
Slow Setting	SS	Low	Prime coat, Tack coat, Pre-mixed (cold) asphalt, Sand seal

Source: JICA Project Team based on Standard Specification for Road and Bridge Works in Ghana

(3) Availability in Ghana

Platinum Seal Ltd is a major supplier of bituminous products including bitumen emulsion, cutback and straight bitumen in Ghana. The company supplies almost 80% of bitumen emulsion used all over the country according to the interview. The company's refinery plant is located in Gomoa Akoti along National Road 1 (N1) between Kasoa and Winneba in the Central Region. All bitumen emulsions are produced in the plant and transported to various project sites.

Although a variety of emulsion products can be provided by the company, rapid-setting emulsions are commonly available as shown in Table 4-3 whilst medium and slow setting emulsion can produce by order 1 week prior to delivery.

Table 4-3: Examples of Available Products of Bitumen Emulsion

Product Code	Setting	Emulsifier	Bitumen Content (%)	Availability
K1-70	Rapid	Cationic	70	Stocked
K1-60	Rapid Setting	Cationic	60	Stocked
K1-40	Rapid Setting	Cationic	40	Stocked
K2-70	Medium	Cationic	70	By order
K3-70	Slow	Cationic	70	By order

Source: JICA Project Team based on interview with Platinum Seal Ltd.

The company provides delivery services of bituminous emulsion by 40-tonne tank lorry only, but not in form of drums. DFR and JICA Project Team may need to arrange transportation service provider for haulage of 200 litre drums supplied by Platinum Seal at their plant for the forthcoming field trial.

4-2 Chipping Aggregates

(1) General Situation

Availability of chipping aggregates near a construction site is important because contractors, in most cases, relay on local quarry to reduce transportation cost. The quality of aggregates is also

an important factor to construct good pavement. Medium to coarse aggregates are widely available from established quarries in each region. Fine aggregate for road works is sourced mainly from the Volta Region, therefore, use of sand in other regions may result in an additional transportation cost.

(2) Type of Chipping Aggregates

Chipping aggregates are categorised into 4 classes by abrasion defined in the Standard Specification for Road and Bridge Works (SSRBW) in Ghana. Chippings with low abrasion are required for road with high heavy traffic. In the project, feeder roads with low heavy traffic are expected to be selected for labour-based bituminous surfacing technology, therefore chipping class 4 will be the requirement. In addition, aggregates are classified by its size as shown in Table 4-5. In chip seal, 14, 10 and 7 mm are often applied and size of chipping aggregate should be determined in design stage.

Table 4-4: Characteristics of Aggregate for Chippings

Chipping Class	1	2	3	4
Heavy vehicles per day in one direction	300-700	150-300	25-150	0-25
LAA (%) max	25	27	30	35
SSS (%) max	12	12	12	12
FI max	25	25	25	25
10% Fines Min (dry) kN	210	210	210	210
Wet/Dry %	75	75	75	75
Stripping Test (ASTM D 4867) % max	5	5	5	5

Note: LAA-Los Angeles Abrasion, SSS-Sodium Sulfate Soundness, FI-Flakiness Index
Source: Standard Specification for Road and Bridge Works in Ghana

Table 4-5: Grading of Aggregate for Chipping

Sieve Size (mm)	Percentage by mass passing				
	Nominal Size (mm)				
	20	14	10	7	5
26.5	100				
19.0	85 - 100	100			
13.2	0 - 30	95 - 100	100		
9.5	0 - 5	0 - 20	85 - 100	100	
6.7		0 - 5	0 - 30	85 - 100	100
4.75		-	0 - 5	0 - 30	85 - 100
2.36		-	-	0 - 10	0 – 30
1.18		0 – 0.5	0 – 0.5	0 – 0.5	0 – 5

Source: Standard Specification for Road and Bridge Works in Ghana

(3) Availability in Ghana

Whilst the Volta and Eastern regions are one of the best locations which produce aggregates in good quality, the other regions also produce chipping aggregates to some extent. In general, chipping aggregates are available all over the country.

Transportation cost is a key factor for aggregate procurement. Source of aggregate near a project site is to be confirmed prior to implementation. In the meantime, method of transportation and its cost should be checked. Some quarries which possess tipper trucks can provide transportation services, but contractor shall ensure transportation equipment in case small-sized quarries are the best source of aggregate.

4-3 Gravel

(1) General Situation

The Standard Specification for Road and Bridge Works (SSRBW) in Ghana exemplifies types of gravel in Ghana such as lateritic gravel, quartzite gravel and calcareous gravel. In particular, lateritic gravel is one of the common materials for base and sub-base course as shown in Figure 4-2. Lateritic soil, which contains a lot of iron and aluminium with rusty-red colour, may not comply with the specification of base/sub-base course material, it has been examined in other countries that lateritic gravel performed equally well[10] as base course material.

Source: JICA Project Team

Figure 4-2: Example of Gravel Road in Ghana

[10] U.Mahalinga-lyer, D. J. Williams, Road construction using lateritic soil (1994) Engineering Geology

(2) Type of Gravel

In SSRBW, 4 types of natural gravel materials are defined as shown in Table 4-6. G80, which exceeds the CBR of 80%, is used for base course whilst G60 is applied for base course for low traffic roads. In this project, since LBST is expected to be introduced on road with low traffic volume, G60 shall be the minimum requirement for base course material.

According to examples of contract in Ghana, contractor usually has responsibility to procure gravel material for sub-base and base course. In most cases, contractor's responsibility includes negotiation with landowners for use of borrow pits, extraction, haulage, payment to landowners, and restoration of the borrow pit.

Table 4-6: Typical Use of Natural Gravel Materials

Class	Typical Use
G80	Base course
G60	Base course for low traffic roads
G40	Base course for sealed rural access roads, Sub-base course
G30	Sub-base course

Source: Standard Specification for Road and Bridge Works in Ghana

Table 4-7: Requirements for Natural Gravel Materials for Base and Sub-base

Class	G80	G60	G40	G30
CBR (%)	80	60	40	30
CBR Swell (%)	0.25	0.5	0.5	1.0
Grading				
% Passing Sieve Size (mm)				
75	100	100		
37.5	80 - 100	80 - 100		
20	60 - 85	75 - 100		
10	45 - 70	45 - 90		
5.0	30 - 55	30 - 75		
2.0	20 - 45	20 - 50		
0.425	8 - 26	8 - 33		
0.075	5 -15	5 -22		
Grading Modulus (min)	2.15	1.95	1.5	1.25
Maximum size (mm)	53.0	63.0	75.0	2/3rd layer thickness
Atterberg Limits				
Liquid Limit (%) (max)	25	30	30	35
Plasticity Index (%) (max)	10	12	14	16
Linear Shrinkage (%) (max)	5	6	7	8
Plasticity modulus (max)	200	250	250	250
Other properties				
10%Fines (kN) (min)	80	50	-	-
Ratio dry/soaked 101-Fines (min)	0.6	0.6		

Source: Standard Specification for Road and Bridge Works in Ghana

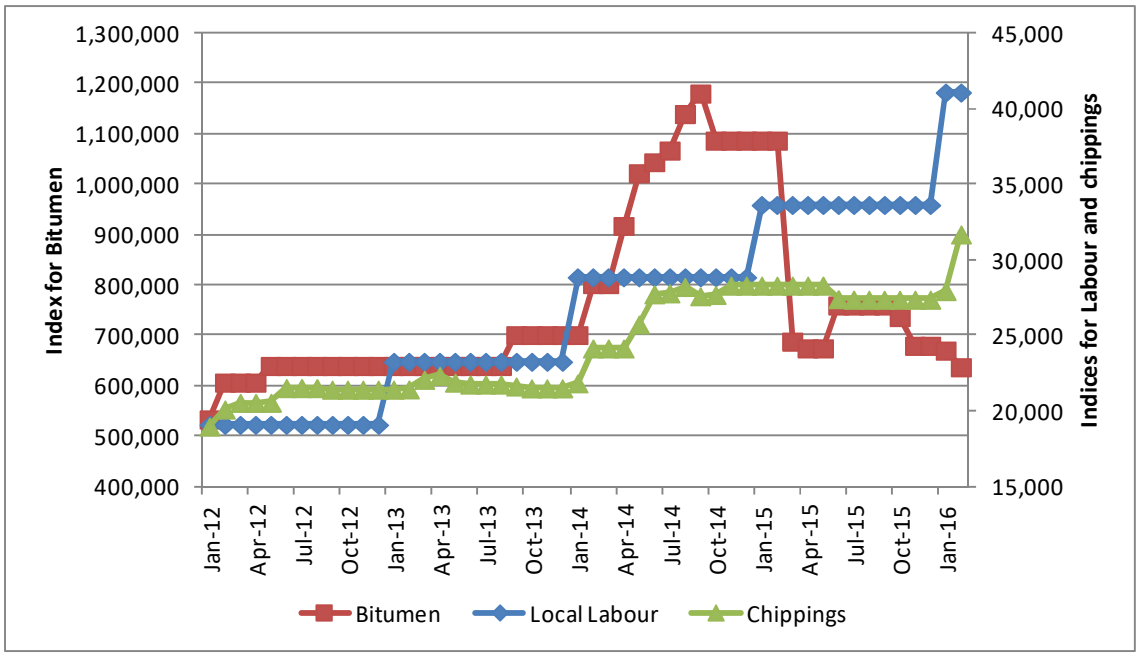
(3) Availability in Ghana

In general, natural gravel materials are available all over the country. Nearby gravel borrow pits are to be found through interview with local engineers and residents, and the materials shall be tested to confirm the quality.

4-4 Price Fluctuation

Price of materials often fluctuates and construction cost should be estimated reflecting the latest market prices. In order to estimate costs with the latest prices, the Ministry of Roads and Highways issues monthly cost indices. As key cost indicators for LBST, price fluctuation of bitumen and chippings in line with local labour cost are shown in Figure 4-3.

Since bitumen is usually imported in Ghana, the prices seem to be influenced by international oil price. The price doubled from 2012 to 2014, but the price sharply plunged and came back to similar price range since 2015. The price of chipping steadily increased 1.5 times in the past 4 years. Local labour cost also increased almost twice during the 4 years, increasing the price by 20% every year.



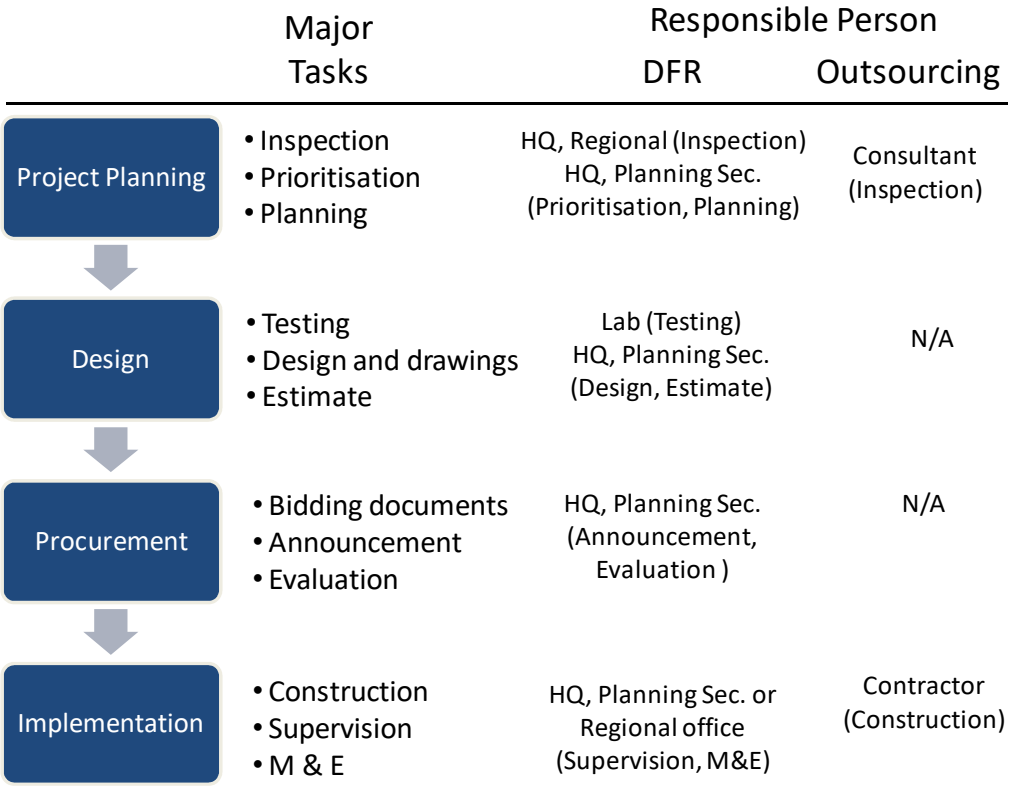
Source: JICA Project Team based on Monthly Cost Indices in February 2016 by MRH

Figure 4-3: Price Fluctuation of Materials and Labour in the Past 4 Years

Chapter 5 Project Implementation Procedure

5-1 Outline of Project Implementation Procedure

In order to complete a road work, a number of processes and input of human resources are required. Figure 5-1 illustrates a typical procedure for project implementation from planning stage. Responsible persons in DFR and outsourcing for each work are also shown in the figure. The details of respective work processes are described in the following sections.



Source: JICA Project Team based on interview with DFR staff

Figure 5-1: Outline of Project Implementation Procedure

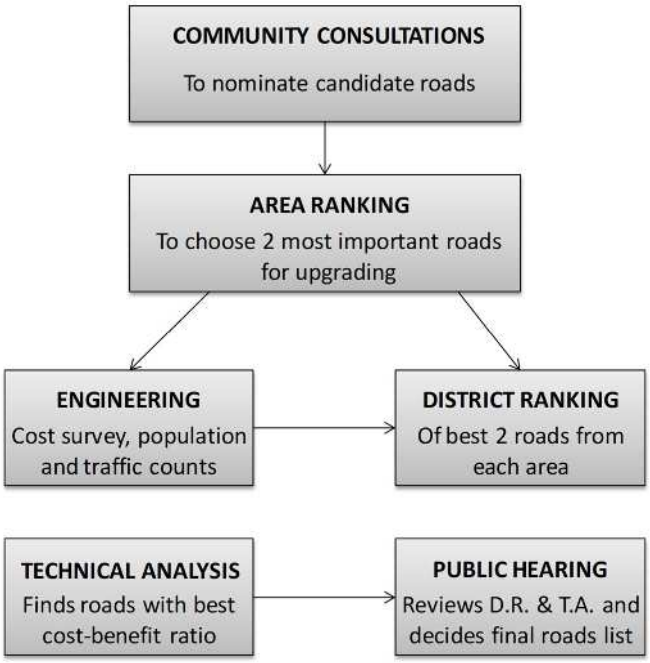
5-2 Planning and Maintenance Management Systems

As DFR manages approximately 3 times longer road network compared to Ghana Highway Authority (GHA), maintenance and project planning are one of the most important and difficult works to make the most use of budget allocated. The three tools have been introduced in DFR for maintenance planning as follows;

- Road Prioritisation Methodology (RPM)
- Database and Geographical Information System (GIS)
- Maintenance Performance Budgeting System (MPBS)

(1) Road Prioritisation Methodology (RPM)

The Handbook for Road Prioritisation Methodology (RPM) was issued in 2005 with the support from the Department for International Development (DFID) in the U.K. RPM is a bottom-up approach to select the roads to be maintained/upgraded via involvement of local communities. Firstly, community consultations are held to explain how to nominate candidate roads to be maintained, followed by area ranking procedure in which two most important roads for upgrading are selected from the nominated roads in each area. All the selected roads are investigated from the engineering point of views and are accumulated at district level to rank the all select roads. Prior to finalise the maintenance road list, public hearing is held and the result of technical analysis is presented in the workshop.

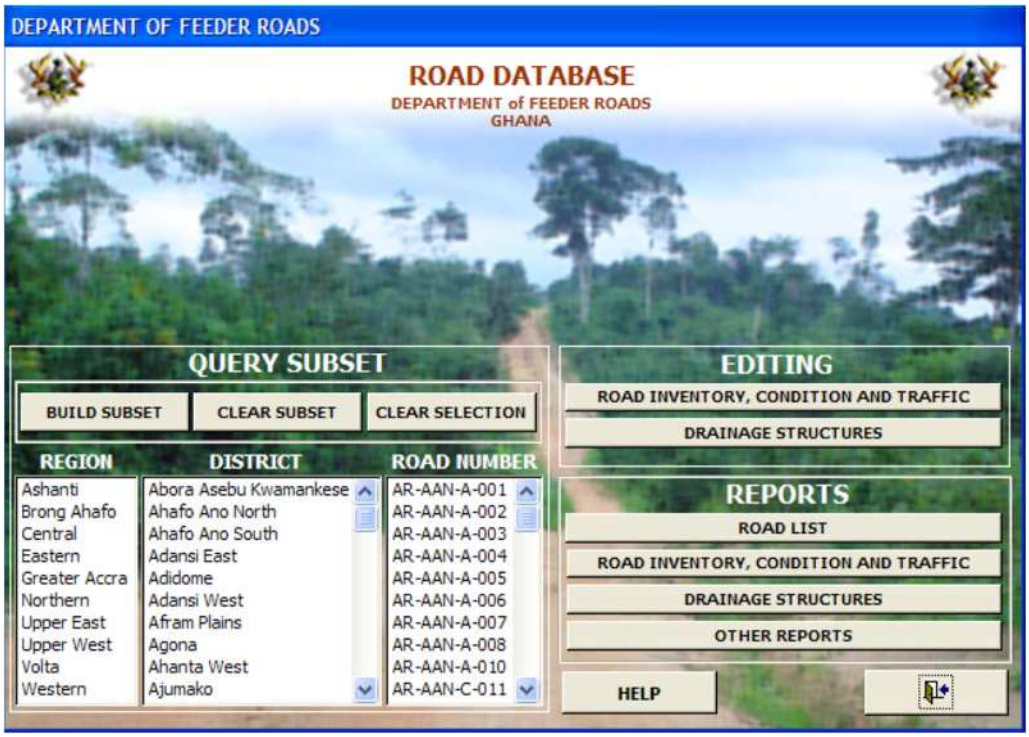


Source: The Handbook for Road Prioritisation Methodology (RPM) (2005)

Figure 5-2: The RPM Process

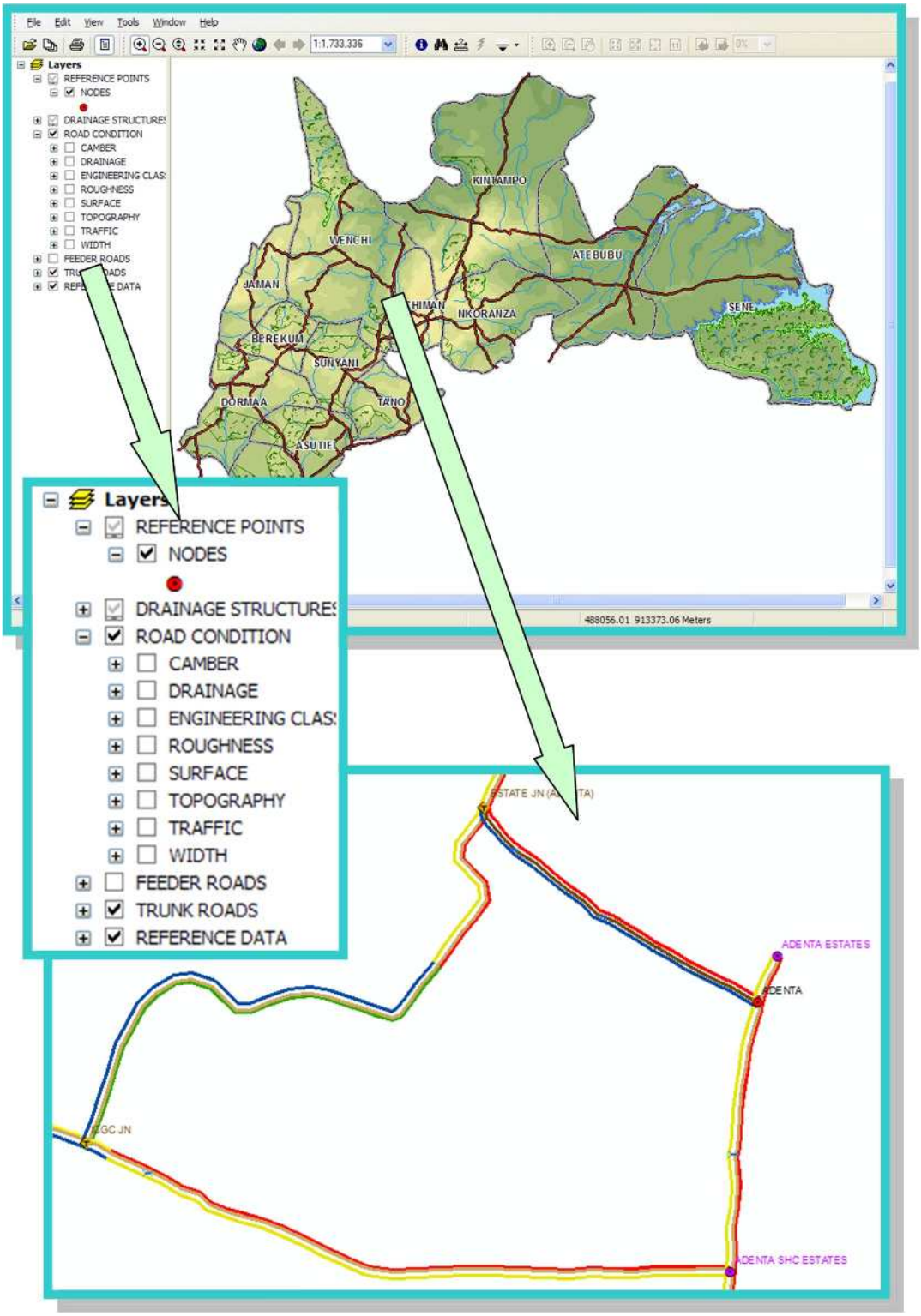
(2) Database and Geographical Information System (GIS)

The first step for road management is to prepare an inventory for all the roads managed and to grasp the surface condition regularly. In order to manage more than 40,000 km of feeder roads, DFR has introduced a road database system supported by the Department for International Development (DFID) in the U.K. The interface of database is shown in Figure 5-3.



Source: Road Database User Manual, DFID

Figure 5-3: User Interface of DFR Road Database



Source: Road Database User Manual, DFID

Figure 5-4: Example of Visualisation using GIS

As shown in Figure 5-3, the database was customised for the use by DFR and specific names (i.e. region, district) can be utilised to query the database. The database mainly deals with three types

of data – road inventory, road condition/traffic, and drainage. Road inventory is "invariable data" over time such as road width, surface type, engineering class and topography whilst road condition and traffic change with the lapse of time. In addition, data for drainage, the condition of which largely influences road deterioration, are also stored in the database.

The data can be visualised using Geographical Information System (GIS). Numerical and text data described above are connected to map data. It enables to illustrate the status of an attribute (i.e. road condition) on map as shown in Figure 5-4. Roads are divided into approximately 1 km and every data are stored in the records with 1 km length.

(3) Maintenance Performance Budgeting System (MPBS)

The MPBS is a maintenance management tool developed in 1994. The MPBS simulates work programme and financial requirement to keep the service level of roads specified in advance. It provides theoretical indication for maintenance programme and assists DFR officials to prepare a road maintenance plan.

(4) Road Inspection

Although International Roughness Index (IRI) is often used as an indicator for road condition over the world, it requires special equipment for measurement. It makes it difficult for road authorities managing feeder/rural roads to apply IRI as an indicator for road condition.

As an adequate alternative method, DFR applies average speed to pass the road sections with unpaved surface as shown in Table 5-1. This method follows the concept of IRI which expresses comfortability during driving and seems decent indicator for feeder road since the method requires no special equipment and enables to measure relatively in short time to cover large amount of feeder roads.

In principal, road inspection is conducted by DFR regional offices until data processing. The processed data are sent to DFR HQ and all the data are accumulated into the database in the HQ.

Table 5-1: Criteria for Condition of Unpaved Road

Road Condition	Average Speed
Good	More than 60 km/h
Fair	40 ~ 60 km/h
Poor	Less than 40 km/h

Source: DFR

5-3 Design

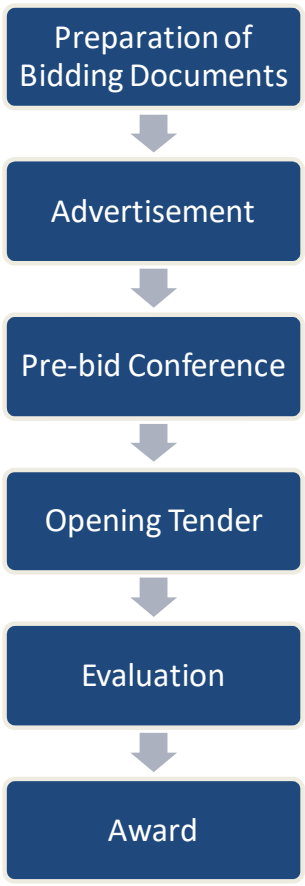
In general, road design is performed by DFR HQ or regional office. Through field visit and topographic survey, the current conditions are inspected such as traffic condition, land use, prospective sources of materials and field & laboratory testing where necessary.

Based on data and information collected above, drawings are prepared which includes profile, cross sections of every 25 m, structure of drainage and other ancillary works if applicable. Construction schedule is also prepared in line diagram based on the drawings. All the activities and materials are computed by Quantity Surveyor (QS) and compiled in the form of bill of quantities.

5-4 Procurement

In DFR projects, most of the construction works are implemented by registered contractors. Using a contractor requires procurement process prior to the implementation. Figure 5-5 presents the standard procedure for procurement of contractor.

Firstly, tender documents are to be prepared. DFR has set up a standard form of tender document and the form can be applied for LBT project as well. The documents consist of eight sections as shown in Table 5-2 and results of design such as drawings and bill of quantities are compiled. After completion of tendering documents, a tender is advertised to public (generally national bidding) via news paper or other measures followed by pre-bid conference to clarify enquiries from prospective tenderers. Following the receipt of biddings from tenderers, the documents are evaluated in Quality and Cost Based Selection (QCBS). The contract is awarded toward a tenderer with the highest score.



Source: DFR

Figure 5-5: Standard Procedure for Procurement of Contractor

Table 5-2: Content of Tender Document

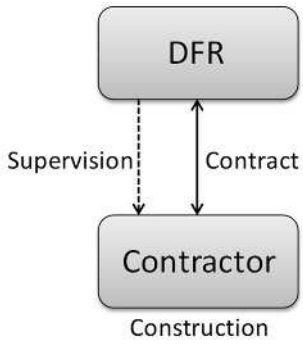
Section I	Instruction to Tenderers
Section II	Forms of Tender, Qualification Information, Letter of Acceptance, and Agreement
Section III	Conditions of Contract
Section IV	Contract Data
Section V	Specifications
Section VI	Drawings
Section VII	Bill of Quantities
Section VIII	Security Forms

Source: Sample Form of Tender Documents, DFR

5-5 Work Implementation

(1) Implementation Structure

The implementation structure for LBT project in DFR is simple – A contract is signed between DFR and a contractor, and the contractor is responsible for construction and DFR is for its supervision. Since a number of contractors certified for LBT works are running their business in Ghana, competitiveness for bidding is ensured and the implementation structure has gone well.



Source: JICA Project Team based on the interview with a DFR Official

Figure 5-6: Implementation Structure for LBT works

(2) Quality Control

The Standard Specifications for Road and Bridge Works (2007) determines quality control methods and their tolerances. For material testing, Ghanaian Standards are applied along with standards in the United States (AASHTO, ASTM) and standards in the United Kingdom (BS). For tolerances, the Standard Specifications for Road and Bridge Works (2007) specifies the most items. For instance, the rate of application of binder (emulsion) for surfacing dressing shall be within +/- 5% of the target rate.

(3) Safety

The Standard Specifications for Road and Bridge Works (2007) specifies that *"The Contractor shall ensure, so far as is reasonably practicable, the occupational health, safety and welfare at work of his employees as required by the Labour Act, including those of his sub-contractors and of all other persons on the Site."* Especially, in the projects which require use of bitumen, it is clearly described that *"Workers handling concrete, bitumen, acids, or paints, or exposed to heavy dust or vibrating equipment (e.g., rollers) shall be provided additional equipment including gloves, goggles, masks, or ear protectors."* Therefore, more safety awareness is required for implementation of this project in comparison to LBT gravel surfacing projects.

(4) Environmental Consideration

In the Republic of Ghana, the Environmental Protection Agency (EPA) has been established based

on the Environmental Protection Agency Act (Act 490) in 1994 and the Act empowers the EPA to ensure environmental protection. The Ministry of Roads and Highways (previously the Ministry of Transportation) issued "Environmental and Social Management Framework (ESMF) for the Transport Sector Development Program (Road sector) in 2007 and it describes the policy for environmental protection in the road sector.

In terms of CO2 emission, which is one of the greenhouse gases contributing global warming, bituminous surfacing technology with bitumen at ordinary temperatures is considered as environment-friendly technology due to its low emission. For instance, Keches et. al (2007) compared the emissions from Hot Mix Asphalt (HMA) and Warm Mix Asphalt (WMA), and it was revealed that the carbon dioxide emissions were reduced by 43.9% by applying WMA. It is expected that application of surfacing technology with bitumen at ordinary temperatures results in more reduction of greenhouse gases.

Chapter 6 Discussions for Project Implementation

Through fact-finding surveys including interviews with relevant officials and bibliographic survey, the following discussion points were extracted;

1. Relevance to National Policies
2. Necessity of Bituminous Surfacing
3. Type of Surface Treatment for LBT
4. Prospect of Technology Dissemination
5. Technical Challenges

6-1 Relevance to National Policies

As described in Chapter 2-5, GoG has promoted LBT since 1990's and LBT projects are executed throughout the country. Koforidua Training Centre (KTC) is also active so that technology is expected to be disseminated after establishment. In addition, GoG has already started to investigate a possibility of use of labour-based bituminous surfacing in the Western region by applying otta seal due to demand of increase in paved road ratio.

Thus, it is confirmed that this project is in line with the national policies of the government of Ghana.

6-2 Necessity of Bituminous Surfacing

Necessity of bituminous surfacing by LBT is summarised as follows;

- Pavement with hot-mixed asphalt concrete is not inexpensive to cover large amount of unpaved roads for upgrading to bituminous surface to ensure access in all weather
- Unpaved roads (gravel and earth surface) are vulnerable for rainfall and are deteriorated in a short term by rain water washing out its road surface
- The proportion of paved surface in feeder roads is only 4% and the remaining 96% of feeder roads are vulnerable for rainfall, which results in frequent maintenances
- Adequate surfacing technology is expected to reduce life cycle cost of roads with low/medium traffic and enables to make the most use of the limited budget of DFR
- Employment generation by LBT is required all over the country and LBT gravel surfacing projects are still active

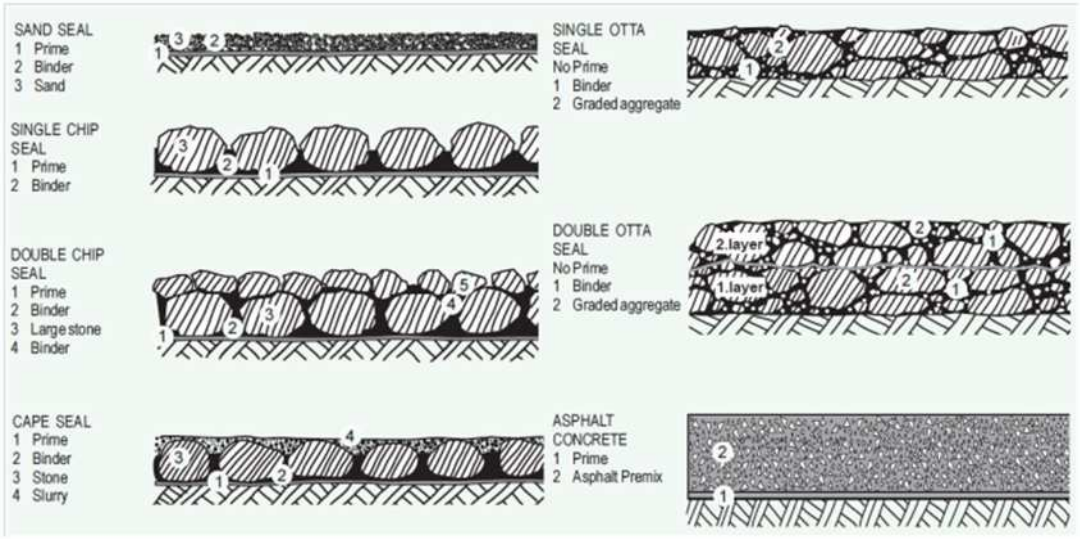
6-3 Type of Surface Treatment for LBT

Various types of bituminous surfacing have been developed over the world as shown in Figure 6-1 and Table 6-1. Possible types of bituminous surfacing will be applied to the field trials conducted in this project to confirm their suitability for the environment of Ghana.

As described in Chapter 2-5 (4) f) Lessons learnt from the previous otta seal trial, the risk of hot bitumen was recognised because hot bitumen requires high safety standard and a plenty of unskilled labours are expected to engage in its implementation. Therefore, application of bituminous surfacing other than otta seal has been pursued. From the viewpoint of aggregate availability, chipping is easily available in most areas. Thus, chip seal can be the first option for the field trial because main materials are available as well as it is a common method in the country.

Meanwhile, cold-mixed asphalt could be an alternative method because; i) Bitumen at ordinary temperatures is applicable, ii) longer durability is expected under the condition of proper construction, iii) cold-mix asphalt is also a common surfacing method in Ghana.

Therefore, it is recommended that chip seal and cold-mixed asphalt be examined through the field trials in this project.



Source: A Guide to the Use of Otta Seals (1999) Norwegian Public Roads Administration

Figure 6-1: Schematic Illustration of Various Types of Bituminous Surfacing

Table 6-1: Typical Service Life of Surface Treatment

Type of Surfacing	Service Life
Single Sand Seal	2 – 4 years
Slurry Seal	2 – 6 years
Single Chip Seal	4 – 6 years
Double Sand Seal	6 – 9 years
Double Chip Seal	7 – 10 years
Single Otta Seal + Sand Seal	8 – 12 years
Cape Seal (13mm + Single Slurry)	8 – 10 years
Cape Seal (19mm + Double Slurry)	10 – 14 years
Double Otta Seal	12 – 16 years

Source: The Otta Seal Surfacing (2012) C. Overby, M.I. Pinard

Table 6-2: Major Material Required

Type of Surfacing	Bitumen	Aggregate
Sand Seal	Emulsion	Sand/Crusher dust
Slurry Seal	Emulsion	Sand/Crusher dust
Chip Seal	Emulsion	Chipping
Otta Seal	Hot bitumen	Graded Crush rock/Natural gravel
Cape Seal	Emulsion	Chipping, Sand/Crusher dust
Cold-mixed Asphalt	Cutback asphalt/Emulsion	Chipping, Sand, Crusher dust

Source: JICA Project Team based on Ethiopian Roads Authority (2013)

6-4 Prospect of Technology Dissemination

GoG has experience to disseminate LBT since 1990's through trainings provided by Koforidua Training Centre (KTC) and implementation of LBT projects over the country. In 2015, LBT projects were carried out in most of the regions and the number of LBT contractors has reached 64 firms.

Thus, dissemination of labour based surfacing technology (LBST) is highly possible provided that KTC is involved in the project from the early stage to incorporate their opinions from the viewpoint of training for contractor into the guideline.

In particular, categorisation of contractor (i.e. A1, C) shall be reviewed to ensure the capacity for executing LBST works.

6-5 Technical Challenges

In order to establish a labour-based bituminous surfacing technology, the following technical challenges are to be addressed through study, training and field trials;

(1) Proportion of Labour and Equipment

In comparison to LBT gravel surfacing works, the proportion of labour against equipment is generally low to manage bitumen which cannot be dealt with by hand. In Table 2-5, the example of combination of labour and equipment is shown. However it still has margins to be more labour-intensive, for instance, replacement "truck-mounted chip spreader" with "hand-operated chip spreader" which requires more labour to place chippings. Thus, the adequate combination of labour and equipment should be found out in light of work efficiency and employment generation.

(2) Type of Surface Treatment

As discussed in Chapter 6-3, a couple of types of surface treatment are considered for LBST. Whilst investigating effectiveness of some surface treatments through field trials, other viewpoints which affect the adequacy of surface treatment, such as availability of materials, existence of casual labours and transportation costs, are organised.

(3) Implementation Structure

In LBT projects for gravel surfacing, all the equipment is provided by contractors as stipulated in contract. In the field trials, however, most of equipment are expected to be provided by DFR/KTC using the equipment procured by this project. Therefore, adequate implementation structure for the field trials is to be determined prior to the commencement.

After establishment of the technology, it might be necessary to have transition period from

implementation structure for the field trials to the structure which contractors are responsible for provision of all the equipment until several contractors purchase equipment for LBST.

In addition, contractor classification eligible for LBST is to be discussed.

(4) Task Rates

Task rate for LBST is one of the key issues to be confirmed through the field trials. This enables to estimate cost of LBST projects by applying unit prices adjusted for a project site at that time. The factors which vary by site condition, such as transportation cost of materials, should be recorded separately to generalise the cost estimate method for other regions.

(5) Quality Control

Quality control is quite important since it determines durability of surface treatment. In comparison to LBT gravel surfacing works, quality control for LBST is expected to be more difficult due to use of bitumen. In particular, not like hot-mixed asphalt concrete, quality cannot be controlled by temperatures and some amount of time is required for curing to use bituminous emulsion. In the meantime, complicated methods for quality control would cause confusion of unskilled labours and could be an obstacle for dissemination of the technology. Therefore, key points for quality control of LBST should be extracted and the method to transfer such quality control skills to unskilled labours is to be considered.

(6) Pre-conditions

Pre-conditions to apply LBST are to be organised using lessons learnt through field trials and other studies. For instance, availability of labours and materials, transportation cost, traffic, road class, use of land along a section are considered.

References

- Local Resource-Based Approaches for Infrastructure Investment Source Book (2010) International Labour Office (ILO)
- Draft Performance Agreement for the Director of DFR
- Koforidua Training Centre Organisational Manual
- DFR Annual Report in 2013 -2015
- Road Condition Report year 2011 (2012) Ghana Highway Authority
- Draft Sector Medium-Term Development Plan (SMTDP): 2014-2017 (2015) Ministry of Roads and Highways
- List of contractors in good standing as at 08 April 2016, Ministry of Roads and Highways (http://www.mrh.gov.gh/5/3/in-good-standing/contractor-classification: 20 May 2016

accessed)

- List of contractors not in good standing as at 08 April 2016, Ministry of Roads and Highways (http://www.mrh.gov.gh/5/3/not-in-good-standing/contractor-classification: 20 May 2016 accessed)
- Guidelines for Classification of Contractors for Road and Bridge Works (2004) Ministry of Roads and Transport
- Investigation into a Potentially Labour-Intensive Alternative Surfacing Technology for Feeder Roads in Ghana (2011) S.I.K. Ampadu, F.J.F. Ayeh, E.N.K. Ashong and J. Obeng-Asiedu
- The Otta Seal Surfacing (2012) C. Overby, M.I. Pinard
- A Guide to the Use of Otta Seals (1999) Norwegian Public Roads Administration
- Handbook for Road Prioritisation Methodology (RPM) (2005) Department of Feeder Roads
- Standard Specification for Road and Bridge Works (2007) Ministry of Transportation
- Road Design Guide (1991) Ghana Highway Authority (GHA)
- Pavement Design Guide (1991) GHA
- Bitumen Surface Treatment Work Instruction Manual (2000) GHA
- Bituminous Sealing of Low Volume Roads using Labour Based Methods Training Manual (2013) Ethiopian Roads Authority (ERA)
- Monthly Cost Indices in February 2016, Ministry of Roads and Highways (http://www.mrh.gov.gh/5/8/monthly-cost-indices: 20 May 2016 accessed)
- Road Database User Manual for Department of Feeder Roads, DFID
- Sample Form of Tender Documents, Department of Feeder Roads
- Environmental and Social Management Framework (ESMF) (Road Sector) (2007) Ministry of Transportation
- Reducing Greenhouse Gas Emissions from Asphalt Materials (2007) Christine Keches and Amy LeBlanc
- Road construction using lateritic soil (1994) U.Mahalinga-lyer, D. J. Williams, Engineering Geology

ANNEX-3: PDM (ALL VERSIONS OF PDM)

Annex 3 (3): Project Design Matrix (PDM_1)

Project Title: Project for Developing Labour Based Bituminous Surfacing Technology (LBST) in Republic of Ghana **Project Period:** February, 2016 – February, 2019 (36 months) Version No. 1
Implementation Agency in Ghana: Department of Feeder Roads (DFR), Ministry of Road and Highways (MRH) Date: 16th February, 2016
Target Groups: DFR officials, officials concerned in Eastern Region, KTC staff, and trial construction contractors **Project Sites:** Accra (capital) and parts of feeder roads in Eastern Region

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions	Achievements	Remarks
Overall Goal Measures are taken to make labour based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.	1. Field trials are conducted for further improvement and additional validation of LBT surfacing in different climate and traffic conditions. 2. LBT surfacing is officially adopted by DFR for feeder road surfacing. 3. Training course for surfacing technology is set up at the Koforidua Training Centre.	1. Field trial records at DFR 2. Approved manuals/guidelines by DFR 3. Training records at KTC	1. Budget for maintenance is secured. 2. There are capable contractors for labour based bituminous surfacing technology and the maintenance. 3. Complying with the guidelines, maintenance of feeder road is properly carried out by DFR.		
Project Purpose The methodology and application of labour based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.	Labour-based bituminous surfacing technology is available to the Ghanaian-side through the guidelines.	1. Observation by experts 2. Interview to C/P and experts 3. Work report prepared by the experts (i.e., monitoring of OJT on the field trials) 4. Training Report on OJT	1. There is no significant change for the activities of DFR for feeder road services. 2. There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road.		
Outputs 1. Current conditions and issues for labour based bituminous surfacing technology in Ghana are identified.	1-1. Data collected and analysed by experts and counterparts	1-1. Progress Report submitted by the experts	1. There is no significant change in C/P. 2. The draft guidelines prepared is adopted by DFR as its official rule or regulation.		
2. Field trials of labour based bituminous surfacing technology are carried out.	2-1. Necessary material test completed 2-2. The first field trial completed. 2-3. Task rates for labour based bituminous surfacing technology prepared	2-1. Result of the lab test 2-2. Reports on the field trials 2-3. Task rates			
3. Guidelines for labour based bituminous surfacing technology are prepared.	3-1. Draft guidelines for labour based bituminous surfacing technology is completed.	3-1. Draft Guidelines for labour based bituminous surfacing technology			

Activities

1-1 Collect and analyse information on the counterparts (C/Ps) organisational capacity (e.g. personnel, budget, experiences, etc.).
1-2 Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana.
1-3 Review and evaluate the similar technical standards and manuals prepared by such organisations as Department for International Department (DFID), South African Department of Public Works, etc.
1-4 Confirm the procurement and cost of materials (e.g., gravels, etc.).
1-5 Characteristics of the materials is tested and evaluated as stipulated by respective technical standards.
1-6 Assess the procedures for design and procurement of feeder roads 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 labour based bituminous surfacing technology in Ghana.

2-1 Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials).
2-2 Conduct necessary lab tests to assess the characteristics of materials.
2-3 Identify technical requirements (e.g., materials, methodology and process, quality control, etc.) through the field trials.
2-4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials.
2-5 Collect information on task rates.
2-6 Identify the applicable conditions of the labour based bituminous surfacing technology.
2-7 Identify the safeguard issues.
2-8 Prepare a report on above.
2-9 Carry out on-the-job (OJT) through above activities.

3-1 By reviewing the result of the trails, the contents of the guidelines are determined.
3-2 The outline of the guidelines is prepared and agreed by both sides.
3-3 Draft the guidelines.
3-4 Carry out the second field trial following the guidelines.
3-5 Revise the draft based on the result of the second trail as necessary.
3-6 Carry out OJT through above activities.

Inputs

Japanese side

1. Experts
   - Chief Advisor / Feeder Road Development
   - LBT Guideline / Cost Estimate
   - Road Pavement Technology
   - Site Supervisor
   - Maintenance of Machinery and Equipment
   - Safe Guard/Environment
   - Project Coordination and Training Planning
2. Provision of machinery and equipment
   - Compactor
   - Asphalt sprayer
   - Asphalt heater
   - Tractor
   - Trailer
   - Impact tamping rammer
   - Equipment for Dynamic Cone Penetrometer (DCP) testing
3. Transportation for the experts
4. Provision of third country training (e.g., South Africa)
5. Costs for base and bituminous surface treatment

Ghanaian side

1. Personnel
   - C/P
   - Supervisor
   - Workers
2. Transportation for C/P staff
3. Material test conducted in DFR (equipment, cost, etc.)
4. Hand tools for pavement
5. Office space
6. Furniture (e.g., desks, etc.)
7. Means of communication at the head office (e.g., internet connection)
8. DFR to select roads at sub-base level

DFR is able to utilize and mobilise available resources related to bituminous surface treatment technology in Ghana (e.g., GHA Central Lab and its expertise, etc.) for implementation of the Project.

Pre-conditions

1. Ghanaian side provides technical documents on LBT.
2. Laboratory testing of materials is available.
3. Ensure the site for field trials (these sites must be prepared for the road bed and filled with sub base course materials. etc.).

<Issues and Countermeasures>

Annex 3 (2): Project Design Matrix (PDM_2)

Project Title: Project for Developing Labour Based Bituminous Surfacing Technology (LBST) in the Republic of Ghana **Project Period:** February, 2016 – December, 2018 Version No. 2
Implementation Agency in Ghana: Department of Feeder Roads (DFR), Ministry of Roads and Highways (MRH) Date: 26th July, 2016
Target Groups: DFR officials and the officials concerned in Eastern Region **Project Sites:** Accra (capital) and feeder roads in Eastern Region

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions	Achievements	Remarks
Overall Goal Measures are taken to make labour-based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.	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. 2. Labour-based bituminous surfacing technology is officially adopted by DFR for feeder road surfacing. 3. Training course for labour-based bituminous surfacing technology is set up according to the guidelines at the Koforidua Training Centre (KTC).	1. Field trial records, including the checklist of the LBST construction standard, prepared by DFR 2. Approved guidelines by DFR 3. Training records at KTC			
Project Purpose The methodology and application of labour-based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.	1. Labour-based bituminous surfacing technology fulfilling the criteria defined in the monitoring checklist is developed through the field trials. 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.	1. Monitoring checklist filled out by JICA experts 2. Questionnaire surveys to DFR officials and the officials concerned in Eastern Region	1. There is no significant change for the activities of DFR for feeder road services. 2. There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road. 3. The budget for the measures necessary for the labour-based bituminous surfacing technology is secured.		
Outputs 1. Current conditions and issues for labour-based bituminous surfacing technology in Ghana are identified. 2. Field trials of labour-based bituminous surfacing technology are carried out. 3. Guidelines for labour-based bituminous surfacing technology are prepared.	1-1. Issues and results analysed by the experts and counterparts are indicated in the Project Monitoring Sheet (Summary). 2-1. Lab tests of materials are conducted in accordance with the material standard. 2-2. The field trials are conducted in line with the construction standard for labour-based bituminous surfacing technology (LBST construction standard). 2-3. Task rates for labour-based bituminous surfacing technology are defined. 3-1. Draft guidelines for labour-based bituminous surfacing technology is completed.	1-1. Project Monitoring Sheet (Summary) 2-1. Certificate ("Results") of the lab tests 2-2. Checklist of the LBST construction standard 2-3. Summary table of task rates 3-1. Draft guidelines for labour-based bituminous surfacing technology	There is no significant change in C/P assignment.		

Activities

1-1 Collect and analyse information on the counterparts (C/Ps) organisational capacity (*e.g.*, personnel, budget, experiences, etc.).
1-2 Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana.
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.
1-4 Confirm the procurement and cost of materials (*e.g.*, gravels, etc.).
1-5 Test and evaluate characteristics of the materials as stipulated by respective technical standards.
1-6 Assess the procedures for design and procurement of feeder roads 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 labour-based bituminous surfacing technology in Ghana.

2-1 Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials).
2-2 Conduct necessary lab tests to assess the characteristics of materials.
2-3 Identify technical requirements (*e.g.*, materials, methodology and process, quality control, etc.) through the field trials.
2-4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials.
2-5 Collect information on task rates.
2-6 Identify the applicable conditions of the labour-based bituminous surfacing technology.
2-7 Identify the safeguard issues.
2-8 Prepare a report on above.
2-9 Carry out on-the-job training (OJT) through above activities.

3-1 Determine the contents of the guidelines by reviewing the result of the first field trials.
3-2 Prepare and agree with the outline of the guidelines by both sides.
3-3 Draft the guidelines.
3-4 Carry out the second field trial following the guidelines.
3-5 Revise the draft based on the result of the second field trials as necessary.
3-6 Carry out OJT through above activities.

Inputs

Japanese side

1. Experts
   - Chief Advisor/Feeder Road Development
   - Road Pavement Technology
   - LBT Guideline
   - Cost Estimate/Safe Guard
   - Site Supervisor
   - Maintenance of Machinery and Equipment
   - Environment
   - Project Coordination/Training Planning
   - Monitoring and Evaluation
   - Project Review

2. Provision of machinery and equipment
   - Compactor
   - Asphalt sprayer
   - Asphalt heater
   - Tractor
   - Trailer
   - Impact tamping rammer
   - Equipment for Dynamic Cone Penetrometer (DCP) testing

3. Transportation for the experts

4. Provision of third country training (*e.g.*, South Africa)

5. Costs for base and bituminous surface treatment

Ghanaian side

1. Personnel
   - Project Director (DFR Director)
   - Project Manager (Dy. Director of Planning, DFR)
   - C/P (Mainly Planning Section and Eastern Region Office of DFR)

2. Human resources and expenses necessary for the field trials
   - Supervisors
   - Workers
   - Transportation for C/P staff
   - Material test conducted at DFR (equipment, cost, *etc.*)
   - Hand tools for pavement
   - Road preparation at sub-base level for the field trials

3. Office space

4. Furniture (*e.g.*, desks, etc.)

5. Means of communication at the head office (*e.g.*, internet connection)

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.

Pre-conditions

1. Ghanaian side provides technical documents on LBT.
2. Laboratory testing of materials is available.
3. The sites for field trials are ensured (these sites must be prepared with the road bed and filled with sub base course materials, etc.).

<Issues and Countermeasures>

Annex 3 (1): Project Design Matrix (PDM_3)

Project Title: Project for Developing Labour Based Bituminous Surfacing Technology (LBST) in the Republic of Ghana **Project Period:** February, 2016 – December, 2018 Version No. 3
Implementation Agency in Ghana: Department of Feeder Roads (DFR), Ministry of Roads and Highways (MRH) Date: 31st January, 2017
Target Groups: DFR officials and the officials concerned in Eastern Region **Project Sites:** Accra (capital) and feeder roads in Eastern Region

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions	Achievements	Remarks
Overall Goal Measures are taken to make labour-based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.	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. 2. Labour-based bituminous surfacing technology is officially adopted by DFR for feeder road surfacing. 3. Training course for labour-based bituminous surfacing technology is set up according to the guidelines at the Koforidua Training Centre (KTC).	1. Field trial records, including the checklist of the LBST construction standard, prepared by DFR 2. Approved guidelines by DFR 3. Training records at KTC			
Project Purpose The methodology and application of labour-based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.	1. Labour-based bituminous surfacing technology fulfilling the criteria defined in the monitoring checklist is developed through the field trials. 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.	1. Monitoring checklist filled out by JICA experts 2. Questionnaire surveys to DFR officials and the officials concerned in Eastern Region	1. There is no significant change for the activities of DFR for feeder road services. 2. There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road. 3. The budget for the measures necessary for the labour-based bituminous surfacing technology is secured.		
Outputs 1. Current conditions and issues for labour-based bituminous surfacing technology in Ghana are identified. 2. Field trials of labour-based bituminous surfacing technology are carried out. 3. Guidelines for labour-based bituminous surfacing technology are prepared.	1-1. Issues and results analysed by the experts and counterparts are indicated in the Project Monitoring Sheet (Summary). 2-1. Lab tests of materials are conducted in accordance with the material standard. 2-2. The field trials are conducted in line with the construction standard for labour-based bituminous surfacing technology (LBST construction standard). 2-3. Task rates for labour-based bituminous surfacing technology are defined. 3-1. Draft guidelines for labour-based bituminous surfacing technology is completed.	1-1. Project Monitoring Sheet (Summary) 2-1. Certificate ("Results") of the lab tests 2-2. Checklist of the LBST construction standard 2-3. Summary table of task rates 3-1. Draft guidelines for labour-based bituminous surfacing technology	There is no significant change in C/P assignment.		

Activities

1-1 Collect and analyse information on the counterparts (C/Ps) organisational capacity (*e.g.*, personnel, budget, experiences, etc.).
1-2 Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana.
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.
1-4 Confirm the procurement and cost of materials (*e.g.*, gravels, etc.).
1-5 Test and evaluate characteristics of the materials as stipulated by respective technical standards.
1-6 Assess the procedures for design and procurement of feeder roads 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 labour-based bituminous surfacing technology in Ghana.

2-1 Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials).
2-2 Conduct necessary lab tests to assess the characteristics of materials.
2-3 Identify technical requirements (*e.g.*, materials, methodology and process, quality control, etc.) through the field trials.
2-4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials.
2-5 Collect information on task rates.
2-6 Identify the applicable conditions of the labour-based bituminous surfacing technology.
2-7 Identify the safeguard issues.
2-8 Prepare a report on above.
2-9 Carry out on-the-job training (OJT) through above activities.

3-1 Determine the contents of the guidelines by reviewing the result of the first field trials.
3-2 Prepare and agree with the outline of the guidelines by both sides.
3-3 Draft the guidelines.
3-4 Carry out the second field trial following the guidelines.
3-5 Revise the draft based on the result of the second field trials as necessary.
3-6 Carry out OJT through above activities.

Inputs

Japanese side

1. Experts
   - Chief Advisor/Feeder Road Development
   - Road Pavement Technology
   - LBT Guideline
   - Cost Estimate/Safe Guard
   - Site Supervisor
   - Maintenance of Machinery and Equipment
   - Environment
   - Project Coordination/Training Planning
   - Monitoring and Evaluation
   - Project Review

2. Provision of machinery and equipment
   - Compactor
   - Asphalt sprayer
   - Asphalt heater
   - Tractor
   - Trailer
   - Impact tamping rammer
   - Equipment for Dynamic Cone Penetrometer (DCP) testing

3. Transportation for the experts

4. Provision of third country training (*e.g.*, South Africa)

5. Costs for the field trials
   - Base and bituminous surface treatment
   - Supervisors
   - Workers
   - Others as necessary

Ghanaian side

1. Personnel
   - Project Director (DFR Director)
   - Project Manager (Dy. Director of Planning, DFR)
   - C/P (Mainly Planning Section and Eastern Region Office of DFR)

2. Expenses necessary for the field trials
   - Transportation for C/P staff
   - Material test conducted at DFR (equipment, cost, *etc.*)
   - Hand tools for pavement
   - Road preparation at sub-base level for the field trials

3. Office space

4. Furniture (*e.g.*, desks, etc.)

5. Means of communication at the head office (*e.g.*, internet connection)

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.

Pre-conditions

1. Ghanaian side provides technical documents on LBT.
2. Laboratory testing of materials is available.
3. The sites for field trials are ensured (these sites must be prepared with the road bed and filled with sub base course materials, etc.).

<Issues and Countermeasures>

Annex 3: Project Design Matrix (PDM_{3-1})

Project Title: Project for Developing Labour Based Bituminous Surfacing Technology (LBST) in the Republic of Ghana **Project Period:** February, 2016 – December, 2018 Version No. 3-1
Implementation Agency in Ghana: Department of Feeder Roads (DFR), Ministry of Roads and Highways (MRH) Date: 15th February, 2018
Target Groups: DFR officials and the officials concerned in Eastern Region **Project Sites:** Accra (capital) and feeder roads in Eastern Region

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions	Achievements	Remarks
Overall Goal Measures are taken to make labour-based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.	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. 2. Labour-based bituminous surfacing technology is officially adopted by DFR for feeder road surfacing. 3. Training course for labour-based bituminous surfacing technology is set up according to the guidelines at the Koforidua Training Centre (KTC).	1. Field trial records, including the checklist of the LBST construction standard, prepared by DFR 2. Approved guidelines by DFR 3. Training records at KTC		*There is a prospect to be achieved. Refer to the PCR in detail.*	*N/A*
Project Purpose The methodology and application of labour-based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.	1. Labour-based bituminous surfacing technology fulfilling the criteria defined in the monitoring checklist is developed through the field trials. 2. The self-rating of DFR officials and the officials concerned in Eastern Region for acquiring labour-based bituminous surfacing technology exceeds 70% on average.	1. Monitoring checklist filled out by JICA experts 2. Questionnaire surveys to DFR officials and the officials concerned in Eastern Region	1. There is no significant change for the activities of DFR for feeder road services. 2. There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road. 3. The budget for the measures necessary for the labour-based bituminous surfacing technology is secured.	*The LBST was developed through the field trials. Refer to the PCR in detail.*	*As the self-rating results exceeded the target in the past two surveys, the target will be changed from 65% to 70%.*
Outputs 1. Current conditions and issues for labour-based bituminous surfacing technology in Ghana are identified.	1-1. Issues and results analysed by the experts and counterparts are indicated in the Project Monitoring Sheet (Summary).	1-1. Project Monitoring Sheet (Summary)	There is no significant change in C/P assignment.	*This Output was achieved as scheduled.*	*N/A*
2. Field trials of labour-based bituminous surfacing technology are carried out.	2-1. Lab tests of materials are conducted in accordance with the material standard. 2-2. The field trials are conducted in line with the construction standard for labour-based bituminous surfacing technology (LBST construction standard). 2-3. Task rates for labour-based bituminous surfacing technology are defined.	2-1. Certificate ("Results") of the lab tests 2-2. Checklist of the LBST construction standard 2-3. Summary table of task rates		*1st and 2nd field trials were completed. Refer to the PCR in detail.*	*N/A*
3. Guidelines for labour-based bituminous surfacing technology are prepared.	3-1. Draft guidelines for labour-based bituminous surfacing technology is completed.	3-1. Draft guidelines for labour-based bituminous surfacing technology		*Draft LBST Guideline was completed.*	*N/A*

Activities

1-1 Collect and analyse information on the counterparts (C/Ps) organisational capacity (*e.g.*, personnel, budget, experiences, etc.).
1-2 Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana.
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.
1-4 Confirm the procurement and cost of materials (*e.g.*, gravels, etc.).
1-5 Test and evaluate characteristics of the materials as stipulated by respective technical standards.
1-6 Assess the procedures for design and procurement of feeder roads 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 labour-based bituminous surfacing technology in Ghana.

2-1 Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials).
2-2 Conduct necessary lab tests to assess the characteristics of materials.
2-3 Identify technical requirements (*e.g.*, materials, methodology and process, quality control, etc.) through the field trials.
2-4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials.
2-5 Collect information on task rates.
2-6 Identify the applicable conditions of the labour-based bituminous surfacing technology.
2-7 Identify the safeguard issues.
2-8 Prepare a report on above.
2-9 Carry out on-the-job training (OJT) through above activities.

3-1 Determine the contents of the guidelines by reviewing the result of the first field trials.
3-2 Prepare and agree with the outline of the guidelines by both sides.
3-3 Draft the guidelines.
3-4 Carry out the second field trial following the guidelines.
3-5 Revise the draft based on the result of the second field trials as necessary.
3-6 Carry out OJT through above activities.

Inputs

Japanese side

1. Experts
   - Chief Advisor/Feeder Road Development
   - Road Pavement Technology
   - LBT Guideline
   - Cost Estimate/Safe Guard
   - Site Supervisor
   - Maintenance of Machinery and Equipment
   - Environment
   - Project Coordination/Training Planning
   - Monitoring and Evaluation
   - Project Review

2. Provision of machinery and equipment
   - Compactor
   - Asphalt sprayer
   - Asphalt heater
   - Tractor
   - Trailer
   - Impact tamping rammer
   - Equipment for Dynamic Cone Penetrometer (DCP) testing

3. Transportation for the experts

4. Provision of third country training (*e.g.*, South Africa)

5. Costs for the field trials
   - Base and bituminous surface treatment
   - Supervisors
   - Workers
   - Others as necessary

Ghanaian side

1. Personnel
   - Project Director (DFR Director)
   - Project Manager (Dy. Director of Planning, DFR)
   - C/P (Mainly Planning Section and Eastern Region Office of DFR)

2. Expenses necessary for the field trials
   - Transportation for C/P staff
   - Material test conducted at DFR (equipment, cost, *etc.*)
   - Hand tools for pavement
   - Road preparation at sub-base level for the field trials

3. Office space

4. Furniture (*e.g.*, desks, etc.)

5. Means of communication at the head office (*e.g.*, internet connection)

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.

Pre-conditions

1. Ghanaian side provides technical documents on LBT.
2. Laboratory testing of materials is available.
3. The sites for field trials are ensured (these sites must be prepared with the road bed and filled with sub base course materials, etc.).

<Issues and Countermeasures>

N/A

ANNEX-4: R/D, M/M MUNUTES OF JCC (COPY)

RECORD OF DISCUSSIONS

ON

THE PROJECT FOR DEVELOPING LABOUR BASED BITUMINOUS SURFACING TECHNOLOGY

IN

THE REPUBLIC OF GHANA

AGREED UPON BETWEEN

MINISTRY OF ROADS AND HIGHWAYS

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

Accra, 17 August 2015

Koji Makino
Chief Representative
Ghana Office
Japan International Cooperation Agency

Godwin J. Brocke
Ag. Chief Director
Ministry of Roads and Highways

Kwadwo Awua-Peasah
Director,
External Resources Mobilization/ Bilateral
Ministry of Finance

George A. Aidoo
Director
Department of Feeder Roads

Based on the minutes of meetings on the Preparatory Survey on the Project for Developing Labour Based Bituminous Surfacing Technology (hereinafter referred to as "the Project") signed on 5 August 2012 between the Department of Feeder Roads (hereinafter referred to as "DFR") of the Ministry of Roads and Highways (hereinafter referred to as "MRH"), and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA held a series of discussions with MRH, DFR and relevant organizations to develop a detailed plan of the Project.

Both parties agreed on the details of the Project and the main points discussed as described in the Appendix I and the Appendix II.

Both parties also agreed that DFR, the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA, coordinate with other relevant organizations and ensure that the self-reliant operation of the Project is sustained during and after the implementation period in order to contribute toward social and economic development of the Republic of Ghana.

The Project will be implemented within the framework of the Note Verbale to be exchanged between the Government of Japan (hereinafter referred to as "GOJ") and the Government of the Republic of Ghana (hereinafter referred to as "GOG").

Appendix I: Project Description
Appendix II: Main Points Discussed
Appendix III: Minutes of Meetings on 5 August 2012

Appendix I

PROJECT DESCRIPTION

I. BACKGROUND

Labour Based Technology (hereinafter referred to as "LBT") has been utilized for road maintenance and rehabilitation, especially for low-volume road in the developing countries. LBT road construction in the Republic of Ghana was introduced during the mid 1980's with supports from World Bank and Danish International Development Agency (DANIDA), and it is now a viable alternative technology for road construction.

LBT for road maintenance and rehabilitation up to a sub-base level is well established in Ghana. However, LBT for bituminous surfacing is yet to be developed. Department of Feeder Roads (hereinafter referred to as "DFR") is now trying to introduce the Labour Based Bituminous Surfacing Technology as one of technologies which optimize maintenance cost of feeder roads.

Given the backgrounds mentioned above, the Government of the Republic of Ghana requested Japan to conduct a technical cooperation project for developing Labour Based Bituminous Surfacing Technology.

II. OUTLINE OF THE PROJECT

Details of the Project are described in the Logical Framework (Project Design Matrix: PDM) (Annex I) and the tentative Plan of Operation (Annex II).

1. Title of the Project

Project for Developing Labour Based Bituminous Surfacing Technology.

2. Overall Goal

Measures are taken to make labour based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.

3. Project Purpose

The methodology and application of labour based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.

4. Outputs

(1) Current conditions and issues for labour based bituminous surfacing technology in Ghana are identified,
(2) Field trials of labour based bituminous surfacing technology are carried out, and
(3) Guidelines for labour based bituminous surfacing technology are prepared.

5. Activities

5.1 Activities for Output (1):

(1) Collect and analyse information on the counterparts (C/Ps) organisational capacity (e.g. personnel, budget, experiences, etc.),

(2) Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana,
(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,
(4) Confirm the procurement and cost of materials (e. g. gravels, etc.).
(5) Characteristics of the materials is tested and evaluated as stipulated by respective technical standards,
(6) Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana,
(7) Check the quality control systems and the procedures of road pavement work in Ghana,
(8) Check the maintenance management systems of feeder roads in Ghana, and
(9) Compile and report the analysis on issues on labour based bituminous surfacing technology in Ghana.

5.2 Activities for Output (2):
(1) Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials),
(2) Conduct necessary lab tests to assess the characteristics of materials,
(3) Identify technical requirements (e.g. materials, methodology and process, quality control, etc.) through the field trials,
(4) Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials,
(5) Collect information on task rates,
(6) Identify the applicable conditions of the labour based bituminous surfacing technology,
(7) Identify the safeguard issues,
(8) Prepare a report on above, and
(9) Carry out on-the-job Training (OJT) through above activities.

5.3 Activities for Output (3):
(1) By reviewing the result of the trials, the contents of the guidelines are determined,
(2) The outline of the guidelines is prepared and agreed by both sides,
(3) Draft the guidelines,
(4) Carry out the second field trial following the guidelines,
(5) Revise the draft based on the result of the second trial as necessary, and
(6) Carry out OJT through above activities.

6. Input
(1) Input by JICA
(a) Dispatch of Experts
- Chief advisor/Feeder Road Development
- LBT Guidelines/Cost Estimate
- Road Pavement Technology
- Site Supervisor
- Maintenance of Machinery and Equipment
- Safeguard and Environment

- Project Coordination and Training Planning
- Monitoring/Evaluation

(b) Training
Provision of third country training

(c) Machinery and Equipment
Provision of machinery and equipment (compactor, asphalt sprayer, asphalt heater, tractor, trailer, impact tamping rammer, equipment for Dynamic Cone Penetrometer test).

The machinery, equipment and other materials under II-6 (1) (c) above will become the property of the GOG. In case any machinery and equipment cannot be obtained in Ghana, it will be delivered C.I.F. (cost, insurance and freight) to the Ghana authorities concerned at the ports and/or airports of disembarkation. The Ghanaian side will bear the in-land clearing costs.

(d) Cost for the base and bituminous surface dressing in the field trials

(2) Input by DFR
DFR will take necessary measures to provide at its own expense:
(a) Services of DFR's counterpart personnel and administrative personnel as referred to in II-7;
(b) Suitable office space with furniture including utility costs;
(c) Use of equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the equipment provided by JICA;
(d) Assistance for obtaining medical service;
(e) Available data (including maps and photographs) and information related to the Project;

7. Implementation Structure
The Project organization chart is given in the Annex III. The roles and assignments of relevant organizations are as follows:

(1) DFR
(a) Project Director
Director of DFR as the Project Director will bear overall responsibility for the administration and implementation of the Project.
(b) Project Manager
Deputy Director (Planning) of DFR as the Project Manager will be responsible for the managerial and technical matters of the Project.
(c) Counterpart
DFR staffs, engineers will be the counterparts to Japanese Experts.

(2) JICA Experts
The JICA experts will give necessary technical guidance, advice and recommendations to DFR on any matters pertaining to the implementation

of the Project.

(3) Joint Coordinating Committee
Joint Coordinating Committee (hereinafter referred to as "JCC") will be established in order to facilitate inter-organisational coordination. JCC will be held at least once a year and whenever it deems necessary. JCC will approve an annual work plan, review overall progress, conduct monitoring and evaluation of the Project, and exchange opinions on major issues that arise during the implementation of the Project. A list of proposed members of JCC is shown in the Annex III.

8. Project Sites and Beneficiaries
(1) Project sites: Accra. Field Trials focus in Eastern Region of Ghana.
(2) Beneficiaries: DFR staff, District Works Department (DWD) of district assemblies, contractors and communities along the sites for field trials

9. Duration
About 3 years from the Project commencement.

10. Reports to JCC
DFR and JICA experts will jointly prepare the following reports in English:
(1) Inception Report
(2) Progress Report on annual basis until the project completion.
(3) Project Completion Report at the time of project completion.

11. Safeguards including Environmental and Social Considerations
DFR agreed to abide by Environmental Protection Agency (EPA) of Ghana and JICA Guidelines for Environmental and Social Considerations in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

12. Management of Safety for Construction Works
For construction works which will be carried out in the Project, DFR and JICA will assure the management of safety in accordance with the "Safety Plan" and "Method Statements of Safety"submitted by contractors based on the Guidance for the Management of Safety for Construction Works in Japanese ODA Projects.

III. UNDERTAKINGS OF DFR/GoG

1. DFR will take necessary measures to:

(1) ensure that the technologies and knowledge acquired by the Ghana nationals as a result of Japanese technical cooperation contributes to the economic and social development of Ghana, and that the knowledge and experience acquired by the personnel of Ghana from technical training as well as the equipment provided by JICA will be utilised effectively in the implementation of the Project.

2. GoG will take necessary measures to:
   (1) Facilitate the grant of privileges, exemptions and benefits to the JICA experts referred to in II-6 above and their families, which are in no less favourable than those granted to experts and members of the missions and their families of third countries or international organisations performing similar missions in Ghana.
   (2) provide security-related information as well as measures to ensure the safety of the JICA experts;
   (3) permit the JICA experts to enter, leave and sojourn in Ghana for the duration of their assignments therein and exempt them from foreign registration requirements and consular fees.
   (4) exempt the JICA experts from taxes and any other charges on the equipment, machinery and other material necessary for the implementation of the Project;
   (5) exempt the JICA experts from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to them and/or remitted to them from abroad for their services in connection with the implementation of the Project; and
   (6) meet taxes and any other charges on the equipment, machinery and other material, referred to in II-5 above, necessary for the implementation of the Project.

3. GOG will bear claims, if any arises, against the JICA experts resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Project, except when such claims arise from gross negligence or wilful misconduct on the part of the JICA experts.

IV. MONITORING AND EVALUATION

JICA, MOF, MRH and DFR will jointly and regularly monitor the progress of the Project through the Monitoring Sheets based on the Project Design Matrix (PDM) and Plan of Operation (PO). The Monitoring Sheets will be reviewed every six (6) months.
Also, a Project Completion Report will be drawn up one (1) month before the termination of the Project.

JICA will conduct the following evaluations and surveys to verify sustainability and impact of the Project and draw lessons. The MRH and DFR are required to provide necessary support (e.g. Data relating to the Project, Interview of C/P) for them.

1. Ex-post evaluation three (3) years after the project completion, in principle
2. Follow-up surveys on necessity basis

V. PROMOTION OF PUBLIC SUPPORT

For the purpose of promoting support for the Project, DFR will take appropriate measures to make the Project widely known to the people of Ghana.

VI. Misconduct

If JICA or DFR receives information related to suspected corrupt or fraudulent practices in the implementation of the Project, DFR and relevant organizations will provide JICA with such information as JICA may reasonably request, including information related to any concerned official of the government and/or public organizations of Ghana, and vice versa.

DFR and relevant organizations shall not, unfairly or unfavorably treat the person and/or company which provided the information related to suspected corrupt or fraudulent practices in the implementation of the Project.

VII. MUTUAL CONSULTATION

JICA and DFR will consult each other whenever any major issues arise in the course of Project implementation.

VIII. AMENDMENTS

This record of discussions can be amended by minutes of meetings between JICA and DFR. However, PO may be amended in the Monitoring Sheets.

The minutes of meetings will be signed by authorized persons of each side who may be different from the signers of the record of discussions.

Annex I Logical Framework (Project Design Matrix: PDM)
Annex II Tentative Plan of Operation
Annex III Project Organization Chart

Annex I

Project Design Matrix

Name of the Project: Project for Developing Labour Based Bituminous Surfacing Technology in Republic of Ghana
Implementing Agency in Ghana: Department of Feeder Roads (DFR), Ministry of Road and Highways
The Duration of the Project: 36months

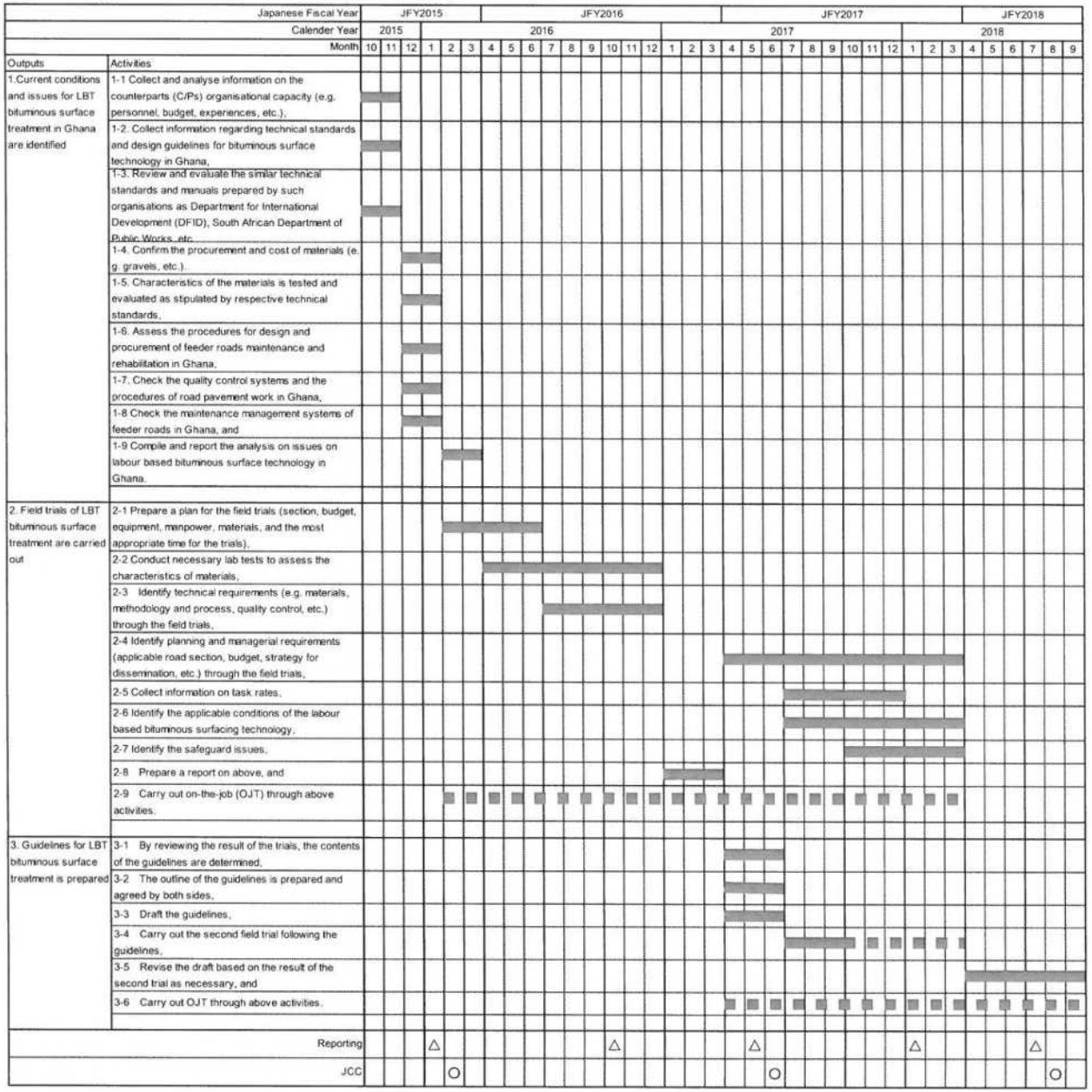
Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
Overall Goal Measures are taken to make labour based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.	1. Field trials are conducted for further improvement and additional validation of LBT surfacing in different climate and traffic conditions. 2. LBT surfacing is officially adopted by DFR for feeder road surfacing. 3. Training course for surfacing technology is set up at the Koforidua Training Centre.	1. Field trial records at DFR, 2. Approved manuals/guidelines by DFR, 3. Training records at KTC	Budget for maintenance is secured There are capable contractors for labour based bituminous surfacing technology and the maintenance Complying with the guidelines, maintenance of feeder road is properly carried out by DFR.
Project Purpose The methodology and application of labour based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.	Labour-based bituminous surfacing technology is available to the Ghanaian-side through the guidelines.	1. Observation by experts 2. Interview to C/P and experts 3. Work report prepared by the experts (i.e. monitoring of OJT on the field trials) 4. Training Report on OJT	There is no significant change for the activities of DFR for feeder road services. There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road.
Output 1. Current conditions and issues for labour based bituminous surfacing technology in Ghana are identified.	1. Data collected and analysed by experts and counterparts.	1. Progress Report submitted by the experts	
2. Field trials of labour based bituminous surfacing	2-1. Necessary material test completed	2-1. Result of the lab test	There is no significant change in C/P's

technology are carried out.	2-2. The first field trial completed 2-3. Task rates for labour based bituminous surfacing technology prepared	2-2. Reports on the field trials 2-3. Task rates	
3. Guidelines for labour based bituminous surfacing technology are prepared.	Draft guidelines for labour based bituminous surfacing technology is completed	Draft Guidelines for labour based bituminous surfacing technology	The draft guidelines prepared is adopted by DFR as its official rule or regulation
Activities 【Activities for Output 1: "Current conditions and issues for labour based bituminous surfacing technology in Ghana are identified"】 1-1 Collect and analyse information on the counterparts (C/Ps) organisational capacity (e.g. personnel, budget, experiences, etc.), 1-2. Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana, 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, 1-4. Confirm the procurement and cost of materials (e. g. gravels, etc.). 1-5. Characteristics of the materials is tested and evaluated as stipulated by respective technical standards, 1-6. Assess the procedures for design and procurement of feeder roads 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, and 1-9 Compile and report the analysis on issues on labour based bituminous surfacing technology in Ghana.		**Input from Ghana** C/P Supervisor Workers, Transportation for C/P staff Material test conducted in DFR (Equipment, cost, etc.) Hand tools for pavement Office space Furniture (e.g. desks, etc.) Means of communication at the head office (e.g. internet connection) DFR to select roads at sub-base level **Input from Japan** 1. Chief advisor/Feeder Road Development 2. Expert (LBT Guidelines/Cost Estimate) 3. Expert (Road Pavement Technology) 4. Expert (Site Supervisor) 5. Expert (Maintenance of Machinery and Equipment) 6. Expert (Safe Guard/ Environment) 7. Expert (Project Coordination and Training Planning)	DFR is able to utilize and mobilise available resources related to bituminous surface treatment technology in Ghana (e.g. GHA Central Lab and its expertise, etc.) for implementation of the project Preconditions Ghanaian side provides: 1. Technical documents on LBT, 2. Laboratory testing of materials is available, 3. Ensure the site for field trials (these sites must be prepared the road bed and filled with sub base course material. etc.)

【Activities for Output 2:"Field trials of labour based bituminous surfacing technology are carried out"】 2-1 Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials), 2-2 Conduct necessary lab tests to assess the characteristics of materials, 2-3 Identify technical requirements (e.g. materials, methodology and process, quality control, etc.) through the field trials, 2-4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials, 2-5 Collect information on task rates, 2-6 Identify the applicable conditions of the labour based bituminous surfacing technology, 2-7 Identify the safeguard issues, 2-8 Prepare a report on above, and 2-9 Carry out on-the-job (OJT) through above activities. 【Activities for Output 3: "Guidelines for labour based bituminous surface technology are prepared"】 3-1 By reviewing the result of the trials, the contents of the guidelines are determined, 3-2 The outline of the guidelines is prepared and agreed by both sides, 3-3 Draft the guidelines, 3-4 Carry out the second field trial following the guidelines, 3-5 Revise the draft based on the result of the second trial as necessary, and 3-6 Carry out OJT through above activities.	Provision of machinery and equipment (compactor, asphalt sprayer, asphalt heater, tractor, trailer, impact tamping rammer, equipment for Dynamic Cone Penetrometer (DCP) testing). Transportation for the experts Provision of third country training (e.g. South Africa) Costs for base and bituminous surface treatment	

TENTATIVE PLAN OF OPERATION (P/O)

Annex II



Japanese Fiscal Year		JFY2015			JFY2016												JFY2017												JFY2018								
Calender Year		2015			2016												2017												2018								
Month		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
Outputs	Activities																																			
1.Current conditions and issues for LBT bituminous surface treatment in Ghana are identified	1-1 Collect and analyse information on the counterparts (C/Ps) organisational capacity (e.g. personnel, budget, experiences, etc.),																																			
	1-2. Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana,																																			
	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.																																			
	1-4. Confirm the procurement and cost of materials (e. g. gravels, etc.).																																			
	1-5. Characteristics of the materials is tested and evaluated as stipulated by respective technical standards,																																			
	1-6. Assess the procedures for design and procurement of feeder roads 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, and																																			
	1-9 Compile and report the analysis on issues on labour based bituminous surface technology in Ghana.																																			
2. Field trials of LBT bituminous surface treatment are carried out	2-1 Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials),																																			
	2-2 Conduct necessary lab tests to assess the characteristics of materials,																																			
	2-3 Identify technical requirements (e.g. materials, methodology and process, quality control, etc.) through the field trials,																																			
	2-4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials,																																			
	2-5 Collect information on task rates,																																			
	2-6 Identify the applicable conditions of the labour based bituminous surfacing technology,																																			
	2-7 Identify the safeguard issues,																																			
	2-8 Prepare a report on above, and																																			
	2-9 Carry out on-the-job (OJT) through above activities.																																			
3. Guidelines for LBT bituminous surface treatment is prepared	3-1 By reviewing the result of the trials, the contents of the guidelines are determined,																																			
	3-2 The outline of the guidelines is prepared and agreed by both sides,																																			
	3-3 Draft the guidelines,																																			
	3-4 Carry out the second field trial following the guidelines,																																			
	3-5 Revise the draft based on the result of the second trial as necessary, and																																			
	3-6 Carry out OJT through above activities.																																			
Reporting					△									△							△								△						△		
JCC						○																○														○	

	Ghana side	Japanese side
Joint Coordinating Committee	● Chief Director, Ministry of Roads and Highways (MRH) ● Director, Department of Feeder Roads (DFR) ● Director, External Resources Mobilization/Bilateral, Ministry of Finance and Economic Planning (MoFEP) ● Other personnel recommended by Ghana side or JICA	● JICA Experts of the Project ● Chief Representative of JICA Ghana Office ● Other personnel recommended by Ghana side or JICA
Project Director	● Director, Department of Feeder Roads (DFR)	-
Project Manager	● Deputy Director (Planning), DFR	-
Couterparts	● Dr. Osafo Ampadu – Principal Engineer, DFR ● Mr. Omane Brimpong – Senior Engineer, DFR ● Other personnel recommended by Ghana side or JICA	● JICA Experts of the Project ● Other personnel recommended by Ghana side or JICA

Appendix II

MAIN POINTS DISCUSSED

1. LBT bituminous surfacing

There are a number of successful cases in Africa where bituminous surfacing was conducted by small scale contractors with labour-based methods employing local community members. Their experiences were put into the form of manual, for example, Transport Research Laboratory (2003) "Manual for the labour-based construction of bituminous surfacing on low-volume roads" and International Labour Organization (2013) "Ethiopian Roads Authority Bituminous Sealing of Low Volume Roads using Labour-based Methods Training Manual." A South African company invented a manually operated chip spreader called "Chippy" to apply chipping aggregates more evenly than with hand tools. DFR aims to duplicate the successes of peer countries with the use of tools and light equipment. The Project is not designed to apply conventional bituminous surfacing using heavy machines used in the equipment based bituminous surfacing which are not readily available to small contractors in rural areas.

2. Field trials for LBT bituminous surfacing

The field trials are to be conducted by the Project to introduce LBT bituminous surfacing onto feeder roads in Ghana which has not yet established in the country. Due to the trial and error nature of the planned project activities, the Project is not held liable for defects which may arise in the trial period or after completion of the trials.

3. Equipment

It is expected that equipment and machinery to be provided by JICA for field trials is to be transferred to the Koforidua Training Centre (KTC) for future training courses for LBT bituminous surfacing. DFR, as the implementing agency of the Project, is the prime recipient of equipment responsible for storing and maintaining the equipment in good condition until its ownership is transferred to KTC. DFR will secure budget for the maintenance of equipment during the project implementation. The Mechanical section of DFR has 2 in-house staff and although major maintenance services are outsourced by DFR, the mechanical section will be in charge of maintenance of the equipment.

4. Maintenance

Both sides agreed to modify the field of Japanese expert given in the Minutes of Meeting signed on 5 August 2012. The "Road Maintenance Planning" expert is replaced by "LBT guidelines/cost estimate" expert who is in a more pertinent position to the project activities to develop LBT bituminous surfacing rather than capacity building of the planning aspect of road maintenance in general.

5. Monitoring and Evaluation

Following JICA's Procedure Guidelines for Monitoring Technical Cooperation Projects (July 2014), the project will be monitored through the use of a

"Monitoring Sheet" prepared based on the Project Design Matrix (PDM) and Plan of Operation (PO) which will be jointly reviewed by both sides biannually. Hence the mid-term review is replaced by periodic monitoring of the project by the monitoring sheet. Also terminal evaluation is substituted by a project completion report that entails assessment of achievement of project objectives and outputs.

PROJECT FOR DEVELOPING LABOUR- BASED BITUMINOUS SURFACING (LBST)
THE FIRST JOINT CO-ORDINATION COMMITTEE (JCC) MEETING

MINUTES OF THE MEETING
INVOLVING JICA/EJEC, HEADS OF AGENCIES AND MRH MANAGEMENT
HELD ON TUESDAY 16TH FEBRUARY, 2016.

For implementing The Project for Developing Labour-Based Bituminous Surfacing (hereinafter referred to as "LBST"), Record of Discussions (R/D) was signed on 17 August, 2015 between the Government of the Republic of Ghana and Japan International Cooperation Agency (JICA), and LBST started from February, 2016 accordingly.

In accordance with R/D, the first Joint Coordinating Committee (JCC) was held on 16 February 2016 at Conference Room (Ground Floor), Department of Feeder Roads Head office in Accra for discussions of Work Plan, Project Design Matrix (PDM), sharing of project progress so far and so forth.

As a result of the discussion during the first JCC, it was confirmed and agreed among all members as referred to in the documents attached hereto.

16TH FEBRUARY, 2016

Mr. Motoki Ogawa
Chief Advisor, JICA-LBST
EJEC

Mr. F.O.M. Digber
Director
Department of Feeder Roads

for
Mr. Hiroshi Sumiyoshi
Senior Representative
JICA Ghana Office

Mr. G.J. Brocke
Ag. Chief Director
Ministry of Roads and Highways

1.0 PARTICIPANTS

1.1	Mr. G. J. Brocke	- Ag. Chief Director- Ministry of Roads and Highways
1.2	Mr. F.O.M. Digber	- Director (DFR)
1.3	Mr. John O. Asiedu	- Deputy Director of Planning (DFR)
1.4	Mad. Yvonne Quansah	- Director, ERM-B
1.5	Mr. Hiroshi Sumiyoshi	- Deputy Representative- JICA Ghana Office
1.6	Mr. Hiroki Tazawa	- Assistant Representative-JICA Ghana Office
1.7	Mr. Prince Bio	- Local Consultant, JICA Ghana Office
1.8	Mad. Efua Effah	- Senior Engineer, P&P MRH
1.9	Mr. Ali Mohammed	- Head, (Japan, China, South Korea) MOF
1.10	Mad. Matilda M. Annor	- Ministry of Finance
1.11	Mr. K. Omane-Brimpong	- Counterpart Engineer
1.12	Mr. Motoki Ogawa	- JICA Expert/EJEC
1.13	Ms. Mayumi Shoji	- JICA Expert/ EJEC

ACTION

1.0 OPENING PRAYER

The meeting started at 10:00am with an opening prayer by the Deputy Director Planning, Mr. John O. Asiedu who went further to state the purpose of the meeting.

2.0 OPENING REMARKS BY THE CHAIRPERSON (MRH)

The chairperson, Ag. Chief Director of Ministry of Roads and Highways, Mr. G.J Brocke officially opened the meeting and gave his opening remarks. He commended participants for being part of the Japan International Cooperation Agency meeting and requested for the necessary support and cooperation from members.

The chairperson indicated that, the members in the meeting are going to be the steering committee members for the Project. He mentioned that Labour-Based technology has been practiced in Ghana for quite a while but this effort will move the technology to another level with Labour-Based Bituminous technology and there is a lot to learn in terms of data application by the end of the project to determine the progress so far made.

The chairperson further reiterated that the Ministry of Roads and Highways has a policy to support Labour-Based Projects and local Contractors in terms of priority and that JICA should come up with proper modalities to guide the project implementation.

There would be the need to communicate this to players in the industry. This is the first meeting to set the pace and also chat the path for the project. The Ministry will be supportive including representatives from Ministry of Finance. This is critical and we believe that we can all work together and make this successful, said the chairperson.

2.1 OPENING REMARKS FROM JICA

Mr. Hiroshi Sumiyoshi, senior representative of JICA, Ghana Office in his remarks expressed great pleasure in participating in the first Joint Coordinating Committee meeting under Technical Cooperation Project for Developing Labour Based Bituminous Surfacing Technology.

He further made known to the meeting that, the Government of Ghana has been putting emphasis on deepening the implementation of labour-based construction in urban and rural areas to reduce unemployment. He commented that Labour-Based Technology as an approach is not new to Ghana. The approach was used in construction and maintenance of feeder roads and the development of needed socio-economic infrastructure to accelerate state-led post-independence economic growth and development and in the past, various Development Partners supported it.

He also mentioned that, Ghana is now trying to introduce Labour-Based Bituminous Surfacing Technology as one of the technologies which optimize

maintenance cost of feeder roads and JICA is proud to be a part of it.

As he put it, this project is termed "technical cooperation for developing Labour-Based Bituminous Surfacing Technology", in which Japanese experts are deployed to support DFR to conduct field trials and develop guidelines for labour-based bituminous surfacing technology.

The project will also provide machinery and equipment for the field trials as well as training for counterpart staff and major stakeholders. And through those activities methodology for the aforementioned Technology will be established. The overall goal of this project is that Government of Ghana will take measures to make Labour-Based Bituminous Surfacing Technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.

He emphasized that it is the hope of all concerned that the necessary cooperation would be received from all stakeholders to ensure that this project is implemented smoothly and successfully.

3.0 OUTLINE OF THE PROJECT

ACTION

Mr. Motoki OGAWA, JICA Expert / EJEC was grateful for being in Ghana for the first time and outlined the project as indicated below.

(a) Project outputs, Purpose and Overall Goal

Outputs

- Current conditions and issues for labour based bituminous surfacing technology in Ghana are identified
- Field trials of labour based bituminous surfacing technology are carried out.
- Guidelines for labour based bituminous surfacing technology are prepared.

Purpose.

- The methodology and application of labour-based bituminous surfacing technology is established through the field trails in Eastern Region of Ghana.

Overall Goal

- Measures are taken to make labour-based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.

(b) Members of the Project **ACTION**

The following eleven (11) experts will be dispatched to join the Project.

1. Mr. Motoki Ogawa -Chief Advisor/Rural Roads Development
2. Mr. Seiji Kadooka -Road Pavement Technology
3. Mr. Hiroaki Takahashi -LBT Guideline
4. Mr. Kazunori Kobayash-Cost Estimate/Safe Guard
5. Mr. Masahiko Nishida -Site Supervisor
6. Mr. Masanori Takeishi -Maintenance of machinery and Equipment
7. Ms. Chiemi Osada -Environment
8. Ms. Yumiko Takeda -Project Coordination 1/Training Planning
9. Mr. Takaaki Hirakawa -Monitoring and Evaluation 1
10. Ms. Mayumi Shoji -Project Coordination 2/Monitoring & Evaluation 2
11. Dr. Tatsumi Tokunaga -Project Review

(c) Outline of the Schedule

Mr. Ogawa explained that this project will last for 3 years. The first year will focus on collecting current data such as standards, guidelines and related research papers. Also, the preparation for the trial construction which is expected to be conducted soon in the next years reflecting the data collected and analyzed shall be carried out.

In the second year, the first trial construction shall be carried out and the draft guideline will be developed. Followed by the third year, the second trial construction will be carried out to verify the contents of the developed guideline. Seminars will be held twice to share knowledge among stakeholders. Dr. Tatsumi Tokunaga from Japan and Prof. Ampadu from KNUST are expected to lecture regarding tentative utilization of bituminous surfacing technology by LBT and dissemination of the Guideline.

Mr.Ogawa also emphasized that, considering the dissemination of the guideline of the third year, it is significant asking government's collaboration such as statement utilizing LBT on bituminous treatment and to allocate budget to this field.

3.1 CONTENTS OF PROJECT WORK PLAN

ACTION

3.1.1 Contents of the Project were presented by Eng. Omane-Brimpong /DFR as follows.

Basic policy 1: Accurately understand and analyze the current situation

Eng.Omane explained the importance of understanding the current situation such as existing standards, guidelines and related project activates precisely and accurately. Therefore, following data items and others shall be collected at the beginning of the Project.

- Counterpart organization, capacity mobilization and budget
- Available technical standards and design guidelines
- Market price of materials which is procurable
- Management structure of pavement construction in DWD
- Maintenance and management system of rural roads

3.1.2 Basic policy 2: Manage project through proper monitoring

Monitoring is the pillar of the project management performed to check whether the activity has taken place according to the plan. Therefore in this project it is planned to submit monitoring report every six months. The Monitoring plan shall be submitted to MRH, JICA HQ and JICA Ghana office respectively by creating together with the DFR and the Japanese Expert Team.

3.1.3 Basic Policy 3: Perform effective on-the job training

OJT would be carried out in this Project to deepen the understanding of the output mentioned above. Therefore, the following areas are expected to carry out such OJT activities.

- Project operation
- Pavement technology
- Equipment management
- Construction management /Safety Control
- Quality Control
- Contract management/ Cost Estimation
- Training

3.1.4 Basic Policy 4: Select appropriate equipment based on circumstances in Ghana

The equipment for the trial construction shall be provided from the Project. Although the type and specification of the equipment shall be determined in accordance with the type of the pavement in the trial construction, here tentatively the following equipment shall be procured.

- Pedestrian Roller
- Bitumen distributer
- Bitumen heating unit
- Tractor
- Towing trailer
- Tamping Rammer
- Chip Spreader
- DCP

3.1.5 Basic policy 5: Obtain many findings through trial construction

ACTION

Trial construction shall be carried out twice in two years before the rainy season starts to avoid rain while using bitumen. It should be taken into account that approximately 6 months is required for the preparation of site, including site selection, cost estimation and development of tendering documents. Expected findings from the trial construction are shown below.

- Contract management
- Labour Management
- Construction Schedule
- Quality Control
- Site management
- Application of Guideline

Also the roles of each party were confirmed as follows.

- Counterpart: Cost for personnel such as labour and supervisor, Contract with the Contractor
- The Project: Construction Materials, Equipment

3.1.6 Basic Policy 6: Create user-friendly Guideline

The guideline should be plain and easy to understand, and will be developed through the Guideline Working Group, which would be consisted of DFR, KTC and other related stakeholders. Tentatively this Working Group schedules 8 times; however it should be reviewed according to the necessity.

3.1.7 Basic Policy 7: Devising an effective training plan

Third Country Training is included in the activity of the Project. The country to visit is tentatively fixed to South Africa by strong request of the Counter Parts. However, it was agreed to choose country to visit practically by evaluating the results of the activities so far. ILO regional seminar which is taken place in every 2 years were introduced and recommended to submit paper to this conference

3.1.8 Basic Policy 8: Conduct seminars for information sharing and explanation

Seminars are planned to be carried out two times, one in the med-term of JCC meeting in 2017 and another after the second trial construction in 2018. The purpose of the seminar is to disseminate the lessons obtained from the trial construction and developing guideline, and share among the related stakeholders. The professors from Japan and Ghana shall be invited for lecture also.

4.0 MONITORING

ACTION

The system of monitoring was explained by Mr.Ogawa /Chief Advisor.
He explained that monitoring report shall be prepared by both the C/P and the Project, and submitted to JICA-HQ, JICA Ghana Office and Government of Ghana. The monitoring will follow the standard form attached in the Work Plan. He also mentioned that, there will be JCC meeting three times through the Project to explain the achievement and ask approval of the activity.

5.0 PROJECT DESIGN MATRIX (PDM) AND PLAN OF OPERATION (PO)

The function and contents of the PDM and PO was explained by Eng. Omane and Ms.Shoji. The following contents were agreed on.

(1) Project purpose

- The methodology and application of labour based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.

(2) Outputs

- Current conditions and issues for labour based bituminous surfacing technology in Ghana are identified
- Field trials of labour based bituminous surfacing technology are carried out.
- Guidelines for labour based bituminous surfacing technology are prepared.

6.0 DISCUSSION/COMMENTS

The Chairperson requested the participants to give their comments on the Presentation of the Work Plan. Mr. Ogawa/Chief Adviser of the Project answered the questions.

6.1 QUESTIONS/COMMENTS FROM PARTICIPANTS

CHAIRPERSON:

Q1: Government of Ghana shall be included to the ones submit to the monitoring report, and number of times conducting JCC meeting shall be increased.

A1: The monitoring report shall be created by both the Project and the C/P, and shall be report to JICA-HQ, JICA Chief Representative and MRH, Government of Ghana. The number of times for JCC meeting will be discussed further and find out ways to implement such as increasing the numbers of guideline workshop as an example.

Q2: Looking at experience from other countries for utilizing LBT will guide us in formulating our project.

A2: Since our team has an experience at the other African countries such as Tanzania and South Africa, we are planning to utilize our experience and personal relation to this Project.

Q3: The site of the trial construction shall be considered by the classification and network as well as decentralization. **ACTION**

A3: The site and its criteria of the section for the trial construction shall be discussed with DFR. It also will be controlled by the type of pavement to construct.

Q4: It is important to involve Eastern Region which as experience in LBT

A4: We are aware of importance involving the local government and community as well as central departments to the Project since it is LBT project. We understand the significance of involving the Easter Region in particular, since they have a lot of experience of LBT through the KTC's Activities.

Q5: It is important to consider the safety, environment and health in the trial construction.

A5: Japanese experts in environment and safety are assigned. Regarding the health, we will consider how to manage the issue among the current assigned experts.

Q6: It should be considered, after the Project completes, how to actually implement this to be a part of the industry in Ghana.

A6: The topic indicated above will be discussed at the third year of the Project. Regarding the dissemination of the guideline produced, following three items should be pointed out. First a strong statement from the Government for utilizing LBT in bituminous surfacing treatment, second a technical background and third a practical job creation (allocation of budget). In particular, the third one is considered significant because it envisaged that where a business private sector will invest and lead it to the industry.

DIRECTOR (DFR)

Q7: Talked about the weather condition. We want further explanation

A7: The season of the trial construction was proposed between February and April to avoid rainy seasons, enable to apply the heated bitumen. Since the climate and weather condition in Eastern Region is not so clear at this moment, we will keep consulting with DFR.

Q8: The reasons why the Project proposed to secure both for labour-based and equipment applications.

A8: It was considered important to have both data of LBT and EBT to find out the difference of condition utilizing bitumen surface treatment in LBT. So it does not have to be the same route or same duration, and other projects just for comparison.

DEPUTY DIRECTOR OF PLANNING (DFR)

Q9: There is a report that trial construction in otta seal, requires hot bitumen, has many issues in Ghana. Therefore, the type of bituminous emulsion will be recommended as a pavement in the trial construction and guideline.

A9: Further and continuous discussion for this topic will be expected.

Q10: KNUST has a programme which we are monitoring.

A10: We are expecting KNUST to be a part of this Project as well as other stakeholders.

FINANCE: BY MAD MATILDA M. ANNOR

Q11: Is Environmental Protection Agency (EPA) involved in the Project?

A11: Environment expert is assigned in this Project. She will take necessary measures if required.

CLOSING REMARK BY CHAIRPERSON

The chairperson remarked that comments raised in the meeting have been taken note of and have the assurance that in the end the overall goal will be achieved.

7.0 CLOSING

The Deputy Director of Planning (DFR) Mr. John O. Asiedu closed the meeting at 12:00 pm.

ATTACHMENT: WORK PLAN

THE PROJECT FOR DEVELOPING LABOUR-BASED BITUMINOUS SURFACING TECHNOLOGY (LBST)

Department of Feeder Roads, Ministry of Roads and Highways

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

LBST 2ND Joint Coordinating Committee Meeting, 2nd August 2017

MINUTES OF THE MEETING

The Second (2nd) Joint Coordinating Committee Meeting was held on 2nd August, 2017 at the Conference Room (Ground Floor) of the Department of Feeder Roads Head Office in Accra to discuss the **Current Achievements of the Project, Progress of the first Trial Construction, Findings and Lessons Learnt from the Trial for the development of Guidelines and Way forward.**

Mr. N. Yonebayashi
Deputy Country Director
JICA

Mr. E. Duncan Williams 9/2/18
Director
Department of Feeder Roads

Mr. G J. Brocke
Chief Director
Ministry of Roads and Highways.

1.0 PARTICIPANTS

1.1	Mr. G J. Brocke	-	Chief Director, MRH
1.2	Mr. Ibrahim Siedu	-	Director of RSIM, MRH
1.3	Mr. E. Williams Duncan	-	Director (DFR)
1.4	Dr. K. OsafoAmpadu	-	Deputy Director Planning (DFR)
1.5	Mr. Mr. N. Yonebayash	-	Deputy Country Director, JICA Ghana
1.6	Mr. Masaahi Yamanoro	-	Staff- JICA Ghana
1.7	Mr. Naonari Miyoshi	-	Staff- JICA Ghana
1.8	Mr. Prince Bio	-	Local Consultant, JICA Ghana
1.9	Mr. Motoki Ogawa	-	Project Leader, EJEC
1.10	Mr. Takaki Hirakawa	-	Monitoring, EJEC
1.11	Ms. Yumiko Takeda	-	Project Coordinator, EJEC
1.12	Ms. Tomoe Iehisa	-	Project Coordinator, EJEC
1.13	Mr. Anthony Mensah	-	Assistant Supervisor, EJEC
1.14	Mr. Bernard Badu	-	Dept Director Development, DFR
1.15	Mr. K. Omane-Brimpong	-	Principal Engineer (DFR)
1.16	Dr. Patrick Amoah Bekoe	-	Senior Engineer, DFR
1.17	Mr. Bernard W. Amoah	-	Mechanical Engineer (DFR)
1.18	Mr. Mawusi Joseph A.	-	Assistant Engineer, DFR
1.19	Mr. Frank Amofa A.	-	Assistant engineer, DFR
1.20	Mr. Kwabena Afrifa	-	Assistant engineer, DFR
1.21	Mr. Joseph A. M. Idun	-	Chief Quantity Surveyor, DFR
1.22	Mr. Seth Osei Nketiah	-	Regional Manager, DFR E/R
1.23	Mr. Isaac Mensah	-	Principal Quantity Surveyor DFR E/R
1.24	Mr. Christopher E. Ampah	-	Lab. Technician, DFR E/R
1.25	Mr. Frederick K. Addison	-	Senior Engineer, DFR E/R
1.26	Mr. Michael Ribeiro	-	Engineer, KTC E/R
1.27	Ms. Gifty Gbenyo	-	Secretary EJEC

2.0 AGENDA

2.1 Opening Prayer
2.2 Self Introduction
2.3 Opening Remarks
2.4 Presentations on
- Current Achievement of the Project
- Progress on the first Trial Construction
- Findings and Lessons Learnt from the Trial Construction for the development Guidelines

2.5 Way Forward
2.6 Discussion
2.7 Closing

3.0	*PROCEEDINGS OF THE MEETING*	ACTION
3.1	**SELF INTRODUCTION**	
	Self-introduction was done as per the list of Participates attached.	
3.2	**OPENING PRAYER**	
	The meeting started at 10:15am with an opening prayer by Dr. Isaac Mensah.	
	The Chairman asked members to go through the minutes for corrections, additions and omissions if any. The minute were moved for acceptance by Mr. Omane Brimpong and it was seconded by Mr. Prince Bio.	
3.3	**WELCOME ADDRESS**	
	The Director of DFR, Mr E. Duncan Williams welcomed members to the Second (2nd) Joint Coordinating Committee meeting and requested their cooperation during the meeting.	
	Mr. K. Osafo Ampadu, the Deputy Director Planning, mentioned that, the purpose of the meeting was to review the progress of the LBST trial construction.	
	Mr. N. Yonebayashi, the Senior Representative from JICA Office said he was pleased to participate in the 2nd Joint Coordinating Committee meeting under this Technical Cooperation Project for Developing Labour Based Bituminous Surfacing Technology. He reminded members that the project was launched in February 2016 with the aim of establishing labour based bituminous surfacing technology (LBST) in Ghana. He mentioned that Japanese Experts were deployed since then to support DFR to conduct field trials and develop guidelines for the LBST in Ghana. The "Project" he said procured the following equipment for the Trial Construction. • Bitumen Sprayer • Chip Spreader • Duplex and Plate Compactors • Tractor Heads and Trailers • DCP & Accessories • Concrete Mixer etc. With this equipment he said, the trial construction had progressed successfully. He was happy the project has gathered very useful information and experience to institutionalize and develop guidelines for the LBST in Ghana.	

	Additionally, he mentioned that the project was planning to undertake 3rd country training for counterpart staff and major stakeholders to broaden their knowledge in LBST in November 2017. He expressed his gratitude for the enormous cooperation received not only from their main counterpart-DFR, but also from other key stakeholders including MRH, KNUST, KTC and the residents of Obomofodensua and Akote where the field trial construction is ongoing. He expressed the hope that, they will continue to enjoy this mutual cooperation to ensure successful implementation of the project. He said if stakeholders kept working together in that manner, he had no doubt that the overall goal of the project which is to make Labour Based Bituminous Surfacing Technology adopted as a viable alternative for surface treatment of feeder roads by the Government of Ghana, will be achieved and the achievement of the goal will contribute to the reduction of unemployment especially in rural areas which government keeps emphasizing.	
4.0	***PRESENTATION ON:***	
	➢ **Current Achievement of the Project by Mr. Omane-Brimpong**	
	➢ **Progress on the first Trial Construction by Mr. Frank Amofa Agyeman.**	
	➢ **Findings and Lessons Learnt from the Trial Construction for the Guidelines by Dr. Patrick Amoah Bekoe**	
	➢ **Way Forward by Mr. Motoki Ogawa**	

Please, find attachments of the Presentations.

		ACTION
5.0	**COMMENTS/ SUGGESTIONS FROM MEMBERS** The Chairman requested members to give comments on the Presentation.	
5.1	**Q1**: Chairman, Mr. G J. Brocke asked whether apart from DFR Officials, assessing themselves on the questionnaires, any other group(s) were also involved in the assessment such as contractors. **A1**: Mr. Omane-Brimpong, Principal Engineer (DFR) and theProject Manager's representative of the Trial Construction answered that, because the project was a trial one, the assessment involved DFR staff only but contractors would be involved at the Second Trial. A2: Dr. K. Osafo Ampadu explained that, the Project Team taught it was necessary to train DFR Officials to understand the whole process first before training contractors.	
5.2	**Q2:** Mr. Joseph A. M. Idun, the Chief Quantity Surveyor of DFR Accra, asked whether the project Team had some Cost Target that they were working towards. He explained further that, he asked these question because, at the end of the project, it should be established how competitive the labour based method is compared with the capital based method. **A1**: Mr. Ogawa replied that, one of the cost method used, was the Production Rate. The Chief Director of MRH advised that, since JCC is held once in a year, Presentations/documents must be detailed and include Cost Estimate of the project. Dr. Isaac Mensah mentioned that, because the LBST project is new in Ghana, the production rates were based on the one established by South Africans on Labour Based Bituminous Surfacing Technology. He added that now that the first Trial was getting to an end, the team would be using the production rates actually obtained at the site to build the Rates. Dr. Ampadu mentioned that, the project team had an intensive workshop in the Eastern Region on developing the guidelines for LBST in Ghana, and so far a lot of data had been collected in respect of production rates which Dr. Isaac Mensah was working on; he further explained that cost per each activity of an item of work would be compared with the equipment based method and the team to clearly establish the way forward.	

	Q3: Alhaji Siedu asked of the amount spent on the first trial so far. A1: Dr. Isaac Mensah answered that, the project team is now computing the production rates obtained at the site into the estimating spread sheet that has been developed. He explained further that, the team would look at the cost per kilometer for the asphaltic concrete as against chip seal to establish the one that is economically viable. The Chief Director Mr. Brocke asked for another meeting so that Dr. Isaac Mensah the Contracts Manager for this trial project to present what was actually spent on the first trial. **Q4.** Mr. Prince Bio asked that, in the presentation, findings and lessons learnt from the Trial Construction, nothing was made on Health and Safety. A1. The Chairman, Mr. Brocke advised that the preparation stage of the project should even start with Health and Safety. **ON THE WAY FORWARD.** Mr. Motoki Ogawa the Project Manager, mentioned the following: ➢ There was going to be a Technical Seminar on 17th August 2017at KTC to discuss the first trial construction and presentations would be made on the achievements so far ➢ After the meeting, the Team will visit the Trial Construction Site at Obomofodensua. ➢ The Study Tour at the Third Country (South Africa and Ethiopia) in November 2017 ➢ The Second Trial Construction would start next year 2018 but the project team would select another contractor and would compare both contractors and analyze the data collected from both trials to inform what should be put into the guide lines. He further mentioned that, if there was going to be Annual Seminar in the Engineering field, then he would like to present the guideline and talk about its update from time to time. **OTHER MATTERS** Director of DFR Mr. Duncan asked whether the project team encountered any problems during the trial construction. Mr. Omane-Brimpong, answered that, the main challenge was the building to be demolished at CH 0+175 which was not done due to the nonpayment of compensation to the building owner. He said the compensation was included in a GOG IPC raised by the contractor which is not yet paid.	DFR

Dr. Ampadu pointed out that, delay payment on GOG projects poses a lot of danger to the labour based contractors. He cited an example where the contractor's workers blocked the road because he owed them.
He requested the Ministry of Roads and Highways to device a means of paying labour based contractors on time to avert some of these problems.

The Chief Director of MRH Mr. Brocke promised to see to it that, labour based contractors whose IPC's are at the ministry would be paid. He added that IPC's of labour based contractors should be clearly labeled for easy identification so they can be prioritized for prompt payment.

Dr. Patrick Bekoe suggested that, training of DFR Officials should be done at the end of the project. He also suggested the engagement of a statistician or an economics to analyze the data collected from the project.

Mr. Prince Bio suggested the involvement of the media in the trial construction for publicity since visibility of the project is not enough.

Mr. Omane Brimpong requested an increase in the number of participants to a study tour in South Africa and Ethiopia in November 2017.

Closing Remarks by Chairman.
The chairman thanked all members for attending the 2nd JCC meeting.
The meeting was adjourned at 12:30 pm and a closing prayer was said by Dr. Ampadu.

THE PROJECT FOR DEVELOPING LABOUR-BASED BITUMENOUS SURFACING TECHNOLOGY (LBST)
Ministry of Roads and Highways, Department of Feeder Roads
Japan International Cooperation Agency (JICA)

LBST Final JCC and Presentation of the Guideline/Seminar, 11th December, 2018.

The Final JCC and Presentation of Guideline/Seminar of the **Project for Developing Labour Based Bituminous Surfacing Technology (LBST)** in Ghana was **held on Tuesday 11th December, 2018** at the **Conference Hall of the Ghana Institution of Engineers (GhIE) at Roman Ridge Accra**, to present **the contents of the prepared Guideline and to report the achievements of the Project with the summarization of the project**. In addition, discussions were made focusing on further action to be taken in Ghana for the dissemination and sustainability of the LBST.

.....

Mr. Offei Annor
Chief Director
Ministry of Roads and Highways

.....

Ms. Maki Ozawa
Senior Representative
Japan International Cooperation Agency
Ghana Office

.....

Mr. Bernard Badu
Director
Department of Feeder Roads

.....

Mr. Motoki Ogawa
Team Leader
Eight-Japan Engineering Consultants

1. PARTICIPANTS

1.1	Hon. Anthony Kabo	-	Deputy Minister/MRH
1.2	Mr. Edmund Offei-Annor	-	Chief Director, MRH
1.3	Mrs. Rita Ohene Sarfoh	-	Director Policy & Planning, MRH
1.4	Mr. Ernest Obeng	-	Director/RSIM/MRH
1.5	Mr. Nii O. Manieson	-	Assistant Public Relation Officer/MRH
1.6	Mr. J. O. Asiedu	-	Consultant/Former RSIM/MRH
1.7	Mr. Francis O. M. Digber	-	Former Director/ DFR
1.8	Mr. Bernard Badu	-	Director/DFR
1.9	Mr. K. N. Akosah-Koduah	-	Deputy Director Planning/DFR
1.10	Mr. David Brobbey	-	Chief Engineer MTCE/DFR
1.11	Mr. R. O. Otoo	-	Deputy Director Maintenance/DFR
1.12	Mr. Nii Sarpei-Nunoo	-	Deputy Director Development/DFR
1.13	Mr. Peter K. Yawson	-	Chief Engineer/DFR
1.14	Mr. Omane-Brimpong	-	Principal Engineer/DFR
1.15	Mr. Lawrence Abbew	-	Chief Quantity Surveyor (DFR)
1.16	Mr. Joseph A. M. Idun	-	Chief Quantity Surveyor/CM/DFR
1.17	Mr. Kwame Nimako	-	Senior Engineer/DFR
1.18	Mr. Martin K. Mensah	-	Assistant Engineer/DFR
1.19	Mr. Eric K. Anyidoho	-	Technical Engineer/DFR
1.20	Mrs. Efua Akwetea-Mensah	-	Principal Engineer/DFR/Regional
1.21	Mr. Bernard Amoah	-	Mechanical Engineer
1.22	Mr. Mawusi Joseph A	-	Assistant Engineer, DFR
1.23	Mrs. Juliet Amponsah	-	Engineer/Environmentalist/DFR
1.24	Mr. Seth Osei Nketiah	-	Regional Manager/DFR/ER
1.25	Dr. Isaac Mensah	-	Contracts Manager/DFR/ER
1.26	Mr. Frederick K. Addison	-	Senior Engineer/DFR/ER
1.27	Mr. Christopher E. Ampah	-	Material Engineer/DFR/ER
1.28	Mr. Theodore Quaye	-	Chief Engineer Maintenance/DUR
1.29	Mr. Kobina Ennim	-	Principal Engineer/DUR
1.30	Mr. Cuthbert K. Tegah	-	Chief Engineer/GHA
1.31	Ms. Olivia Foli	-	Chief Mat. Engineer/GHA
1.32	Ms. Nancy Donkor	-	Senior Engineer/GHA
1.33	Ms. Nancy Qetsil	-	Senior Tech. Engineer/ GHA
1.34	Mr. Raymond Opoku Nuamah	-	Engineer/GHA
1.35	Mr. Isaac T. Nyadol	-	Engineer/GHA
1.36	Mr. Dartey Nathan	-	Engineer/GHA
1.37	Mr. Kofi A. Wiafe	-	Engineer/GHA
1.38	Mr. Henry Kofey	-	Engineer/GHA
1.39	Mr. Franklin A. Agbanator	-	Director/KTC
1.40	Mr. E. Opoku-Adusei	-	Assistant Engineer/KTC
1.41	Mr. Michael Ribeiro	-	Assistant Engineer/KTC
1.42	Prof. S. I. K. Ampadu	-	Consultant/KNUST
1.43	Dr. Osafo K. Ampadu	-	Consultant/AR
1.44	Ms. Maki Ozawa	-	Senior Representative/JICA
1.45	Mr. Kenshio Tanaka	-	Mission Leader/JICA

1.46	Mr. Yamamoto Masashi	-	Rep./Infrastructure/JICA
1.47	Ms. Ayumi Gosho	-	Project Formulation Advisor/JICA
1.48	Mr. Prince Bio	-	Infrastructure/JICA
1.49	Mr. Motoki Ogawa	-	Team Lear/EJEC/JICA
1.50	Mr. Anthony Mensah	-	Assistant Supervisor/EJEC/JICA
1.51	Ms. Gifty Gbenyo	-	Secretary/EJEC/JICA
1.52	Mr. Dan Agroh	-	National Chairman/ASROC
1.53	Mr. Alfred N. Tetteh	-	Executive Director/ Naggesten Ltd.
1.54	Mr. Stephen K. Amponsah	-	Managing Director/Naggesten Ltd.
1.55	Mr. Bernard Brown	-	Administrator/Naggesten Ltd.
1.56	Mr. Godwin N. Tetteh	-	General Works Supervisor/Naggesten Ltd.
1.57	Mr. Emmanuel Annor	-	Managing Director/Bend-Kay Ltd.
1.58	Mr. Samuel Opoku	-	Site Supervisor/Bend-Kay Ltd.
1.59	Ms. Adwoa Asotia-Boakye	-	Engineer/GSOP
1.60	Mr. Desmond Duameta	-	Former MLGRD/GSOP
1.61	Mr. Kofi Agyekum	-	C.E.O/J. K. Royal/PROCA
1.62	Mr. Joseph Hewton	-	Managing Director/Johaze Ltd.
1.63	Mr. Elliot Awuku	-	Camera/GTV
1.64	Mr. Schorm Ayittey	-	Reporter/GTV
1.65	Mr. Moro Yaro	-	Reporter/UTV
1.66	Mr. Godfred Dornapo	-	Camera/UTV
1.67	Mr. Lawrence Alpah	-	Reporter/Ghanaian Times
1.68	Mr. Edmond Acquah	-	Reporter/Daily Graphic
1.69	Mr. Felix Antonio	-	Reporter/info. Service Dept.
1.70	Mr. Edward Odonkor	-	C. E. O./4CAMRES

2. AGENDA

2.1 Opening Prayer
2.2 Opening Remarks by Chairperson
2.3 Message from the Chief Representative of the JICA Ghana office
2.4 Message from the Hon. Minister of Roads and Highways
2.5 Power Point Presentations of the Guideline

- Executive Summary of the Guideline
- Chapter-1 Introduction to Sealing
- Chapter-2 Planning
- Chapter-3 Design
- Chapter-4 Construction
- Chapter-5 Quality Assurance and Control
- Chapter-6 Maintenance
- Chapter-7 Production Rates and Unit Rates Build Up
- Appendices
- Discussion.

2.6 The final Joint Coordinating Committee

- Achievements of the Project

- Summarization of the Project and Proposal for further Action in Ghana
- Discussion on Dissemination of LBST and the Way Forward
- Closing Remarks.

3. Minutes of the Meeting.

3.1 Self-Introduction

The moderator requested participants to introduce themselves to the meeting after which he introduced those at the high table. The meeting started at 9.15 am with an opening prayer by Mr. Anthony Mensah.

3.2 Opening Remarks

The meeting was chaired by the Chief Director of the Ministry of Roads and Highways. He stated some benefits of the LBST as a technology for maintaining our roads and job creation which is in line with the governments' agenda. He mentioned that, one of the main reasons for establishing the Koforidua Training Centre (KTC) is for training in Labour Based Technology for constructing our roads up to the sub-base level. He said, the Labour Based Technology has now developed to include bituminous surfacing of the gravel roads, and he was impressed about the Guideline which has been developed for the bituminous surfacing with assistance of JICA. He assured JICA that the Guidelines for Labour Based Bituminous Surfacing Technology (LBST) will be used for the benefit of the country. He praised the Team Leader and the Team members who worked to achieve the Guidelines.

3.3 Message from the SeniorRepresentative of JICA

The SeniorRepresentative of JICA Ghana office who represented the Chief Representative, mentioned that JICA has been in cooperation with infrastructure sector in Ghana with several schemes, including technical cooperation. She said JICA has in the past provided over 700 Kilometers of national trunk roads and a number of bridges as well as training for Ghanaian engineers and other staff in the road sector. She mentioned that, JICA recognized the use of LBST as an effective method in construction for socio-economic benefits. She requested that, the Guidelines should not only be used for the development of our quality roads but also as a means of generating employment for our people in rural area.

3.4 Message from the Hon. Minister

The Hon. Deputy Minister of Roads and Highways who represented the Minister, commended JICA for the various interventions in support of the country. He apologized for the inability of the Minister of Roads and Highways to attend the programme due to some other equally important national assignment.

He mentioned the various interventions of government in solving the unemployment problem confronting the nation, key among it being infrastructural development.

He recalled the inception of the Labour Based Technology in 1987 which aimed at constructing our roads up to the sub-base level. He praised the development of the Guidelines for Labour Based Bituminous Surfacing Technology and assured the JICA Team and participants of its use. He thanked JICA and the members who worked to develop the Guideline. The Deputy Minister after delivering the message of the Minister, outdoored the first ever Guidelines for Labour Based Bituminous Surfacing Technology in Ghana.

3.5 Presentation of the Guideline

Presentation of the Guideline was done as follows:

(i) The Executive Summary of the Guideline was presented by Ing. Dr. Ampadu
(ii) Chapter-1 Introduction to Sealing was presented by Ing. K. Omane-Brimpong
(iii) Chapter-2 Planning was presented by Ing. Frederick Addison.
(iv) Chapter-3 Design was presented by Ing. Frederick Addison
(v) Chapter-4 Construction was presented by Ing. Frederick Addison.
(vi) Chapter-5 Quality Assurance and Control was presented by Ing. Joseph Mawusi
(vii) Chapter-6 Maintenance was presented by Ing. Frederick Addison
(viii) Chapter-7 Production Rates and Unit Rates Build up was presented by Dr. Mensah.

Video of the Trial Construction was shown to the participants.

3.6 Discussion

The following discussions were made among the participants.

- ✓ Mr. John Asiedu asked whether there was any time lag between the Primer Seal and the Seal Coat in respect of the unit rates build up. Dr. Mensah responded that, the time lag has no influence on the unit rate build up.

- ✓ Mr. Joseph Hewton questioned about the funding of the programme. Members agreed that, there will be the need to set aside some funds for the programme by government.

- ✓ Mr. Peter Yawson inquired about preparations being made by the Ministry for future training. He also inquired about the use of other materials for sealing since chippings may not be readily available in some areas of the country. He suggested the use of natural gravel as an alternative for sealing works.

- ✓ The Director of KTC, Ing. Franklin Agbanator suggested the allocation of funds to KTC and other agencies for future training programmes. He mentioned that, some funds need to be made available to contractors on time for the sustainability of labour based works.

- ✓ Ms. Olivia Foli – GHA referred to page 49 of the Guideline inquiring about the design criteria for the Cold Mix Asphalt and testing. She also suggested that, the pre-coating design used for the trial construction can be owned as the Ghana Specification for LBST works where bitumen emulsion would be used. Mr. Omane-Brimpong responded that, tests were conducted at the GHA Central Lab in Accra for the various Cold Mix Asphalt design mix proportions which met

the MRH Standard Specification for Roads and Bridge works 2007. However, the Project Team could not incorporate the results into the Guideline due to time constraint.

- ✓ The Director of DFR, Mr. Bernard Badu appealed to JICA for further assistance in the training and dissemination of the LBST in Ghana.

- ✓ Dr. Ampadu was of the view that, the country can plan and begin the process first before asking for foreign assistance.

- ✓ Mr. Desmond Duameta mentioned that, based on his experience, the labour content of labour-based acitivities was about 22% and suggested if this could be moved to 30% in the LBST to make it attractive. Dr. Mensah however indicated that, using the direct cost, the labour content was about 30% for the Trial Construction.

- ✓ Mr. Brobby asked whether the Contractors were trained before the Trial Construction. Mr. Omane-Brimpong answered in the affirmative.

- ✓ Mr. Kofi Wiafe-GHA, asked whether the equipment used for the Trial Construction is available in our local market. Mr. Omane-Brimpong said that, currently we don't have some of the equipment i.e the chippy and the bitumen sprayers in the local market but the Gratis Foundation Centers in the country can manufacture these equipment for the local market.

- ✓ Prof. Ampadu commented on the life circle cost of the chip seal and the cold mix asphalt. He suggested that 10% difference in cost established between the chip seal and the cold mix asphalt may offset in the maintenance cost of the cold mix asphalt rather than the initial cost. He requested the Ministry to check this as the two surfacing types used are being monitored. He suggested the use of the LBST in the 'Zongo Development' initiative by the current government to create employment opportunities using the local dwellers in the 'Zongo' communities for the construction of their roads. He urged the Ministry to consider this suggestion. He also considered the labour content of the cost estimation in comparison with the conventional asphalt roads suggesting that the LBST cold mix asphalt can be a viable alternative in that case.

- ✓ Mr. John Asiedu suggested the involvement of Local Government Service in the LBST programme.

- ✓ Ms. Juliet Amponsah inquired about road safety measures in respect of speed calming measures were used in the Trial Construction. Mr. Omane-Brimpong mentioned that, these measures were already in place. She also suggested the involvement of the Environmental Protection Agency in the LBST programme.

- ✓ Mr. Peter Yawson also suggested the involvement of the Ghana Standards Authority in the LBST programme to ensure standards are guaranteed since light equipment for construction would be manufactured locally.

- ✓ Mr. Joseph Hewton also commented on the need to involve the Ghana Standards Authority citing examples of some local materials used in the Construction Industry were not meeting the required standards.

4. The Final Joint Coordination Committee

The final Joint Coordinating Committee meeting started at 2.00pm and was chaired by the Director of the Department of Feeder Roads.

4.1 Achievement of the Project

Mr. Omane-Brimpong made a power point presentation on the achievements of the project as documented. He explained the achievement as follows;

(1) Project Purpose

There are 2 indicators for verification of the project purpose where one is the development of the LBST technology and another is achievement of the understanding by self-evaluation of DFR Staff. At the first trial which would be positioned as the preparation stage, some difficulties were encountered which does not meet the engineering requirements however, instruction from the JICA experts was reflected in the second trial and significant improvement was observed. Also, for the self-evaluation, the score marked was 72.4% where the target was 70%. From these, the following indicators were achieved.

(2) Outputs

The requirement and achievement of the indicators for the output is summarized in the following table.

Table-1 Indicator and achievement of outputs

Item	Indicator	Achievement
Output-1	Indicator 1: Issues and results analyzed by the experts and counterparts are indicated.	The Report contains all necessary issues and results, and it has been approved.
Output-2	Indicator 1: Lab tests of materials in accordance with the material standard	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.

	Indicator 2: The field trials in line with the LBST construction standard	Since the constrain found in the first trial was solved in the second trial, it could be said that the trial was done in the LBST construction standard
	Indicator 3: Task rates for LBST	For two types of labour based bituminous surfacing operations, i.e., "chip seal operation" and "cold mix asphalt operation" were built. 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, m2, or m3).
Output-3	Indicator-1: Completion of the LBST guidelines	Building the Guideline was accomplished in December 2018 with 100 copies.

(3) Important Assumptions

The current status of the important assumptions is given in the next table.

Table-2 Important assumptions and current status

Important assumptions	Current status
<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 as scheduled. Therefore, it is crucial for DFR to monitor the budget disbursement from Road Funds even if the budget is allocated for the LBST measures. DFR shall undertake the promotion of budget disbursement because contractors cannot apply LBST to feeder roads without GOG disbursement for the LBST expansion. Ring Fencing some funds for LBST works

<Output> There is no significant change in C/P assignment.	There are several counterparts replaced by their successors. However, this condition does not severely affect to the achievement of the Project Purpose because the successors have sufficient time to catch up with their predecessors before the termination of the Project.
<Activities> Available resources related to LBST in Ghana (e.g., KTC, KNUST, GHA Central Lab, etc.) are utilized and mobilised.	DFR can utilize and mobilize available resources related to LBST on rural roads in Ghana. KTC is supportive for the project activities. It is necessary to reflect the results and experiences of the Project into the training courses at KTC. KNUST provides the Project with the professional advice on labor-based bituminous surfacing technology. GHA Central Lab supports material tests for the field trial.

4.2 Summarization of the Project and the Proposal for further action in Ghana

A power point presentation on the summarization of the project and proposal for further action in Ghana was made by Mr. Motoki Ogawa. He made the following suggestions:

(i) Government to establish equipment centers to help small scale contractors who would be unable to procure their own equipment.
(ii) The Guideline should be constantly updated from time to time.
(iii) The Ministry should aim at presenting the Guideline at official conferences such as engineering day to ask its approval. The contents of the update should be reported at the ILO Regional seminars if possible.
(iv) Guideline to be uploaded on the DFR website for the authorities to collect the latest version of the Guideline after updating.
(v) For the dissemination of the LBST, although the government has a strong policy to utilize LBT for job creation, LBST should be able to compete with EBT in the market price.

4.3 Discussion on the Dissemination of the LBST and the way forward

✓ The Rep. from JICA Head Office mentioned the successful completion of the JICA section of the project and thanked all the people involved. He stated that, LBST should be evaluated from the social-economic view point such as creating employment for development. He also mentioned delay payment to local contractors as a cause of delay in completing projects on time.

Contractors need cash monthly for various payments and delay in paying them would affect the project. He recommended that payment system should be established to ensure prompt payment to local contractors and to be paid automatically with simple administrative procedure after confirmation of completed amount of works. For the sustainability of the LBST programme, he recommended social consideration should be made as well as economic consideration. He thanked all those who were involved in the development of the LBST Guideline.

- ✓ Ms. Gosho from JICA Ghana office referred to page H-20 and commented on the drop in the labour interest of participation in LBST project. She asked a question on why this drop-in interest for LBST projects. Mr. Ogawa mentioned that the interest of labour force joining LBST project was not only about the wages but also about the development of their road. Prof. Ampadu said the drop in the interest of the labour force may be as result of their expectations being raised high at the beginning of the project but dropped when they got to know the reality. He suggested an engagement with the communities concerning the issue. Mr. Yawson suggested that the drop-in interest may be due to engagement of the labour force in other competing economic activities such as farming. Ing. Franklin Agbanator also suggested the coincidence of the construction period with the farming season.

- ✓ Ms. Gosho wanted to understand what the expectations were at the beginning if that really was the situation. Mr. Yawson also wanted more clarification whether the problem may be as a result of the task given to the workers or the wages paid them. Mr. Prince Bio mentioned that the daily wages paid to the workers could be lower than the right wage based on page H-22 (item no. 80) and that may account for the drop in the worker interest. Mr. Omane suggested that the issue need to be further investigated.

- ✓ Prof. Ampadu commented on the creation of decent jobs in line with the ILO Conventions for example work environment, provision of lunch etc. as incentives which serves as motivation to the work force. He mentioned the payment of contractor's/ the payment of workers if not made on time could demotivate the workforce and affect their output.

- ✓ Mr. Yamamoto from the JICA Ghana office asked that, although there is funding problem, the LBST programme is in line with the government policy of job creation so how is the Ministry liaising with the government to achieve the project goals. Dr. Ampadu said that, the government policy for jobs and payment plan for project does not match. He suggested that, the Director of DFR could decide to use say 10% of DFR budget for labour based projects and ask for additional funding from the Road Fund.

Mr. Omane-Brimpong thanked members for the various suggestions made.

4.4 Closing remarks

Mr. Bernard Badu thanked the Project Team and the Contractors for the work done in developing the Guideline. He mentioned the benefits to be gained by the communities in the use of the LBST. He requested further work study to confirm the established task rates.

He presented some gifts from DFR to three individual members of the JICA Project Team.

Mr. Omane-Brimpong on behalf the Chairman thanked all members for attending the final JCC of the Project for Developing Labour Based Bituminous Surfacing Technology (LBST).

The meeting ended at 3.35 pm with a closing prayer by Dr. Isaac Mensah.

END

ANNEX-5: MONITORING SHEET (COPY)

PMS Ver.1.0

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. 1 (February-2016)
Submission Date: 16th, February 2016

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

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

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project name: Project for Developing Method for Bituminous Surface Treatment Using Ghana LBT
Implementation Agency: Department of Feeder Roads and JICA experts
Period of the project: Feb 2016 to Dec 2018
Project site: Accra (capital) and Eastern Region feeder roads
Target groups: Department of Feeder Roads, Ministry of Roads and Highways officials, Eastern Region officials, KTC staff, and trial construction contractors.

Project Summary	Indicators	Means of Verification	External conditions	Achievement	Remarks
Overall Goal Measures are taken to make labour based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.	1. Field trials are conducted for further improvement and additional validation of LBT surfacing in different climate and traffic conditions. 2. LBT surfacing is officially adopted by DFR for feeder road surfacing. 3. Training course for surfacing technology is set up at the Koforidua Training Centre.	1. Field trial records at DFR 2. Approved manuals/guidelines by DFR 3. Training records at KTC	Budget for maintenance is secured There are capable contractors for labour based bituminous surfacing technology and the maintenance Complying with the guidelines, maintenance of feeder road is properly carried out by DFR		
Project Purpose The methodology and application of labour based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.	Labour-based bituminous surfacing technology is available to the Ghanaian-side through the guidelines.	1. Observation by experts 2. Interview to C/P and experts 3. Work report prepared by the experts (i.e. monitoring of OJT on the field trials) 4. Training Report on OJT	There is no significant change for the activities of DFR for feeder road services. There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road.		
Outputs 1. Current conditions and issues for labour based bituminous surfacing technology in Ghana are identified. 2. Field trials of labour based bituminous surfacing technology are carried out. 3. Guidelines for labour based bituminous surfacing technology are prepared.	1 Data collected and analysed by experts and counterparts. 2-1 Necessary material trial completed 2-2 The first field trial completed 2-3 Task rates for labour based bituminous surfacing technology prepared 3 Draft guidelines for labour based bituminous surfacing technology is completed	1 Progress Report submitted by the experts 2-1 Result of the lab test 2-2 Reports on the field trials 2-3 Task rates 3 Draft Guidelines for labour based bituminous surfacing technology	There is no significant change in C/Ps The draft guidelines prepared is adopted by DFR as its official rule or regulation		
Activities **【Activities for Output 1: Current conditions and issues for labour based bituminous surfacing technology in Ghana are identified 】** 1-1 Collect and analyse information on the counterparts (C/Ps) organisational capacity (e.g. personnel, budget, experiences, etc.) 1-2 Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana, 1-3 Review and evaluate the similar technical standards and manuals prepared by such organisations as Department for International Department (DFID), South African Department of Public Works, etc., 1-4 Confirm the procurement and cost of materials (e. g. gravels, etc.). 1-5 Characteristics of the materials is tested and evaluated as stipulated by respective technical standards, 1-6 Assess the procedures for design and procurement of feeder roads 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, and 1-9 Compile and report the analysis on issues on labour based bituminous surfacing technology in Ghana. **【Activities for Output 2: Field trials of labour based bituminous surfacing technology are carried out 】** 2-1 Prepare a plan for the fields trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials), 2-2 Conduct necessary lab tests to assess the characteristics of materials, 2-3 Identify technical requirements (e.g. materials, methodology and process, quality control, etc.) through the field trials, 2-4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials, 2-5 Collect information on task rates, 2-6 Identify the applicable conditions of the labour based bituminous surfacing technology, 2-7 Identify the safeguard issues, 2-8 Prepare a report on above, and 2-9 Carry out on-the-job (OJT) through above activities. **【Activities for Output 3: Guidelines for labour based bituminous surface technology are prepared 】** 3-1 By reviewing the result of the trials, the contents of the guidelines are determined, 3-2 The outline of the guidelines is prepared and agreed by both sides, 3-3 Draft the guidelines, 3-4 Carry out the second field trial following the guidelines, 3-5 Revise the draft based on the result of the second trial as necessary, and 3-6 Carry out OJT through above activities.	**Inputs** **Japanese side** 1. Experts ・Chief advisor/ Feeder Road Development ・Expert (LBT Guideline/ Cost Estimate) ・Expert (Road Pavement Technology) ・Expert (Site Supervisor) ・Expert (Maintenance of Machinery and Equipment) ・Expert (Safe Guard/ Environment) ・Expert (Project Coordination and Training Planning) 2. Provision of machinery and equipment (compactor, asphalt sprayer, asphalt heater, tractor, trialer, impact tamping rammer, equipment for Dynamic Cone Penetrometer (DCP) testing). 3. Transportation for the experts 4. Provision of third country training (e.g. South Africa) 5. Costs for base and bituminous surface treatment. **Ghanaian side** 1. Personnel ・C/P ・Supervisor ・Workers, 2. Transportation for C/P staff 3. Material test conducted in DFR (Equipment, cost, etc.) 4. Hand tools for pavement 5. Office space 6. Furniture (e.g. desks, etc.) 7. Means of communication at the head office (e.g. internet connection) 8. DFR to select roads at sub-base level		DFR is able to utilize and mobilise available resources related to bituminous surface treatment technology in Ghana (e.g. GHA Central Lab and its expertise, etc.) for implementation of the project **Pre-conditions Ghanaian side provides:** 1. Technical documents on LBT 2. Laboratory testing of materials is available, 3. Ensure the site for field trials (these sites must be prepared the road bed and filled with sub base course materials. etc.) **<Issues and countermeasures>**		

Project Monitoring Sheet II (Revision of Plan of Operation)

Version 1
Dated 16, FEB, 2016

Project Title : The Project for Developing Labour Based Bituminous Surfacing Technology

Inputs	2016 I	2016 II	2016 III	2016 IV	2017 I	2017 II	2017 III	2017 IV	2018 I	2018 II	2018 III	2018 IV	Remarks	Monitoring: Issue	Monitoring: 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			
Expert															
Motoki OGAWA (Chief advisor/Feeder Road Development)	Plan / Actual														
Seiji KADOOKA (Road Pavement Technology)	Plan / Actual														
Hiroaki TAKAHASHI (LBT Guideline)	Plan / Actual														
Kazunori KOBAYASHI (Cost Estimate / Safe Guard)	Plan / Actual														
Masahiko NISHIDA (Site Supervisor)	Plan / Actual														
Masanori TAKEISHI (Maintenance of Machinery and Equipment)	Plan / Actual														
Chiemi OSADA (Environment)	Plan / Actual														
Takaaki HIRAKAWA (Monitoring and Evaluation1)	Plan / Actual														
Yumiko TAKEDA (Project Coordination 1/Training Planning)	Plan / Actual														
Mayumi SHOJI (Project Coordination 2/ Monitoring and Evaluation2)	Plan / Actual														
Tatsumi TOKUNAGA (Project Review)	Plan / Actual														
Equipment															
Procurement	Plan / Actual														
Delivery	Plan / Actual														
Handover	Plan / Actual														
In-country/Third country Training															
Seminar	Plan / Actual														
(Tentative) South Africa	Plan / Actual														

Activities / Sub-Activities	Plan / Actual	2016 I	2016 II	2016 III	2016 IV	2017 I	2017 II	2017 III	2017 IV	2018 I	2018 II	2018 III	2018 IV	Responsible Organization: Japan	Responsible Organization: GOG	Achievements	Issue & Countermeasures
Output 1: Current Conditions and Issues of labour based bituminous surfacing technology in Ghana are identified																	
1.1 Collect and analysis information on the counterparts organizational capacity (e.g. personal, budget, experience, etc.)	Plan / Actual																
1.2 Collect information regarding technical standards and design guidelines regarding bituminous surface technology in Ghana.	Plan / Actual																
1.3 Review and evaluate the similar technical standards and manuals prepared by such organizations as DFID, South African Development of Public Works, etc.	Plan / Actual																
1.4 Confirm the procurement and cost of materials (e.g. gravels)	Plan / Actual																
1.5 Characteristics of the materials is tested and evaluated as stipulated by respective technology standards.	Plan / Actual																
1.6 Assess the procedures for design and procurement of feeder road pavement work in Ghana.	Plan / Actual																
1.7 Check the quality control systems and the procedures of road pavement work in Ghana	Plan / Actual																
1.8 Check the maintenance management systems of feeder roads in Ghana	Plan / Actual																
1.9 Compile and report the analysis on issues on labour based bituminous surfacing technology in Ghana.	Plan / Actual																
Output 2: Field trails of labour based bituminous surfacing technology are carried out																	
2.1 Prepare a plan for the fields trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials)	Plan / Actual																
2.2 Conduct necessary lab tests to assess the characteristics of materials	Plan / Actual																
2.3 Identify technical requirements (e.g. materials, methodology and process, quality control, etc.) through the field trials	Plan / Actual																
2.4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials	Plan / Actual																
2.5 Collect information on task rates	Plan / Actual																
2.6 Identify the applicable conditions of the labour based bituminous surfacing technology	Plan / Actual																
2.7 Identify the safeguard issues	Plan / Actual																
2.8 Prepare a report on above	Plan / Actual																
2.9 Carry out on-the-job (OJT) through above activities	Plan / Actual																
Output 3: Guidelines for labour based bituminous surfacing technology are prepared																	
3.1 By reviewing the result of the trails, the contents of the guidelines are determined	Plan / Actual																
3.2 The outline of the guidelines is prepared and agreed by both sides	Plan / Actual																
3.3 Draft the guidelines	Plan / Actual																
3.4 Carry out the second field trial following the guidelines	Plan / Actual																
3.5 Revise the draft based on the result of the second trail as necessary	Plan / Actual																
3.6 Carry out OJT through above activities	Plan / Actual																
Duration / Phasing	Plan / Actual																

Monitoring Plan	Plan / Actual	2016 I	2016 II	2016 III	2016 IV	2017 I	2017 II	2017 III	2017 IV	2018 I	2018 II	2018 III	2018 IV	Remarks	Issue	Solution
Monitoring																
Joint Coordinating Committee (JCC)	Plan / Actual															
Setup the means of Verification and monitoring Sheet ver.0	Plan / Actual															
Submission of Monitoring Sheet	Plan / Actual															
Reports/Documents																
Mid-term progress report	Plan / Actual															
Project Completion Report	Plan / Actual															
Public Relations																
Project news	Plan / Actual															

Contents of the Project Completion Report

4. Monitoring Plan from the end of the Project to Ex-post Evaluation

(If the Project will be continuously monitored by JICA after the completion of the Project, mention the plan of post-monitoring here.)

ANNEX 1: Results of the Project

(List of Dispatched Experts, List of Counterparts, List of Trainings, etc.)

ANNEX 2: List of Products (Report, Manuals, Handbooks, etc.) Produced by the Project

ANNEX 3: PDM (All versions of PDM)

ANNEX 4: R/D, M/M, Minutes of JCC (copy) (*)

ANNEX 5: Monitoring Sheet (copy) (*)

(Remarks: ANNEX 4 and 5 are internal reference only.)

Separate Volume: Copy of Products Produced by the Project

PMS Ver 2.0

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. 2 (July-2016)

Submission Date: 1st August, 2016

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

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

I. SUMMARY

1. PROGRESS

1-1 Progress of Inputs

(1) Japanese Side

<table>
<tr><th>Item</th><th>Achievement (as of 31st July)</th></tr>
<tr><td>Japanese Experts</td><td>Following 7 experts in total have been dispatched to the Project, under the titles below. The total Man/Month of these experts was 9.90 MM up to 31st July. Details are given in Attachment-1.
● Motoki OGAWA(Chief Adviser /Rural Road Development) 2.60MM
● Seiji KADOOKA(Deputy Chief Advisor/Road Pavement technology) 1.23MM
● Kazunori KOBAYASHI (Cost Estimation /Safety Guard) 1.50MM
● Masanori TAKEISHI (Maintenance and Machinery Equipment) 1.50MM
● Yumiko TAKEDA (Project Coodination1 /Training Plan) 0.70MM
● Takaaki HIRAKAWA (Monitoring and Evaluation 1) 1.67MM
● Mayumi SHOJI (Project Coordination 2/Monitoring and Evaluation 2) 0.70MM</td></tr>
<tr><td>Local Operation Cost</td><td>Local operation cost was mainly utilized for the following items
<table>
<tr><th>No.</th><th>Items</th><th>US$</th><th>No.</th><th>Items</th><th>US$</th></tr>
<tr><td>1</td><td>Transport Cost (domestic)</td><td>10,250</td><td>5</td><td>Meeting, Workshop and JCC</td><td>113</td></tr>
<tr><td>2</td><td>Communication Cost</td><td>474</td><td>6</td><td>Allowance and Accommodation</td><td>N/A</td></tr>
<tr><td>3</td><td>Equipment Purchased</td><td>6,484</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>3,385</td></tr>
</table></td></tr>
<tr><td>Equipment</td><td>Copy machine and projector were provided to the Project. Also, Construction and Maintenance Machinery is under procurement. Details are given in Attachment-2.</td></tr>
<tr><td>Study tour in the Third country</td><td>N/A (Scheduled in mid-2017)</td></tr>
</table>

(2) Ghana's side

<table>
<tr><th>Item</th><th>Achievement (as of 31st July)</th></tr>
<tr><td>C/P's</td><td>34 Counter parts have been participating in the project.
<table>
<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
3 Engineer
1 Mechanical Engineer
1 Operation Manager /Environmentalist
1 Environmentalist</td></tr>
</table></td></tr>
</table>

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

1-2 Progress of Activities

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

1-3 Achievement of Output

Since the activities of the Output 1 have favorably been promoted as scheduled, the Output 1 based on the indicator 1-1 (clarification of current conditions and issues) will be achieved accordingly before October, 2016.

Other than this, it is not ready to measure the achievements of other Outputs at this moment because those activities have not been launched yet.

1-4 Achievement of Project Purpose

There are two (2) indicators in the Project Purpose. The **indictor 1** (development of labour-based bituminous surfacing technology) will be measured during the implementation of the field trials from February to May in 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 been set at 65.0% since the baseline value was 44.7%. In order to obtain the baseline value, the 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

points, and the overall average ratings were extracted as the baseline value. The results of their self-evaluation on the labour-based bituminous surfacing technology were calculated as the benchmark to show the current status objectively, and the results indicate the strength and weakness of DFR officials in each question item. If the JICA experts recognize such information, they are able to provide technical assistance for DFR officials more efficiently by concentrating on the specific items.

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
Q1. Planning skills and knowledge of road works	45.16%
Q2. Road structure design and/or drawing	46.45%
Q3. Contents of Bill of Quantities (BOQ)	49.68%
Q4. Cost estimation	46.45%
Q5. Road inspection tasks	45.81%
Q6. Safety practice for workers and road users during road works	47.10%
Q7. Technical advice and supports for a contractor	40.00%
Q8. Time management of road works during the execution periods	43.87%
Q9. Monitoring of road works	45.16%
Q10. Standard specification of the labour-based bituminous surfacing technology	37.42%
Total Rating on Average (Q1 – Q10)	**44.71%**
Q11. Overall rating of the labour-based bituminous surfacing technology	47.74%

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

According to the **Table 1,** the question items below the total rating on average (44.71%) are "technical advice and supports for a contractor (Q7)", "time management of road works (Q8)", and "standard specification of the labour-based bituminous surfacing technology (Q10)." Specially, although the standard specification (Q10) is the lowest rating point (37.42%), there are prospects that the rating point will be raised from now on because the Project seeks to establish the standard specification of the labour-based bituminous surfacing technology through the field trials starting from next year. On the other hand, it seems that DFR officials are more confident of the "contents of BOQ (Q3)" compared to other question items. Regarding the technical advice & supports (Q7) and time management (Q8), therefore, it is required to enhance those technical skills much further than other items

through the technical transfers of the JICA experts who can provide the instructions of these items for the counterpart personnel through the OJT. The Project specially pays attention to these three (3) items how the improvement turns up as a positive impact of the Project.

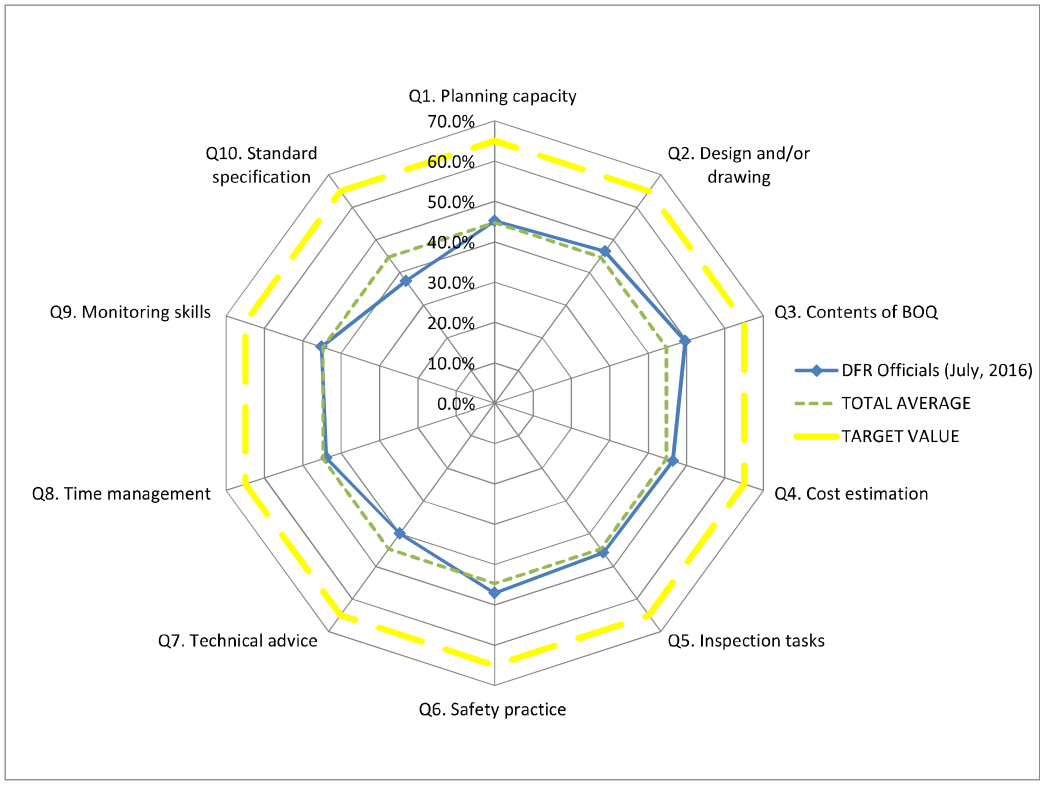


Figure 1: Self-rating results of DFR officials, including Eastern Region (Spider Chart)

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 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. Although it is too early to judge the fulfillments of those conditions as indicated below, 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 labour-based bituminous surfacing technology in Ghana (*e.g.*, KTC, KNUST, GHA Central Lab and their expertise, etc.) for the implementation of the Project.

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

There is no significant change in C/P assignment.

1-6 Progress of Actions undertaken by JICA

Following equipment is under procurement by JICA.

Table-2 Equipment procured by JICA

Name of Equipment	Model/Specification	Location to deliver
Tractor with spare parts	Approx. 70 to 90 HP Diesel Engine Rear Attachment	KTC
Trailer with spare parts	Towed type 3-5000 kg(2-3 m3) capacity Front attachment	KTC
DCP and cones	British standard model	KTC

1-7 Progress of Actions undertaken by Government of Ghana

According to the PDM, 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

There was 2 month delay on procurement of the equipment due to negotiation with the suppliers on condition of the Agreement. However, the agreement was finally reached between the Project and the suppliers (CEMIX and AGRIA) in July, and the signing was made, all the equipment on list is on the procurement procedure now. The Project will keep monitoring the progress to avoid any delay caused by the third person in particular as well as the supplier. Under the agreement, the deadline was made on 8th October for CEMIX and 30th November for Agria.

3. MODIFICATION OF THE PROJECT IMPLEMENTATION PLAN

3-1 PDM

PDM_2 was approved by the key stakeholders, including the Project Director (DFR Director) and Project Manager (Dy. Director of Planning, DFR). The indicators and means of verification as well as the important assumptions were mainly modified as shown in the **Table 4.** Also, the activities and inputs were rephrased more understandably without changing those meanings, *per se*.

Table 4 Modification of the PDM

Components of the PDM		Corrections
Activities	General	Parts of the activities were modified so as to start from the verb.
	Activity 3-1	The first and second field trials were clearly distinguished.
Indicators	General	The expressions of indicators at each level of the PDM were clarified, such as labour-based bituminous surfacing technology, etc.
	Project Purpose	The expression of the indicator 1 was modified in the way to develop the labour-based bituminous surfacing technology based on the criteria of the monitoring checklist. In terms of the acquisition of the technology in the indicator 2, the achievement of the technology development is grasped through the self-evaluation of the DFR officials, including Eastern Region. The target value has been set at 44.7% because the baseline value was 65.0% (July 2016).
	Output 2	The indicator 2-1 was modified in the way to carry out the lab tests in accordance with the material standard.
		Regarding the indicator 2-2, the field trials came to be carried out in line with the LBST construction standard. With reference to the implementation of field trials, moreover, the word of "first" was deleted because the second field trials should also be included.
Means of Verification	Project Purpose	As a tool for confirming the development of the labour-based bituminous surfacing technology in the indicator 1, the Project prepared the monitoring checklist filled out by JICA experts and objectively observes the achievements according to the checklist.
		In the indicator 2, the Project prepared the questionnaire and came to use the one for the self-evaluation of the DFR officials in order to observe their acquisition status of the LBT bituminous surfacing technology.
	Output 2	As the means of verification of the indicator 2-1, the Project utilizes the certificate ("Results") of the lab tests based on the material standard.

		As a tool for confirming the progress of field trials in the indicator 2-2, the Project prepared the checklist of the LBST construction standard and objectively observes the achievements in line with the checklist.
		In the means of verification of the indicator 2-3, the Project will prepare the summary table of task rates and fill out the unit cost of each work item.
Inputs	Japanese side	JICA experts, *i.e.*, "Monitoring and Evaluation" and "Project Review", were added in the Japanese side.
	Ghanaian side	The layer of counterpart personnel and persons in charge were clarified in the Ghanaian side.
		The component of field trials was rearranged, and parts of expression were modified in the Ghanaian side.
Important Assumptions	For the achievements of the Outputs	As available resources related to the LBT bituminous surfacing technology, the KTC and KNUST were added to GHA Central Lab.
	For the achievement of the Project Purpose	The "assignment" after the C/P was added.
		Although the PDM_1 described that the draft guidelines was adopted as its official rule or regulation, the achievement of the Project Purpose would not be accepted if the draft was not adopted before the termination of the Project. Because the official adoption is acceptable even after the termination of the Project, the description was deleted. Thus, the trial operations will be carried out in line with the draft guidelines in this Project.
	For the achievement of the Overall Goal	Although this condition was originally placed in the same line of the Overall Goal, this has been replaced at one-rank lower level, *i.e.*, for the achievement of the Overall Goal because the budgetary condition shall be fulfilled for *the* achievement.
	In the same line of the Overall Goal	Because the Super Goal, above the Overall Goal, is not described in the PDM_1, those important assumptions except the "budgetary condition" were deleted. There were no corresponding parts of those important assumptions for the achievements of the objectives at other levels.

3-2 PO

Although the implementation schedule in the PO has not been changed, the persons and organizations responsible for each activity ("responsible organizations" in the PO) are filled out, and the minor adjustments of the activities were also done without changing their meanings as mentioned in "3-1 PDM" above.

3-3 Other modification on detail implementation plan

N/A

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

After completion of the Project, the most primal issue will be the dissemination of the developed Guideline. From this, being aware on the following subjects will be important.

1) Government Policy on LBT works

The government policy and its statement paper are understood as a national declaration, and it becomes a source of all activities implemented by the Government. From this, obtaining statement on continuous LBT utilization in an official paper is extremely significant to disseminate the Guideline.

Currently, in the Ghana's official development paper, the Ghana Shared Growth and Development Agenda II (GSGDAII: 2014-2017), the use of LBT for infrastructure development in rural area is clearly mentioned. GSGDAII is a national medium-term development plan in Ghana, and it has seven (7) thematic areas of which four (4) areas align the Sector Medium-term Development Plan (SMTDP: 2014-2017) of the MRH. These areas give the guidelines to the SMTDP for the period. Notably, this Project is in line with the Thematic Area 5: "Infrastructure and Human Settlement Development" in which the MRH establishes the Sector Goal 2: "Create the sustainable, accessible, affordable, reliable, effective, and efficient transport system that meets user needs."

In the Sector Goal 2, the MRH highlights that the road maintenance programmes also seek to inject capital into rural economies by adopting the labour-based methodology for feeder road construction to create employment for the rural folks. In terms of the maintenance and minor rehabilitation, furthermore, the MRH adopted the strategy for sustaining labour-based methods of road construction and maintenance to improve rural roads and maximize employment opportunities. During the period of road works, the MRH encourages to train labour-based contractors and award some maintenance contracts to them for the execution.

For this, the Project will keep monitoring the Government's movement and the update of the GSGDAII which comes in 2017 in particular.

2) Allocating budget to LBT Projects

Secondly, allocating budget actually to ground, as a reflection of government policy mentioned-above, is also an important factor to use the Guideline with sustainability. The target person of the Guideline is not only the government officers who relate building the guideline but also the contractors in the private sectors. These contractors will start utilizing the guideline after they see projects actually established. And also they will participate in LBT business when they observe the budget will be allocated continuously.

Otherwise, even though LBT works require minimum investment, such as light machinery, it will not be easy for the contractors to choose the LBT works indicated in the Guideline without stable business opportunity established by the Government. For this reason, it will be very important to prepare for taking necessary measures to bring budget to ground and create business continuously for sustainable use of the Guideline. For this, the Project will keep discussion in this regard with MRH.

3) Technical Transfer

Thirdly, technical transfer will be pointed out as another key factor for dissemination. Since LBT use in bituminous surfacing is an introduced technology in Ghana, it is extremely clear that training is needed for the third person to understand its contents. The organization which is appropriate to handle this issue is considered KTC, and for the training, training materials such as curriculum and syllabus referring to the Guideline shall be prepared. And even after finishing the training, to make trainee's understanding certain, they need frequent feedback from the trainer or given condition doing self-learning. In preparation for this factor, the Project will keep communication

and discussion with KTC in this regard.

II. PROJECT MONITORING SHEET I & II

II-1. Project Monitoring Sheet I (Version 2: 31st July, 2016)

Project Design Matrix (PDM_2)

Project Title: Project for Developing Labour Based Bituminous Surfacing Technology (LBST) in the Republic of Ghana **Project Period:** February, 2016 – December, 2018 Version No. 2
Implementation Agency in Ghana: Department of Feeder Roads (DFR), Ministry of Roads and Highways (MRH) Date: 26th July, 2016
Target Groups: DFR officials and the officials concerned in Eastern Region **Project Sites:** Accra (capital) and feeder roads in Eastern Region

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions	*Achievements*	*Remarks*
Overall Goal Measures are taken to make labour-based bituminous surfacing technology adopted as a viable alternative for surface treatment of feeder roads in Ghana.	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. 2. Labour-based bituminous surfacing technology is officially adopted by DFR for feeder road surfacing. 3. Training course for labour-based bituminous surfacing technology is set up according to the guidelines at the Koforidua Training Centre (KTC).	1. Field trial records, including the checklist of the LBST construction standard, prepared by DFR 2. Approved guidelines by DFR 3. Training records at KTC		*N/A*	*N/A*
Project Purpose The methodology and application of labour-based bituminous surfacing technology is established through the field trials in Eastern Region of Ghana.	1. Labour-based bituminous surfacing technology fulfilling the criteria defined in the monitoring checklist is developed through the field trials. 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.	1. Monitoring checklist filled out by JICA experts 2. Questionnaire surveys to DFR officials and the officials concerned in Eastern Region	1. There is no significant change for the activities of DFR for feeder road services. 2. There is no significant change in DFR's institutional arrangement for the maintenance and management of feeder road. 3. The budget for the measures necessary for the labour-based bituminous surfacing technology is secured.	*N/A*	*N/A*
Outputs 1. Current conditions and issues for labour-based bituminous surfacing technology in Ghana are identified.	1-1. Issues and results analysed by the experts and counterparts are indicated in the Project Monitoring Sheet (Summary).	1-1. Project Monitoring Sheet (Summary)	There is no significant change in C/P assignment.	*This will be achieved as scheduled.*	*Completed by the middle of September.*
2. Field trials of labour-based bituminous surfacing technology are carried out.	2-1. Lab tests of materials are conducted in accordance with the material standard. 2-2. The field trials are conducted in line with the construction standard for labour-based bituminous surfacing technology (LBST construction standard). 2-3. Task rates for labour-based bituminous surfacing technology are defined.	2-1. Certificate ("Results") of the lab tests 2-2. Checklist of the LBST construction standard 2-3. Summary table of task rates		*N/A*	*N/A*
3. Guidelines for labour-based bituminous surfacing technology are prepared.	3-1. Draft guidelines for labour-based bituminous surfacing technology is completed.	3-1. Draft guidelines for labour-based bituminous surfacing technology		*N/A*	*N/A*

Activities	Inputs		
	Japanese side	**Ghanaian side**	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.
1-1 Collect and analyse information on the counterparts (C/Ps) organisational capacity (*e.g.*, personnel, budget, experiences, etc.). 1-2 Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana. 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. 1-4 Confirm the procurement and cost of materials (*e.g.*, gravels, etc.). 1-5 Test and evaluate characteristics of the materials as stipulated by respective technical standards. 1-6 Assess the procedures for design and procurement of feeder roads 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 labour-based bituminous surfacing technology in Ghana.	1. Experts ・ Chief Advisor/Feeder Road Development ・ Road Pavement Technology ・ LBT Guideline ・ Cost Estimate/Safe Guard ・ Site Supervisor ・ Maintenance of Machinery and Equipment ・ Environment ・ Project Coordination/Training Planning ・ Monitoring and Evaluation ・ Project Review 2. Provision of machinery and equipment ・ Compactor ・ Asphalt sprayer ・ Asphalt heater ・ Tractor ・ Trailer ・ Impact tamping rammer ・ Equipment for Dynamic Cone Penetrometer (DCP) testing 3. Transportation for the experts 4. Provision of third country training (*e.g.*, South Africa) 5. Costs for base and bituminous surface treatment	1. Personnel ・ Project Director (DFR Director) ・ Project Manager (Dy. Director of Planning, DFR) ・ C/P (Mainly Planning Section and Eastern Region Office of DFR) 2. Human resources and expenses necessary for the field trials ・ Supervisors ・ Workers ・ Transportation for C/P staff ・ Material test conducted at DFR (equipment, cost, *etc.*) ・ Hand tools for pavement ・ Road preparation at sub-base level for the field trials 3. Office space 4. Furniture (*e.g.*, desks, etc.) 5. Means of communication at the head office (*e.g.*, internet connection)	**Pre-conditions** 1. Ghanaian side provides technical documents on LBT. 2. Laboratory testing of materials is available. 3. The sites for field trials are ensured (these sites must be prepared with the road bed and filled with sub base course materials, etc.).
2-1 Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials). 2-2 Conduct necessary lab tests to assess the characteristics of materials. 2-3 Identify technical requirements (*e.g.*, materials, methodology and process, quality control, etc.) through the field trials. 2-4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials. 2-5 Collect information on task rates. 2-6 Identify the applicable conditions of the labour-based bituminous surfacing technology. 2-7 Identify the safeguard issues. 2-8 Prepare a report on above. 2-9 Carry out on-the-job training (OJT) through above activities.			
3-1 Determine the contents of the guidelines by reviewing the result of the first field trials. 3-2 Prepare and agree with the outline of the guidelines by both sides. 3-3 Draft the guidelines. 3-4 Carry out the second field trial following the guidelines. 3-5 Revise the draft based on the result of the second field trials as necessary. 3-6 Carry out OJT through above activities.			***<Issues and Countermeasures>*** *N/A*

English

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

Version 2
Dated 31/07/'16

Project Title : The Project for Developing Labour Based Bituminous Surfacing Technology

Inputs		2016												2017												2018												Remarks	Monitoring	
		I			II			III			IV			I			II			III			IV			I			II			III			IV				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			
Expert																																								
Motoki OGAWA (Leader/ Rural Road Planner)	Plan																																					N/A	—
	Actual																																						
Seiji Kadowaki (Road Pavement Technology)	Plan																																					N/A	—
	Actual																																						
Hiroaki TAKAHASHI (LBT Guideline)	Plan																																					N/A	—
	Actual																																						
Kenzunori KOBAYASHI (Cost Estimate / Safe Guard)	Plan																																					N/A	—
	Actual																																						
Masahiko NISHDA (Site Supervisor)	Plan																																					N/A	—
	Actual																																						
Masanori TAKEBHI (Maintenance of Machinery and Equipment)	Plan																																					N/A	—
	Actual																																						
Chiemi OSADA (Environment)	Plan																																					N/A	—
	Actual																																						
Takaaki HIRAKAWA (Monitoring and Evaluation1)	Plan																																					N/A	—
	Actual																																						
Yumiko TAKEDA (Project Coordination 1/Training Planning)	Plan																																					N/A	—
	Actual																																						
Mayumi SHOJI (Project Coordination 2/ Monitoring and Evaluation2)	Plan																																					N/A	—
	Actual																																						
Tatsumi TOKUNAGA (Project Review)	Plan																																					N/A	—
	Actual																																						
Equipment																																							
Procurement	Plan																																					Refer to Monitoring Sheet Summary	ditto
	Actual																																						
Delivery	Plan																																					N/A	—
	Actual																																						
Handover	Plan																																					N/A	—
	Actual																																						
In-country/Third country Training																																							
Seminar	Plan																																					N/A	—
	Actual																																						
South Africa (Tentative)	Plan																																					N/A	—
	Actual																																						

Activities		2016												2017												2018												Responsible Organization	Achievements	Issue & Countermeasures
Sub-Activities	Actual	I			II			III			IV			I			II			III			IV			I			II			III			IV			GOG		
Output 1: Current Conditions and Issues of labour based bituminous surfacing technology in Ghana are identified																																							
1.1 Collect and analyze information on the counterparts (CPs) organizational capacity (e.g. personal, budget, experience, etc.)	Plan																																					Principal Eng. & Eng. Planning Div., DPR	Completed	N/A
	Actual																																						
1.2 Collect information regarding technical standards and design guidelines for bituminous surface technology in Ghana.	Plan																																					Principal Eng. & Eng. Planning Div., DPR	Completed	N/A
	Actual																																						
1.3 Review and evaluate the similar technical standards and manuals prepared by such organizations as DPR, South African Development of Public Works, etc.	Plan																																					Principal Eng. & Eng. Planning Div., DPR	Completed	N/A
	Actual																																						
1.4 Confirm the procurement and cost of materials (e.g. gravels)	Plan																																					Principal Eng. & Eng. Planning Div., DPR	Completed	N/A
	Actual																																						
1.5 Test and evaluate characteristics of the materials as stipulated by respective technical standards.	Plan																																					Principal Eng. & Eng. Planning Div., DPR	Completed	N/A
	Actual																																						
1.6 Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana.	Plan																																					Principal Eng. & Eng. Planning Div., DPR	Completed	N/A
	Actual																																						
1.7 Check the quality control systems and the procedures of road pavement work in Ghana.	Plan																																					Principal Eng. & Eng. Planning Div., DPR	Completed	N/A
	Actual																																						
1.8 Check the maintenance management systems of feeder roads in Ghana	Plan																																					Principal Eng. & Eng. Planning Div., DPR	Completed	N/A
	Actual																																						
1.9 Compile and report the analysis on issues on labour-based bituminous surfacing technology in Ghana.	Plan																																					Principal Eng. & Eng. Planning Div., DPR	N/A	—
	Actual																																						
Output 2 Field trails of labour based bituminous surfacing technology are carried out																																							
2.1 Prepare a plan for the fields trials (sector, budget, equipment, manpower, materials, and the most appropriate time for the trials).	Plan																																					Principal Eng. & Eng. Planning Div., DPR	N/A	—
	Actual																																						
2.2 Conduct necessary lab tests to assess the characteristics of materials	Plan																																					Same as above Material Eng., EB	N/A	—
	Actual																																						
2.3 Identify technical requirements (e.g. materials, methodology and process, quality control, etc.) through the field trials	Plan																																					Principal Eng. & Eng. Planning Div., DPR	N/A	—
	Actual																																						
2.4 Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials	Plan																																					Principal Eng. & Eng. Planning Div., DPR	N/A	—
	Actual																																						
2.5 Collect information on task rates	Plan																																					Same as above Contract Manager, EB	N/A	—
	Actual																																						
2.6 Identify the applicable conditions of the labour based bituminous surfacing technology	Plan																																					Principal Eng. & Eng. Planning Div., DPR	N/A	—
	Actual																																						
2.7 Identify the safeguard issues	Plan																																					Same as above Environmentalist	N/A	—
	Actual																																						
2.8 Prepare a report on above	Plan																																					Principal Eng. & Eng. Planning Div., DPR	N/A	—
	Actual																																						
2.9 Carry out on-the-job training(OJT) through above activities	Plan																																					Principal Eng. & Eng. Planning Div., DPR	N/A	—
	Actual																																						
Output 3: Guidelines for labour based bituminous surfacing technology are prepared																																							
3.1 Determine the contents of the guidelines by reviewing the result of the first field trials.	Plan																																					Principal Eng. & Eng. Planning Div., DPR	N/A	—
	Actual																																						
3.2 Prepare and agree with the outline of the guidelines by both sides.	Plan																																					Principal Eng. & Eng. Planning Div., DPR	N/A	—
	Actual																																						
3.3 Draft the guidelines	Plan																																					Principal Eng. & Eng. Planning Div., DPR	N/A	—
	Actual																																						
3.4 Carry out the second field trial following the guidelines	Plan																																					Principal Eng. & Eng. Planning Div., DPR	N/A	—
	Actual																																						
3.5 Revise the draft based on the result of the second field trials as necessary.	Plan																																					Principal Eng. & Eng. Planning Div., DPR	N/A	—
	Actual																																						
3.6 Carry out OJT through above activities	Plan																																					Principal Eng. & Eng. Planning Div., DPR	N/A	—
	Actual																																						
Duration / Phasing	Plan																																							
	Actual																																						

Monitoring Plan		2016												2017												2018												Remarks	Issue	Solution
		I			II			III			IV			I			II			III			IV			I			II			III			IV					
		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			
Monitoring																																								
Joint Coordinating Committee (JCC)	Plan																																					N/A	—
	Actual																																						
Set-up the indicators and means of verification	Plan																																					N/A	—
	Actual																																						
Submission of Monitoring Sheet	Plan																																					N/A	—
	Actual																																						
Reports/Documents																																							
Mid-term progress report	Plan																																					N/A	—
	Actual																																						
Project Completion Report	Plan																																					N/A	—
	Actual																																						
Public Relations																																							
Project news	Plan																																					N/A	—
	Actual																																						

Attachment-1 Japansese Experts Assignment

Name	in charge of	Plan /Actual	Num. of Trips	2016 2	3	4	5	6	7	8	9	10	11	12	2017 1	2	3	4	5	6	7	8	9	10	11	12	2018 1	2	3	4	5	6	7	8	9	10	11	12	2019 1	2	M/M 2016	2017	2018	TOTAL
Motoki OGAWA 小川基樹	Chief Adviser /Rural Road Development	Plan	9	45					30				30		30				30			30						30						30				30			3.50	3.00	3.00	9.50
		Actual	2	45 1 16					34 27 31																															2.63	0.00	0.00	2.63
Seiji KADOOKA 角岡正爾	Road Pavement Technology	Plan	6			45					30									30			38								30						30			2.50	2.27	2.00	6.77
		Actual	1			37 18 24																																		1.23	0.00	0.00	1.23
Hiroaki TAKAHASHI 高橋宏明	LBT Guidelines	Plan	3										45	45										45	45									45						1.50	1.50	1.50	4.50
		Actual	0																																					0.00	0.00	0.00	0.00
Kazunori KOBAYASHI 小林一典	Cost Estimation /Safety Gard	Plan	5					45								30				45								30					30							1.50	2.50	2.00	6.00
		Actual	1				10	24																																0.00	0.00	0.00	0.00
Masahiko NISHIDA 西田正彦	Site Supervisor	Plan	3									45	45				60	60											60	60										1.50	2.00	2.00	5.50
		Actual	0																																					0.00	0.00	0.00	0.00
Masanori TAKEISHI 嶽石正典	Maintenace and Machinary and Equipment	Plan	3		45						30				21																									2.50	0.70	0.00	3.20
		Actual	1		45 22	6																																		1.50	0.00	0.00	1.50
Chiemi OSADA 長田千恵美	Environment Considerations	Plan	2												30												30													0.00	1.00	1.00	2.00
		Actual	0																																					0.00	0.00	0.00	0.00
Yumiko TAKEDA 武田由美子	Project Coordination 1/ Training Plan	Plan	3			15															15																	15		0.50	0.50	0.50	1.50
		Actual	1					12	21 2																															0.70	0.00	0.00	0.70
Takaaki HIRAKAWA 平川貴章	Evaluation & Monitoring 1	Plan	5				30		24						15						24																	30		1.80	1.30	1.00	4.10
		Actual	2			25 6 30			25 5 29																															1.67	0.00	0.00	1.67
Mayumi SHOJI 庄子真由美	Project Coordination 2 /Evaluation Monitoring 2	Plan	5	21											15												15							15						0.70	0.50	1.00	2.20
		Actual	1	21 1 21																																				0.70	0.00	0.00	0.70
Tatsumi TOKUNAGA 徳永達己	Project Review	Plan	2																		12													9							0.00	0.40	0.30	0.70
		Actual	0																																					0.00	0.00	0.00	0.00
Tomoe IEHISA 家久 冬萌	EJEC-OJT	Plan	1																																								
		Actual	1						25 5 29																																		
																																									PLANNED	16.00	15.67	14.30	45.97
																																									ACTUAL	8.43	0.00	0.00	8.43

ASSIGNED FINISHED SCHEDULED

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	12-Feb-16	Printer	Ricoh MPC2011	1	6,039.31	USD	IMPC Intercom Programming & Manufacturing Co. Ltd.	Expert	Means of Documentation	DFR	Expert	
2	12-Feb-16	Projector	EPSON EB-S31	1	445.70	USD	(Electronic retail shop in Japan)	Expert	Workshop /Presentation	DFR	Expert	
3	Under Procurement Process	Water Bowser	ID5000L	1	9,837.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
4	Under Procurement Process	Manual hand Asphalt Sprayer	1D10M	2	4,085.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
5	Under Procurement Process	Cold Bitumen Sprayer	1D10CB	2	6,861.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
6	Under Procurement Process	Chip Spreader	NCA, Chippy	4	27,580.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
7	Under Procurement Process	Plate Compactor	Bell, PCX450	2	4,935.00	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
8	Under Procurement Process	Mobile Concrete Mixer	Bell, 400D	1	3,567.50	USD	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
9	Under Procurement Process	Duplex Roller	Atlas, LP750	2	122,000.00	GHS	Agria Machinery Services & Co. Ltd	C/P	For Project Activities	KTC	KTC/DFR	
10	Under Procurement Process	Engine Suction Water Pump	Technoele, KGP80D	2	5,090.00	GHS	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	
11	Under Procurement Process	Mechanical Tool Set	-	1	2,080.00	GHS	Cemix Ltd	C/P	For Project Activities	KTC	KTC/DFR	
12												
13												
14												

Attachement-3 Counterparts Assignment

Name	Position	in charge of	2016											2017											2018											2019	
			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
Mr. F. O. M. Digber	DFR Director	Project Dirctor																																			
Mr. John Obeng Asiedu	Deputy Director of Planning	Project Manager																																			
Dr. Kwasi Osafo Ampadu	Deputy Director of Planning	Counterpart																																			
Mr. K . Omane Brimpong	Principal Engineer	Counterpart																																			
Dr. PatriceAmoah Betoe	Engineer Planning	Counterpart																																			
Mr. Bernard Williams Amoah	Mechanical Engineer	Counterpart																																			
Mr. Bernard Afari Kuma	Regional Director /DFR (Eastern Region)	Counterpart																																			

Attachment-4 Local Operation Costs (Ghanan Side)

Local Cost Allocated by Ghana Side

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

Activity Performed (as of end of July, 2016)

<table>
<tr><th colspan="2">OUTPUT-1 Current Conditions and issues for labour based bituminous surfacing technology in Ghana are identified.</th></tr>
<tr><td>Activity 1-1
<u>Completed</u></td><td><u><Collect and analyze information on the counterparts (C/P's) organizational capacity (e.g. personal, budget, experiences, etc.)></u>
・ Origination, number of engineers, budget and experience on LBT of DFR as well as the eastern region office were surveyed
・ 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.</td></tr>
<tr><td>Activity 1-2
<u>Completed</u></td><td><u><Collect information regarding technical standards and design guidelines for bituminous surface technology on Ghana></u>
・ 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.</td></tr>
<tr><td>Activity 1-3
<u>Completed</u></td><td><u><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.></u>
・ 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.
・ 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.
・ 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.</td></tr>
<tr><td>Activity 1-4
<u>Completed</u></td><td><u><Confirm the procurement and cost of materials (e.g. gravels, etc.)></u>
・ From interview, following were found as a general price of materials to be used in the trial construction.
<table>
<tr><th>Materials</th><th>General Unit Price from interview</th></tr>
<tr><td>Cold emulsion</td><td>560 GHS /drum include transport to trial site
(drum =200 litters)</td></tr>
<tr><td>Chippings</td><td>65 GHS /m^3 (20-25mm)
40 GHS/m^3 (Dust)
56 GHS/m^3(0-40 mixed)</td></tr>
<tr><td>Gravel</td><td>33 GHS/m3 incl. transport to trial site</td></tr>
</table>
・ 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.
・ 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.</td></tr>
<tr><td>Activity 1-5
<u>Completed</u></td><td><u><Test and evaluate characteristics of the materials as stipulated by respective technical standards></u>
・ 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.
・ Quality and general cost for chipping (aggregate), gravel and cold emulsion were confirmed though interview to suppliers, contractors and DFR engineers.</td></tr>
<tr><td>Activity 1-6
<u>Completed</u></td><td><u><Assess the procedures for design and procurement of feeder roads maintenance and rehabilitation in Ghana></u>
・ 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,</td></tr>
</table>

<table>
<tr><td></td><td>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.
・ 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.</td></tr>
<tr><td>Activity 1-7
<u>Completed</u></td><td><u><Check the quality control systems and the procedures of road pavement work in Ghana></u>
・ Quality control in actual construction is a roll of the regional office. The regional office does the quality control followed by the MRH standard.</td></tr>
<tr><td>Activity 1-8
<u>Completed</u></td><td><u><Check the maintenance management systems of feeder roads in Ghana></u>
・ 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.</td></tr>
<tr><td>Activity 1-9
<u>Under Implementation</u></td><td><u><Compile and report the analysis on issues on labour-based bituminous surfacing technology in Ghana></u>
・ Contents of the activity 1-1 to activity 1-9 have been compiled in a report except part of quality of the material. This was caused due to delay of delivering results from the central lab, and soon after the results of the tests return, the report shall be finalized.</td></tr>
<tr><td colspan="2">OUTPUT-2 Field Trials of labour-based bituminous surfacing technology are carried out.</td></tr>
<tr><td>Activity 2-1
<u>Under Implementation</u></td><td><u><Prepare a plan for the field trials (section, budget, equipment, manpower, materials, and the most appropriate time for the trials></u>
・ The technical workshop was conducted as follows
<table>
<tr><th>S/N</th><th>Date</th><th>Participants</th><th>Major discussion and Conclusion</th></tr>
<tr><td>1</td><td>27th July, 2016</td><td>DFR, Eastern Region, JICA, LBST</td><td>・ Basic contents of the trial construction plan were confirmed.
・ Cold Bitumen, Sand Seal and Single Surface were chosen as a target pavement type to be incorporated in the guideline.
・ A contractor shall be hired by DFR to conduct the trial construction while the materials shall be provided by the Project.
・ A private consultant shall be hired by the Project to collect data from the trail construction.
・ The essence of utilizing LBT is the construction cost and durability.</td></tr>
<tr><td>2</td><td>Scheduled on Sep., 2016</td><td>-</td><td>-</td></tr>
<tr><td>3</td><td>Scheduled on Nov., 2016</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>Activity 2-2
<u>Under Implementation</u></td><td><u><Conduct necessary lab tests to assess the characteristics of materials></u>
・ Quality of chipping and bitumen has been ordered to the central lab. However, waiting for test results delivered.</td></tr>
<tr><td>Activity 2-3</td><td><Identify technical requirements (e.g., materials, methodology and process, quality control, etc.) through the field trials></td></tr>
<tr><td>Activity 2-4</td><td><Identify planning and managerial requirements (applicable road section, budget, strategy for dissemination, etc.) through the field trials></td></tr>
<tr><td>Activity 2-5</td><td><Collect information on task rates></td></tr>
<tr><td>Activity 2-6</td><td><Identify the applicable conditions of the labour-based bituminous surfacing technology></td></tr>
<tr><td>Activity 2-7</td><td><Identify the safeguard issues></td></tr>
<tr><td>Activity 2-8</td><td><Prepare a report on above></td></tr>
<tr><td>Activity 2-9</td><td><u><Carry out on-the-job training (OJT) through above activities></u></td></tr>
</table>

<table>
<tr><td><u>Under Implementation</u></td><td>・ Preparation of the Technical Workshop (1) was implemented. In detail, preparation of documents such as list of existing manuals and guidelines which was collected, trial construction site description, trial construction plan (draft) and others.</td></tr>
<tr><td colspan="2">OUTPUT-3 Guidelines for labour-based bituminous surfacing technology are prepared</td></tr>
<tr><td>Activity 3-1</td><td><Determine the contents of the guidelines by reviewing the result of the first field trials>
<table>
<tr><th>S/N</th><th>Date</th><th>Participants</th><th>Major discussion and Conclusion</th></tr>
<tr><td>4</td><td>Scheduled on Jun., 2017</td><td>-</td><td>-</td></tr>
<tr><td>5</td><td>Scheduled on Sep. 2017</td><td>-</td><td>-</td></tr>
<tr><td>6</td><td>Scheduled on Nov. 2017</td><td>-</td><td>-</td></tr>
<tr><td>7</td><td>Scheduled on Jun. 2018</td><td>-</td><td>-</td></tr>
<tr><td>8</td><td>Scheduled on Sep. 2018</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>Activity 3-2</td><td><Prepare and agree with the outline of the guidelines by both sides></td></tr>
<tr><td>Activity 3-3</td><td><Draft the guidelines></td></tr>
<tr><td>Activity 3-4</td><td><Carry out the second field trial following the guidelines></td></tr>
<tr><td>Activity 3-5</td><td><Revise the draft based on the result of the second field trials as necessary></td></tr>
<tr><td>Activity 3-6</td><td><Carry out OJT through above activities></td></tr>
<tr><td colspan="2">OTHER OUTPUTS</td></tr>
<tr><td>Procurement of equipment <u>Under Implementation</u></td><td>・ For details, refer to Attachment-2.</td></tr>
<tr><td>The third country Training</td><td>N/A</td></tr>
<tr><td>Technical Seminar</td><td>N/A</td></tr>
</table>