RECORD OF DISCUSSIONS

ON

PROJECT FOR OPTICAL FIBER TECHNIQUES IN TELECOMMUNICATIONS ENGINEERING

IN

KINGDOM OF BHUTAN

AGREED UPON BETWEEN

GROSS NATIONAL HAPPINESS COMMISSION

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

Thimphu, October 31, 2013

Ms. Yamiko Asakuma
Chief Representative
Bhutan Office
Japan International Cooperation Agency

Mr. Karma Tshiteem
Secretary
Gross National Happiness Commission

Based on the minutes of meetings on the Detail Planning Survey on the Project for Optical Fiber Techniques in Telecommunications Engineering (hereinafter referred to as "the Project") signed on September 27, 2013 between Gross National Happiness Commission (hereinafter referred to as "GNHC"), and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA held a series of discussions with Bhutan Telecom Limited (hereinafter referred to as "BT") and relevant organizations to develop a detailed plan of the Project.

Both parties agreed 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 BT, the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA, will coordinate with other relevant organizations and will 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 Kingdom of Bhutan.

The Project will be implemented within the framework of the Note Verbal exchanged on February 08, 2013 between the Government of Japan (hereinafter referred to as "GOJ") and Government of Bhutan (hereinafter referred to as "GOB").

Appendix I: Project Description
Appendix II: Minutes of Meetings on September 27, 2013.

Appendix I

PROJECT DESCRIPTION

Both parties confirmed that there is no change from the minutes of meetings of Detail Planning Survey signed on September 27, 2013 (Appendix II).

I. BACKGROUND

The Domestic Long-distance Communications Transmission Network (City to City) has been completed by the Digital Microwave System initially through the grant aids by Government of Japan in the year 1991-1998. Despite the successful introduction of the system to BT, however at present, in the face of continuous technology developments, its Local/Access Network (intra city) remains to be the legacy facilities (metal cable), which are unable to meet the government policies and increasing customer demands. Taking into account of the situation, BT has started to introduce the Optical fiber cable (OPGW) links & NGN-SDH System, which now connects all the Dzongkhags (districts) in Bhutan. OPGW now functions as the backbone network of telecommunication system in Bhutan. Not only for backbone network, but also it can be utilized for long & short high-speed local area networks (LANs). However, such network has only reached each district and therefore, the designing and planning, as well as implementing of the networks within each cities remain unattended. Considering the above and under such transition period of telecommunication systems, BT, as a main telecommunication services provider, is now in the position to realize the planning, designing and implementing fiber optic local area network (LAN), such as Fiber-to-The Cabinet, Fiber-to-The Building, Fiber-to-The Home (FTTC/FTTB/FTTH), to meet the demands of the general public and the government's policy of reaching ICT services to rural areas. However, despite BT's commitment for materializing these plans, the existing engineers are not exposed to such network and are facing difficulties in planning, designing & implementing fiber networks.

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 Optical Fiber Techniques in Telecommunications Engineering

2. Overall Goal
Unified ICT network is provided in Bhutan

3. Project Purpose
Capacity of BT's engineering in optical fiber access network design, construction, and maintenance will be developed.

4. Outputs

(1) Three technical manuals (1. FTTX design/construction manual, 2. Quality Inspection and FTTX specification, 3. Safety work management) are developed.
(2) O&M system is developed.
(3) Experiment work in trial sites (two areas) is completed.

5. Activities

5.1 Activities for Output (1):

(1) To collect information regarding actual technical standards and design guidelines of optical fiber in Bhutan.
(2) To develop solution guideline, clarifying problems in work procedure and identifying solutions for each problem.
(3) To conduct experiment work according to the guideline.
(4) To review and evaluate the experiment work.
(5) To elaborate manuals reflecting the result of experiment work.

5.2 Activities for Output (2):

(1) To verify existing equipment including GIS/GPS system and check their conditions of deterioration.
(2) To identify problems in operation and maintenance system related to the fiber optical network in Bhutan.
(3) To develop guideline of equipment substitution and calculate annual budget to keep good condition of it.
(4) To conduct technical guidance through local training for engineers working at BT headquarters office and local telephone exchange station.

5.3 Activities for Output (3):

(1) To conduct site survey as a preparation for the experiment work.
(2) To design and plan the experiment work including identification of necessary equipment and budget.
(3) To carry out the first experiment work in Phuntsholing following the plan.
(4) To review and evaluate the first experiment in order to plan the second experiment work.
(5) To carry out the second experiment work in Mongar.
(6) To review and evaluate the second experiment.

6. Input

(1) Input by JICA
  (a) Dispatch of Experts
    - Chief Advisor/FTTX Technology and Quality Control of material and safety work
    - FTTX Design Expert
    - FTTX Construction Expert
    - GIS/GPS Operation Expert for Engineering
    - FTTX R&D engineering Expert
    - Advanced BB Application Expert
    - Other Fields, If Necessary

(b) Training
Provision of training in Bhutan and in Japan

(c) Machinery and Equipment
Provision of machinery and equipment (Annex IV)

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

(d) Cost for the experiment work in trial sites

(2) Input by BT
BT will take necessary measures to provide at its own expense:
(a) Services of BT'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 for Experts;
(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) BT
(a) Project Director
General Manager of Operation Division, BT, as the Project Director will bear overall responsibility for the administration and implementation of the Project.
(b) Project Manager
Project Manager of Druknet Division, BT, as the Project Manager will be responsible for the managerial and technical matters of the Project.
(c) Counterpart
BT staffs, engineers will be the counterparts to Japanese Experts.

(2) JICA Experts
The JICA experts will give necessary technical guidance, advice and recommendations to BT 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: Thimphu, Phuntsholing and Mongar.
(2) Beneficiaries: BT staff, Local Telephone Exchange Station of district assemblies, contractors and communities along the sites for field trials

9. Duration
3 years from the Project commencement (Assignment of first Japanese expert in Bhutan).

10. Reports to JCC
BT 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
BT agreed to abide by National Environment Commission (NEC) of Bhutan 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.

III. UNDERTAKINGS OF BT

1. BT will take necessary measures to:

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

(2) grant privileges, exemptions and benefits to the JICA experts referred to in II-6 (1) above and their families, which are no less favorable than those granted to experts of third countries performing similar missions in Bhutan under the Colombo Plan Technical Cooperation Scheme.

2. BT will take necessary measures to:

(1) provide security-related information as well as measures to ensure the

safety of the JICA experts,

(2) permit the JICA experts to enter, leave and sojourn in Bhutan for the duration of their assignments therein and exempt them from foreign registration requirements and consular fees.

(3) exempt the JICA experts from taxes and any other charges on the equipment, machinery and other material necessary for the implementation of the Project;

(4) 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

(5) meet taxes and any other charges on the equipment, machinery and other material, referred to in II-7 above, necessary for the implementation of the Project.

3. BT 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. EVALUATION

JICA, GNHC and BT will jointly conduct the following evaluations and reviews.

1. Mid-term review at the middle of the cooperation term
2. Terminal evaluation during the last six (6) months of the cooperation term

JICA will conduct the following evaluations and surveys to mainly verify sustainability and impact of the Project and draw lessons. The GNHC and BT 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, BT will take appropriate measures to make the Project widely known to the people of Bhutan.

VI. MUTUAL CONSULTATION

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

VII. AMENDMENTS

This record of discussions can be amended by minutes of meetings between

JICA and BT.
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 IV List of Equipment

ANNEX I
Version 0

Project Design Matrix

Name of the Project: Technical Cooperation Project for Optical Fiber Techniques in Telecommunications Engineering

Implementing Agency in Bhutan: Bhutan Telecom Limited

The Duration of the Project: April 2014 to March 2017 (36months) (Tentative)

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
Overall Goal Unified ICT network is provided in Bhutan.	By2019, extension rate of FTTX(Installed Dzongkhags/whole country)will be increased by △%. (This indicator will be discussed and decided by 1st JCC meeting)	Report of GNHC or ITU report	Politics condition is stable There is no significant technological change in ICT sector
Project Purpose Capacity of BT's engineering in optical fiber access network design, construction, and maintenance will be developed.	BT's engineers are able to conduct expansion work of FTTX.	1. Interview to C/P and experts 2. Work report prepared by the experts (i.e. monitoring of OJT on the experimental work) 3. Training Report on OJT 4. BT annual report 5. Other Means of Verification will be discussed and decided by 1st JCC meeting	There is no significant change for the activities of BT for expansion of FTTX in country. There is no significant change in BT's institutional arrangement for the expansion of FTTX in country.
Output 1. Three technical manuals are developed. (1. FTTX design/construction manual, 2. Quality inspection and FTTX specification, 3. Safety work management).	Technical manuals are ready to be used by BT's FTTX engineers.	1. BT annual report 2. Other Means of Verification will be discussed and decided by 1st JCC meeting	1. There is no significant change in C/P's 2. Developed manuals are adopted by BT as its official rule or regulation.
2. O&M system is developed.	1. 3(three) GIS/GPS operation engineers are trained. 2. 20(twenty) O&M operator of regional staff are trained.	1. Evaluation of pre-test and post-training-test. 2. Other Means of Verification will be discussed and decided by 1st JCC meeting	There is no significant change in C/P's
1. Experiment work in trial sites (two areas) is completed.	FTTX is completed in trial sites.	1. Evaluation of the experimental work. 2. Other Means of Verification will be discussed and decided by 1st JCC meeting	There is no significant change in C/P's

Activities	Input from Bhutan side	
【Activities for Output 1: "Three technical manuals are developed. (1. FTTX design/construction manual, 2.Quality inspection and FTTX specification, 3. Safety work management)."】 1. Collect information regarding actual technical standards and design guidelines of optical fiber in Bhutan, 2. Develop solution guideline, clarifying problems in work procedure and identifying solutions for each problem. 3. Conduct experiment work according to the guideline 4. Review and evaluate the experiment work. 5. Elaborate manuals reflecting the result of experiment work.	1.C/Ps 2.Necessary Expenses (e.g. Salaries, local traveling costs and daily subsistence allowance (DSA) for the Bhutan counterpart personnel) 3.Assignment of C/P Office space, Furniture for Japanese experts(e.g. desks, etc.), and transportation vehicle to project sites 4.Maintenance for machinery and equipment provided by JICA 5.Means of communication at the head office (e.g. internet connection)	
【Activities for Output 2: "O&M system is developed."】 1. Verify existing equipment including GIS/GPS system and check their conditions of deterioration. 2. Identify problems in operation and maintenance system related to the fiber optical network in Bhutan. 3. Develop guideline of equipment substitution and calculate annual budget to keep good condition of it. 4. Conduct technical guidance through local training for engineers working at BT headquarters office and local telephone exchange station.	**Input from Japan** 1.Experts [Long term Expert] -Chief Advisor/FTTX Technology and Quality Control of material and safety work [Short term Experts] - FTTX Design Expert - FTTX Construction Expert - GIS/GPS Operation Expert for Engineering - FTTX R&D engineering Expert - Advanced BB Application Expert -Other fields, if necessary 2.Provision of machinery and equipment for Training and Field trial work 3.Training of counterpart personal in Bhutan and in Japan 4.Local expenses for the project activities Teaching materials for training //workshop/seminars	
【Activities for Output 3: "Experiment work in trial site (two areas) is completed."】 1. Conduct site survey as a preparation for the experiment work 2. Design and plan the experiment work including identification of necessary equipment and budget. 3. Carry out the first experiment work in Phuntsholing following the plan. 4. Review and evaluate the first experiment in order to plan the second experiment work. 5. Carry out the second experiment work in Mongar. 6. Review and evaluate the second experiment.		Preconditions Bhutan side provides: 1. Ensure the site for experimental work (Phuntsholing and Mongar) 2. The importance of personnel training does not change in the Bhutan telecom.

ANNEX II
version 0

TENTATIVE PLAN OF OPERATION (P/O)

ANNEX III: Organization Chart of the Project

	Bhutan side	Japanese side
Joint Coordinating Committee	• Chief ICT Officer, Ministry of Information and Communication (MoIC) • Chief Program Coordinator, Gross National Happiness Commission(GNHC) • CEO, Bhutan Telecom Limited(BT)	• JICA Expert of the Project(Long Term Expert) • Representatives of JICA Bhutan Office • Director of Transportation and ICT Division 2, Economic Infrastructure Department of JICA HQ
Project Director	• General Manager of Operation Division, BT	
Project Manager	• Project Manager of Druknet Division, BT	
Counterparts	• Engineer, Fiber Access Network, DrukNet Division(FTTX Design) • Technician, Fiber Access Network, Druknet(FTTX Construction) • Engineer, Fiber Access Network, DrukNet Division(GIS/GPS Operation) • Manager, Corporate Office(FTTX R&D Engineering) • Engineer, IP services, Druknet Division(Advanced BB)	• JICA Experts of the Project(Short Term Experts) • Project Formulation Adviser of JICA Bhutan Office • Program Officer of JICA Bhutan Office

List of Equipment (MATERIALS NEED FOR FIBER ACCESS NETWORK SECTION)

1. GPON Equipment (GPON system & Access Cabinets) as pilot project..... 2 sites
2. Splicing VAN ------- 1 No.
3. Splicing Machines ..... 2 sets
4. OTDR ..... 2 Sets
5. Power Meter ..... 2 sets
6. Fault locater ..... 2 sets
7. Tools kits ..... 2 sets
8. FTTH passive Indoor materials: Outlets, patch cords, etc
9. Ducting Rods, 200 mtrs. ..... 5 Nos.
10. UG drilling machine (If possible) ..... 1 No.
11. Semira ..... 10 pairs
12. Safety belts ..... 10 Nos.
13. Wretch range ..... 10 Nos.
14. Side cutter ..... 20 Nos.
15. Cable web cutter ..... 20 Nos
16. Water Pump ..... 3 Nos.
17. Connector Punching tools .....20 Nos.
18. Cable ladder ..... 5 Nos.
19. Soil remover ..... 20 Nos.

FOR GIS/GPS:

1. GIS Software ArcGIS 10/10.1. Or Intergraph Software for Fiber Management(G-technology)
2. Hybrid Computer desktop (24") with High resolution Graphic card with CPU for digitizing the network infrastructure system.
3. High version Lap top for mapping of GIS system
4. Two in one Color Printer & scanner for printing of maps (A3 & A4 size paper)
5. Plotter for printing of Maps max A0 size paper
6. Digital Camera with external card
7. External Hard drive(terabyte) for GIS data backup

ANY OTHER EQUIPMENTS/TOOLS REQUIRED FOR THE EXPERIMENTAL PROJECT SITES AND TRAINING

MINUTES OF MEETINGS
BETWEEN
JAPANESE DETAIL PLANNING SURVEY TEAM
AND
GROSS NATIONAL HAPPINESS COMMISSION, ROYAL GOVERNMENT OF BHUTAN
ON
JAPANESE TECHNICAL COOPERATION
ON
PROJECT FOR OPTICAL FIBER TECHNIQUES IN TELECOMMUNICATIONS ENGINEERING

In response to the request from the Royal Government of Bhutan (hereinafter referred to as 'Bhutan'), the Detail Planning Survey Team (hereinafter referred to as 'the Team') organized by Japan International Cooperation Agency (hereinafter referred to as 'JICA') and headed by Shigeki MIYAKE, visited Bhutan from September 23 to October 1, 2013 for the purpose of working out the details of the technical cooperation concerning the "Project for Optical Fiber Techniques in Telecommunications Engineering".

During its stay in Bhutan, the Team exchanged views and had a series of discussions with the Bhutan authorities concerned with respect to necessary measures to be taken by JICA and the Government of Bhutan represented by Gross National Happiness Commission (hereinafter referred to as "GNHC") and Bhutan Telecom Limited. (hereinafter referred to as "BT") for the successful implementation of the above mentioned project.

As a result of the discussions, both sides agreed to convey to their respective government the matters referred to in the documents attached hereto.

Thimphu, September 27, 2013

三宅 繁樹

Mr. Shigeki Miyake
Leader
Detail Planning Survey Team
Japan International Cooperation Agency

Mr.Rinchen Wangdi
Chief Program Coordinator
Development Cooperation Division
Gross National Happiness Commission

Mr.Nidup Dorji
CEO
Bhutan Telecom Limited.

ATTACHED DOCUMENT

I. PROJECT TITLE

Both sides agreed that the project title is 'Project for Optical Fiber Techniques in Telecommunications Engineering' (hereinafter referred to as 'the Project').

II. PROJECT SITE

Project head office: Bhutan Telecom Limited., Thimphu.
Project Site: Thimphu, Phuntsholing and Mongar

III. SUMMARY OF THE PROJECT'S FRAMEWORK

Both sides jointly discussed and agreed the basic design of the Project. The Project Design Matrix (hereinafter referred to as 'PDM') version 0 is shown in ANNEX 1.

1. SUPERVISING MINISTRY

Ministry of Information and Communication (MoIC)

2. IMPLEMENTING AGENCY

Bhutan Telecom Limited. (BT)

3. COOPERATING AGENCY

Bhutan Telecom Limited. (BT)

4. DURATION OF THE PROJECT

3 years from the Project commencement. (Assignment of first Japanese expert in Bhutan)

5. SCOPE OF THE TECHNICAL COOPERATION

5.1 Overall goal

Unified ICT network is provided in Bhutan.

5.2 Project Purpose

Capacity of BT's engineering in optical fiber access network design, construction, and maintenance will be developed.

5.3 Outputs

5.3.1. Three technical manuals (1. FTTX design/construction manual, 2. Quality inspection and FTTX specification, 3. Safety work management) are developed.

5.3.2. O&M system is developed.

5.3.3. Experiment work in trial sites (two areas) is completed.

5.4 Project Activities

5.4.1 Activities for output 5.3.1

MINUTES OF MEETING
BETWEEN
GROSS NATIONAL HAPPINESS COMMISSION
AND
JAPAN INTERNATIONAL COOPERATION AGENCY
ON
JAPANESE TECHNICAL COOPERATION PROJECT
FOR
PROJECT FOR OPTICAL FIBER TECHNIQUES IN TELECOMMUNICATIONS ENGINEERING IN KINGDOM OF BHUTAN

The Japan International Cooperation Agency (hereinafter referred to as "JICA") exchanged views and had a series of discussions with the concerned officials of Gross National Happiness Commission (hereinafter referred to as "GNHC") and Bhutan Telecom Limited (hereinafter referred to as "BT") with respect to desirable measures to be taken for the successful implementation of the Project for Optical Fiber Techniques in Telecommunications Engineering in Kingdom of Bhutan (hereinafter referred to as "the Project").

As a result of the discussions, GNHC on behalf of BT and JICA agreed upon the matters described in the documents attached hereto. This document is what revises the Record of Discussion on the Project signed on 31st October 2013.

Thimphu, July 17, 2014

Ms. Yumiko ASAKUMA
Chief Representative
JICA Bhutan Office
Japan International Cooperation Agency

Mr. Thinley Namgyel
Officiating Secretary
Gross National Happiness Commission

Witnessed by:

Mr. Nidup Dorji
CEO
Bhutan Telecom LTD.

THE ATTACHED DOCUMENT

1. Revision of Evaluation Method

GNHC on behalf of BT and JICA agreed to revise evaluation method as follows:

(1) "II. OUTLINE OF THE PROJECT, 5.3 Activities for Output (3), (3) and (5) shall be amended as follows;

(3) To carry out the first experiment work in Paro following the plan.
(5) To carry out the second experiment work in Jakar.

(2) "II. OUTLINE OF THE PROJECT, 7. Implementation Structure, (3) Joint Coordinating Committee " of the Record of Discussion on the Project shall be amended as follows;

Joint Coordinating Committee (hereinafter referred to as "JCC") will be established in order to facilitate inter-organizational coordination. JCC will be held at least once a year and whenever deems it necessary. JCC will approve an annual work plan, review overall progress, conduct 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.

(3) "II. OUTLINE OF THE PROJECT, 10. Report to JCC" of the Record of Discussion on the Project shall be amended as follows;

BT and JICA experts will jointly prepare the following reports in English:
(1) Inception Report
(2) Monitoring Sheet on biannual basis until the project completion
(3) Project Completion Report at the time of project completion

(4) "IV. EVALUATION" of the Record of Discussion on the Project shall be amended as follows;

JICA and BT 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 shall be reviewed every six (6) months.
Also, Project Completion Report shall be drawn up one (1) month before the termination of the Project.

2. Revision of the PDM

As per the original PDM (version 0) attached to the Record of Discussions, objectively verifiable indicator have been discussed and approved at the 1st JCC. The revised PDM is described in the Annex I and this will be utilized from now on for the monitoring of project progress.

3. Revision of the Participants of JCC

GNHC on behalf of BT and JICA agreed to strike "Director of Transportation and ICT

Division 2, Economic Infrastructure Department of JICA HQ" off the list as described in the Annex 2.

4. Revision of the Equipment

As GNHC and BT determined to change the system to GE-PON which they can procure themselves, several equipment which is input by JICA is revised. Details of revised list of equipment is described in Annex 3.

Annexes

1. Project Design Matrix

2. Project Organization Chart

3. List of Equipment

4. Record of Discussions

Project Design Matrix

Project Title : Technical Cooperation Project for Optical Fiber Techniques in Telecommunications Engineering

Version 1

17th July 2014

Implementing Agency Bhutan Telecom Limited

Period of Project : May 2014 to January 2017 (33 months)

Project Site : Paro / Jakar Model Site : Thimphu

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal Unified ICT network is provided in Bhutan.	By 2019, Fiber Access Network services will cover 90% Dzongkhag in the country.	Annual Report of MoIC or BT	Politics condition is stable There is no significant technological change in ICT sector		
Project Purpose Capacity of BT's engineering in optical fiber access network design, construction, and maintenance will be developed.	BT's Fiber Access Network team can design, construct and maintain FTTX access network.	1. Interview/interaction to C/P and experts 2. Work report prepared by the experts (i.e. monitoring of OJT on the experimental work) 3. Training Report on OJT 4. Conduct exam/Test after training	There is no significant change for the activities of BT for expansion of FTTX in country There is no significant change in BT's institutional arrangement for the expansion of FTTX in country		
Output 1. Three technical manuals are developed [i) FTTX design/construction manual, ii) Quality inspection and FTTX specification, iii)Safety work management]	Technical manuals are adopted, distributed to each exchange OSP/FAN section (30 copies)and utilized	1. Printed technical manuals 2. Report on usefulness of the manuals (Field staff will submit feedback to CHQ through Regional Managers)	1. There is no significant change in C/P's 2. Developed manuals are adopted by BT as its official rule or regulation		
2. O&M system for FTTX is developed.	1. 2(two) GIS/GPS operation engineers are trained. 2. 20(twenty) O&M operator of regional staff are trained	1.1 Assessment result Pre and Post assignment of GIS expert. 1.2 BT Annual Reports 1.3 Training Report on OJT 2.1 Exams/Tests after each training	There is no significant change in C/P's		

3. Experiment work in trial sites (two areas) is completed.	Trial sites completion report submitted.	1. Completion report of the experimental work 2. Acceptance test Check list for network parameter by Design Expert. 3. Acceptance test report of physical Installation by C/A, BT(P/D,P/M).	There is no significant change in C/P's		
Activities		**Input**		**Pre-conditions**	
[Activities for Output 1: "Three technical manuals are developed (1. FTTX design/construction manual, 2 Quality inspection and FTTX specification, 3. Safety work management)."] 1. Collect information regarding actual technical standards and design guidelines of optical fiber in Bhutan, 2. Develop solution guideline, clarifying problems in work procedure and identifying solutions for each problem 3. Conduct experiment work according to the guideline 4. Review and evaluate the experiment work. 5. Elaborate manuals reflecting the result of experiment work.		**Japanese Side** 1.Experts [Long term Expert] -Chief Advisor/FTTX Technology and Quality Control of material and safety work [Short term Experts] - FTTX Design Expert - FTTX Construction Expert - GIS/GPS Operation Expert for Engineering - FTTX R&D engineering Expert - Advanced BB Application Expert -Other fields, if necessary 2.Provision of machinery and equipment for Training and Field trial work 3.Training of counterpart personal in Bhutan and in Japan 4.Local expenses for the project activities Teaching materials for training //workshop/seminars	**Bhutan side** 1.C/Ps 2.Necessary Expenses (e.g. Salaries, local traveling costs and daily subsistence allowance (DSA) for the Bhutan counterpart personnel) 3.Assignment of C/P Office space, Furniture for Japanese experts(e.g. desks, etc.), and transportation vehicle to project sites 4.Maintenance for machinery and equipment provided by JICA	<Issue and countermeasure>	
[Activities for Output 2 "O&M system is developed "] 1. Verify existing equipment including GIS/GPS system					

and check their conditions of deterioration 2. Identify problems in operation and maintenance system related to the fiber optical network in Bhutan. 3. Develop guideline of equipment substitution and calculate annual budget to keep good condition of it. 4. Conduct technical guidance through local training for engineers working at BT headquarters office and local telephone exchange station.			
【Activities for Output 3: "Experiment work in trial site (two areas) is completed."】 1. Conduct site survey as a preparation for the experiment work. 2. Design and plan the experiment work including identification of necessary equipment and budget. 3. Carry out the first experiment work in Paro following the plan. 4. Review and evaluate the first experiment in order to plan the second experiment work. 5. Carry out the second experiment work in Jakar. 6. Review and evaluate the second experiment.		Preconditions Bhutan side provides: 1. Ensure the site for experimental work (Paro and Jakar) 2. The importance of personnel training does not change in the Bhutan telecom.	

ANNEX III: Organization Chart of the Project

	Bhutan side	Japanese side
Joint Coordinating Committee	• Chief ICT Officer, Ministry of Information and Communication (MoIC) • Chief Program Coordinator, Gross National Happiness Commission(GNHC) • CEO, Bhutan Telecom Limited(BT)	• JICA Expert of the Project(Long Term Expert) • Representatives of JICA Bhutan Office
Project Director	• General Manager of Operation Division, BT	
Project Manager	• Project Manager of Druknet Division, BT	
Counterparts	• Engineer, Fiber Access Network, DrukNet Division(FTTX Design) • Technician, Fiber Access Network, Druknet(FTTX Construction) • Engineer, Fiber Access Network, DrukNet Division(GIS/GPS Operation) • Manager, Corporate Office(FTTX R&D Engineering) • Engineer, IP services, Druknet Division(Advanced BB)	• JICA Experts of the Project(Short Term Experts) • Project Formulation Adviser of JICA Bhutan Office • Program Officer of JICA Bhutan Office

List of Equipment (MATERIALS NEED FOR FIBER ACCESS NETWORK SECTION)

1. Splicing VAN ..... 1 No
2. Splicing Machines ..... 2 sets
3. Small Excavator (wheeled mini excavator) with attached: Mini bucket, Skid steer for trenching and soil clearance ..... 1 set
4. OTDR ..... 2 sets
5. Power Meter ..... 2 sets
6. Fault locater ..... 2 sets
7. Tools kits ..... 1 sets
8. FTTH passive Indoor materials: Outlets, patch cords, etc
9. Ducting Rods, 200 mtrs. ..... 3 Nos.
10. Shimelar..... 10 pairs
11. Safety belts ..... 10 Nos.
12. Wretch range ..... 10 Nos.
13. Side cutter ..... 20 Nos.
14. Cable web cutter ..... 20 Nos
15. Water Pump ..... 3 Nos.
16. Connector Punching tools .....20 Nos.
17. Cable ladder ..... 5 Nos.
18. Soil remover ..... 10 Nos.
19. Air blower 3 Nos.
20. Gas detector 3 Nos.
21. Optical fiber cables, etc.

22. Leakge voltage detector ..... 5 Nos.
23. Bitumin Road surface cutter (Hydraulic Power) with attached: Disc cutter(Concrete, metal & stone),Trash Pump, Hydraulic Power Pack-Beaver (Rock breaking, concrete & cement cutting and demolishing) ..... 1 No.

FOR GIS/GPS:

1. Hybrid Computer desktop (24") with High resolution Graphic card with CPU for digitizing the network infrastructure system, ... 1 Set
2. High version Lap top for mapping of GIS system ..... 1 Nos
3. Two in one Color Printer & scanner for printing of maps (A3 & A4 size paper) .....1 Nos
4. Plotter for printing of Maps max A0 size paper ..... 1 Nos
5. Tablet ipad..... 1Nos
6. External Hard drive(terabyte) for GIS data backup 1Nos
7. GPS Pathfinder office ..... 1 No.

ANY OTHER EQUIPMENTS/TOOLS REQUIRED FOR THE EXPERIMENTAL PROJECT SITES AND TRAINING

(1) Collect information regarding actual technical standards and design guidelines of optical fiber in Bhutan.

(2) Develop solution guideline, clarifying problems in work procedure and identifying solutions for each problem.

(3) Conduct trial work according to the guideline.

(4) Review and evaluate the trial work.

(5) Elaborate manuals reflected the result of trial work.

5.4.2 Activities for output 5.3.2

(1) Verify existing equipment including GIS/GPS system and check their conditions of deterioration.

(2) Identify problems in operation and maintenance system related to the fiber optical network in Bhutan.

(3) Develop guideline of equipment substitution and calculate annual budget to keep good condition of it.

(4) Conduct technical guidance through local training for engineers working at BT headquarters office and local telephone exchange station.

5.4.3 Activities for output 5.3.3

(1) Decide two trial sites to conduct experiment work.

(2) Conduct site survey as a preparation for the experiment work.

(3) Design and plan the experiment work including identify necessary equipment and budget.

(4) Carry out the first experiment work in Thimphu following the plan.

(5) Review and evaluate the first experiment in order to plan the second experiment work.

(6) Carry out the second experiment work.

(7) Review and evaluate the second experiment.

IV. PLAN OF OPERATIONS

Both sides had jointly prepared and agreed Plan of Operations (PO) as shown in ANNEX II. The activities of the Project are subject to change when necessity arises in the course of implementation.

V. MEASURES TO BE TAKEN BY JICA

The following matters were confirmed in the discussion between the Bhutan and JICA sides:

1. Dispatch of JICA experts

JICA will dispatch experts from Japan and/or other countries with its own expenses for the following purposes:

1) JICA will dispatch appropriate numbers of Long-Term and/or Short-Term experts during the project period, to ensure the smooth implementation of the Project. The

number of these experts will be decided each year by JICA according to the limitation of its budget and availability of personnel. Followings are the fields of the experts:

[Long term Expert]
-Chief Advisor/FTTX Technology and Quality Control of material and safety work

[Short term Expert]
- FTTX Design Expert
- FTTX Construction Expert
- GIS/GPS Operation Expert for Engineering
- FTTX R&D engineering Expert
- Advanced BB Application Expert
- Other fields, if necessary.

2. Provision of Machinery and Equipment

JICA will provide the necessary machinery and equipment for the implementation of the Project effectively and efficiently. The items and quantity of the equipment shall be decided by JICA within its budget limitation.

3. Short-Term Training in Bhutan and in Japan.

The Counterparts Training will be conducted within the Project budget for acquiring the knowledge and skills in concerned fields.

4. Expenses for Experiment Work

The Experiment Works are planned to be conducted in the Project, and JICA will provide the expenses for the implementation of FTTX. The quantity shall be decided by JICA within its budget limitation.

VI. MEASURES TO BE TAKEN BY BHUTAN SIDE

The following matters were confirmed in the discussion between the Bhutan and JICA sides:

1. Necessary Expenses

In accordance with the laws and regulations which are in force in Bhutan, the Bhutan side takes following measures at its own expenses.

1) Salaries, local traveling costs and daily subsistence allowance (DSA) for the Bhutan counterpart personnel,
2) Expenses for the maintenance of office facilities,
3) Running costs of project offices, i.e. electricity, water etc., and
4) Others to be discussed by both sides, when necessary.

2. Assignment of Counterparts

The Bhutan side agreed to assign necessary counterparts during the duration of the Project period and the counterparts will collaborate with Japanese experts to make the Project fruitful, effective and viable. The list of Counterpart personnel is provided and shown in ANNEX III.

3. Office Space and Furniture

Both sides confirmed that the office space and furniture for implementation of the Project shall be provided by the Bhutan side prior to the commencement of the Project.

4. Maintenance for machinery and equipment provided by JICA

Machinery and equipment provided by JICA when made available for the Project become the property of Bhutan side. They shall be used solely for the Project during the duration of the experiment works. During the duration of the experiment works, all operational and maintenance cost shall be borne by JICA side. All running and maintenance costs shall be borne by Bhutan side after the Experiment works. Bhutan side may put the equipment and machinery to any other use thereafter.

VII. ADMINISTRATION OF THE PROJECT

1. Joint Coordinating Committee

For the effective and successful implementation of the Project, the Joint Coordinating Committee (JCC) will be established to fulfil the following functions:

1) To approve the annual work plan of the Project based on the Plan of Operation (PO) within the framework of the Record of Discussions,
2) To oversee the overall progress of the annual work plan and to evaluate the result of the Project, and
3) To review and exchange opinions of major issues arisen from the Project.

JCC will be held at least once a year. The prospective members of JCC are listed in ANNEX III.

2. Counterpart

Mr. Karma Tshewang, General Manager of Operation Division, BT, as the Project Director will bear an overall responsibility for the administration and implementation of the Project.
Mr. Sonam Rinchen, Project Manager of Druknet Division, BT, as the Project Manager will be responsible for the managerial and technical matters of the Project.
The other counterparts are listed in ANNEX III.

VIII. EVALUATION

JICA, GNHC, MoIC and BT will conduct jointly the following evaluations and reviews.

1. Mid-term review at the approximately the half the period of the duration of the Project
2. Terminal evaluation at six (6) months prior to the end of the duration of the Project.

JICA will conduct the following evaluations and surveys to draw lessons from the Project to verify mainly the sustainability and the impact. GNHC, MoIC and BT will be requested to

provide necessary support (e.g. data relating to the Project, interview of C/P) for the survey.

1. Ex-post evaluation carried out generally at three (3) years after the completion of the Project; and
2. Follow-up surveys whenever necessary.

IX. RECORD OF DISCUSSIONS

The Record of Discussions will be signed between JICA Bhutan Office and GNHC prior to the commencement of the Project to determine the framework of the Project. The Record of Discussions will include the contents of this Minutes of Meetings.

X. OTHERS

1. Equipment

The suggestion by the Team to utilize construction vehicles that have given through the Follow-up Cooperation of the Project for Development of the Domestic Telecommunication Network (Equipment Supply) in JFY2003 was accepted by Bhutan side.

2. Dispatch of Advanced BB Application Expert

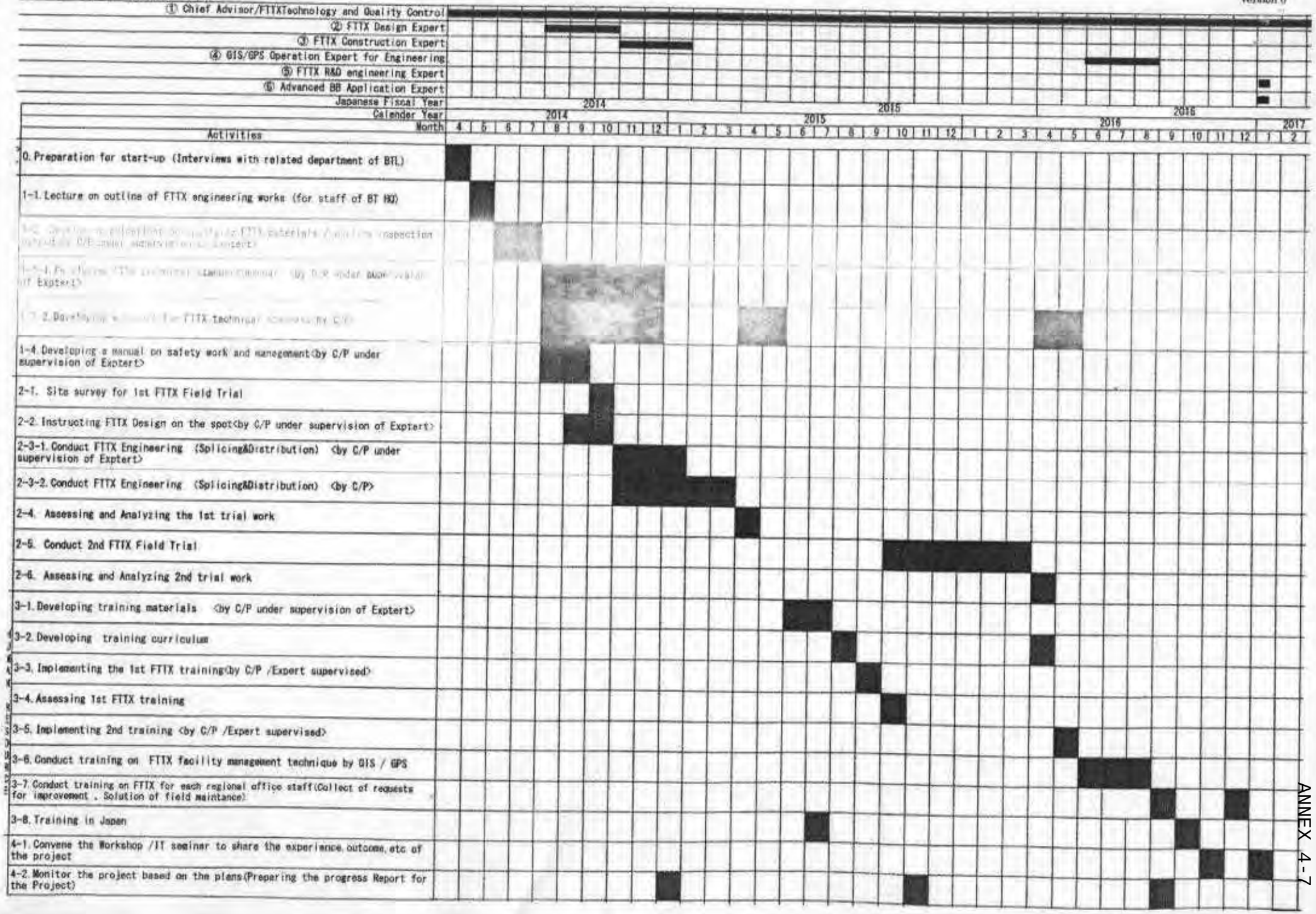
BT suggested to consider the dispatching schedule of Advanced BB Application Expert earlier than mentioned in PO(annex Ⅱ) and Team agreed it.

ANNEX

ANNEX I.	PROJECT DESIGN MATRIX (PDM), VERSION 0
ANNEX II.	PLAN OF OPERATIONS (PO), VERSION 0
ANNEX III.	ORGANIZATION CHART OF THE PROJECT
ANNEX IV.	LIST OF EQUIPMENT
ANNEX V.	RECORD OF DISCUSSIONS (DRAFT)

Activities 【Activities for Output 1: "Three technical manuals are developed. (1. FTTX design/construction manual, 2.Quality inspection and FTTX specification, 3. Safety work management)."】 1. Collect information regarding actual technical standards and design guidelines of optical fiber in Bhutan, 2. Develop solution guideline, clarifying problems in work procedure and identifying solutions for each problem. 3. Conduct experiment work according to the guideline. 4. Review and evaluate the experiment work. 5. Elaborate manuals reflecting the result of experiment work. 【Activities for Output 2: "O&M system is developed."】 1. Verify existing equipment including GIS/GPS system and check their conditions of deterioration. 2. Identify problems in operation and maintenance system related to the fiber optical network in Bhutan. 3. Develop guideline of equipment substitution and calculate annual budget to keep good condition of it. 4. Conduct technical guidance through local training for engineers working at BT headquarters office and local telephone exchange station. 【Activities for Output 3: "Experiment work in trial site (two areas) is completed."】 1. Conduct site survey as a preparation for the experiment work. 2. Design and plan the experiment work including identification of necessary equipment and budget. 3. Carry out the first experiment work in Phuntsholing following the plan. 4. Review and evaluate the first experiment in order to plan the second experiment work. 5. Carry out the second experiment work in Mongar. 6. Review and evaluate the second experiment.	**Input from Bhutan side** 1.C/Ps 2.Necessary Expenses (e.g. Salaries, local traveling costs and daily subsistence allowance (DSA) for the Bhutan counterpart personnel) 3.Assignment of C/P Office space, Furniture for Japanese experts(e.g. desks, etc.), and transportation vehicle to project sites 4.Maintenance for machinery and equipment provided by JICA 5.Means of communication at the head office (e.g. internet connection) **Input from Japan** 1.Experts [Long term Expert] -Chief Advisor/FTTX Technology and Quality Control of material and safety work [Short term Experts] - FTTX Design Expert - FTTX Construction Expert - GIS/GPS Operation Expert for Engineering - FTTX R&D engineering Expert - Advanced BB Application Expert -Other fields, if necessary 2.Provision of machinery and equipment for Training and Field trial work 3.Training of counterpart personal in Bhutan and in Japan 4.Local expenses for the project activities Teaching materials for training //workshop/seminars	Preconditions Bhutan side provides: 1. Ensure the site for experimental work (Phuntsholing and Mongar) 2. The importance of personnel training does not change in the Bhutan telecom.

NTATIVE PLAN OF OPERATION (P/O)



ANNEX III: Organization Chart of the Project

	Bhutan side	Japanese side
Joint Coordinating Committee	• Mr. Karma Wangdi, Chief ICT Officer, Ministry of Information and Communication (MoIC) • Mr.Dindesh Wangdi, Chief Program Coordinator, Gross National Happiness Commission(GNHC) • Mr. Nidup Dorji, CEO, Bhutan Telecom Limited(BT)	• JICA Expert of the Project(Long Term Expert) • Chief Representative of JICA Bhutan Office • Director of Transportation and ICT Division 2, Economic Infrastructure Department of JICA HQ
Project Director	• Mr. Karma Tshewang, General Manager of Operation Division, BT	-
Project Manager	• Mr.Sonam Rinchen,Project Manager of Druknet Division, BT	-
Counterparts	• Mr.Dorji Yeshi, Engineer, Fiber Access Network, DrukNet Division(FTTX Design) • Mr.Rinzin Dorji and Mr.Nima Lotey, Technician, Fiber Access Network, Druknet(FTTX Construction) • Mr.Ugyen Dorji, Engineer, Fiber Access Network, DrukNet Division(GIS/GPS Operation) • Mr.Jambay Sither, Manager, Corporate Office(FTTX R&D Engineering) • Mr. Sangay Wangchuk, Engineer, IP services, Druknet Division(Advanced BB)	• JICA Experts of the Project(Short Term Experts) • Project Formulation Adviser of JICA Bhutan Office • Program Officer of JICA Bhutan Office

List of Equipment (MATERIALS NEED FOR FIBER ACCESS NETWORK SECTION)

1. GPON Equipment (GPON system & Access Cabinets) as pilot project..... 2 sites
2. Splicing VAN ------- 1 No.
3. Splicing Machines ..... 2 sets
4. OTDR ..... 2 Sets
5. Power Meter ..... 2 sets
6. Fault locater ..... 2 sets
7. Tools kits ..... 2 sets
8. FTTH passive Indoor materials: Outlets, patch cords, etc
9. Ducting Rods, 200 mts. ..... 5 Nos.
10. UG drilling machines (if possible) ..... 1 No.
11. Semira ..... 10 pairs
12. Safety belts ..... 10 Nos.
13. Wretch range ..... 10 Nos.
14. Side cutter ..... 20 Nos.
15. Cable web cutter ..... 20 Nos
16. Water Pump ..... 3 Nos.
17. Connector Punching tools .....20 Nos.
18. Cable ladder ..... 5 Nos.
19. Soil remover ..... 20 Nos.

FOR GIS/GPS:

1. GIS Software ArcGIS 10.0 UL Or Intergraph Software for Fiber Management(G-technology)
2. Hybrid Computer desktop (24") with High resolution Graphic card with CPU for digitizing the network infrastructure system.
3. High version Lap top for mapping of GIS system
4. Two in one Color Printer & scanner for printing of maps (A3 & A4 size paper)
5. Plotter for printing of Maps max A0 size paper
6. Digital Camera with external card
7. External Hard drive (1TB) for GIS data backup

ANY OTHER EQUIPMENTS/TOOLS REQUIRED FOR THE EXPERIMENTAL PROJECT SITES AND TRAINING

ANNEX 5: Monitoring Sheet (copy)

ANNEX 5-1: PM1 Summary Sheet
ANNEX 5-2: PM2 Summary Sheet
ANNEX 5-3: PM3 Summary Sheet
ANNEX 5-4: PM4 Summary Sheet
ANNEX 5-5: PM5 Summary Sheet

1st Monitoring Sheet Summary

TO CR of JICA Bhutan OFFICE

PROJECT MONITORING SHEET

Project Title : Technical Cooperation Project for Optical Fiber Techniques in Telecommunications Engineering
Version of the Sheet: Ver.1（Term: July 2014– December 2014）

Name: Junya YAMAGUCHI
Title: Chief Advisor
Submission Date: 13 January,2015

I. Summary

1 Progress

1-1 Progress of Inputs

1) Japanese side:One Long term Expert(Chief Advisor) and two short term Expert (FTTX design Expert, FTTX construction Expert)
2) Bhutan side: Six Counterparts (Project Director, Project Manager,Four Officer).
Necessary Expenses (Salaries, DSA)for BT counterpart.
Office space,Furniture,and transportation vehicle to project site.

1-2 Progress of Activities

1) Develop Technical manuals on FTTX (Design/construction, Quality & Specification, Safety Management)
2) Experimental work at 2 trial sites (Paro & Jakar)
3) Procurement preparation of materials and equipment

1-3 Achievement of Output

1) 3separate volumes of draft manuals completed
2) Paro: On-site technical guidance by the experts. Problems and improvements were presented by the experts to the BT Annual & Budget meeting on 22nd November, 2014 in Phuentsholing.
Jakar: Site survey & detailed design done by the JICA experts in close consultation with BT. Draft bill of quantities/materials prepared based on the design.
3) Confirmation of Quantity and Specification
Carried out the design process at Jakar(2nd trial site) Prepared draft bill of materials for Jakar site. Submitted to JICA HQ for approval.

1-4 Achievement of the Project Purpose

・Held project member regular meetings/consultations, and advised how to develop these manuals. Discussion and then corrections of contents perform during meetings every week.
・Describes the proceedings memo, and shared

1-5 Changes of Risks and Actions for Mitigation
Nothing
1-6 Progress of Actions undertaken by JICA
JICA Bhutan office monitors on submitted progress and follow-up over telephone calls/e-mail.
1-7 Progress of Actions undertaken by Gov. of Bhutan (GNHC/MoIC)
No comments on progress as it is in-line with plan of action.

1-8 Progress of Environmental and Social Considerations (if applicable)
Nothing

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)
Nothing

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)
Nothing

2 Delay of Work Schedule and/or Problems (if any)
Nothing
2-1 Detail
2-2 Cause
2-3 Action to be taken
2-4 Roles of Responsible Persons/Organization (JICA, Gov. of●●,etc.)

3 Modification of the Project Implementation Plan
3-1 PO
・Construction expert duration 10 days shorter then Original Plan.
Add 10 days more in 2015 program for construction expert.
・In-house training which was scheduled June-July 2015,shifted in June-July 2016
As the training material from Japan will be not be arriving as scheduled training period.(Discussed in 2nd JCC meeting)
3-2 Other modifications on detailed implementation plan
Nothing
(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

4 Preparation of Gov. of Bhutan toward after completion of the Project

II. Project Monitoring Sheet I & II ***as Attached***

2nd Monitoring Sheet Summary

TO CR of JICA Bhutan OFFICE

PROJECT MONITORING SHEET

Project Title : Technical Cooperation Project for Optical Fiber Techniques in Telecommunications Engineering

Version of the Sheet: Ver.2（Term: January 2015– June 2015）

Name: Junya YAMAGUCHI
Title : Chief Advisor

Submission Date: 30th June,2015

I. Summary

1 Progress

1-1 Progress of Inputs

1) Japanese side:

- One Long term Expert(Chief Advisor) and two short term Expert (FTTX design Expert, FTTX construction Expert)
- Some project materials like white board, safety box and printer were procured
- Attended JICA training program in April 2015 funded by JICA HQ.

2) Bhutan side:

- The Following counterpart personnel were assigned:
  - -Project Director: General Manager, Operations Division
  - -Project Manager, Access Network.
  - -Four Engineers/Officers, Access network and IT Division.
- Office space for the project was allocated in western region, Thimphu with necessary furniture and equipment
- Support for obtaining route permit for Japanese expert and provide vehicle from BT Head quarter to JICA trial site.
- Some running expenses for project implementation such as utility payment and some consumable items were provided.

1-2 Progress of Activities

1-2-1 Output 1: Three Technical Manual Developed

(1) For review of standard manual, we are having a monthly meeting in presence of GM, Project manager and counterparts.

(2) After review of standard manual, we have sent copies to all BT Regional Managers in January 2015 for their feedback and received their comments. Then we upgraded the standard manual accordingly (ex...more additional diagram or chart).

(3) After attending the JICA training in Japan in the month of April 2015, we have updated the standard manual (ex…for standard construction method and safety measures).

1-2-2 Output 2: O & M System for FTTx development
(1) For easy operation and maintenance, we have completed collection of existing data and for designing and planning of FTTX network trail work at Jakar.
(2) Collection of equipment details from the local dealers/agent and procedures for re-evaluation of GIS equipment specification and submitting to JICA Bhutan Office for further procurement process.
(3) We had discussions on the need to put in place an efficient operation and maintenance system in the BT network. We have started to collect, update and maintain data on BT network from May to June 2015.

1-2-3 Output 3: Experiment work in trial sites (two areas) is completed
(1) Pre- trial work preparation work like cleaning of underground duct and joint box for a distance of 3km in June 2015.
(2) Erection of additional poles and maintenance of existing aerial cable route along the identified trial work route at Jakar in June to July 2015.
(3) Issued the official letter in May 2015 to each CATV cable operator management to modify the existing network used along BT infrastructure in Jakar. Accordingly in the months of June and July 2015, we have monitored and instruct them to layout their cables neatly with BT's existing network.
(4) Due to the re-location of JICA trial work site from Mongar to Jakar, we had to re-evaluate the specification and materials through Japan Recom Ltd., since the area has increased from previous site i.e Mongar in January to February 2015.
(5) We held a meeting for smooth implementation of trial work by providing the awareness on safety measures to carry out the work in June to July 2015.

1-3 Achievement of Output
1-3-1 Output 1: 3 separate volumes of draft manuals completed
We have modified the manuals based on the technical training in Japan

1-3-2 Output 2: O&M system for FTTX is developed
Compilation of the existing data and design for FTTX network trial in Jakar.
1-3-3 Output 3: Experimental work in trial sites is completed
Preparation of the trial site in Jakar

1-3-4 Other
(1)Training in Japan
Developed Training curriculum and arranged the Schedule with R&D and other Institutions
January to March 2015.
Five trainees from BTL attended the training and completed successfully.

1-4 Achievement of the Project Purpose
・Several indicators for verification for the project purpose has been developed (FTTX

Evaluation Sheet, work report by experts, Training report on OJT). The indicators will be can be completed after the completion of the trial experiment in Jakar and the evaluation of the

1-5 Changes of Risks and Actions for Mitigation

Nothing

1-6 Progress of Actions undertaken by JICA

JICA Bhutan office monitors on submitted progress and follow-up over telephone calls/e-mail.

JICA Bhutan Office also coordinated with the Ministry of Finance, GNHC for clarifications and procedures on Tax Exemptions

1-7 Progress of Actions undertaken by Gov. of Bhutan (GNHC/MoIC)

No comments on progress as it is in-line with plan of action.

1-8 Progress of Environmental and Social Considerations (if applicable)

Nothing

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

Nothing

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

Nothing

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

2-1 Detail

Due to JICA HQ procurement procedure, Fusion splicer and Splicing Van may not reach in time during the trial work at Jakar

2-2 Cause

Depending upon the JICA HQ processing time, may take longer time to deliver the items.

Due to the modification required for Splicing Van, it is expected that it will take atleast about two more months.

2-3 Action to be taken

Fusion Splicer in an urgent need while implementing the trail work. Therefore, it may be need to be dispatched by air transport as soon as possible.

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of●●,etc.)

JICA HQ concerned division.

3 Modification of the Project Implementation Plan

3-1 PO

・In-house training which was scheduled June-July 2015,shifted in June-July 2016

As the training material from Japan will be not be arriving as scheduled training period.(Discussed in 2nd JCC meeting)

* 3rd JCC meeting which was scheduled to be held in July 2015 is postponed to December 2015 (Discussed in 2nd JCC meeting) since there were no major events like training and also due to the busy schedule for preparation of Jakar trail work.

3-2 Other modifications on detailed implementation plan

Nothing

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

4 Preparation of Gov. of Bhutan toward after completion of the Project

II. Project Monitoring Sheet I & II *as Attached*

3rd Monitoring Sheet Summary

TO CR of JICA Bhutan OFFICE

PROJECT MONITORING SHEET

Project Title : Technical Cooperation Project for Optical Fiber Techniques in Telecommunications Engineering

Version of the Sheet: Ver.3（Term: July 2015– December 2015）

Name: Junya YAMAGUCHI
Title : Chief Advisor

Submission Date: 18th January,2016

I. Summary

1 Progress

1-1 Progress of Inputs

1) Japanese side:

・One Long term Expert(Chief Advisor)

・One Short term Expert (FTTX construction Expert)

・Some project materials like Fiber cable, Closure, Cable clamp were procured and arrived in July 2015.

・ Construction Machine(Excavator and Road surface cutter) were procured and registered in August 2015.

・Some equipment such as OTDR, Fusion splicer, Fault Locater,Gas detector and Safety-belt were procured and arrived in August 2015.

・Vehicle(Splicing-VAN) was procured and registered in December 2015.

2) Bhutan side:

・The Following counterpart personnel were assigned:

-Project Director: General Manager, Technology & Strategy Division

-Project Manager: Manager, Technology & Strategy Division

-Four Engineers/Officers, Access network and Operation Division.

・Office space for the project was allocated in western region, Thimphu with necessary furniture and equipment

・Field trial site office was also allocated in Central region, Jakar with necessary furniture and equipment in Sep-October 2015.

・Support for obtaining route permit for Japanese expert and also tax exemption certificate for vehicle/equipment were provided.

・Some running expenses for project implementation such as utility payment and some consumable items were provided.

1-2 Progress of Activities

1-2-1 Output 1: Three Technical Manual Developed

(1) For review of standard manual, we are having a monthly meeting in presence of GM, Project manager and counterparts.

(2) In line with the project trial work, updated the manuals in consultation with JICA construction engineer.

(3) After review of standard manual, we will send copies to all BT Regional Managers with effect from January 2016 for their feedback and comments.

1-2-2 Output 2: O & M System for FTTx development

(1) Updated the JICA trial work network data information in GIS for easy analysis and reference in the near future.

1-2-3 Output 3: Experiment work at trial sites (two areas) were completed

(1) Preparation of trial work like cleaning of underground duct and joint box for a distance of 3km in the months of June to August 2015.

(2) Erection of additional poles and maintenance of existing aerial cable route along the identified trial work at Jakar in August 2015.

(3) Implementation of trial works at Jakar in coordination with each osp staff from different telecom office and also BT counterpart in September to November 2015.

1-3 Achievement of Output

1-3-1 Output 1: 3 separate volumes of draft manuals completed.

(1) After having monthly meeting we have modified the manual by adding additional documents like diagram, chart and pictures.

(2) Based on the trial site work, we have modified the module on construction and safety management manuals.

1-3-2 Output 2: O&M system for FTTX to be developed

(1) Compilation of an existing data and design for FTTX network trial in Jakar.

(2) Provided the information on how the trial networks is to be maintained to keep the record up to date.

1-3-3 Output 3: Experimental work at trial sites was completed

From August 2015, the experiment work at trial site was successfully completed without any injury or damage to the people and infrastructure.

Also the JICA short-term expert conducted 4 days training to the BT engineers and technicians involved in the implementation of the trail work from 1st Oct to 6th Oct 2015.

Refer completion report and acceptance test report attachment enclosed.

The Chief Advisor of JICA FTTX project presented and submitted the completion report of the trial work to the Bhutan Telecom Management during the Annual Budget Meeting on the 24th of November 2015 in Phuentsholing.

1-3-4 Other

During the implementation of Jakar trial work, Bhutan Broadcasting Service (BBS), the national TV broadcasted the news on the introduction of the new fiber optic technology thereby getting more positive feedback from the customers

1-4 Achievement of the Project Purpose

After the FTTX trial work was successfully done, we have provided the customers with improved high speed Internet broadband connection whereby the demand of services was increased drastically from 0 to 24 subscribers as of 10/12/2015.

Training feedback from the individual trainees were very much positive and encouraging on the use of the advance materials and tools of JICA trial project. Refer the enclosed feedback attachment.

1-5 Changes of Risks and Actions for Mitigation

Mr.Sonam Richen (project manager) has retired from Bhutan Telecom effective 31st December 2015 on account of personal reasons. Mr.Sonam Phuntsho, Manager of backbone network (optical fiber & Radio) has been appointed as the successor Project Manager. Since he is familiar with implementation and operation & maintenance of optical fiber networks, there should not be any hindrance to the project.

1-6 Progress of Actions undertaken by JICA

JICA Bhutan office monitors on submitted progress and follow-up over telephone calls/e-mail. JICA Bhutan Office also coordinated with the Ministry of Finance, GNHC for clarifications and procedures on Tax Exemptions

1-7 Progress of Actions undertaken by Gov. of Bhutan (GNHC/MoIC)

No comment on progress as it is in-line with plan of action.

1-8 Progress of Environmental and Social Considerations (if applicable)

Nothing

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

Nothing

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

Nothing

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

2-1 Detail

Nothing

2-2 Cause

Nothing

2-3 Action to be taken

Nothing

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of●●,etc.)

JICA HQ concerned division.

3 Modification of the Project Implementation Plan

3-1 PO

Nothing

3-2 Other modifications on detailed implementation plan

Nothing

4 Preparation of Gov. of Bhutan toward after completion of the Project

II. Project Monitoring Sheet I & II *as Attached*

4th Monitoring Sheet Summary

TO CR of JICA Bhutan OFFICE

PROJECT MONITORING SHEET

Project Title : Technical Cooperation Project for Optical Fiber Techniques in Telecommunications Engineering

Version of the Sheet: Ver.4（Term: January 2016– July 2016）

Name: Junya YAMAGUCHI

Title : Chief Advisor

Submission Date: 31st July,2016

I. Summary

1 Progress

1-1 Progress of Inputs

1) Japanese side:

- One Long term Expert(Chief Advisor); arrived in Bhutan on 28th April 2016.
- One short term Expert (GIS Expert): arrived in Bhutan on 3rd June 2016 to Till 29th July 2016.
- Some project materials like pliers, side-cutter for practice training materials were procured
- Attended JICA training program in April 2016 funded by JICA HQ.

2) Bhutan side:

- The Following counterpart personnel were assigned:
  - -Project Director: General Manager, Technical & Strategy Division
  - -Project Manager, Dy,GM Operation Division.
  - -Four Engineers/Officers, Access network and Operation Division.
- Office space for the project was allocated in western region, Thimphu with necessary furniture and equipment
- Support for obtaining route permit for Japanese expert and provide vehicle from BT Head quarter to Field site.
- Some running expenses for project implementation such as utility payment and some consumable items were provided.

1-2 Progress of Activities

1-2-1 Output 1: Three Technical Manual Developed

(1) For review of standard manual, we are having a monthly meeting in presence of GM, Project manager and counterparts. Pledged to the flow chart and illustration/diagrams for easy understand to O&M staff.

(2) These manual ware used as the textbook of the in-house training on July 2016.

1-2-2 Output 2: O & M System for FTTx development

(1) GIS Expert recommended two GIS engineers in BT for proper management based on the technical guidance result.

・Assistance in reforming O&M system for managing access network

・Advice and Instruct by GIS expert in proper handling of GIS equipment and methodology while collection of GIS data

・Data information (mapping data, facility information data etc) for FTTX trial network at Jakar has been built up.

(2) Placement of proper O&M system human resources

BT management proposed the streamlining of personnel, but

For proper maintenance and operation, claimed to have a minimum of two people continuously without effecting the human resources.

(3) Suggestions for improvement of FTTX O&M equipment storage warehouse

Because the existing storage location looks messy, I suggested that proper shelves would be maintain and keep the materials properly by pasting the code numbers on each shelves rather than putting all in one corner of the room/outside the room.

BTL is launching a working team for improving proper store, JICA team will follow up the activates until Sep 2016. .

(4) Presentation implementation

Present GIS technology & Case-study for BTL engineer on 6th July and preparation of FTTX training on 19th July.

1-2-3 Output 3: Experiment work in trial sites (two areas) is completed

After completion of trail work on Nov 2015, handover equipment's like (Splicing VAN, Measuring instrument, tool etc) to utilization in FTTX expansion and construction work throughout BTL.

1-3 Achievement of Output

1-3-1 Output 1: Technical manuals completed

(1) We have completed the Technical manuals final version on July 2016.

(2) Based on the feedback from the trainees during the FTTX training program, scheduled to take place in July 2016. Accordingly bring improvement and changes in the manual book.

1-3-2 Output 2: O&M system for FTTX is developed

(1) Data information on FTTX trail network at Jakar was competed successfully. (Refer attachment-1: Sample of Jakar data map)

(2) Framed the guidelines for GIS operation manual and GIS data collection methodology.

(3) Carried out O&M training for trainees on FTTX engineering work on 18th July to 22nd July 2016.

1-3-3 Output 3: Experimental work in trial sites is completed

It was successfully completed in November 2015

Already it has been reported in the previous report (Ver.3: 8th January 2016)

1-3-4 Other (Human Resource Development)

(1) 2nd Training in Japan

Developed Training curriculum and arranged the Schedule with R&D, FTTX Factory, Network Operation center and other Institutions in Japan (January to March 2016).

Seven trainees from BTL attended the training and completed successfully . (April 2016)

(2) In-house training :FTTX training program)

・Developing training curriculum on May to June 2016

・Creating training support material(Training practical equipment/ illustration)

・Created skill level evaluation sheet of trainees.

・Implementation of FTTX training on 18th July to 22nd July 2016.(Refer attachment-2 the training result)

1-4 Achievement of the Project Purpose

After the successfully completion of FTTX field trial project in November 2015 at Bumthang, BTL made significant for FTTX expansion work throughout country.

The progress report with details will submitted in the next quarter.

1-5 Changes of Risks and Actions for Mitigation

Nothing

1-6 Progress of Actions undertaken by JICA

JICA Bhutan office monitors on submitted progress and follow-up over telephone calls/e-mail. JICA Bhutan Office also coordinated with the Ministry of Finance, GNHC for clarifications and procedures on Tax Exemptions

1-7 Progress of Actions undertaken by Gov. of Bhutan (GNHC/MoIC)

No comment on progress as it is in-line with plan of action.

1-8 Progress of Environmental and Social Considerations (if applicable)

Nothing

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

Nothing

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

Nothing

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

2-1 Detail

Nothing

2-2 Cause

Nothing

2-3 Action to be taken

Nothing

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of ●●, etc)

JICA HQ concerned division

4 Modification of the Project Implementation Plan

4-1 PO

Nothing

4-2 Other modifications on details implementation plan

Nothing

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target

Group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any parts of R/D and PDM, the team may propose the draft.) **5 Preparation of Gov. of Bhutan toward after completion of the Project**
II. Project Monitoring Sheet I & II ***as Attached***

5th Monitoring Sheet Summary

To CR of JICA Bhutan Office

PROJECT MONITORING SHEET

Project Title: Technical Cooperation Project for Optical Fiber Techniques in Telecommunications Engineering

Version of the Sheet: Ver.5（Term: August 2016– December2016）

Name: Junya YAMAGUCHI
Title: Chief Advisor
Submission Date: 4th January, 2017

Ⅰ Summary

1. Progress

1-1 Progress of Inputs

(1) Japanese Side

- One long term Expert (Chief Advisor) since 28th April, 2016
- Two short term Expert (FTTx R&D Engineering and Broadband applied technology) from 28th Nov-4th Dec, 2016
- IT Workshop venue setting expense including fee, audio equipment rental, light meal, etc.

(2) Bhutan Side

- The following counterpart personnel were assigned:
  - Project Director (Director Technical Division,BTL)
  - Project Manager(Dy. GM Operation Division,BTL)
  - Four Engineers/Officers, Access Network, Operation Division,BTL
- Office Space for the project was allocated in western region, Thimphu with all necessary equipment
- Provided assistance in obtaining route permit for Japanese expert and a vehicle for site visit
- Some Utility payment and consumable items were provided for project implementation

1-2 Progress of Activities

1-2.1 Output 1: Three Technical Manual Developed

- After monthly C/P meetings and discussion with project team, manual are further modified as per feedback from the trainee/regional office manager
- Three technical manuals have been developed on Nov 2016 and 30 prints out are distributed to all the BT's OSP section on Dec, 2016

1-2.2 Output 2: O&M System for FTTx development

- Two GIS Engineers conducted the trainings in three regional offices (Trongsa, Tashigang and Phuntsholing) in Dec, 2016. The training consists of data collection and storage in database system for future reference. It also covered on FTTx Manual usage and GIS O&M guidelines.
- Although one of the team, GIS Engineer, left during the period, BT Management immediately assigned successors who is well versed with the project and was given OJT and hands on practice before he was relieved. BT again will recruit GIS engineers to carry on the work further.

1-2.3 Output 3: Experiment work in trial sites (2 area) is completed

These 2 experimental trial work has successfully done in 2015.Ater that
The knowledge and the experiences that BT staff have gained during project period, the trails works, in expanding FTTx access network in the country, played a very significant role in the national project named “Safe-City”. The safe city fiber network was designed and implemented by BT staff. They are now in charge of handling operation and maintenance of safe city fiber network, which connects all the surveillance camera of the capital city.

1-3 Achievement of Output

1-3.1 Output 1: Completion of Technical Manuals

In Nov. 2016, 3 manuals were developed and combined into Technical Manual consisting of Design (42 pages), Construction (39 pages), Safety Work (14 pages), and Specification and Quality Control (23 pages). The manual has been already delivered to the working level at each Regional telephone office and is being used by the technical staffs.

1-3.2 Output 2: O&M system for FTTx is developed

- Data Information on FTTx trail network at Jakar was completed successfully
- BT promoted extension of FTTx construction. FTTx facility database is sequentially stored and used for daily O&M, and technology transfer is progressing
- Framed the guidelines for GIS operation manual and GIS data collection methodology

1-3.3 Output 3: Experimental Work in trial sites is completed

Two sites (Paro and Jakar) was successfully completed in 2015 and it is already mentioned in previous report.

1-3.4 Others

(1) IT workshop

Workshop (IT seminar) was held on Nov. 30, 2016 in Thimphu with participants from Ministries, academic society, Bhutan Telecom, foreign telecommunications operators, and private companies in Bhutan.

About 100 participants attended including Minister of MoIC, CEO of DHI, ICT officers of Cabinet Secretariat, Ministry of Health, Disaster Prevention Bureau, Department of Road, IT Park, Thimphu

City Office,NTT Laboratory, NTT East, and JICA Bhutan , etc.

Major topics were;

- Case Study of e-Government by ICT officer of Cabinet Secretariat,
- Case Study of e-Education by Bhutan Royal University,
- IT Techno-park by a private sector,
- Outline of Fab Lab by JICA representative,
- Trend of FTTX R&D by NTT Laboratory,
- Applications on broadband network by NTT East, etc.

Each presentation was useful for Bhutan to promote and develop IT strategies for future, and there were active exchanges of opinions among attendants.

Media coverage of the workshop was taken up largely by the national broadcasting company, BBS and Kuensel, the national newspaper.

(2) In-Country Training (4 Regional Telephone Offices)

Each BT's telephone office has been so far developing FTTX access network at its responsible area in the countryside. The CA and one of the C/Ps carried out the training tour for complementing related staffs those who could not attend the FTTX course in Jul. 2016. The training included FTTX design,construction technique, safety work, etc. and was held at following Regional Telephone offices.

- Western Regional office in Oct. 2016, 8 staffs participated in
- South-Western Regional office in Dec. 2016, 15 staffs participated in
- Central Regional office in Dec. 2016, 15 staffs participated in
- East Regional office in Dec. 2016, 15 staffs participated in

1.4 Achievement of the Project Purpose

The Knowledge and skill acquired from JICA training in Japan (April 2015 and April 2016) and Field trial work (Sep-Oct 2015) have mastered the skills to play a mission as instructor of the in-house training (July 2016). They could also develop FTTX technical manuals for reference to their colleagues. The purpose of the project whereby the individual is well trained and skilled, is achieved.

1.5 Changes of Risks and Actions for Mitigation

Nothing

1.6 Progress of Actions undertaken by JICA

JICA Bhutan Office monitors on submitted progress report and follow-up over telephone, calls/email. They also coordinated with Ministry of Finance, GNHC for clarifications and procedures required on Tax Exemptions.

1.7 Progress of Actions undertaken by Gov. of Bhutan (GNHC/MoIC)

It was in-line with plan of action

1.8 Progress of Environmental and Social Considerations (if applicable)

Nothing

1.9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)
Nothing

1.10 Other remarkable/considerable issues related/affect to the project (such as JICA's Projects, activities of counterparts, other donors, private sectors, NGOs, etc)
During the period, three C/P resigned. C/A raised this concern to BT executives where BT quickly replenished the replacement, and C/A developed their skills through OJT and practical field training.

2 Delay of Work Schedule and/or Problems (if any)
2.1 Detail
Nothing

2.2Cause
Nothing

2.3Action to be taken
Nothing

2.4 Roles of responsible persons/organization (JICA, Gov of ●●●, etc.)
JICA HQ Concern Division

3 Modification of the project implementation plan
3.1 PO
Nothing

3.2 Other Modifications on detailed implementation plan
Nothing

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target gropu(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft)

4 Preparation of Gov. of Bhutan toward after completion of project

Ⅱ Project Monitoring Sheet I & II
as Attached