**Republic of Iraq**
**Ministry of Communications**
**Iraqi Telecommunications and Post Company**
**State Company for Internet Service**

# PREPARATORY SUREVEY REPORT
# ON
# THE CONSTRUCTION AND DEVELOPMENT OF TELECOMMUNICATIONS NETWORK FOR MAJOR PROVINCES IN IRAQ

**MARCH 2011**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

**NIPPON KOEI CO., LTD.**


Project Location Map

# *Executive Summary*

# Executive Summary

Teledensity of fixed telephones in Iraq from 1985 to 1990 was maintained at a constant level of 5.6%. Due to the 1991 Gulf War and the subsequent economic sanctions, destruction and deterioration of the telecommunications infrastructure was extensive, causing a decline in teledensity to 3.3 % in 2002.

Telecommunications infrastructure, like water and electricity, is a vital industrial base and social infrastructure for people's lives. Therefore, the Government of Iraq set the development of telecommunications infrastructure as one of its highest priorities in the National Development Strategy for 2007-2010.

Under such situation, the Medium-Term Development Strategy (MTDS) for planning of 2010 to 2014 was formulated in the end of 2009 by the Ministry of Communications (MOC). MTDS emphasizes development of the following telecommunications infrastructure as high priorities.

(1)Expansion of the telecommunication network

(2)Maintaining the existing networks at current level in terms of quality

In order to achieve telecommunications development as indicated above, a budget of USD 216 million was allocated.

### Current Condition of Telecommunications Network in Iraq

Present telecommunications network in Iraq is composed of three configurations: 1) Backbone transmission network, 2) Switching system, and 3) Local access network.

Backbone transmission network consists of two ways of communications: one is Dense Wavelength Division Multiplexing (DWDM) and the other is microwave radio network. DWDM is operated as a main backbone network, and microwave radio network functions as the back-up of DWDM. Microwave network has been completed through Japan's Grant Aid Project and the aid of the World Bank during 2004 to 2010. DWDM will be fully operational by the end of March 2011. These two backbones can be operated as a reliable integrated telecommunications network backbone in Iraq.

Backbone network and local access network are connected through exchange stations which function for switching and distribution. Most of the existing switching equipment is legacy public switched telephone networks (PSTN) which can migrate to routers as a component of next generation networks (NGN). As of 2010, there are a total of 397 exchanges over the whole country of Iraq, and only 6 out of these are out of service. This condition has been much improved if compared with the status in 2006, when there were 71 of 333 exchanges were out of service. This development can be attributed to the great efforts of MOC.

Local access networks have two types which are metallic cable type and optical fiber type. Metallic type is usually used for voice telephone as legacy system, and optical type is for data transmission like computers as Internet Protocol (IP)-based communication. These subscriber lines are installed between the nearest exchange station and each home or building.

### Demand Forecast

Demand forecast for the MTDS was reviewed by considering the latest actual data such as population and available telephone lines. The required expansion of telephone lines in 2016 for Baghdad, Basra and Mosul will be in accordance with the 2009 population of each province as shown below.

Required Expansion for Baghdad, Basra and Mosul in City

| City | Population in City in 2009 | Ratio of population in 2009 | Required expansions in 2016 (K lines) | Requested expansion by MOC in 2009 (K lines) |
|---|---|---|---|---|
| 1. Baghdad | 6,250,000 | 22.9 % | 847 | 200 |
| 2. Basra | 1,200,000 | 4.4 % | 163 | 30 |
| 3. Mosul | 1,800,000 | 6.6 % | 244 | 56 |
| Total in three Cities | 9250,000 | 33.9 % | 1,254 | 286 |
| Total in Iraq | *27,295,573 | 100 % | 3,700 | - |

Source: MOC
(*) The populations of 3 Kurdistan provinces are excluded.

The forecasted expansions based on the teledensity target for 2016 are remarkably higher than the requested numbers by MOC (200,000 lines for Baghdad, 30,000 lines for Basra and 56,000 lines for Mosul). It can be concluded that the total requested expansion of 286,000 lines is urgently required for implementation as early as possible to assist improvement of the existing telecommunications network being seriously damaged and to cope with the growing telephone and internet users. In addition, further expansions of the network are continuously needed in the telecommunications sector in Iraq in order to achieve the target of MTDS.

### Applicable Technology of the Project

NGN is now taking the place of the present legacy PSTN. It is now gradually becoming difficult to repair the conventional PSTN due to the following reasons:

(1)Manufacturer’s production of PSTN will soon be terminated, shifting to IP-related products and thus, it will be difficult to procure spares for repair.

(2)Change of business models, i.e., transition from voice to data service, on the part of telecom operators/carriers

(3)Recommendations issued by the International Telecommunications Union's Telecommunication Standardization Sector (ITU-T) and Internet Engineering Task Force (IETF) on the utilization of NGN.

Due to the above situation, it will be inevitable to migrate from the legacy PSTN to a new IP technology-based network, thus MOC and other telecom entities are urgently required to have schemes to establish reliable and efficient nationwide IP networks in the framework of NTDS in the ICT Sector in Iraq.

### Operation and Maintenance Structure

The Iraqi communications sector is divided into telecommunications and postal services which are provided by the Iraqi Telecommunication and Post Company (ITPC) under the control of the Administrative Management Agency of MOC. ITPC is an state-owned and monopoly company. The regulatory authority is the Communications and Media Commission (CMC) which controls not only telecom but also the broadcasting sector.

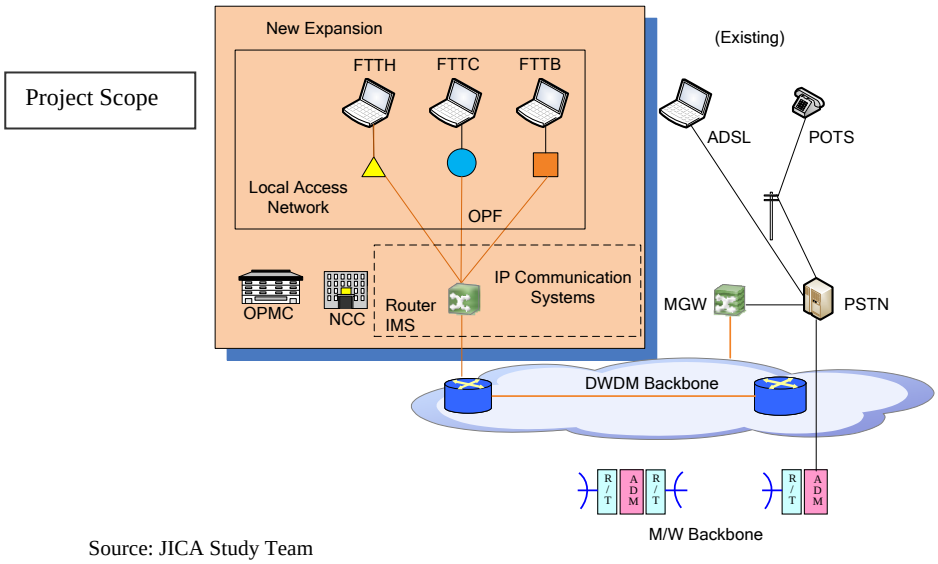
In 2010, MOC/ITPC has completed or has implemented telecommunication projects related backbone transmission network, switching system and local access network. The total budget related these projects reaches USD 131.31 million, and other USD 85 million has been invested for the reinforcement of operating foundations such as communication complex, security and so on. It is evaluated that MOC/ITPC will have management capability of the project from technical and organizational viewpoints.

Regarding financial aspect, MOC's on-going projects will be completed from 2011 to 2013 and the completion of these projects can bring new income to MOC/ITPC, which will rise up the revenue sharply in addition to jumping up of the revenue in 2008 to 2010.

Through the above consideration, MOC/OTPC has project implementation capability in terms of technical, organizational and financial aspects.

### Project Scope

The following new expansion as illustrated in the figure below is necessary to be established for the improvement of the telecommunications network in Iraq. The project consists of five components as described below.




Source: JICA Study Team

(1) IP Communication Systems

IP communication systems are provided for Baghdad, Basra and Mosul. It is composed of IP Multimedia Subsystem (IMS) core, core routers and edge routers. IMS core is installed at a principal core exchange, namely the al-Sink exchange in Baghdad. The core router(s) is/are installed at the core exchange(s) and the edge routers are installed at the local exchanges, respectively. The core exchange is linked with the local exchanges via the existing optic fiber transmission system.

(2) Local Access Network

In the local access network, fiber-to-the-curb (FTTC), fiber-to-the-building (FTTB) and fiber-to-the-home (FTTH) are to be adopted for the project. The line capacities covered by FTTC are 244,000 lines, FTTB for 33,500 lines and FTTC for 8,500 lines, for 286,000 lines in total for the project. The local access network provides broadband services to the subscribers. Among the methods, FTTC plays a prevailing role followed by FTTB. FTTH has minimal application for the sake of security and for protection from power outage.

(3) New Communication Center (NCC)

NCC is constructed in order to handle the increase of the internet traffic in Iraq and to provide reliable internet service to the subscribers. The building is 3-storey and its size is approximately 12 m by 18 m, with a total floor area of 648 $m^2$.

(4) Outside Plant Maintenance Center (OPMC)

OPMC is constructed in order to provide operation/maintenance services for the new optic fiber cables and will serve as a training center as well. The building is also 3-storey and its size is approximately 30 m by 50 m, with a total floor area of 4,500 $m^2$.

## Project Cost

Total amount of capital cost for the 286,000 lines in Baghdad, Basra and Mosul is JPY 33,528 million which is equivalent to ID 484,480 million as of December 31, 2010. Capital cost for each area is also estimated assuming the following seven cases.

| Case | Target Area | | | Line (k lines) | Cost (Million JPY) | Cost Equivalent (Million USD) |
|---|---|---|---|---|---|---|
| Case-1 | Baghdad | Basra | Mosul | 286 | 30,174 | 370 |
| Case-2 | Baghdad | Basra | | 230 | 25,636 | 314 |
| Case-3 | Baghdad | | Mosul | 256 | 27,680 | 339 |
| Case-4 | | Basra | Mosul | 86 | 11,516 | 141 |
| Case-5 | Baghdad | | | 200 | 23,146 | 284 |
| Case-6 | | Basra | | 30 | 7,088 | 87 |
| Case-7 | | | Mosul | 56 | 9,174 | 112 |
| Note: USD 1= 81.55USD | | | | | | |

Source: JICA Study Team

## Financial and Economic Analysis

(1)Financial Analysis

The results of financial analysis for each case (Case-1 ~ Case-7) is summarized in the following table.

Results of Financial Analysis

| Case | Target Area | FIRR (%) | NPV (Mil IQD) | B/C |
|---|---|---|---|---|
| Case-1 | Baghdad/Basra/Mosul | 20.9 | 280,825 | 1.50 |
| Case-2 | Baghdad/Basra | 19.3 | 198,185 | 1.41 |
| Case-3 | Baghdad/Mosul | 20.1 | 236,346 | 1.45 |
| Case-4 | Basra/Mosul | 14.4 | 38,304 | 1.18 |
| Case-5 | Baghdad | 18.1 | 153,633 | 1.35 |
| Case-6 | Basra | -2.0 | -46,712 | 0.66 |
| Case-7 | Mosul | 8.6 | -9,082 | 0.95 |

Source: JICA Study Team

(2)Economic Analysis

The results of economic analysis for each case (Case-1 ~ Case-7) is summarized in the following table.

Results of Economic Analysis

| Case | Target Area | EIRR (%) | NPV (Mil ID) | B/C |
|---|---|---|---|---|
| Case-1 | Baghdad/Basra/Mosul | 28.7 | 427,847 | 1.95 |
| Case-2 | Baghdad/Basra | 27.0 | 321,969 | 1.83 |
| Case-3 | Baghdad/Mosul | 27.8 | 370,631 | 1.89 |
| Case-4 | Basra/Mosul | 21.4 | 90,628 | 1.52 |
| Case-5 | Baghdad | 25.7 | 264,694 | 1.76 |
| Case-6 | Basra | 5.7 | -15,823 | 0.86 |
| Case-7 | Mosul | 15.6 | 32,471 | 1.23 |

Source: JICA Study Team

### Project Implementation

Implementation schedule for the 286,000 lines, including pre-construction stage such as selection of consultant, detailed design and tendering, is expected to take about 52 months in total and the required period for each stage is shown in the following table.

Implementation Schedule

| Stage | Period |
|---|---|
| 1.Selection of Consultant | 10 months |
| 2.Detailed Design | 11 months |
| 3.Tendering | 7 months |
| 4.Construction, Installation and Training | |
| 1) IP communication system and Local Access Network | 16 months |
| 2) OPMC and NCC | 23 months |
| 3) Human Resource Development | 6 months |

Source: JICA Study Team

### Environmental and Social Considerations

The adverse environmental and social impacts identified for the Project are only typical and general impacts caused by any construction work, although these impacts will be temporary and insignificant in scale and extent.

By considering the identified environmental and social impacts to be encountered during the construction phase of the Project, it is desirable for the proponent (MOC and ITPC) and/or contractor to take necessary mitigation measures, as follows:

- Safety and sanitary education/training program for construction workers;
- Traffic regulation in the vicinity of construction area when necessary;
- Appropriate operation and maintenance of construction machineries/vehicles; and
- Adequate recycling and/or disposal of residual construction soil and waste.

## Conclusions and Recommendations

(1) Early Implementation of the Project

The 2003 war in Iraq has extensively damaged the existing telecommunications infrastructure that has put the progress and development of the Iraqi economy behind its neighboring countries. Under these circumstances, MOC has released the MTDS for the years of 2010 – 2014, pledged the rehabilitation and improvement of war-damaged infrastructure, and also intends to modernize and upgrade the whole outdated telecommunications network in association with its state-owned operators, ITPC and SCIS. In order to achieve the MOC target above, it is strongly recommended to implement the project as early as possible to take the following into account:

- Improvement and development of telecommunications network to catch up with the global transition from the legacy PSTN to IP-based networks; and
- Creation of new business models derived from the broadband services and paradigm shift from voice services to data services that IP-based networks can provide.

(2)Effective Management Organization of Iraqis during Implementation

Organization of the executing agency during project implementation is requested to fully fulfill its function. The organization varies by stages, from the design stage, bidding and contract stage, and implementation stage up to the project completion. In order to keep the implementation schedule, it is recommended that the Iraqi government establishes an effective management organization dedicated to the project, corresponding to each stage of the implementation.

Project management capability and skills on relevant technology are essential for carrying out the project because the NGN system needs high level of knowledge on system integration. It is therefore essential to take into consideration the selection of a capable contractor and consultant.

(3)Human Resource Development (HRD)

HRD is an essential part of operating a telecommunications system. ITPC has been carrying out excellent HRD programs. However, MOC/ITPC needs new and additional programs in its HRD training scheme since IP-based network technologies related to NGN will be part of their daily operation and maintenance works. From the viewpoint of this technological transition, new HRD schemes are required for successful operation and maintenance of the new systems and facilities. Therefore, HRD should be focusing on the new technologies that constitute IP-based networks, associated with other essential technologies of NGN. HRD is, in principle, intended for the engineers of ITPC/SCIS engaged in the IP communication system. The participating trainees are expected to transfer internally their acquired knowledge and skills to other staffs.

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# Preparatory Study on the Construction and Development of Telecommunications Network for Major Provinces in Iraq

## Final Report

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## Abbreviations

| | | |
|---|---|---|
| ADM | : | Add Drop Multiplexer |
| ADSL | : | Asynchronous Digital Subscriber Line |
| ATT | : | Attenuator |
| CCITT | : | Comite Consultatif International Telegraphique et Telephonique |
| C/P | : | Counterpart |
| CMC | | Communications and Media Commission |
| CPA | : | Coalition Provisional Authority |
| CPU | : | Call Processing Unit |
| CU | : | Central Unit |
| DB | : | Direct Buried Cable |
| DDF | : | Digital Distribution Frame |
| DEG | : | Diesel Engine Generator |
| DP | : | Distribution Point |
| DSLAM | : | Digital Subscriber Line Access Multiplexer |
| DWDM | : | Dense Wavelength Division Multiplexing |
| EIA | : | Environmental Impact Assessment |
| EIRR | : | Economical Internal Rate of Return |
| EU | : | European Union |
| F/O | : | Fiber Optic |
| FDF | : | Optical Fiber Distribution Frame, refer to ODF |
| FIRR | : | Financial Internal Rate of Return |
| FTTB | : | Fiber to the Building |
| FTTH | : | Fiber to the Home |
| GDP | : | Gross Domestic Product |
| GIS | : | Geographical Information System |
| GMPLS | : | Generalized Multi-Protocol Label Switching |
| GNI | : | Gross National Income |
| GOI | : | Government of Iraq |
| GOJ | : | Government of Japan |
| GPS | : | Global Positioning System |
| HH | : | Handhole |
| HPA | : | High Power Amplifier |
| HRD | : | Human Resource Development |
| HVT | : | High Voltage Transformer |
| IBTE | : | Iraqi Broadcasting and Television Establishment |
| ICT | : | Information and Communication Technology |
| IETF | : | Internet Engineering Task Force |
| I/O | : | Input/Output Device |
| IMF | : | International Monetary Fund |
| IMS | : | IIP Multimedia Subsystem |
| IP | : | Internet Protocol |
| IP-PBX | : | Internet Protocol Private Branch Exchange |
| ISI | : | Information System International Corp. |
| ISP | : | Internet Services Provider |
| IT | : | Information Technology |

| | | |
|---|---|---|
| ITPC | : | Iraqi Telecommunication and Posts Company |
| ITU | : | International Telecommunication Union |
| JETRO | : | Japan External Trade Organization |
| JICA | : | Japan International Cooperation Agency |
| LAN | : | Local Area Network |
| LNA | : | Low Noise Amplifier |
| MC | : | Media Converter |
| MDF | : | Main Distribution Frame |
| MGW | : | Media Gateway |
| MH | : | Manhole |
| MOC | : | Ministry of Communications |
| MOE | : | Ministry of Environment |
| MPLS | : | Multi-protocol Label Switching |
| MTDS | : | Mid Term Development Strategy |
| NCC | : | New Communication Center |
| NEDO | : | New Energy Development Organization |
| NDP | : | National Development Plan |
| NDS | : | National Development Strategy |
| NGN | : | Next Generation Network |
| O/E, E/O | : | Optical/Electrical, Electrical/Optical conversion |
| O/M, O&M | : | Operation and Maintenance |
| ODF | : | Optical Fiber Distribution Frame, refer to FDF |
| OF | : | Optical Fiber |
| OJT | : | On-the-Job-Training |
| OLT | : | Optical Line Terminal |
| ONT | : | Optical Network Terminal |
| ONU | : | Optical Network Unit |
| OPMC | : | Outside Plant Maintenance Center |
| OSI | : | Open Systems Interconnection |
| OSP | : | Outside Plant |
| PMT | : | Project Management Team |
| PON | : | Passive Optical Network |
| POTS | : | Plain Old Telephone Service |
| PSTN | : | Public Switched Telephone Network |
| PVC | : | Polyvinyl Chloride |
| RU | : | Remote Unit |
| SCIS | : | State Company of Internet Services |
| SDH | : | Synchronous Digital Hierarchy |
| SG | : | Signal Gateway |
| SIP | : | Session Initiation Protocol |
| STM | : | Synchronous Transfer Mode |
| TCP/IP | : | Transmission Control Protocol/Internet Protocol |
| TLS | : | Transit and Local combined Switch |
| TS | : | Transit Switch |
| UAE | : | United Arab Emirates |
| UN | : | United Nations |

| | | |
|---|---|---|
| USA | : | United States of America |
| USAID | : | United States Agency for International Development |
| UPS | : | Uninterrupted Power System |
| VDSL | : | Very high-bit-rate Digital Subscriber Line |
| VoIP | : | Voice over Internet Protocol |
| VSAT | : | Very Small Aperture Terminal |
| WAN | : | Wide Area Network |
| WDM | : | Wave length Division Multiplex |
| WiMAX | : | World Interoperability for Microwave Access, IEEE 802.16 |
| WLL | : | Wireless Local Loop |

# *Chapter 1*
# *Introduction*

# CHAPTER 1 INTRODUCTION

## 1.1 Background

Teledensity of fixed telephones, which is defined as the number of fixed telephone lines per 100 population, in Iraq from 1985 to 1990 was maintained at a constant level of 5.6%. Because of the 1991 Gulf War and its subsequent economic sanctions, the destruction and deterioration of the telecommunications infrastructure was extensive. As a result, teledensity declined to 3.3% in 2002.

Telecommunications infrastructure is a vital industrial base and social infrastructure for people's life similar to water and electricity. Therefore, the Government of Iraq (GOI) set the development of telecommunications infrastructure as one of the highest priorities in the National Development Strategy (NDS) for 2007-2010.

The telecommunications infrastructure in Iraq is composed mainly of three configurations, namely: 1) backbone transmission network, 2) switching system, and 3) local access network.

In 2004, the Government of Japan (GOJ) implemented the Improvement of Trunk Communications Network Project and Improvement of Transit Switches Project as grant aid projects in order to assist reconstruction of the backbone transmission network. These projects have been successfully completed in 2010.

In addition, the World Bank implemented the Microwave Transmission System for Three of the Main Backbone Routes in Iraq Project in order to develop the domestic telephone network with budget of USD 43 million. As part of United States Agency for International Development (USAID) effort to restore critical infrastructure and services, USAID worked with Iraq Telecommunication and Posts Company (ITPC) to restore the national optical fiber telecommunications network, repair the telephone switching in Baghdad, and restore international telecommunications capability.

On the other hand, the reconstruction and development of the switching system and local access network, which is to be interconnected between the backbone transmission network and users, have not yet been making progress. Accordingly, the development status of fixed telephone networks still remains low and in 2006, the teledensity was 3.7%, which is very low compared to neighboring countries such as Jordan (10.68%) and Turkey (26.12%).

In order to improve such situation, GOI requested GOJ in August 2006, to make a feasibility study for the development of telecommunications infrastructure. The feasibility study was carried out by Japan External Trade Organization (JETRO) and the study report (hereinafter called as "JETRO F/S report") was submitted to GOI in 2007.

Following the F/S, the Medium-Term Development Strategy (MTDS) of the telecommunications infrastructure for 2010-2014 was issued in 2009 by the Ministry of Communications (MOC), in which the target teledensity of fixed telephones for 2012 was set at 14.36%.

## 1.2 Purpose of Study

The purpose of the study is to formulate an optimal and effective project for the improvement of the current situation of telecommunications infrastructure in order to contribute for the social and economic development of Iraq. The study was made by reviewing the request of GOI and the JETRO F/S report based on the latest data and information.

## 1.3 Study Area

The study area consists of Iraq's major cities such as Baghdad, Basra, and Mosul, which are the target areas in the requested project.

## 1.4 Scope of Study

The scope of the study is summarized as follows:

a) To analyze the MTDS and confirm the position of the requested project

b) To review and update the current conditions of the telecommunications infrastructure

c) To update the demand forecast of fixed telephones and internet users

d) To grasp GOI's financial plan of considering the possibility of private investment, and to examine the validity of public investment

e) To review applicable technology for the project by considering modern technology in the telecommunications industry

f) To make the most appropriate project scope and implementation plan

g) To review the project implementing organizations (operation, maintenance and management)

h) To make financial and economic analyses

i) To collect information on environmental and social considerations according to Iraq's domestic laws and JBIC's guideline for the confirmation of environmental and social considerations (April 2002 version).

## 1.5 Members of Study Team

Nippon Koei Co., Ltd. was awarded the contract to provide consulting services for the study. The study team consists of six experts as shown in Table 1.5-1.

Table1.5-1 Member List of the Study Team

| Name | Position/Expertise |
|---|---|
| MATSUSHIMA Noriaki | Team Leader / Project Formation |
| TANIGUCHI Tomotaka | Total Planning for Telecommunications Development |
| SHINJI Yoshiyuki | Network Telecommunications Engineering |
| SHIGETOMI Norio | Economic and Financial Analysis |
| SAKAGAMI Masahiro | Implementation Planning and Cost Estimate |
| HOSONO Tomoyuki | Environmental and Social Considerations |

Source: JICA Study Team

## 1.6 Study Schedule

From October to November 2010, the study team conducted works in Japan, which included the review of the JETRO F/S report and collection of current data and information from the local consultant. On December 12-14, 2010, a meeting was held in Amman to recognize the current situation through discussion with concerned authorities/personnel from MOC and the Iraqi Telecommunication Post Company (ITPC). Consequently, the interim report was submitted to the Japan International Cooperation Agency (JICA) by the end of December 2010. The draft final report was prepared based on the results of analysis of relevant data and information, and was presented to MOC in February 2011. Based on the comments on the draft final report and the result of discussion in February 2011, the final report was prepared and submitted to JICA in March, 2011.

# *Chapter 2*
# *Medium-Term Development Strategy*

# CHAPTER 2 MEDIUM-TERM DEVELOPMENT STRATEGY

## 2.1 Outline of the Medium-Term Development Strategy (MTDS)

The National Development Strategy (NDS) for 2007-2010 was established by the Government of Iraq (GOI) on the following four major fundamental principles that govern strategic public actions for the reconstruction and development of Iraq:

(1) Strengthening the foundations of economic growth,

(2) Revitalizing the private sector,

(3) Improving the quality of life, and

(4) Strengthening good governance and security.

Based on the fundamental principles of NDS, the Ministry of Communications (MOC) has designed MTDS in 2009 for the reconstruction of the telecommunications infrastructure in the whole of Iraq. This aims to map out the strategic investment plans for 2010-2014 approved by the Government of Iraq on April 27, 2010.

MOC intends to realize the fundamental principles of NDS in the framework of MTDS and also consider the quality of life of Iraqi people by taking on the following direction.

*Mission is to satisfy the citizens' needs in order to accomplish a typical turning point in the Information and Communication Technology (ICT) fundamental structure through rebuilding and rehabilitating the fundamental telecommunication utilities in Iraq not only for satisfying human basic needs but also for enhancing economic fundamentals and improving the security situation.*

This direction is reflected in the vision of MTDS, as follows:

(1) Developing infrastructure in order to significantly provide access to both rural and civil areas.

(2) Establishing a suitable environment for international interest in providing telecommunications and internet services in Iraq.

(3) Ensuring that the electronic applications benefit the social and economic sectors.

## 2.2 Objectives and Targets of MTDS

The objectives of MTDS are as follows:

(1) Rebuilding and expanding the switches and local access networks in order to reach the same level as in neighboring countries.

(2) Establishing a modern, safe and integrated national long distance backbone network with international connectivity as well as any protocol.

(3) Contributing directly to the revitalization and development of the Iraqi economy as well as information technology (IT) and knowledge society.

(4) Enhancing the situation of Iraqi security through the rebuilding and expanding of the telecommunications network.

In order to achieve the above objectives, the following strategies were stated in MTDS:

(1) Expand local access networks targeting more than three million subscribers,

(2) Allocate budget in order to maintain and rehabilitate the existing telecommunications network at the current level,

(3) Reduce the number of waiting applicants to zero, and

(4) Enhance the MOC organization by developing and strengthening human resources.

Furthermore, the above strategies were emphasized and highly prioritized in MTDS for the development of the telecommunications infrastructure in order to achieve the target teledensity of 14.36% by 2012.

**High Priorities for Development Telecommunications Infrastructure**

(1) Expansion of Telecommunications Network

(2) Maintaining Existing Networks at current level in terms of quality

The target teledensity of 14.36% by 2012 as defined in MTDS was arrived at by MOC as a result of the review of demand forecast of fixed telephones in the JETRO F/S report taking into consideration waiting applicants and Iraq's economic growth. The revised figures of teledensity are shown in Table 2.2-1.

Table 2.2-1 Comparison of Forecast of Teledensity in Iraq (unit: %)

| Year | 2010 | 2011 | **2012** | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|
| JETRO F/S report | 8.84 | 9.82 | **10.92** | 12.16 | 13.55 | 15.12 | 16.88 |
| MTDS in 2009 | 13.29 | 14.03 | **14.36** | 14.73 | 15.11 | 15.52 | 15.95 |

Source: JETRO F/S report and MTDS

As seen in Table 2.2-1, there is a bigger gap of forecasted teledensity between 2010 and 2014 than that for 2015 onwards.

Meanwhile, National Development Plan (NDP) was formulated in 2010 by Iraqi Government whose action year is 2010 to 2014. According to the NDP for Communication Sector, target of teledensity in 2015 is stated as 11.2% which is found deviation from 15.52% stated in MTDS. MOC recognizes that teledensity in 2012 is 11.2% and 15.52% in 2015.

## 2.3 Reconstruction and Development of the Telecommunications Network

At present, MOC has been implementing and formulating various projects with its own funds in order to rehabilitate and maintain the existing telecommunications network in line with the high priorities for development stated in MTDS.

A total budget of USD 216 million had been allocated by MOC's own fund for these projects. The projects being implemented under the categories of 1) backbone transmission system, 2) switching system, and 3) local access network are listed in Table 2.3-1. Their allocated budgets and progress as of 2010 are also given.

Table2.3-1 Status of Projects Implemented by MOC/ITPC/SCIS in 2010

| Category | Project Name | Budgets (Mil. USD) | Start Year | Progress as of 2010 | Completion Year |
|---|---|---|---|---|---|
| 1 | 1.Baghdad - Bassra microwave system for internet services | 1.27 | 2005 | 100% | 2010 |
| | 2.Optical fiber transmission system for connection of exchanges at provinces | 6.78 | 2005 | 100% | 2010 |
| | 3.Baghdad microwave transmission network | 9.32 | 2009 | 16% | 2011 |
| | 4.Expansion of optical fiber system (backbone) | 8.47 | 2005 | 75% | On-going |
| | 5.Connection with submarine cable | 10.17 | 2007 | 25% | 2010 |
| | 6.Erection of towers for microwave | 1.27 | 2005 | 60% | 2011 |
| | **Subtotal 1** | **37.28** | | | |

| | | | | | |
|---|---|---|---|---|---|
| 2 | 1.Optical fiber network (DWDM) Baghdad | 2.97 | 2005 | 98% | 2011 |
| | 2.IP systems | 13.56 | 2004 | 24% | 2011 |
| | **Subtotal 2** | **16.53** | | | |
| 3 | 1.Supply and installation 500,000 telephone line and transmission system | 2.54 | 2005 | 13% | 2010 |
| | 2.Expansion of existing copper network | 5.30 | 2006 | 18% | 2012 |
| | 3.Maintenance for the existing copper cables | 10.37 | 2006 | 62% | 2009 |
| | 4.Supply of copper cable and accessories | 21.19 | 2006 | 13% | On-going |
| | 5.Establishment of local access networks outside Baghdad | 17.20 | 2009 | 90% | On-going |
| | 6.Conduit for copper network | 10.55 | 2006 | 60% | 2012 |
| | 7.Cable laying equipment and cable testing equipment and accessories | 6.96 | 2006 | 100% | On-going |
| | 8.Expansion WLL telephone systems and accessories | 3.39 | 2006 | 13% | 2013 |
| | **Subtotal 3** | **77.5** | | | |
| | **Total** | **131.31** | | | |

Note: Category 1: Backbone Transmission Network
Category 2: Switching System
Category 3: Local Access Network
"On-going" means completion year is not clearly fixed.

Source: MTDS

As seen in Table 2.3-1, a budget of USD 131.31 million was invested for the improvement of networks, and the remaining USD 85 million (= USD 216 million – USD 131 million) has been invested for the reinforcement of operating foundations such as communication complex, security, etc.

On the other hand, MOC has investment plans for 2010-2014 and the project names listed in MTDS are shown in Table 2.3-2.

Table 2.3-2 Major Projects Extracted from MOC Investment Plan (2010～2014)

| No. | Project Name | Total Cost (Mil USD) | Expected Fund Source | Start Year | Completion Year |
|---|---|---|---|---|---|
| 1 | Construction and Development of Telecommunications Network for all Provinces in Iraq (1st Priority for phase 1) | 781.3 (for phase 1 216.2) | Yen Loan | 2011 | 2017 |
| 2 | Supply of NGN Exchange and Replacement of Old Exchanges (Rehabilitation) | 124.3 | Own budget | 2005 | On-going |

| | | | | | |
|---|---|---|---|---|---|
| 3 | Optical Fiber Network(DWDM) (Spare Parts only) | 3.1 | Own budget | 2005 | 2011 |
| 4 | Supply and Installation of WLL System and Accessories (Rehabilitation) | 41.5 | Own budget | 2006 | 2013 |
| 5 | Optical Fiber Transmission system for Connecting Centers of Provinces(nearly completed) | 6.7 | Own budget | 2005 | 2010 |
| 6 | Construction of e-Government | 10.2 | Own budget | 2008 | 2012 |
| 7 | Expansion and Updating of National Data Transmission IP | 50.8 | Own budget | 2004 | 2011 |
| 8 | Implementation of Optical Access Network in Baghdad and Provinces (Rehabilitation) | 317.8 | Own budget | 2009 | On-going |

Note: "On-going" means completion year is not clearly fixed.

Source: MTDS

## 2.4 Position of Requested Yen Loan Project

In August 2007, GOI requested for a Japanese ODA loan for the Construction and Development of Telecommunications Network for All Provinces in Iraq Project based on the investment plan of MTDS. GOI offered phase 1 of the project as the first priority. Phase 1 is the development of new fixed telephone lines in Iraq's major cities, namely: Baghdad, Basra and Mosul. The purpose of this is to assist in achieving the target teledensity in line with the high priority of the MTDS strategies to provide a reliable telecommunications network as a public and fundamental infrastructure for government services, national security, business activities and social life in Iraq.

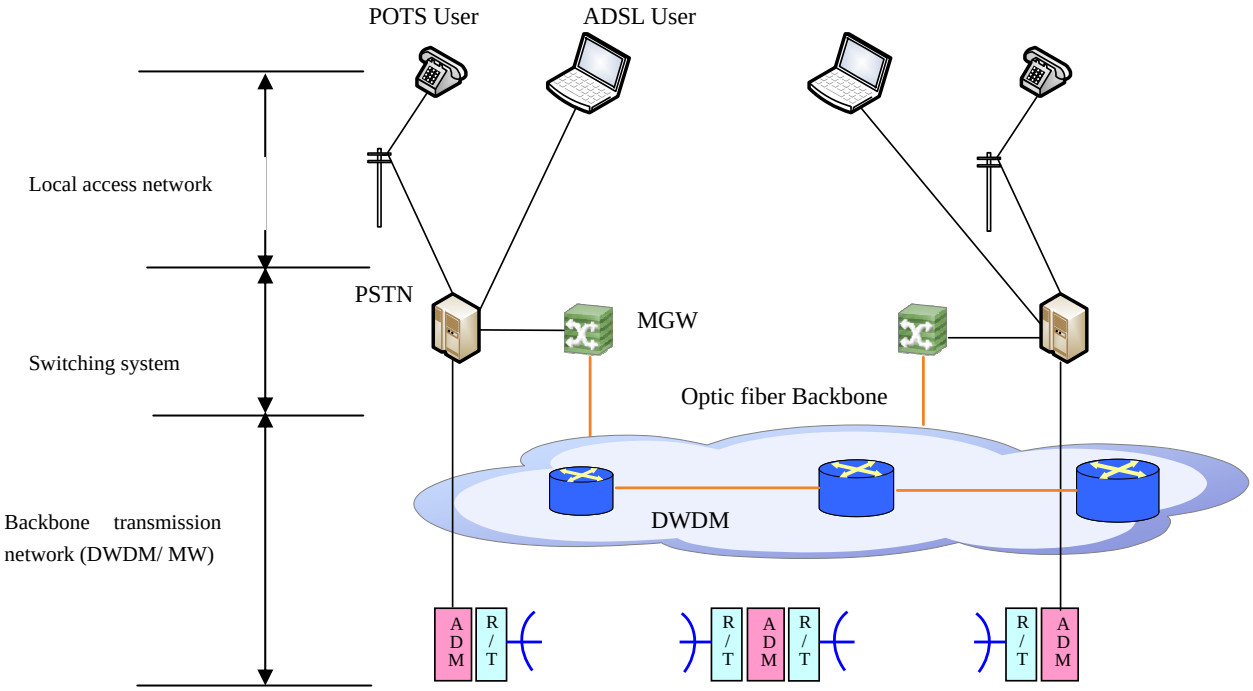
# *Chapter 3*
# *Telecommunications Network*

# CHAPTER 3 TELECOMMUNICATIONS NETWORK

## 3.1 Current Conditions of Telecommunications Network

### 3.1.1 Present Configurations of the Telecommunications Network

As illustrated in Figure 3.1.1-1, the present telecommunications network in Iraq is composed mainly of the following three configurations: 1) backbone transmission network, 2) switching system, and 3) local access network.




Source: JICA Study Team

Figure 3.1.1-1: General Configuration of Telecommunications Network in Iraq

The backbone transmission network interconnecting major cities of all the provinces of Iraq had been seriously damaged since 2004. In order to reconstruct the network, the following four projects were carried out through assistances from Japan's grant aid and the World Bank:

(1) The Project for Improvement of Trunk Communications Network through Japan's grant aid (2004-2008),

(2) The Project for Improvement of Transit Switches through Japan's grant aid (2004-2008),

(3) Microwave Transmission System for Three of the Main Backbone Routes of Iraq through the World Bank (2005-2008), and

(4) The Project for Improvement of Transit Switches (Supplementary Work) through Japan's grant aid (2009-2010).

As of 2010, the above projects have successfully been completed and 18 core exchanges were stationed in Iraq.

### 3.1.2 Backbone Transmission Network

Backbone transmission network consists of two ways of communication. One is through dense wavelength division multiplexing (DWDM), and the other is through microwave radio network. DWDM is operating as the main backbone network while the microwave radio network functions as back up of DWDM.

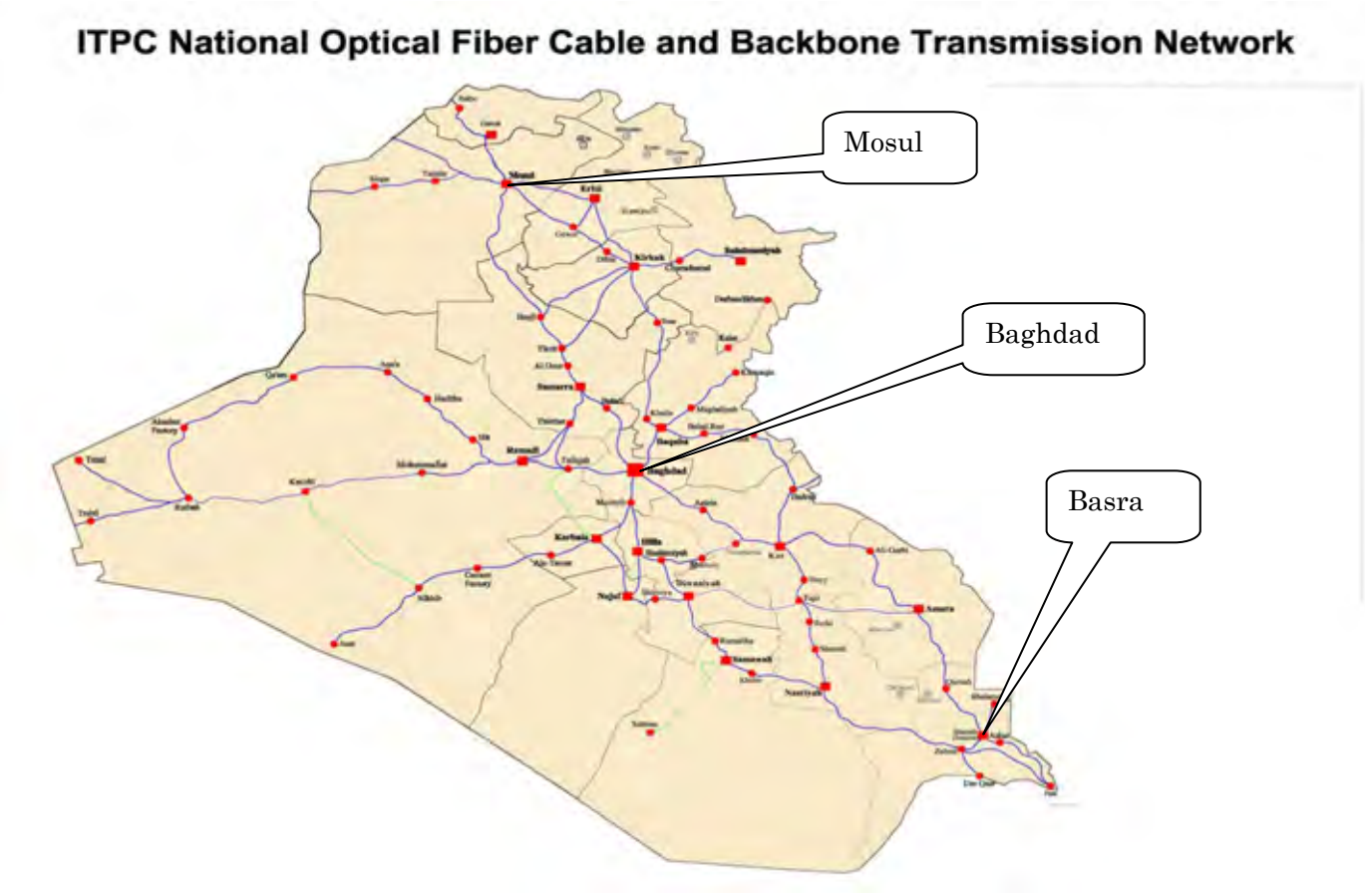
DWDM is built by fiber optic cables which can carry large quantities of data as compared with other transmission modes such as radio and wire transmissions. DWDM works by combining and transmitting multiple signals simultaneously at different wavelengths on the same fiber. In effect, one fiber is transformed into multiple virtual fibers.

One of the key advantages of DWDM is that it is protocol and bit rate independent. This means that DWDM is flexible in carrying different kinds of data. In particular, DWDM-based networks can transmit data in IP, ATM, SONET/SDH, and Ethernet, and handle bit rates between 100 Mb/s and 2.5 Gb/s. Therefore, DWDM-based networks can carry different types of traffic at different speeds over an optical channel, and they are essential for establishing a next generation network (NGN) in Iraq.

The Ministry of Communications (MOC) has started the Nationwide DWDM Optical Fiber Project in which seven fiber optic rings have been completed as of November 2010. This project is to be commissioned in March 2011. In addition, there is another important ongoing project, the Nationwide GMPLS/MPLS Core Router Network Project, which directs and transports data from one network node to the next with high performance and makes it possible to create virtual links between distant nodes by encapsulating with "labeling" IP packet headers. The network consists of 18 core routers at major exchanges.

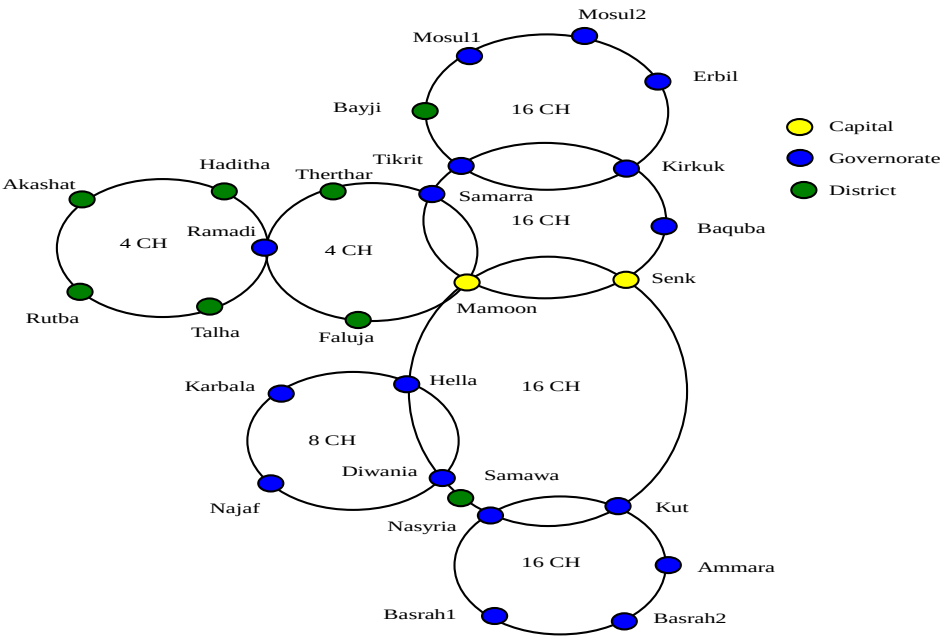
Erbil, Duhok, Mosul, Sumaniya, Tikrit, Kirkuk, Baquba, Ramadi, Mamoon(Baghdad), Karbala, Hella, Najaf, Dawania, Samawa, Nasyria, Basrah, Ammara, Kut (18 Exchanges)

Location map of the nationwide DWDM network and its configuration are shown in Figures 3.1.2-1 and 3.1.2-2.




Source: MOC

Figure 3.1.2-1: Location Map of DWDM Backbone Transmission Network




Source: JICA Study Team

Figure 3.1.2-2 Nationwide DWDM Network in Iraq

On the other hand, the microwave backbone network consists of radio waves with 6 GHz frequency bands for the main routes and 11 GHz frequency bands for the branches. This microwave backbone network applies the synchronous digital hierarchy (SDH) long-haul radio transmission system which enables reliable communication. Table 3.1.2-1 shows the five existing microwave transmission routes undertaken through Japan's grant aid and the World Bank in the rehabilitation program. The outlook of the routes is illustrated in Figure 3.1.2-3, and details of compositions are shown in Figure 3.1.2-4

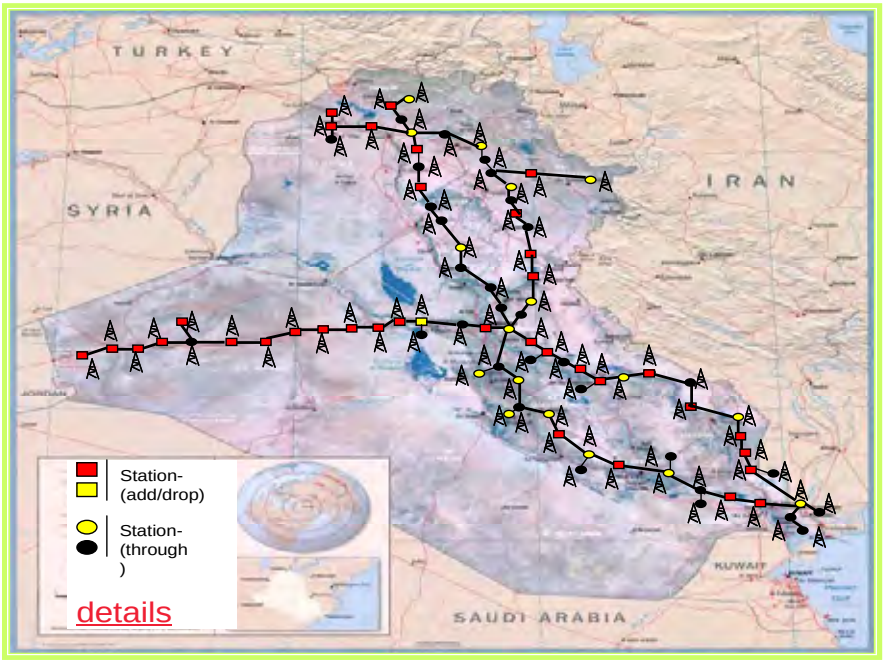
Table 3.1.2-1 Microwave Transmission Routes

| Route | Interconnection cities | Fund *) | Completion year |
|---|---|---|---|
| 1. West route | Baghdad-Ramadi-Trabil | World Bank | 2008 |
| 2. North-East route | Baghdad-Kirkuk-Mosul | World Bank | 2008 |
| 3. South-East route | Baghdad-Amara-Basra | World Bank | 2008 |
| 4. North-South route | Baghdad-Samura - Mosul | Japan's Grant Aid | 2010 |
| 5. South - West route | Baghdad-Samawa-Basra | Japan's Grant Aid | 2010 |

*) 1) Total amount of World Band Fund is approximately USD 43 million.

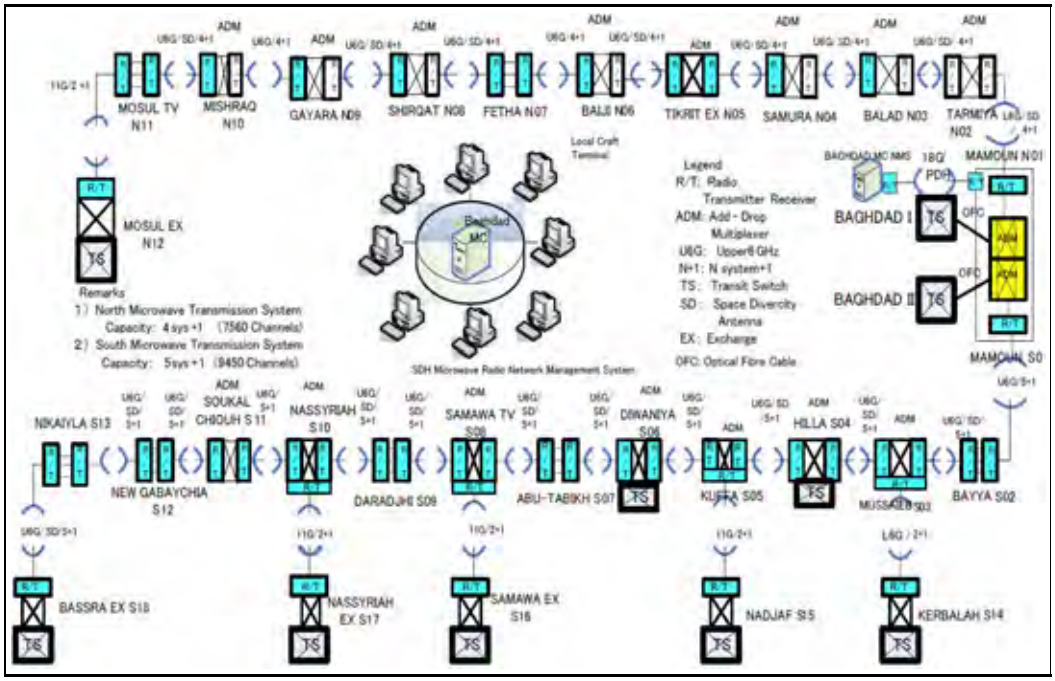
2) Total amount of Japan's Grant Aid is approximately USD million.

Source: JICA Study Team




Source: MOC

Figure3.1.2-3 Microwave Backbone Transmission Routes

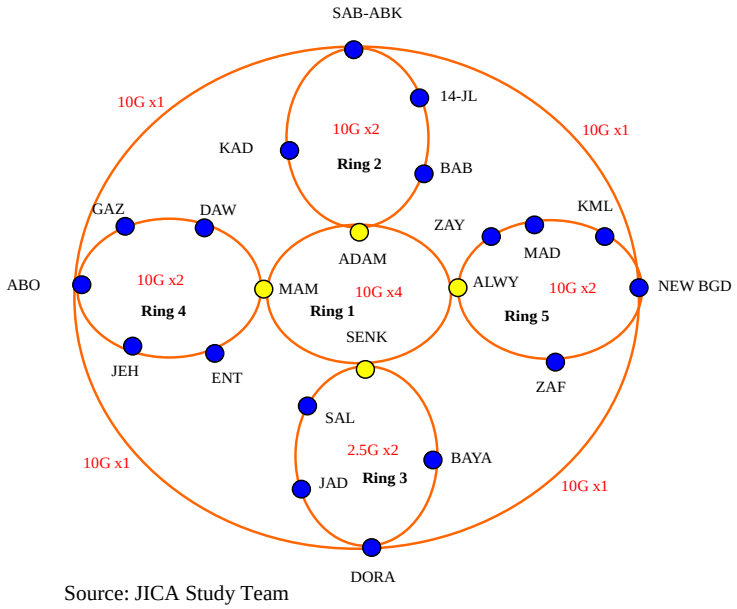



Source: Nippon Koei

Figure3.1.2-4 Composition of Microwave Radio Network

### 3.1.3 Switching System

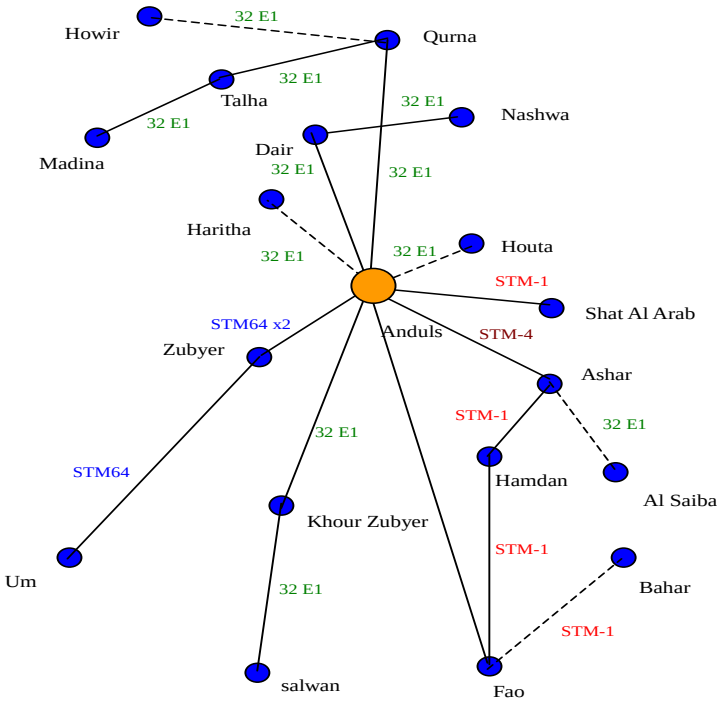
Backbone network and local access networks are connected through exchange stations which function for switching. The switching equipment are legacy type which migrate to routers instead of switching equipment. MOC has tried to shift its communications system from legacy switching to routers for the NGN. The existing optical networks in Baghdad are linked by 24 core fiber optic cables and connected to legacy exchanges with SDH/STM-4 (622 Mb/s) interface. In order to upgrade the networks to attain high quality and reliability, giga-base GMPLS/MPLS switches will be required with DWDM ring network topology as shown in Figure 3.1.3-1. The Iraqi Telecommunication and Post Company (ITPC) has planned to complete the DWDM project in Baghdad, which will be commissioned by the end of 2011.




Source: JICA Study Team

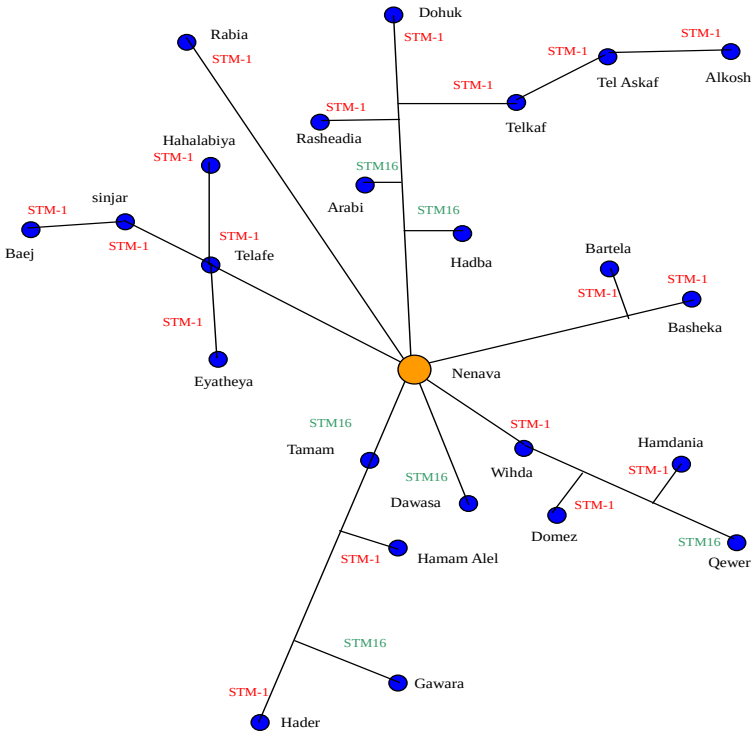
Figure 3.1.3-1 DWDM Ring Network Topology in Baghdad

Unlike in Baghdad, in regional areas such as Basra and Mosul, DWDM projects have not been started yet. Therefore, IP networks will be established based on SDH transmission systems, so-called IP-over SDH. The existing optic fiber topologies of both Basra and Mosul are composed of star connections as shown in Figures 3.1.3-2 and 3.1.3-3, respectively.




Source: JICA Study Team

Figure 3.1.3-2 SDH Transmission Topology of Basra




Source: JICA Study Team

Figure 3.1.3-3 SDH Transmission Topology of Mosul

### 3.1.4 Local Access Network

Local access networks have two types, namely, metallic cable type and optical fiber cable type. The metallic type is usually used for voice telephone, similar to the legacy system. Meanwhile, the optical type is used for data transmission for IP-based communication as in computers. These local access lines are installed between the nearest switching station and each home/office.

Table 3.1.4-1 shows the present condition of access networks in all provinces. There is a total of 397 exchanges over the entire country as of 2010. Among them, six exchanges did not work. In 2006, a total of 333 exchanges existed. However, 71 exchanges were damaged. At present, the number of service exchanges was recovered to 391 (= 397 – 6) from 262 (= 333 – 71) in 2006.

The ratio of not in service lines to the total available line capacity is about 10% in the whole of Iraq. In other words, the demand rate is assumed to be 90% in whole Iraq. On the other hand, the ratios in Baghdad, Basrah and Mosul are 21%, 17% and 2.2%, respectively. This means that the service rates in Baghdad and Basrah are higher than the average, and the rate in Mosul is lower than the average. It was considered that the damage of the local access network in Baghdad has still remained to be more extensive and serious than other provinces.

Table3.1.4-1: Present Condition of Access Networks as of 2010

| Province | Existing | | Line Out Of Services | Not Service | | Waiting Applicants |
|---|---|---|---|---|---|---|
| | No. Exchange | Line Capacity | | No. Exchange | Line Capacity | |
| Baghdad | 42 | 588,116 | 124,049 | 5 | 11,000 | 26,096 |
| Basra | 22 | 101,000 | 17,449 | 0 | 0 | 27,862 |
| Najaf | 13 | 94,000 | 5,341 | 0 | 0 | 20,246 |
| Kerbarah | 14 | 61,000 | 1,349 | 0 | 0 | 33,765 |
| Dawaniya | 27 | 80,100 | 574 | 0 | 0 | 5,922 |
| Kirkuk | 29 | 101,200 | 3,181 | 1 | 200 | 6,061 |
| Kut | 23 | 73,400 | 1,874 | 0 | 0 | 6,977 |
| Samawa | 15 | 64,000 | 262 | 0 | 0 | 3,242 |
| Hilla | 26 | 144,342 | 10,442 | 0 | 0 | 38,123 |
| Baquba | 30 | 68,460 | 5,300 | 0 | 0 | 18,273 |
| Amara | 16 | 78,000 | 5,056 | 0 | 0 | 12,830 |
| Ramade | 47 | 162,761 | 1,993 | 0 | 0 | 21,287 |
| Nassyirah | 24 | 79,000 | 1,801 | 0 | 0 | 25,168 |
| Mosul | 43 | 175,330 | 3,934 | 0 | 0 | 34,816 |
| Tikrit | 26 | 68,120 | 9,448 | 0 | 0 | 1,891 |
| Total | 397 | 1,938,829 | 192,053 | 6 | 11,200 | 282,559 |

Source: MOC

As shown below, figures for 2010 have improved as compared with those of 2006 due to great efforts of MOC/ITPC.

(1) Existing number of exchanges: from 333 to 397 ⇒ increase of 64 exchanges (up by 19%)
(2) Existing line capacity: from 1,506,178 to 1,938,829 ⇒ increase of 432,651 (up by 29%)
(3) Number of exchanges not in service: from 71 to 6 ⇒ decrease of 65 exchanges (down by 91%)
(4) Line capacity not in service: from 35,812 to 11,200 ⇒ decrease of 24,612 (down by 68%)

Despite the increase in line capacity, the number of waiting applicants still reaches to about 283,000. This number is almost the same as in 2006. This assumes that the telephone demand in Iraq has exponentially increased at present as compared with the increase of available line capacity. Also, the local access network has been widely damaged by the past war and its existing condition prevents the effective increase of line capacity. Therefore, one countermeasure is to install a large capacity of subscriber lines by fiber optic cables in order to cope with the telephone demand.

Following pictures during site survey for this Study clearly indicates that existing local access network especially telephone cables are still has badly affected by the previous war damages, and the damages prevent development of local access network because of the damages were very severe and widely affected, and their recoveries are difficult in spite of great efforts by MOC/ITPC.

*Telephone cables in Baghdad*

*Telephone cables appear on ground and in under ground. The war destructions are still there at the present.*

*Telephone Cables in Basra*
*Telephone cables are completely damaged.*

*Telephone Cabinet in Mosul*
*Its function as distribution of telephone cables, but no longer expected to operate.*

ITPC has coped with installation of NGN since 2008. The plan is to replace the current PSTN to IT-based NGN from the major cities such as Baghdad, Basra and Mosul.

ITPC and SCIS signed on Memorandum of Understanding (MOU) in 2009 about the role of ITPC and SCIS regarding the internet services. Based on this MOU, SCIS will provide users with internet services using NGN infrastructure operated and maintained by ITPC.

### 3.1.5 Mobile Telephone Network

Three private mobile operators provide mobile communication service in Iraq in 2010. These operators are Zain Iraq, Asia Cell and Korek providing nationwide services in Iraq.

These mobile telephone operators are having the following number of subscribers.

Table3.1.5-1: Number of Subscribers of Mobile Telephone

| Year | Zain Iraq | Asia Cell | Korek |
|---|---|---|---|
| 2010 (actual) | 12 million | 9 million | 2.8 million |
| 2011 (estimate) | 14 million | - | 3.1 million |

Source: MOC

These private mobile operators have their particular radio frequency band assigned by CMC. The frequencies of mobile telephone are licensed to these private mobile operators and certain amount of revenues earned by operators is paid to CMC as license fee. The number of mobile telephone users is almost 23,800,000 in the year of 2010.

MOC has a plan to be fourth mobile operator to meet increased governmental demand.

### 3.1.6 International Communications Network

Satellite is used for international communication through satellite earth station. There are two satellite earth stations in Baghdad, one in Al Kadimea which is connected to INTELSAT, and another in Al Beiaa of Baghdad which is connected to ARABSAT. These two satellites which belong to ITPC are used in order to connect outside of Iraq. For the purpose of internet services, the State Company of Internet Services (SCIS) has two major very small aperture terminals (VSATs). These VSATs were installed in Baghdad and Basra in order to connect to the world internet.

These satellites for communication form international link as well as fiber optic submarine cables connected at Al Faw in the south of Iraq.

For the development of international telecommunications through the use of satellites and submarine cables, MOC has mainly provided budgets for two projects, as shown in Table 3.1.6-1.

Table 3.1.6-1 Project for International Telecommunications Development

| Project name | Budget | Start Year | Completion Year | Progress as of Dec. 2010 |
|---|---|---|---|---|
| Expansion of International and Satellite Communication System | 1,000 million ID (about 850 thousand USD) | 2006 | 2011 | 5% |
| Connection with Submarine Cable | 12,000 million ID (about 10,200 thousand USD) | 2007 | 2011 | 25% |

Source: MOC

## 3.2 Financial Plan

### 3.2.1 Financing Plan and Status of Procurement from Own Funds

According to data provided by MOC, the allocated budget in the investment plan from 2004 to 2010 from Iraq's own funds fluctuates depending on the year. However, it ranges between JPY 14 billion and JPY 28 billion annually, and is in an increasing trend (refer to Table 3.2.1-1). The allocated budget to MOC among total budget of GOI in year of 2007 was compared 7 to 8 %. Budget of GOI except year 2007 could not be obtained.

Table3.2.1-1 Investment Allocation Budget of MOC/ITPC/SCIS

| Year | Allocation Budget (Million IQD) | Budget of GOI (Million IQD) |
|---|---|---|
| 2004 | 307,873 | - |
| 2005 | 200,000 | - |
| 2006 | 248,000 | - |
| 2007 | 192,800 | 2,500,000 |
| 2008 | 379,400 | - |
| 2009 | 255,000 | - |
| 2010 | 394,800 | - |

Source: MOC

Moreover, the investment plan of MOC from 2015 to 2019 is shown in Table 3.2.1-2. The annual investment ranges from USD 86 million to USD 180 million, in which the total for five years amounts to USD 672 million.

Table3.2.1-2 Investment Plan of MOC from 2015 to 2019

(Mil USD)

| Project name | Total | Allocation Money | | | | |
|---|---|---|---|---|---|---|
| | | 2015 | 2016 | 2017 | 2018 | 2019 |
| Postal rehabilitation | 7 | 2 | 1.5 | 1.5 | 1 | 1 |
| Supply and installation 500,000 telephone line and transmission system | 15 | 4 | 3 | 3 | 2 | 3 |
| International gate way | 10 | 3 | 2 | 2 | 1.5 | 1.5 |
| Optical fiber network (DWDM) | 40 | 15 | 10 | 5 | 5 | 5 |
| Expansion of international and satellite communication system | 20 | 5 | 5 | 5 | 2 | 3 |
| IP systems | 30 | 10 | 5 | 5 | 5 | 5 |
| Access network | 115 | 30 | 30 | 25 | 10 | 20 |
| Supply of copper cable and accessories | 50 | 20 | 10 | 10 | 5 | 5 |
| Construct new communication complexes at the Provinces | 90 | 25 | 20 | 20 | 10 | 15 |
| Expansion of optical fiber system | 50 | 10 | 15 | 15 | 5 | 5 |
| Connection with submarine cable | 50 | 10 | 10 | 10 | 10 | 10 |
| Supplying of short microwave links | 25 | 5 | 5 | 5 | 5 | 5 |
| Canals for copper network | 20 | 5 | 4 | 4 | 3.5 | 3.5 |
| Construction of new complex buildings | 50 | 15 | 5 | 5 | 5 | 20 |
| Project (WAN-LAN) to provide internet services | 30 | 10 | 10 | 4 | 4 | 2 |
| Power and air conditioning requirements | 25 | 5 | 5 | 5 | 5 | 5 |
| Expansion WLL telephone systems and accessories | 25 | 10 | 4.5 | 4.5 | 3 | 3 |
| Wi-MAX technology for E-government | 20 | 4 | 4 | 4 | 4 | 4 |
| Total | 672 | 188 | 149 | 133 | 86 | 116 |

Source: MOC

### 3.2.2 Examination of Validity of Public Investment in the Project

In the project, it is planned to develop 286,000 new lines in Baghdad, Basra and Mosul. The following benefits will be gained through the construction and development of telecommunications infrastructure:

(1) Landline telephones (local, toll, and international calls) and/or internet services will be available to individuals and businesses in these regions through the infrastructure development.

(2) In addition to the registered waiting applicants shown in Table 3.1.4-1, the existence of

unregistered waiting applicants was pointed out. The project will be the basis for future infrastructure development of telephones/internet services, especially for the unregistered waiting applicants.

(3) The traffic is expected to be reduced through the construction and development of telecommunications networks and there will be improvement of environmental conditions including time saving, energy saving, and contributions to solving global warming issues.

(4) The infrastructure development leads to the improvement of efficiency for industrial/commercial activities. The improvement of productivity, expansion of new business potentials using ICT, and the significant contribution to the economic growth of Iraq are consequentially expected.

(5) As the global economy makes further progress, the construction and development of the telecommunications network will raise the value of Iraq as a subject of investment, encouraging more foreign investments. As a result, it is expected to contribute to economic development through the increase of employment opportunities, for example.

As described above, since the ripple effect of the project is considered to be quite large, investing public funds into this project, having the aspect of public nature, is judged to be extremely valid.

### 3.2.3 Fees and Charges of the Telecommunication Services

According to MOC, the fees and charges of the current tariff system are basically the same as that described in JETRO F/S report. However, the subscription fee of landline telephone services was reduced from IQD 250,000 to IQD 100,000; the subscription fee of internet services became free from USD 100; and the monthly charge of internet services (fixed monthly charge) was reduced from USD 350 at that time to USD 30-25. The list of updated fees and charges of telecommunications services in Iraq is shown in Table 3.2.3-1.

Table 3.2.3-1 List of Fees Charges of the Telecommunication Services

| Category | Fee/Charges |
|---|---|
| **Landline Telephone Services** | |
| Subscription fee | ID 100,000 |
| Basic charge per month | ID 500 |
| Local call charge per minute | ID 5 |
| Toll call charge per minute | ID 20 |
| International call charge per minute | ID 500 |
| **Internet Services** | |
| Subscription fee | 0 |
| Monthly charge | US$ 25-30 |

Source: MOC

These fees are collected by Customers Department under Financial Section of ITPC. The collected money is sent to Board of ITPC for discussion of its use. When ITPC produce a benefit of more than 20%, several percentages of its benefit are paid to MOC.

Collecting rate of fees is about 50% after two months from issuance of invoice.

At this moment, MOC does not intend to increase present fees for voice communication. Alternatively more additional fees are expected from new broadband services to users.

## 3.3 Demand Forecast of Fixed Telephones and Internet

The objective of the demand forecast is to understand the future need of telephone exchange capacities and provision of local access networks, and to help invest financial resources effectively and efficiently for the development of the telecommunications network. Generally, there are two methods in the demand forecast, one is the so-called macroscopic demand forecast, and the other is the microscopic demand forecast. The macroscopic demand forecast obtains the demand of the entire country by the regression equation described in the studies by CCITT (ITU-T) GAS 5 (Economic Studies at the National Level in the Field of Telecommunications, 1977-1980). Meanwhile, the microscopic demand forecast estimates the future demand by studying the distribution of offices, commercial facilities, and residencies in the local field.

The macroscopic demand forecast was used for this study since it is difficult to collect detailed local data under current conditions of the country.

In the JETRO F/S report, the demand forecast of fixed telephone lines was made by using the same macroscopic method. However, the F/S report was released in 2007 and four years has already past since then. Therefore, it is necessary to reevaluate and correct, where necessary, the demand forecast considering the latest data regarding fixed telephone lines, gross domestic product (GDP) per capita, and population. In the meantime, MOC has also updated the demand forecast in the Mid-Term Development Strategy (MTDS) so the requirements and statistics of MTDS were considered in the demand forecast of fixed telephone lines in this study.

### 3.3.1 Latest Data of Fixed Teledensity and Internet Users

(1) Teledensity of Fixed Telephones

Generally, it is observed that GDP and the population have a close relationship with the number of telephones or teledensity. As GDP and the population grow, teledensity accordingly increases. Table 3.3.1-1 is taken from the JETRO F/S report.

Table 3.3.1-1 Demand Forecast of Teledensity in Iraq

| Year | GDP/Capita (USD) | GDP Growth per year | Population (mil.) | Population Growth per year | Telephone Lines | Telephone Density |
|---|---|---|---|---|---|---|
| 1997 | 725 | 40.0% | 21.8 | 2.70% | 650,616 | 2.98% |
| 1998 | 925 | 35.0% | 22.4 | 2.95% | 649,963 | 2.90% |
| 1999 | 1,062 | 31.0% | 23.1 | 2.90% | 651,905 | 2.82% |
| 2000 | 1,068 | -4.3% | 24.2 | 2.80% | 677,504 | 2.80% |
| 2001 | 1,184 | -12.0% | 24.8 | 2.80% | 757,480 | 3.05% |
| 2002 | 743 | -7.8% | 25.5 | 2.80% | 851,556 | 3.34% |
| 2003 | 479 | -41.4% | 26.4 | 2.80% | 946,640 | 3.59% |
| 2004 | 947 | 46.5% | 27.1 | 2.80% | 1,034,240 | 3.82% |
| 2005 | 1,237 | 3.7% | 27.9 | 2.95% | 1,039,805 | 3.73% |
| 2006 | 1,635 | 4.0% | 28.7 | 3.00% | 1,057,889 | 3.68% |
| 2007 | 2,060 | 14.4% | 29.6 | 2.90% | 1,916,000 | 6.48% |
| 2008 | 2,319 | 12.9% | 30.4 | 2.80% | 2,182,000 | 7.18% |
| 2009 | 2,608 | 12.7% | 31.2 | 2.70% | 2,485,000 | 7.96% |
| 2010 | 2,861 | 9.6% | 32.0 | 2.60% | 2,831,000 | 8.84% |
| 2011 | 3,029 | 7.1% | 32.8 | 2.50% | 3,224,000 | 9.82% |
| 2012 | 3,106 | 5.0% | 33.6 | 2.40% | 3,672,000 | 10.92% |
| 2013 | 3,188 | 5.0% | 34.4 | 2.30% | 4,182,000 | 12.16% |
| 2014 | 3,275 | 5.0% | 35.1 | 2.20% | 4,763,000 | 13.55% |
| 2015 | 3,368 | 5.0% | 35.9 | 2.10% | 5,425,000 | 15.12% |
| 2016 | 3,467 | 5.0% | 36.6 | 2.00% | 6,179,000 | 16.88% |

Note: Data from 1997 to 2006 are actual data. Figures after 2007are forecasted by JETRO F/S Report

Source: JETRO F/S Report

In Table 3.3.1-1, the data from 1997 to 2006 were obtained by actual data and the figures after 2007 were forecasted in the JETRO F/S report.

Meanwhile, Table 3.3.1-2 below shows the latest data from 2007 to 2009 as collected from MOC/ITPC. Data for Krudistani provinces in the northern part of Iraq such as Dhuk, Erbil and Slaymaniya were not available. Therefore, the teledensity was calculated by deducting the population of these three provinces from the total nationwide population.

It was observed that the teledensity for three years from 2007 to 2009 are lower than the forecast in the JETRO F/S report, while population growth has increased almost at the same level as in said report. This assumes that the telephone facilities, especially local access networks, have not been sufficiently developed along with the growth of population.

It is also observed that the teledensity of Baghdad in 2009 is lower than that in the previous year 2008. This is due to situations that 5 exchange switches in Baghdad have been broken affecting 11,000 lines out of service.

Table 3.3.1-2 Teledensity in 2007 to 2009

| No. | Province | Year 2007 | | | Year 2008 | | | Year 2009 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Population | Teledensity | No. of Lines | Population | Teledensity | No. of Lines | Population | Teledensity | No. of Lines |
| 1 | Bagdad | 7,145,470 | 7.3 | 521,619 | 7,332,256 | 9.3 | 681,900 | 7,522,787 | 8.9 | 669,528 |
| 2 | Diyala | 1,560,621 | 2.8 | 43,697 | 1,610,828 | 3.3 | 53,157 | 1,662,386 | 3.7 | 61,508 |
| 3 | Wassit | 1,064,950 | 3.8 | 40,468 | 1,097,949 | 3.8 | 41,722 | 1,131,790 | 4.3 | 48,667 |
| 4 | Babylon | 1,651,565 | 4.3 | 71,017 | 1,707,508 | 4.6 | 78,545 | 1,765,065 | 4.7 | 82,958 |
| 5 | Kerbala | 887,858 | 4 | 35,514 | 924,085 | 3.9 | 36,039 | 961,638 | 4.5 | 43,274 |
| 6 | Njaf | 1,081,203 | 7.6 | 82,171 | 1,117,624 | 7.7 | 86,057 | 1,155,087 | 8.1 | 93,562 |
| 7 | Anbar | 1,485,985 | 3 | 44,580 | 1,542,152 | 3.4 | 52,433 | 1,600,188 | 6.6 | 105,612 |
| 8 | Tameen | 902,019 | 5.9 | 53,219 | 918,386 | 6.3 | 57,858 | 934,698 | 7.5 | 70,102 |
| 9 | Salah AL-Din | 1,191,403 | 3.6 | 42,891 | 1,237,059 | 3.7 | 45,771 | 1,284,211 | 4.7 | 60,358 |
| 10 | Ninewa (Mosul) | 2,811,091 | 4 | 112,444 | 2,901,809 | 3.9 | 113,171 | 2,994,979 | 3.9 | 116,804 |
| 11 | Qadissiya | 990,483 | 4.8 | 47,543 | 1,018,072 | 5.6 | 57,012 | 1,046,264 | 5.7 | 59,637 |
| 12 | Muthanna | 614,997 | 4.6 | 28,290 | 636,297 | 5.4 | 34,360 | 658,229 | 5.7 | 37,519 |
| 13 | Thi-Qar | 1,616,226 | 3 | 48,487 | 1,666,932 | 3.2 | 53,342 | 1,718,957 | 3.3 | 56,726 |
| 14 | Missan | 824,147 | 5.6 | 46,152 | 845,498 | 5.5 | 46,502 | 867,265 | 5.6 | 48,567 |
| 15 | Basra | 1,912,533 | 4.6 | 87,977 | 1,656,637 | 4.7 | 77,862 | 1,992,029 | 5 | 99,601 |
| 16 | Dhuk | 505,491 | * | * | 516,997 | * | * | 528,680 | * | * |
| 17 | Erbil | 1,542,421 | * | * | 1,595,778 | * | * | 1,650,719 | * | * |
| 18 | Slaymaniya | 1,893,617 | * | * | 1,956,637 | * | * | 2,021,433 | * | * |
| | Total | 29,682,080 | | | 30,282,504 | | | 31,496,405 | | |
| | Without (16) (17) (18) | 25,740,551 | 5.1 | 1,306,069 | 26,213,092 | 5.8 | 1,515,732 | 27,295,573 | 6.1 | 1,654,424 |

* Data not available for those provinces

** Population of (16)(17)(18) are deducted from Total to calculate teledensity.
Teledensity is defined as No. of Lines as per 100 people.

Source: MOC and ITPC

### (2) Internet

Currently the nationwide internet users are assumed to be 15%~20% of total population of Iraq. The Internet Service Providers (ISP) in private sector are supplying needs of internet access for those users. However, as of December 2010, SCIS contracted internet subscribers are still minimal in number. According to MOC/SCIS statistics data the number of ADSL subscribers of SCIS is approximately 600 in total that are mostly governmental offices. In addition to these governmental users, SCIS provides other about 300 subscriber lines for private internet users. This relatively small number of ADSL subscribers is partly due to the insufficient telecommunications infrastructure. Upgrade and improvement of the local access network by providing more ADSL access to the prospective internet users is sure to contribute extensively to the increment of SCIS subscribers of ADSL in future. Only SCIS can provide broadband internet services through cables.

Except for ITPC and SCIS which are governmental bodies, there are two national licensed private ISPs called Suhtian and Kalimata, and three provincial licensed ISPs called Baghdad Cooperative, Iraq Tel and ITC whose service areas are center in Iraq, southern and northern in Iraq respectively. These private ISPs are officially recognized by allocating radio frequencies by Iraqi Government.

On the other side, there are a number of non-licensed private ISPs who can utilize Wi-Fi without license. These non-licensed private ISP's who connect each internet users by Wi-Fi link through VSAT for internet connection worldwide. The problem of these non-licensed private ISP's is for them to provide low quality internet services comparing with cables (ADSL or optical fiber) laid by ITPC. Even MOC does not grasp the exact number of these non-licensed internet carries in Iraq.

### 3.3.2 Demand Forecast of Fixed Telephone and Internet

(1) Demand Forecast of Fixed Telephones

Table 3.3.2-1 shows actual data of Iraq's GDP/capita and population from 2004 to 2009. The actual data for 2004-2006 was collected from the JETRO F/S report and for 2007-2009 from the International Monetary Fund (IMF). It was found that the population relatively indicates linear growth, while GDP/capita did not. This was presumably affected by Iraq's post-war economical and political instabilities.

Table 3.3.2-1 Economic and Social Data from 2004 to 2009

| Year | GDP/Capita (USD) | GDP/Capita Growth(%) | Population (mill) | Population Growth (%) |
|---|---|---|---|---|
| 2004 | 947 | 97.7% | 27.10 | 2.8% |
| 2005 | 1,237 | 30.6% | 27.90 | 3.0% |
| 2006 | 1,635 | 32.2% | 28.70 | 3.0% |
| 2007 | 1,926 | 17.8% | 29.60 | 2.9% |
| 2008 | 2,845 | 47.7% | 30.40 | 2.8% |
| 2009 | 2,107 | -25.9% | 31.20 | 2.7% |

Source: JETRO F/S Report & IMF

The following GDP/capita and population forecasts came from the same IMF and MTDS. The JICA Study Team made the forecast for 2016.

Table 3.3.2-2 Economic and Social Data from 2010 to 2016

| Year | GDP/Capita (USD) | GDP/Capita Growth(%) | Population (mill) | Population Growth (%) |
|---|---|---|---|---|
| 2010 | 2,505 | 18.9% | 32.31 | 2.6% |
| 2011 | 2,826 | 12.8% | 33.12 | 2.5% |
| 2012 | 3,156 | 11.7% | 33.92 | 2.4% |
| 2013 | 3,407 | 7.9% | 34.70 | 2.3% |
| 2014 | 3,682 | 8.1% | 35.46 | 2.2% |
| 2015 | 3,988 | 8.3% | 36.20 | 2.1% |
| 2016 | *4,319 | 8.3% | 36.93 | 2.0% |

Source: IMF & MOC

(*) GDP/Capita for 2016 estimated by JICA Study Team

GDP/capita was expected to grow 8–19% annually indicating a robust economic recovery, while the population shows gradual increase of 2.0–2.6%.

Teledensity can be obtained by the regression equation of the so-called ITU model that appeared in the studies made by CCITT (ITU-T) GAS 5. The regression equation of ITU model is expressed by the following formula:

**Td = 10^(-3.726 + 1.3571log X)**

Where,

Td = Teledensity

X = GDP/capita

The telecommunications infrastructure in Iraq still remains in the developing stage, thus the ITU model is appropriate for demand forecasting. Table 3.3.2-3 shows a comparison of calculations between the study and MTDS. Targeted teledensity in 2015 differs from MTDS and National Development Plan (NDP) for 2011 to 2014 formulated in December, 2010. Targeted teledensity of MTDS is 15.52% contrasting with 11.2% in NDP. During the discussion with Iraqi side in February 2011, it was confirmed with MOC that the targeted teledensity in 2015 was 15.52% not 11.2%.

The study employs the ITU-T modeling, while MTDS uses linear regression with respect to GDP/capita. By this reason, in the case of MTDS, the teledensity shows a linear increase in accordance with the growth of GDP/capita. It is noted that the teledensity in 2016 is almost identical irrespective of any applied methods.

Table 3.3.2-3 Comparison of Teledensity

| Year | GDP/Capita (USD) | Teledensity (%) | |
|---|---|---|---|
| | | Preparatory Survey 2011 | MTDS 2010 - 2014 |
| 2010 | 2,505 | 7.70 | 13.29 |
| 2011 | 2,826 | 9.06 | 14.03 |
| 2012 | 3,156 | 10.53 | 14.36 |
| 2013 | 3,407 | 11.68 | 14.73 |
| 2014 | 3,682 | 12.98 | 15.11 |
| 2015 | 3,988 | 14.46 | 15.52 |
| 2016 | 4,319 | 16.11 | 15.95 |

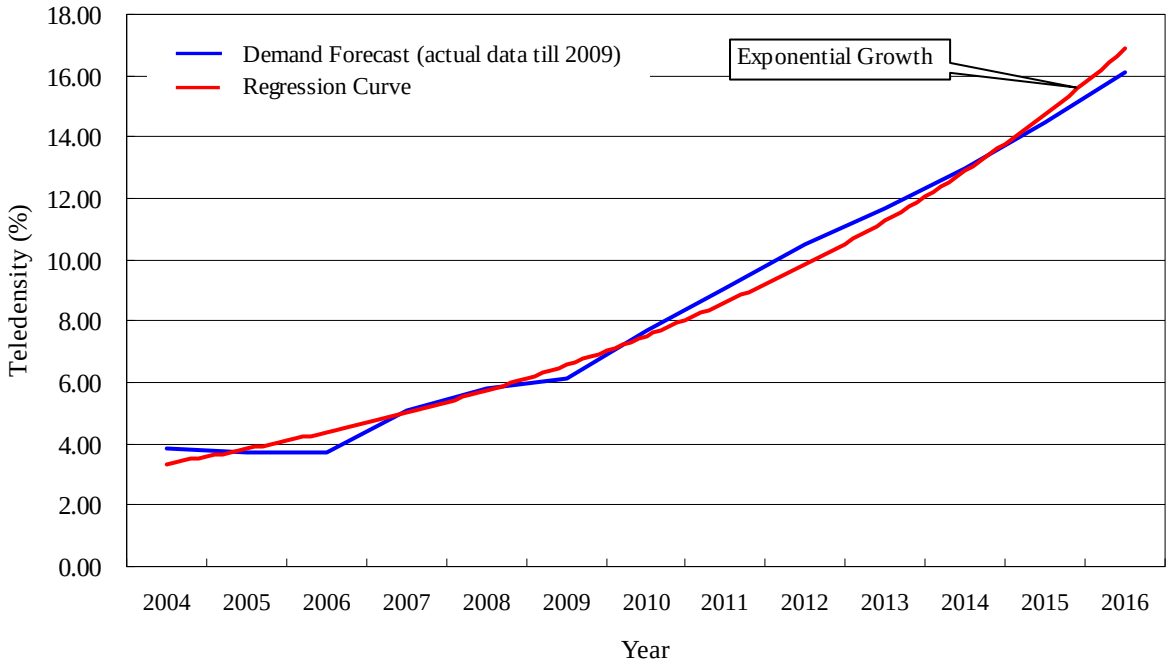
Note (1) GDP/Capita collected from Latest IMF Forecast
Note (2) Teledensity of Preparatory Survey is caclulated by the following from CCITT GAS5 1978.

The growth of teledensity during the developing stage generally shows exponential characteristics. Iraq is one of the instances of this model and is supposed to have an exponential growth curve of teledensity. As shown in Figure 3.3.2-1, the teledensity in blue line fits well to the exponential curve of regression in red line. It is therefore deemed that the demand forecasting has been properly applied. Table 3.3.2-4 shows the growth of teledensity in Iraq, in which data for 2004–2009 are actual figures and for 2010–2016 are as shown in Table 3.3.2-3. In Figure 3.3.2-1, the blue line is the teledensity growth drawn from these figures and the red line is exponentially regressed. Both curves indicated a relatively good fit to the growth curve of teledensity.

Table 3.3.2-4 Growth of Teledensity

| Year | Teledensity (%) | Source |
|---|---|---|
| 2004 | 3.82 | Actural Data |
| 2005 | 3.73 | Actural Data |
| 2006 | 3.69 | Actural Data |
| 2007 | 5.10 | MOC |
| 2008 | 5.80 | MOC |
| 2009 | 6.10 | MOC |
| 2010 | 7.70 | Forecast |
| 2011 | 9.06 | Forecast |
| 2012 | 10.53 | Forecast |
| 2013 | 11.68 | Forecast |
| 2014 | 12.98 | Forecast |
| 2015 | 14.46 | Forecast |
| 2016 | 16.11 | Forecast |

Source: JICA Study Team




Source: JICA Study Team

Figure 3.3.2-1 Growth of Teledensity

(2) Required Nationwide Expansion of Telephone Lines Based on the Demand Forecast

The forecasted teledensities for 2016 by MTDS and the study were 15.95% and 16.11%, respectively. The forecasted values were nearly identical, irrespective of the method employed for the forecasting.

Therefore, the forecasted value of 16.11% for 2016 was adopted as the target teledensity in

calculating the required nationwide expansion of fixed telephone lines.

The required nationwide expansion of telephone lines was obtained by the following equation:

**D = Td*P*R - L**

Where,

D = Required nationwide expansion of telephone lines

Td = Teledensity

P = Population

R = Demand rate

L = Actual number of telephone lines

As derived from MOC/ITPC, the actual number of telephone lines in 2009 is 1.654 million lines. The forecasted teledensity (Td) for 2016 is 16.11%. The number of nationwide demand of telephone lines in 2016 will be obtained by multiplying the teledensity (Td) by the forecasted population (P) of the same year. Hence, it is obtained as 5.949 million lines. The demand rate (R), which is the percentage of the forecasted demand of telephone lines that will practically be foreseeable for subscription, is assumed at 90% considering the actual demand rate of 90% in 2010.

When the 90% demand rate is applied, the required nationwide fixed telephone lines (D) results to 3.7 million lines (= 5,949,000 x 0.9 – 1,654,000) for 2016..

(3) Required Expansion of Telephone Lines in Baghdad, Basra and Mosul

The required expansion of telephone lines for 2016 of 3.7 million lines was forecasted for all provinces in Iraq. In order to obtain those for Baghdad, Basra and Mosul, 3.7 million was proportionately divided using the ratio of population in 2009, as shown in Table 3.3.2-5 as provincial level with some other provinces for comparison, and Table 3.2.2-6 as city level.

Table 3.3.2-5 Required Expansion for Baghdad, Basra and Mosul in Province

| Province | Population in Province in 2009 | Ratio of population in 2009 | Required expansions in 2016 (K lines) | Requested expansion by MOC in 2009 (K lines) |
|---|---|---|---|---|
| 1. Baghdad | 7,522,787 | 27.6 % | 1,021 | 200 |
| 2. Basra | 1,992,029 | 7.3 % | 270 | 30 |
| 3. Ninewa (Mosul) | 2,994,979 | 11.0 % | 407 | 56 |
| Total in three Provinces | 12,509,795 | 45.8 % | 1,698 | 286 |
| Babylon | 1,765,065 | 6.5 % | 239 | 0 |
| Thi-Qar | 1,718,957 | 6.3 % | 233 | 0 |
| Slaymaniya | 2,021,433 | 7.4 % | 274 | 0 |
| Total in Iraq | *27,295,573 | 100 % | 3,700 | - |

Source: JICA Study Team

(*) The populations of 3 Kurdistan provinces are excluded

Table 3.3.2-6 Required Expansion for Baghdad, Basra and Mosul in City

| City | Population in City in 2009 | Ratio of population in 2009 | Required expansions in 2016 (K lines) | Requested expansion by MOC in 2009 (K lines) |
|---|---|---|---|---|
| 1. Baghdad | 6,250,000 | 22.9 % | 847 | 200 |
| 2. Basra | 1,200,000 | 4.4 % | 163 | 30 |
| 3. Mosul | 1,800,000 | 6.6 % | 244 | 56 |
| Total in three Cities | 9250,000 | 33.9 % | 1,254 | 286 |
| Total in Iraq | *27,295,573 | 100 % | 3,700 | - |

Source: JICA Study Team. Population in each city is from the data of “Central Organization for Statistics and Information Technology” (web).

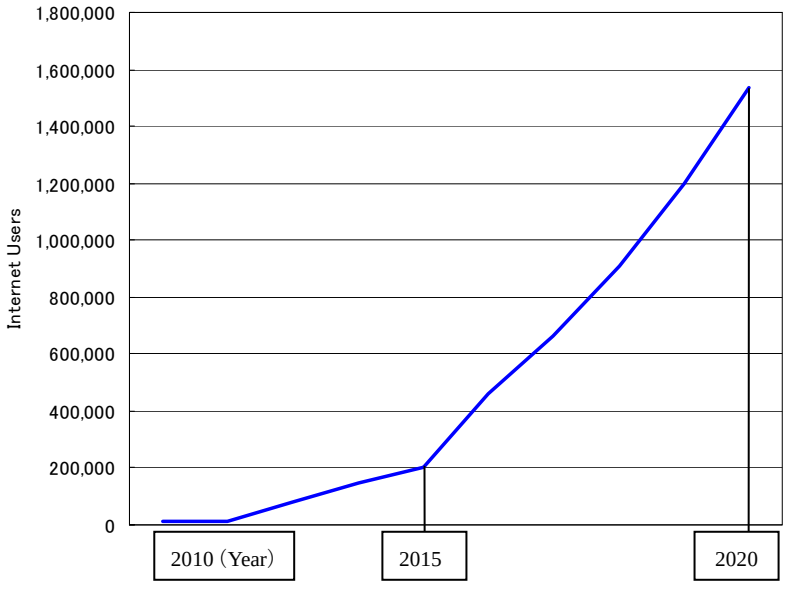
(*) The populations of 3 Kurdistan provinces are excluded

The forecasted expansions based on the target teledensity of 2016 were remarkably higher than the requested numbers by MOC (200,000 lines for Baghdad, 30,000 lines for Basra, and 56,000 lines for Mosul). It can be concluded that the total requested expansion of 286,000 lines for Baghdad,

Basra and Mosul is required for implementation as early as possible in order to assist the improvement of the existing telecommunications network that was seriously damaged, and to cope with the growing number of telephone and internet users. In addition, further expansions of the network are continuously needed in the telecommunications sector in Iraq in order to achieve the target of MTDS.

### (4) Demand Forecast of Internet

Regarding the demand of internet it is difficult to forecast its growth in the market because the increase of internet users is largely dependent on not only on GDP/Capita and population but also on factors such as monthly and initial charges as well as the contents that ISP can offer internet users. Table 3.3.2-7 shows the demand forecast of internet users provided by JERO F/S report, but the actual number of subscribers of SCIS is still minimal only 600 as of 2010. This is partly due to the insufficient telecommunications and relatively high expenses of internet charges in Iraq. Currently SCIS has a capacity of 22,000 ADSL lines and intends to increase its capacity by 160,000 lines which have been installed by ITPC and it will be in service in 2011 in collaboration with SCIS. Other additional 180,000 lines will be installed by the end of 2012. So it is very likely that the number of SCIS subscribers can rise as initially forecasted in the JETRO F/S report once the broadband environment is prepared for service. Under such understanding, it is concluded that the growth of Internet subscribers as shown in Table 3.3.2-7, should be very probable from the viewpoint of Iraqi's high economic potentiality. Figure 3.3.2-2 shows forecast by JETRO F/S report and, following this curve, the Internet users are expected to reach 1,534,000 after 10 years.




Source JETRO F/S report

Figure 3.3.2-2 Demand Forecast of Internet Users

Table 3.3.2-7 Demand Forecast of Internet Users after 10 Years

| Year | Internet Users |
|---|---|
| 2011 | 12,000 |
| 2012 | 15,000 |
| 2013 | 80,000 |
| 2014 | 150,000 |
| 2015 | 200,000 |
| 2016 | 462,000 |
| 2017 | 664,000 |
| 2018 | 908,000 |
| 2019 | 1,198,000 |
| 2020 | 1,534,000 |

Source JETRO F/S Report

In Table 3.3.2-8 and Table 3.3.2-9, the demand forecasts of internet users for Baghdad, Basra and Mosul were calculated based on their respective ratios of population in Iraq in 2009. Table 3.3.2-8 shows in provincial level, and Table 3.3.2-9 shows in city level.

Table 3.3.2-8 Demand Forecast of Internet for Baghdad, Basra and Mosul in Province

| Province | Baghdad | Basra | Ninewa(Mosul) | Babylon | Thi-Qar | Slaymaniya |
|---|---|---|---|---|---|---|
| Ratio of Population | 27.6% | 7.3% | 11.0% | 6.5% | 6.3% | 7.4% |
| 2011 | 3,312 | 876 | 1,320 | 780 | 756 | 888 |
| 2012 | 4,140 | 1,095 | 1,650 | 975 | 945 | 1,110 |
| 2013 | 22,080 | 5,840 | 8,800 | 5,200 | 5,040 | 5,920 |
| 2014 | 41,400 | 10,950 | 16,500 | 9,750 | 9,450 | 11,100 |
| 2015 | 55,200 | 14,600 | 22,000 | 13,000 | 12,600 | 14,800 |
| 2016 | 127,512 | 33,726 | 50,820 | 30,030 | 29,106 | 34,188 |
| 2017 | 183,264 | 48,472 | 73,040 | 43,160 | 41,832 | 49,136 |
| 2018 | 250,608 | 66,284 | 99,880 | 59,020 | 57,204 | 67,192 |
| 2019 | 330,648 | 87,454 | 131,780 | 77,870 | 75,474 | 88,652 |
| 2020 | 423,384 | 111,982 | 168,740 | 99,710 | 96,642 | 113,516 |

Source: JICA study team

Table 3.3.2-9 Demand Forecast of Internet for Baghdad, Basra and Mosul in City

| City | Baghdad | Basra | Mosul |
|---|---|---|---|
| Ratio of Population | 22.9% | 4.4% | 6.6% |
| 2011 | 2,748 | 528 | 792 |
| 2012 | 3,435 | 660 | 990 |
| 2013 | 18,320 | 3,520 | 5,280 |
| 2014 | 34,350 | 6,600 | 9,900 |
| 2015 | 45,800 | 8,800 | 13,200 |
| 2016 | 105,798 | 20,328 | 30,492 |
| 2017 | 152,056 | 29,216 | 43,824 |
| 2018 | 207,932 | 39,952 | 59,928 |
| 2019 | 274,342 | 52,712 | 79,068 |
| 2020 | 351,286 | 67,496 | 101,244 |

Source: JICA study team

# *Chapter 4*
# *Operation and Maintenance Structure*

# CHAPTER 4 OPERATION AND MAINTENANCE STRUCTURE

## 4.1 Functions of MOC, ITPC and SCIS

The communications sector in Iraq provides the following three services to the public: telecommunications, postal, and internet.

Telecommunications and postal services are provided by the Iraqi Telecommunications and Post Company (ITPC), which is a state-owned and monopolized company under the administrative management agency of Ministry of Communications (MOC). Internet service is provided by the State Company of Internet Services (SCIS), which is also a state-owned company. The regulatory authority is the Communications and Media Commission (CMC), which controls not only the communications sector but also the broadcasting sector. CMC is a former Iraqi Broadcasting and Television Establishment (IBTE) which was largely the domain of broadcasting during the regime of Saddam Hussein. The IBTE, in turn, was dominated by the Ministry of Information, which often broadcasted programs favorable towards the regime. After the overthrow of the regime, the IBTE was dissolved and current CMC took its place.

In order to provide telecommunications services to the public by the above relevant organizations, the following networks are presently operating:

### (1) Operation of MOC

MOC is working under full control of the minister and his related office is providing technical and administrative support. Two deputy ministers are working under the direct control of the minister. The first deputy minister is in charge of technical affairs, and the second deputy minister is in charge of administration and financial affairs. Both deputy ministers are supervising different departments of the ministry and the two state companies – ITPC and SCIS.

The structure of MOC also includes the office of the general inspector who is responsible for supervising all activities to be sure that each activity is free from corruption issues. The other office inside the MOC structure is the legal adviser who is responsible for providing legal advice to the minister and supervising all activities from the legal point of view.

Table 4.1-1 shows the number of staff working for MOC, ITPC and SCIS as of 2009. Comparing the numbers in 2007, ITPC increased from 15,647 to 20,467 (131%) while SCIS increased from 298 to 523 (176%).

Table 4.1-1: Numbers of Staffs in MOC, ITPC and SCIS as of 2009

| Human Resources | ITPC | MOC | SCIS | Inspector General |
|---|---|---|---|---|
| Expert Engineer and Engineer | 1,221 | 20 | 70 | 9 |
| Scientist *) | 429 | 0 | 0 | 7 |
| Administrative & Economic | 1,548 | 47 | 63 | 38 |
| Technicians | 9,728 | 20 | 196 | 20 |
| Legislator & administrative | 62 | 8 | 18 | 2 |
| Workers | 5,491 | 130 | 134 | 52 |
| Working in Administrative services | 1,937 | 34 | 42 | 3 |
| Working in Production | 51 | 0 | 0 | 0 |
| **Total** | **20,467** | **259** | **523** | **131** |

*) Scientist means experts who majored science course in their universities.

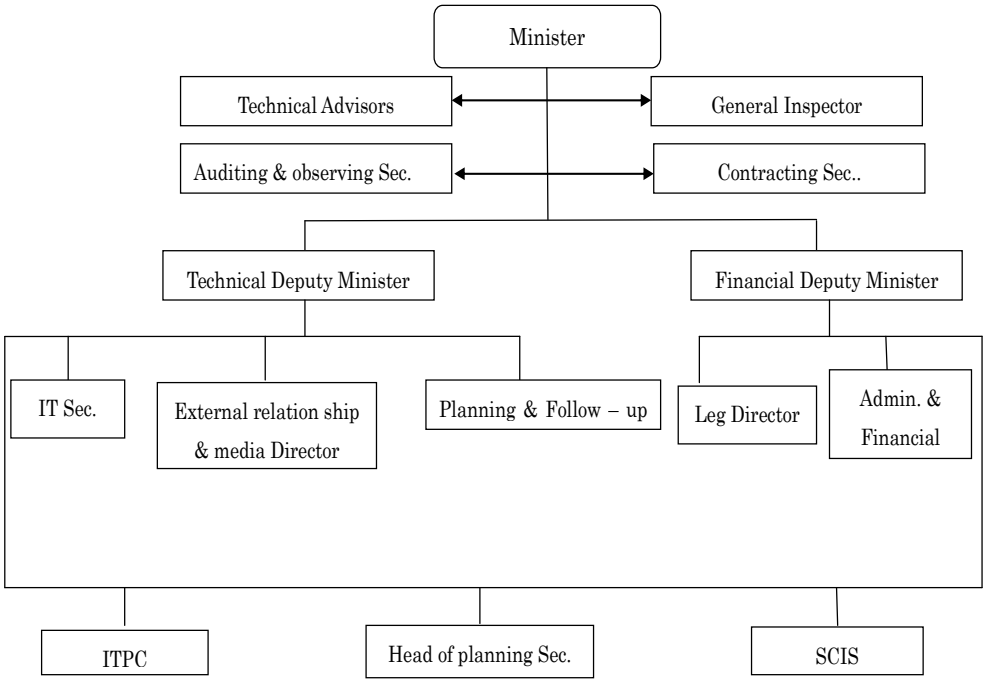
Source: MOC

Among the number of staffs of the above table, following number of staffs shown in Table 4.1-2 work for mainly operation and maintenance in Baghdad, Basra and Mosul. Larger numbers of technicians who have mostly not a university degree are engaged in operation and maintenance work. Their technical level is fit for field work instead of design and planning of telecommunications.

Table 4.1-2: Numbers of O/M Staffs working in three Provinces

| Human Resources | Baghdad | Basra | Mosul |
|---|---|---|---|
| Expert Engineer and Engineer | 452 | 43 | 84 |
| Technicians | 2,542 | 476 | 456 |
| Workers | 530 | 81 | 23 |
| **Total** | **3,524** | **600** | **563** |

The organizational structure of MOC as of 2010 is shown in Figure 4.1-1. ITPC and SCIS are under two Deputy Ministers of Technical and Financial. Each Deputy Minister has his/her controlled sections and department of ITPC and SCIS.



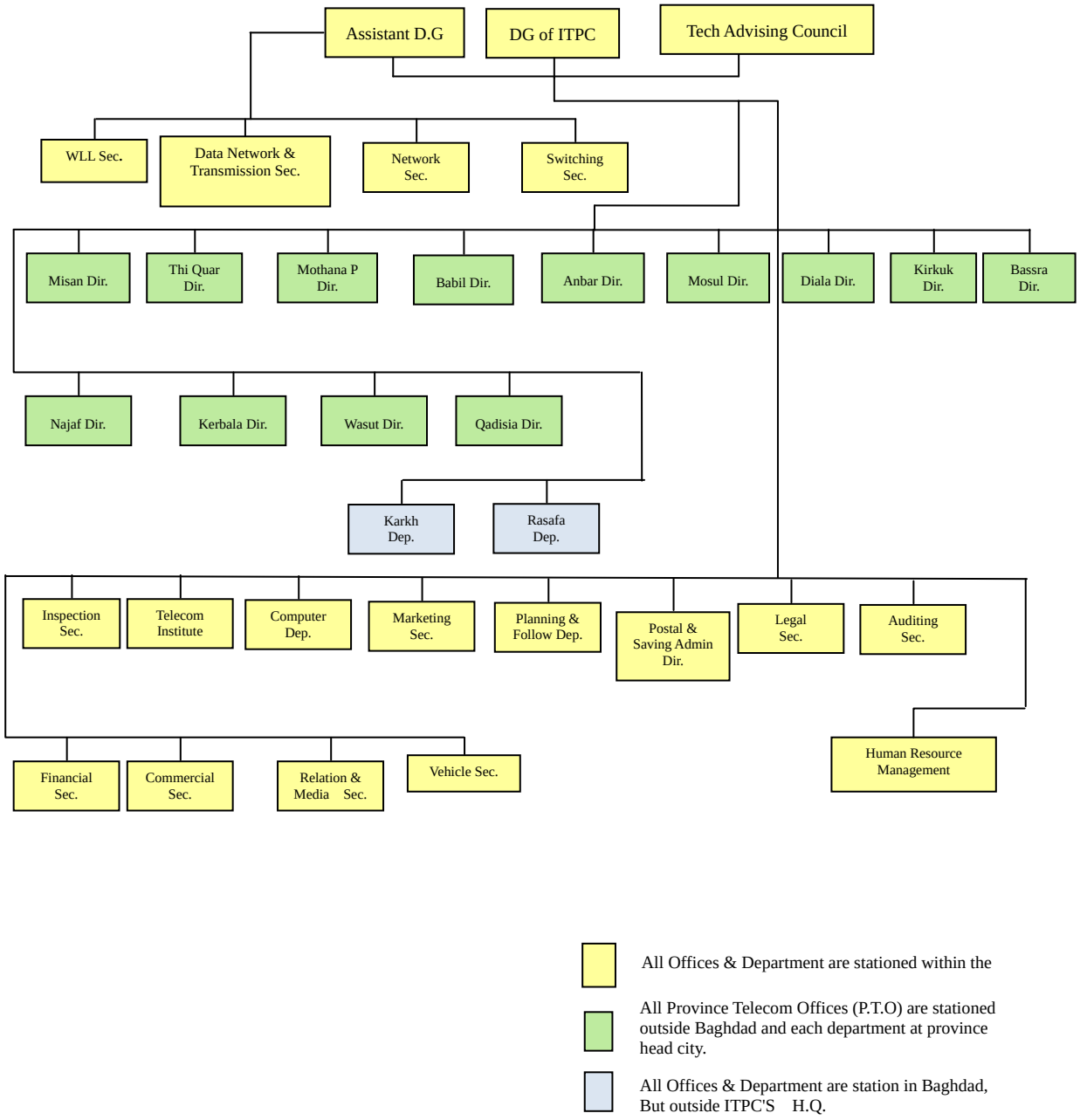

Source: MOC

Figure 4.1-1: Organization of MOC

## (2) Operation of ITPC

ITPC is the oldest organization that provides telecommunications and postal services in Iraq. There are several sections and departments in the ITPC headquarters in Baghdad. There are province telecom offices (PTOs) that are stationed outside Baghdad in addition to PTO in Baghdad. Through this ITPC organization, telecommunications and postal services are provided all over Iraq. Legal mandate of ITPC's activities is Law No. 22 for General Companies.

The organizational structure of ITPC as of 2010 is shown in Figure 4.1-2.




Source: ITPC

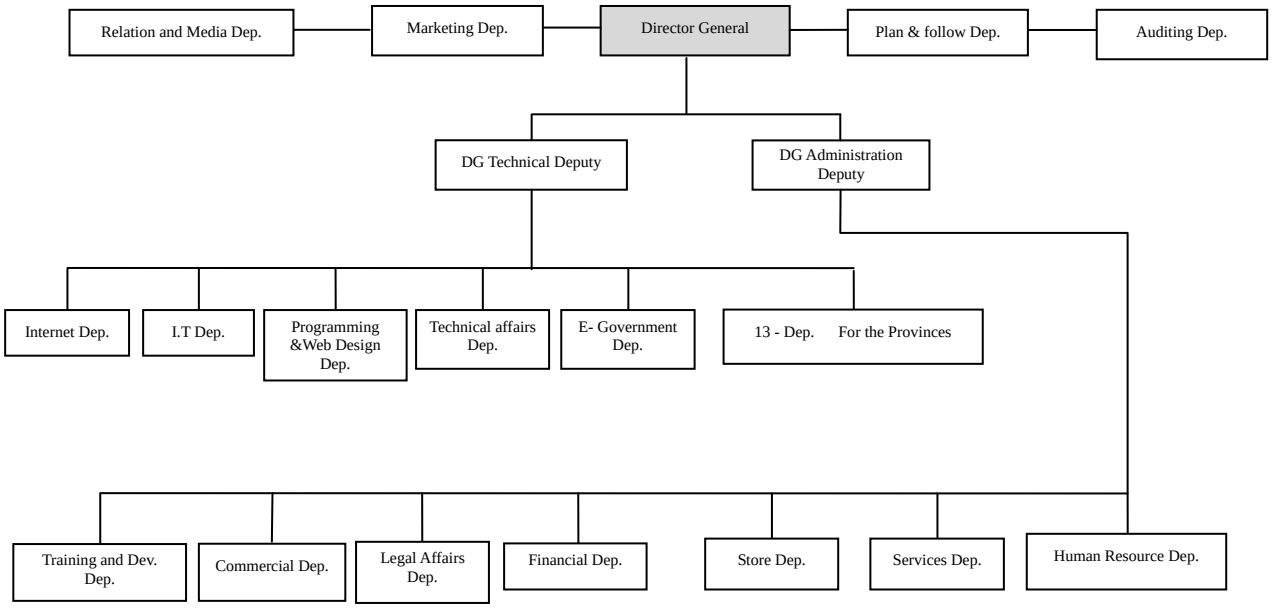
Figure 4.1-2: Organization of ITPC

(3) Operation of SCIS

SCIS is the only organization that provides public internet services. This organization is well-established and has full control of different offices within Baghdad, which manage various internet sites. As of December 2010, the number of internet subscriber contracted with SCIS is about 600 for governmental organization and 300 for private users by ADSL. This small number of subscriber is due to insufficient access network infrastructure. Hence, SCIS has presently 22,000 ADSL capacity of internet which will be increased by additional 160,000 lines which have been installed by ITPC as a part of NGN. In addition to these services by cable lines, SCIS will provide wireless internet services to governmental users by so called WiMAX shortly.

Legal mandate of SCIS's activities is Law No. 22 for General Companies.

The organizational structure of SCIS as of 2010 is shown in Figure 4.1-3.




Source: MOC

Figure 4.1-3: Organization of SCIS

## 4.2 Financial and Procedural Implementation Capability of ITPC/SCIS

The telecommunications and postal services in Iraq are provided by MOC. These services are controlled by ITPC and SCIS. These two companies manage all financial issues through their respective financial departments which are controlled and supervised by the administration and financial department of MOC under the deputy minister. This department is responsible for preparing the financial plan of MOC, supervising the allocated budget for each activity/project and evaluating the financial expenditures and incomes at the end of each fiscal year.

### (1) Financial Condition.

Financial condition of MOC from 2006 to 2009 is shown in Table 4.2-1. The total outcome is over than the total income in 2006 and 2007. Although the data of depreciations in 2008 and 2009 are lacking, tendency of over-outcome in balance is considered to continue in 2008 and 2009 with wider gap of deficit. This is mainly because of increase of payment of salary to employees due to rapid increasing the number of staffs and their salary. On the other hand, the increase of total income from 2008 to 2009 is outstanding due to revenues activity and other income. Those increasing rates from 2008 to 2009 are 179% in cash salaries outcome and 171% in total income. Followings are notable points for analyzing the balance sheet of MOC/ITPC.

- Total outcome indicates expenses except investment costs.
- Before year of 2007, MOC has been budgeted by Iraqi Government. After the year, MOC depends on governmental banks of Rafidin Bank and Al-Rasheed Bank asking loan for covering operational outcome. Interest to the Banks is paid by Ministry of Finance.
- MOC can receive investment money from Ministry of Planning and Ministry of Finance for telecommunications development.
- According to the contract signed in February 2011 (becomes effective in mid of 2011) between ITPC and mobile phone companies, all international calls by mobile phone have to be through an ITPC's gateway. Mobile phone companies have to pay five cents per one minute as gateway fee. 70% of total gateway fees are expected to be paid to ITPC, 30% of them are paid to MOC and SCIS. 200 million minutes call per month is expected for using ITPC's gateway.
- A mutual connection project named "SAIT Link System" utilizing ITPC's networks is now under discussion among ITPC, communications companies both from Saudi Arabia and Turkey. Memorandum of Understanding (MOU) was signed by these three parties in February 2011 and its contract will be inked in April 2011. Through this project, transition fees from these communications companies both from Saudi Arabia and Turkey are expected as new revenue to ITPC.

Although total minus balance (deficit) of income and outcome becomes wider from 2006 to 2007, this is because large investment for telecommunication development. On the other hand, income in 2009 is over 128,000 million IQD and this figure jumps up from income in 2008 of 75,157 million IQD as shown in Figure 4.2-1. This is because both teledensity and telephone users increase as a result of rehabilitation on the existing telecommunications network by MOC's effort.

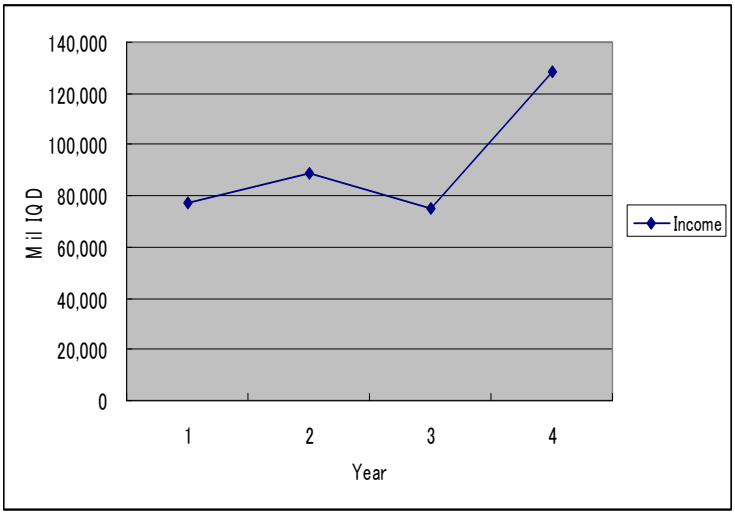
In case that the development continues as it is, present deficit will be improved in near future with healthier financial balance.

Table 4.2-1: Total Balance of ITPC

(Unit: Mil IQD)

| Year | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|
| cash salaries [1)] | 71,479 | 73,541 | 90,514 | 161,846 |
| general purchases [2)] | 3,986 | 5,765 | 6,746 | 12,926 |
| service operational requirements [3)] | 11,651 | 16,245 | 12,380 | 11,563 |
| contractors & services [4)] | 1 | 1,366 | 33 | 5,000 |
| purchases for sale [5)] | 1 | 0 | 0 | 0 |
| interest & renting lands [6)] | 1,012 | 2,203 | 148 | 442 |
| Depreciations [7)] | 9,455 | 12,824 | - | - |
| **Total of Outcome** | **97,585** | **111,944** | **NA** | **NA** |
| revenues activity [8)] | 72,354 | 84,861 | 71,887 | 113,617 |
| other income [9)] | 4,618 | 3,992 | 3,270 | 15,007 |
| **Total of Income** | **76,972** | **88,853** | **75,157** | **128,624** |
| **Balance** | **-20,613** | **-23,091** | **NA** | **NA** |

Source: MOC
(Note)
1) Salary to the staffs of ITPC has been paid by a subsidy from Ministry of Finance by June in 2010. Salary after July in 2010 is paid by ITPC.
2) Purchasing from market such as furniture etc.
3) Outcomes mainly by operation and maintenance.
4) Purchasing from market such as copy machine etc.
5) Purchasing from market such as cables etc.
6) Payment of interest and land rent.
7) Depreciation of MOC/ITPC's building etc. The data in 2008 and 2009 could not be obtained.
8) Revenue of charge for call of customers excluding internet.
9) Income from such as building rent.




1: year 2006

2: year 2007

3: year 2008

4: year 2009

Source: MOC

Figure 4.2-1: Annual Income of MOC/ITPC

### (2) Implementation Capability

MOC/ITPC presently implements on-going projects completed by 2011, 2012 and 2013. Completion of these projects can create new income to MOC/ITPC. Especially ITPC's international gateway and SAIT Link System will increase revenue. And other on-going projects will also be expected to additionally produce revenues. Through the above consideration, MOC/ITPC has project implementation capability from viewpoint of financial aspect.

# *Chapter 5*
# *Technology of Telecommunications Network*

# CHAPTER 5 TECHNOLOGY OF TELECOMMUNICATIONS NETWORK

## 5.1 International Trend in the Development of Communication Infrastructure

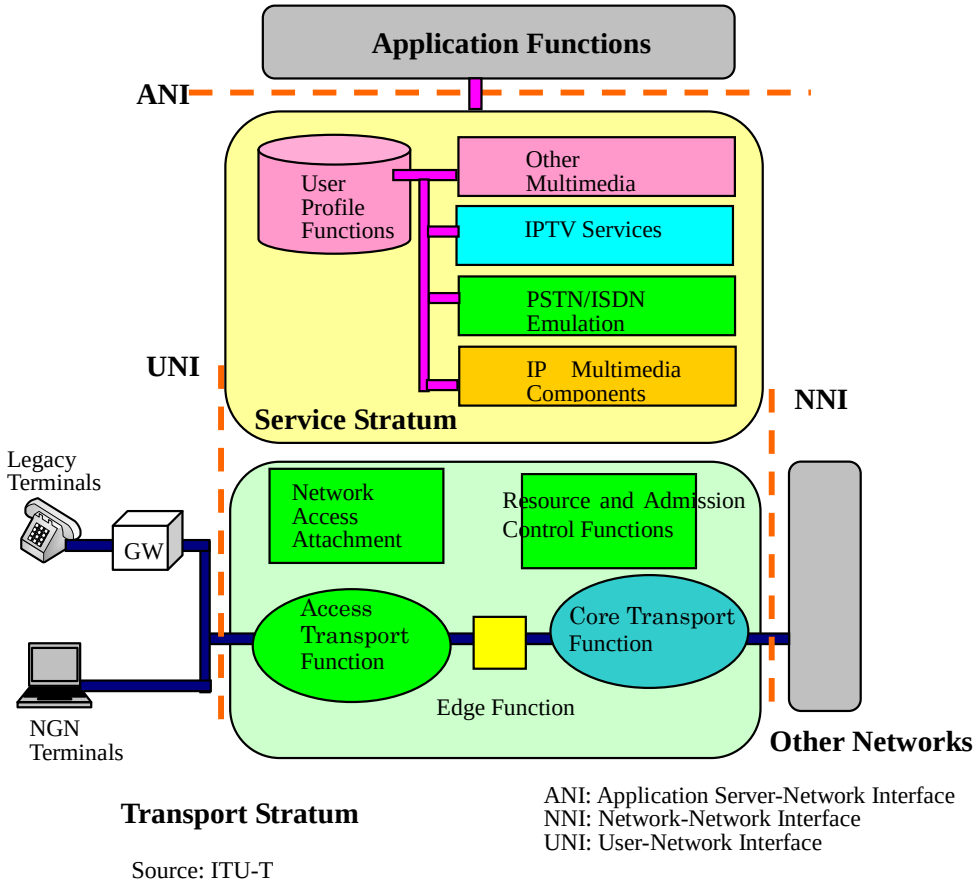
### 5.1.1 IP Technology

It is the nature of modern public telephone networks to be part of the on-going evolution. Firstly, the public telephone started voice service through circuit switches that need only 4 kHz bandwidth for voice communications. Since then, there was technological transition from analog system to digital system. Consequently, the Integrated Services Digital Network (ISDN) came to service by providing low speed data communications such as 64 kbps or 128 kbps to the subscribers. The internet technology then started together with development of IP technology. The data speed required for internet services became faster than ever before. At present, many studies and investigations on Next Generation Network (NGN) based on IP technology have been emerging and continuing globally for the past ten years. It is noted that in January 2008, the ITU Workshop of Next Generation Network (NGN) released the ITU-Y series recommendations on guidelines to establish IP-based networks. Table 5.1.1-1 shown below gives the list of the ITU-Y series recommendations. Meanwhile, the concept of NGN is illustrated in Figure 5.1.1-1. It is configured with three major components such as transport stratum, service stratum and application functions that enables control functions isolated from transport and application functions. The general idea of NGN is that one network transports all information and services (voice, data, and all sorts of media, the so called multi-media). NGN consists of IP-based networks, making it possible to converge multi-media services into an integral architecture of telecommunication system, realizing high quality, security, reliability and openness of the telecommunications. This technological breakthrough has pushed telecom carriers/operators to shift the legacy PSTN networks to IP-based networks. The manufacturers of telecom equipment have also followed this global trend by investing their capital resources on the research and development of cost-effective and competitive NGN products, which has contributed to further evolution and development, leading to possibilities of lower market prices of the products concerned. The key technology deployed in the NGN architecture is Generalized Multi-Protocol Label Switching (GMPLS)/Multi-Protocol Label Switching (MPLS) core router that directs and transports data from one network node to the next, with high performance. Thus, it became possible to create virtual links between distant nodes by encapsulating with “labeling” IP packet headers.

NGN is characterized by the following fundamental aspects:

- Packet-based transfer
- Separation of control functions among bearer capabilities, call/session and application/service

- Independence of service-related functions from underlying transport technologies
- Broadband capabilities with end-to-end QoS and transparency
- Converged services between fixed/mobile
- Interworking with legacy networks via open interfaces
- Support for wide range of services, applications and mechanisms based on service building blocks (including real time/streaming/non-real time services and multi-media)
- Compliant with all regulatory requirements (e.g. emergency, privacy, etc.)




Source: ITU-T

Figure 5.1.1-1 Concept of Next Generation Network

Table 5.1.1-1 Latest ITU-T Recommendations for Next Generation Network

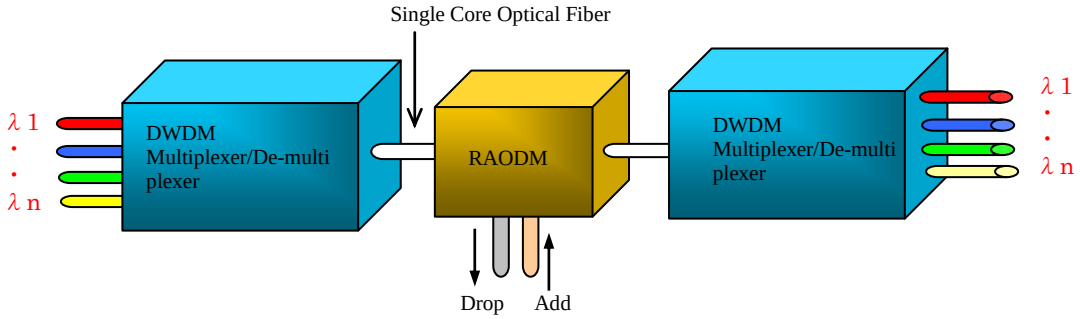
| Category | Rec. | contents |
|---|---|---|
| General | Y2001 | General Overview of NGN |
| Scope | Y2011 | General Principles and General Reference Model for NGN |
| | Supplement | NGN Release 1 Scope |
| | Y2091 | Terms and Definitions for NGN |
| Requirements | Y2201 | NGN Release 1 Requirements |
| | Q1706 | Mobility Management Requirements for NGN |
| Architecture | Y2012 | Functional Requirements and Architecture of the NGN |
| Functions | Supplement | Session/Border Control Functions |
| Services | Y2021 | IMS for NGN |
| | Y2031 | PSTN/ISDN Emulation Architecture |
| | Y2271 | Call Server based PSTN/ISDN Emulation |
| Admission Control | Y2111 | Resource and Admission Control Functions in NGN |
| | Y2171 | Admission Control Priority Levels in NGN |
| Evolution | Y2261 | PSTN/ISDN Evolution to NGN |
| Securities | Y2701 | Security Requirements for NGN Release 1 |

Source: ITU-T

### 5.1.2 Dense Wavelength Division Multiplexing (DWDM)

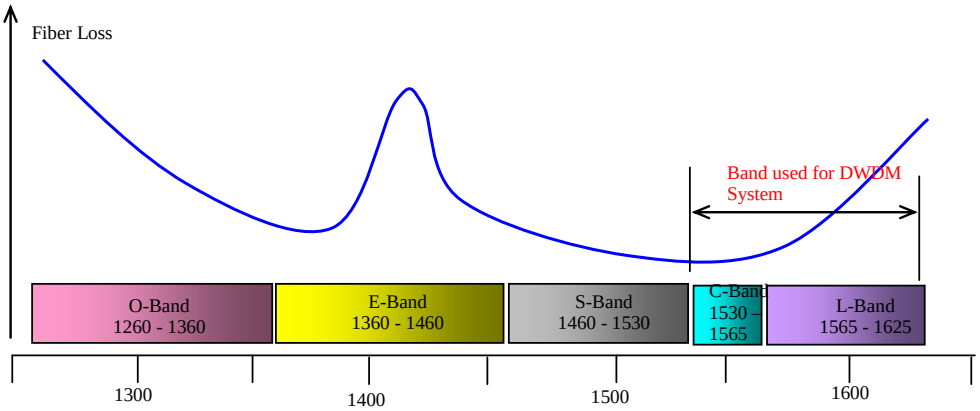
Wavelength Division Multiplexing (WDM) is a technology which multiplexes a number of optical carrier signals onto a single optical fiber. Meanwhile, DWDM uses the same transmission window but with denser channel spacing of about 40 GHz or more (up to 128 GHz) as shown in Figure 5.1.2-2. The DWDM system consists of several main components as illustrated in Figure 5.1.2-1, such as:

- Terminal Multiplexer/De-multiplexer which converts individual signals to multi-wavelength optical signals and breaks them back to the original signals.
- Reconfigurable Optical Add-Drop Multiplexer (ROADM) which allows for the dropping and adding of certain wavelength channels without requiring manual insertion or replacement of wavelength-selective cards. Network operators can remotely reconfigure the multiplexer by sending soft commands.




Source: JICA Study Team

Figure 5.1.2-1 Main Components of DWDM System




Source: JICA Study Team

Figure 5.1.2-2 Optical Band used for DWDM System

### 5.1.3 Local Access Network

Local access network is an integral part of the NGN telecommunications network that physically connects subscribers or users to their carriers'/operators' network facilities. Currently, there are various access networks available, which principally include wireless, xDSL and FTTx solutions described as follows.

(1) Wireless Solution

**WiMAX** is a new technology that delivers carrier class, high-speed, wireless broadband at a much lower cost than cellular technology, and over a much greater range than WiFi. WiMAX delivers not just significant improvement in speed, throughput and capacity to home and small business users, but also enables portable and mobile services to laptops and handheld devices. WiMAX creates the environment for high quality, multi-megabit services to be delivered to end users more cost-effectively. It has two options: Fixed WiMAX based on the standard IEEE 802.16-2004 or 802.16d; and IEEE 802.16-2005 or 802.16e that supports both fixed and mobile usage.

**WiFi** is a short range of wireless connection technology based on IEEE 802.11 standards. WiFi is a license-free communication device but co-exists with the frequency spectrum, which is so called industry-proposed bands that cannot guarantee high and stable quality, security and reliability of the links.

**LTE** is the latest standard, principally in the mobile network systems. The featured technologies such as Orthogonal Frequency Division Multiplex Access (OFDMA) and Multiple Input Multiple Output (MIMO) are adopted in order to realize the LTE mobile network systems. These LTE technologies are prospective candidates of the 4th generation mobile telephone to be replaced by WCDMA and GPRS of 3rd generation. It is still however under research and trial in the field. The current LTE specification provides downlink peak rates of 100 Mbps or more, an uplink of at least 50 Mbps, and supports scalable carrier bandwidths from 1.4 MHz to 20 MHz with both FDD and TDD. The comparisons among these technologies are summarized in Table 5.1.3-1.

Table 5.1.3-1 Comparison of Wireless Technologies

| Item | WiMAX | LTE | WiFi |
|---|---|---|---|
| Legacy | IEEE802.16a | GPRS/EDGE/UMTS | IEEE802.11a/11b/11g |
| Primary Application | Broadband Wireless Access (Fixed) | Broadband Wireless Access (Mobile) | Wireless LAN |
| Frequency Spectrum | 2G to 11GHz | 800MHz to 2.6GHz | 2.4GHz, 5GHz |
| Bandwidth | Scalable 1.25M to 20MHz | Scalable 1.25M to 20MHz | 20MHz |
| Access Technology | DL: OFDMA<br>UL: OFDMA | DL OFDMA<br>UL: SC-FDMA | DSSS and OFDM |
| Access Mode | TDD and FDD | TDD and FDD | TDD |
| Modulation | BPSK, QPSK, 16QAM, 64QAM | BPSK, QPSK, 16QAM, 64QAM | BPSK, QPSK, 16QAM, 64QAM |
| Peak Data Rate | DL: 75Mbps<br>UL: 25Mbps | DL: 100M to 326.4Mbps<br>UL: 50 to 86.4Mbps | 2M, 11M, 54Mbps |
| Cell Radius | 20 km for 3.5 or 7MHz BW<br>8km for 5 or 10MHz BW | 5 km | 5km |
| Antenna Scheme | MIMO | MIMO | SISO, MISO |
| Cell Capacity | 100 to 200 Users | 200 Users 5MHz BW<br>400 users 10MHz | Usually 10 to 20 clients |

Source: JICA Study Team

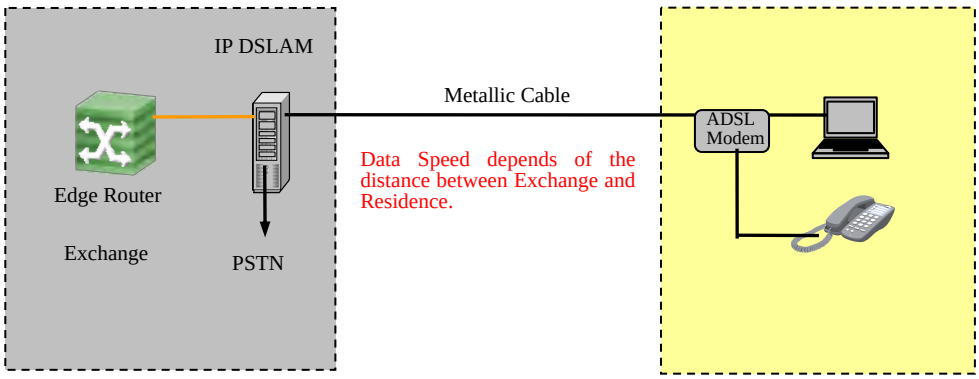
(2) xDSL Solution

xDSL stands for digital subscriber line and is a family of technologies that provide digital data transmission over the metallic wires of a local telephone network. In xDSL methodical families, there are Asymmetric Digital Subscriber Line (ADSL), ADSL2, ADSL2+, Symmetric Digital Subscriber Line (SDSL), Very High Speed Digital Subscriber Line (VDSL), etc., which are discussed as follows:

ADSL

ADSL is the most commonly installed technology among the xDSL family and its configuration is illustrated in Figure 5.1.3-1. It can extend a few kilometers from the exchange to the user's premises. At the exchange, a digital subscriber line access multiplexer (DSLAM) terminates the ADSL circuits and aggregates them, where they are handed off onto IP networking transports.

Data speed between down link and up link is asymmetric. ADSL2 and ADSL2+ are improved versions that can provide higher speeds than ADSL.




DSLAM: Digital Service Line Access Multiplexer

Source: JICA Study Team

Figure 5.1.3-1 System Configuration of ADSL

VDSL

Technologies such as VDSL provide very high speed at short range links, which are typically implemented in fiber to curb or building network architectures.

VDSL can provide a higher speed but has a very short link distance from the exchange, and thus, it is often coupled with FTTB architecture as its last one mile selection.

SDSL

The data flow equally approximately at 2 Mbps both in down link and uplink. In its other features,

it is almost the same as ADSL. This technology was recommended as G991 standard in February 2001.

(3) FTTx Solution

FTTx is a generic term for any broadband network architecture that uses optical fiber to replace all or part of the usual metal local loop used for last one mile communications. The terms most widely use today are:

Fiber-to-the-home (FTTH)

Fiber reaches the home user's premises with a terminal box installed inside. FTTH is realized with the technology of passive optical network (PON). It is composed by OLT, optical splitter and ONU as shown in Figure 5.1.3-2.

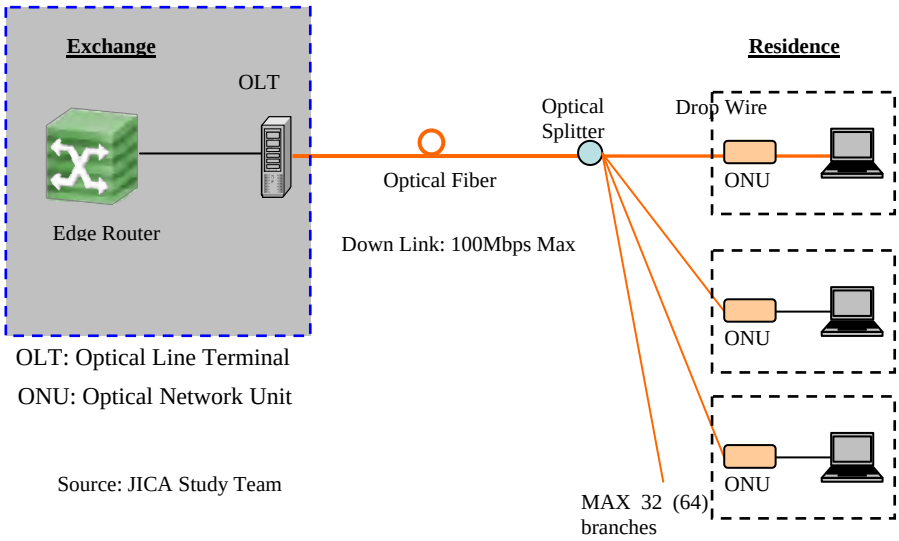



Figure 5.1 3-2 Sytem Configuration of FTTH

In PON system there are 2 standards available as shown in Table 5.1.3-2.

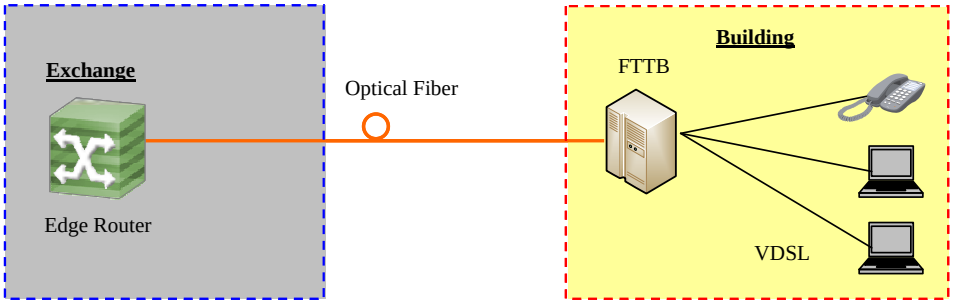
Table 5.1.3-2 Comparison between G-PON and GE-PON

| | | |
|---|---|---|
| Standard | ITU G984 | IEEE 802.3h |
| Data Speed | 1.25Gbps | 1Gbps |
| Branches | 32 (64) | 32 |
| Distance | 20km | 20km |

Source: JICA Study Team

Fiber-to-the-Building (FTTB)

Fiber reaches the boundary of the building directly from the exchange as shown in Figure 5.1.3-3 This satisfies the user's demand for high speed data transactions, and hence, this architecture may be applicable for business use.

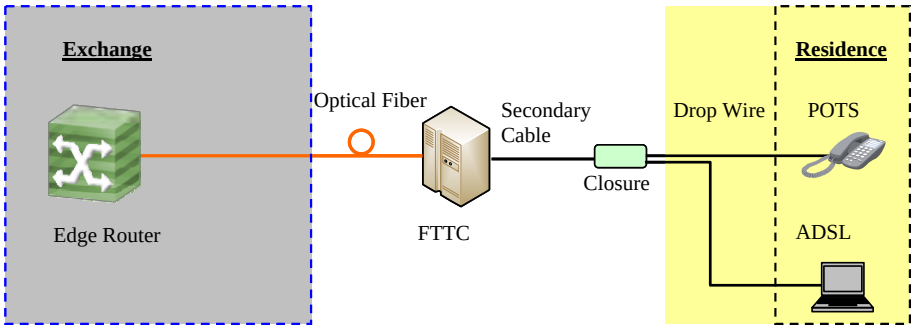



Source: JICA Study Team

Figure 5.1.3-3 System Configuration of FTTB

Fiber-to-the-Curb/Cabinet (FTTC)

Fiber is terminated on a street curb/cabinet at a few kilometers away from the exchange, and extends up to the users' premises with metallic cable as the last one mile connection, shown in Figure 5.1.3-4. This architecture is especially effective for delivery of broadband services such as high speed internet. The area served by the cabinet is usually a few hundred meters more or less in radius.




Source: JICA Study Team

Figure 5.1.3-4 System Configuration of FTTC

## 5.2 Applicable Technologies for the Project

### 5.2.1 Migration from PSTN to IP-Based Technology

As described in Section 5.1.1 IP Technology, NGN is now taking the place of legacy PSTN as it is now gradually difficult to repair conventional PSTN due to the following reasons:

a) Manufacturer's production of PSTN will soon be terminated and will shift to IP-related products. It is also difficult to procure its spare parts for repairs.

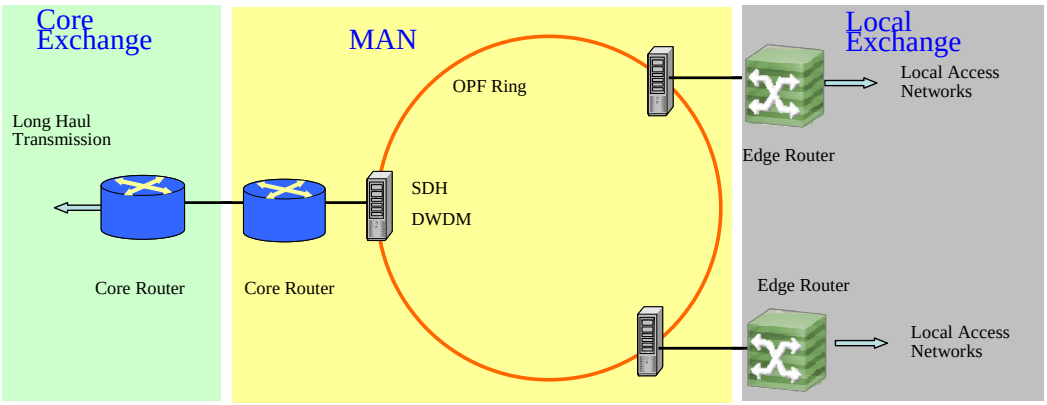
b) Change of business models (transition from voice to data service) on the part of telecom operators/carriers

c) NGN Recommendations issued by ITU-T and IETF

Due to the situation above, it is inevitable to migrate from legacy PSTN to the new IP technology-based network. Thus, MOC and telecom entities are urgently required to have schemes for establishing reliable and efficient nationwide IP networks in the framework of MTDS.

### 5.2.2 IP Network

To construct the IP network, edge routers are deployed in the local exchanges and linked to core router located in the core exchange via Metropolitan Network (MAN) that consists of optic fiber ring with DWDM/SDH, as shown in Figure 5.2.2-1. The edge routers and core routers of high performance carrier-class are provided with GMPLS/MPLS functions compatible with NGN.



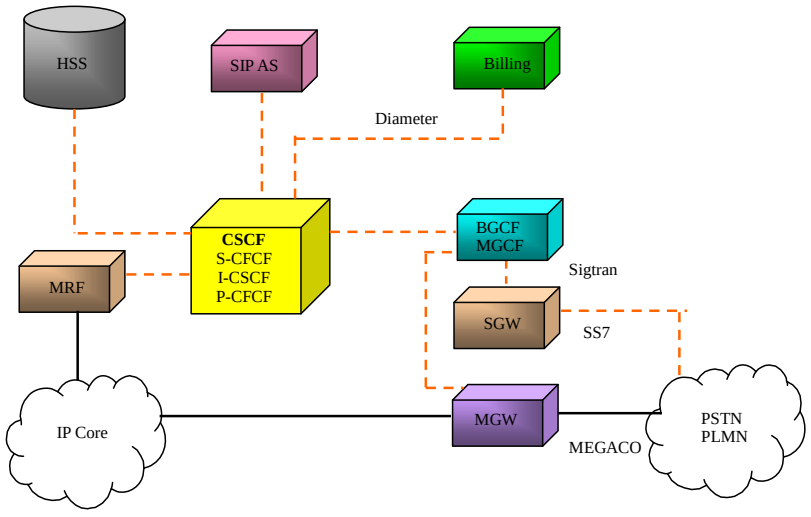

Source: JICA Study Team

Figure 5.2.2-1 Configuration of IP Network

### 5.2.3 PSTN Emulation

Plain Old Telephone System (POTS) is connected to the IP network for users without knowledge in replacement of network with data interfaces of giga-based ethernet type. To realize this emulation from PSTN, the IP network system is provided with the introduction of IP Multimedia Subsystem (IMS) that has a control function of NGN. As illustrated in Figure 5.2.3-1, the system consists of Call Session Control Function (CSCF), Home Subscriber Server (HSS), Media Gateway Control Function (MGCF), Signaling Gateway (SGW) and Media Gateway (MGW). All the functional entities have high degree of redundancy in hardware as well as software to assure immunity to failure. Switching changeover from one unit to the other in case of fault or malfunction must be secured automatically in milliseconds without affecting system performance. The system is to be equipped with a sophisticated Operation and Maintenance System (OMS) to monitor and control IMS. The following are the major components that can establish IMS.

**IMS** is a key technology that makes possible of isolation of the access/transport networks from service plane having a horizontal control plane. It is an architectural framework for delivering Internet Protocol multimedia services. Each function defined in IP Multimedia Subsystem does not necessarily indicate actual hardware. An implementer is free to combine 2 functions into one hardware, or to split a single function into 2 or more sets of hardware.




Source ITU-T

Figure 5.2.3-1 Functional Configuration of IP Multimedia Subsystem (IMS)

Call Session Control Function (CSCF)

With several roles of Session Initiation Protocol (SIP) servers collectively called CSCF, this used to process SIP signaling packets in IMS. It consists of S(Server)-CSCF, P(Proxy)-CSCF and I(Interrogating)-CSCF.

Home Subscriber Server (HSS)

HSS is a master user database that supports the IMS network entities that actually handle calls. It contains subscriber profiles, performs authentication and authorization of the user and can provide information about the subscriber's location and IP information.

Media Gateway (MGW)

MGW interfaces with the media plane of the circuit switched network by converting IP and Voice, so-called VoIP.

Signaling Gateway (SGW)

SGW interfaces with the signaling plane of the circuit-switched network. It transforms Internet Protocol into Signaling System 7.

Media Gateway Control Function (MGCF)

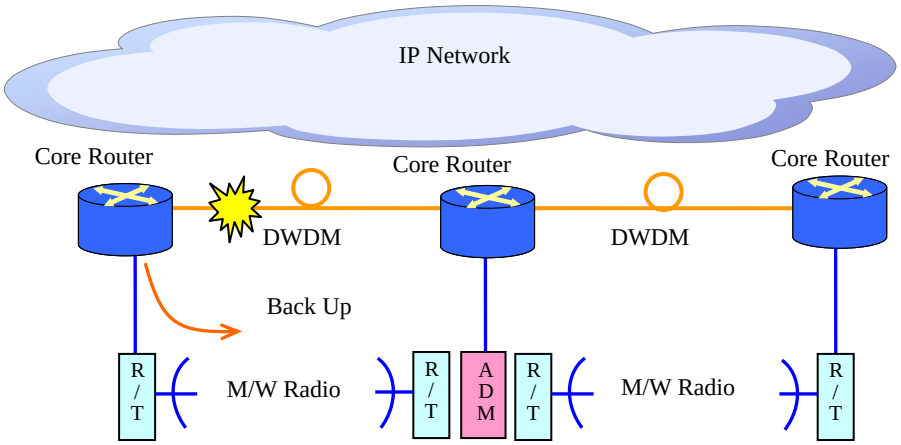
MGCF converts between SIP and SS7 and interfaces with SGW. It also controls the resources in media gateway across MEGACO interface.

Charging /Billing Server

For centralized charge of IP subscriber call, the charging/billing server will be introduced with a function of binary Call Data Record (CDR), which is produced for each individual call, and, charge unit generated by the call processor.

### 5.2.4 Microwave Radio as Back-up

The long haul transmission in Iraq is composed of nationwide optic fiber multiple rings with DWDM. However, there is another microwave backbone that was completed under Japan's Grant Aid Program in 2010 and currently has two idle channels of STM-1. These channels can be used as backup circuits for optic fiber as shown in Figure 5.2.4-1, when the optic fiber system is down. Since the bandwidth of microwave radio is small as compared to optic fiber, it is required to control flowing data through the core routers to the microwave radio circuit.




Source: JICA Study Team

Figure 5.2.4-1 M/W Radio as Back-Up Circuits for OPF

### 5.2.5 Local Access Network

Telephone lines dispersed widely around the local exchange are concentrated and connected to the exchanges and directed to higher hierarchical networks. For aggregation of these telephone lines, local access network is needed. There are several methods of access networks that can be realized under current technologies, which are selected from the viewpoints of construction cost, service types, and topographical, geographical and environmental aspects.

(1) Outside Plants Metallic (Copper) Cable and Wires

The existing outside plants' metallic cable wires are not repaired and used for this project.

According to the JETRO Feasibility Study (F/S) report, 70% of primary cables and 40% of secondary cables are of old type made with paper insulated cables (more than 20 years have passed since these were installed initially). The remaining cables are of new type made with jelly-filled PE insulated cables. About 10% of these existing cables cannot be used now due to obsolete conditions and no maintenance materials are available in the market. The cables are housed in concrete pipes

with inner diameter of 110mm, which are already obsolete and damaged.

Meanwhile, based on the latest data collected from ITPC in 2010, 18.2% and 18.5% of existing manholes and concrete pipes have been damaged, respectively. It is not economically feasible to repair the existing cables if they are of paper insulation type as they do not last long after repairs.

(2) Worldwide Interoperability for Microwave Access (WiMAX)

WiMAX can be constructed as scalable with small investment and is possible for first in hand service. WiMAX can deliver both fixed and mobile services. It does not only serve home and business users but also nomadic and portable users as well in terms of access to high speed broadband networks. It is also one of the FWAs widely used for last one mile solution. However, the deployment of WiMAX has several obstacles in Iraq and will be difficult to solve problems related to local access network. The major reasons recognized are as follows:

a) Limited frequency band available to MOC in Iraq, and difficulty in obtaining license

b) Wireless interference to other networks, especially security networks in Iraq

c) Wireless cannot accommodate large traffic with limited frequency spectrum available

Currently, MOC/SCIS have obtained four channels TDD (5MHz) on 3.5GHz band for WiMAX services from Iraqi National Communication and Media Commission (CMC), taking one and a half years after the first application. It will be difficult to obtain further frequency spectrums since other operators of different sectors also intend to have license to access WiMAX channels as shown in Table 5.2.5-1. In addition, MOC/SCIS and CMC are both governmental entities but operating under different organizations and hence, there are many formalities required for licensing of WIMAX frequency spectrum, which is a time consuming process.

Table 5.2.5-1 Licensing Frequency Spectrum for Carriers/Operators in Iraq

| | Mobile TX (MHz) | Base TX (MHz) | Channel Pair | Bandwidth | |
|---|---|---|---|---|---|
| **National License SCIS & ITPC** | 1) 455.850 - 458.355 | 465.850 - 468.355 | 2 Channels Duplex | 4 X 1.25 MHz | |
| | 2) 824.415 - 828.105 | 869.415 - 873.105 | 3 Channels Duplex | 6 X 1.25 MHz | |
| | 3) 1898.125 - 1903.125 | 1978.125 - 1983.125 | 4 Channels Duplex | 8 X 1.25 MHz | |
| | 4) 3401.25 - 3421.25 | TDD | 4 Channels TDD | 4 X 5 MHz | (WiMAX) |
| | **IEEE 802 16e** | | | | |

| | Mobile TX (MHz) | Base TX (MHz) | Channel Pair | Bandwidth | |
|---|---|---|---|---|---|
| **National License Suhtian** | 450.525 - 453.025 | 460.525 - 463.025 | 2 Channels Duplex | 4 X 1.25 MHz | |
| | 828.105 - 830.565 | 873.105 - 875.565 | 2 Channels Duplex | 4 X 1.25 MHz | |
| | 1903.125 - 1905.625 | 1983.125 - 1985.625 | 2 Channels Duplex | 4 X 1.25 MHz | |
| | 3423.75 - 3437.75 | TDD | 4 Channels TDD | 4 X 3.5 MHz | (WiMAX) |
| | **IEEE 802 16d** | | | | |

| | Mobile TX (MHz) | Base TX (MHz) | Channel Pair | Bandwidth | |
|---|---|---|---|---|---|
| **National License Kalimat** | 453.350 - 455.850 | 463.350 - 465.850 | 2 Channels Duplex | 4 X 1.25 MHz | |
| | 831.795 - 834.255 | 876.795 - 879.255 | 2 Channels Duplex | 4 X 1.25 MHz | |
| | 1905.625 - 1908.125 | 1985.625 - 1988.125 | 2 Channels Duplex | 4 X 1.25 MHz | |
| | 3439.5 - 3453.5 | TDD | 4 Channels TDD | 4 X 3.5 MHz | (WiMAX) |
| | **IEEE- 802 16d** | | | | |

| | Mobile TX (MHz) | Base TX (MHz) | Channel Pair | Bandwidth | |
|---|---|---|---|---|---|
| **Provincial License Baghdad Cooperative** | 830.565 -831.795 | 875.565 - 876.795 | 1 Channels Duplex | 2 X 1.25 MHz | |
| | 1908.125 - 1909.375 | 1988.125 - 1989.375 | 1 Channels Duplex | 2 X 1.25 MHz | |
| | 3455.25 - 3465.75 | TDD | 3 Channels TDD | 3 X 3.5 MHz | (WiMAX) |
| | **IEEE- 802- 16d** | | | | |

| | Mobile TX (MHz) | Base TX (MHz) | Channel Pair | Bandwidth | |
|---|---|---|---|---|---|
| **Provincial License Iraq Tel** | 830.565 -831.795 | 875.565 - 876.795 | 1 Channels Duplex | 2 X 1.25 MHz | |
| | 1908.125 - 1909.375 | 1988.125 - 1989.375 | 1 Channels Duplex | 2 X 1.25 MHz | |
| | 3455.25 - 3465.75 | TDD | 3 Channels TDD | 3 X 3.5 MHz | (WiMAX) |
| | **IEEE- 802- 16d** | | | | |

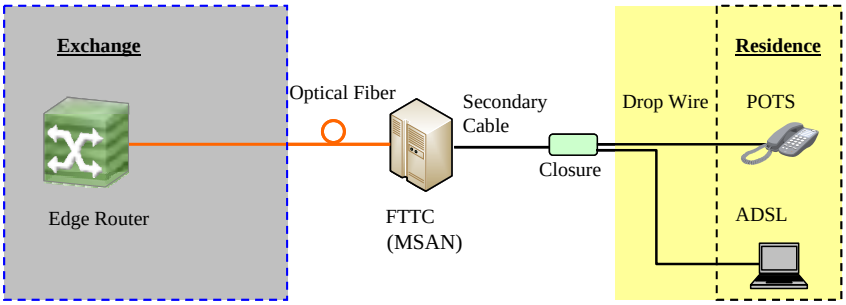
| | Mobile TX (MHz) | Base TX (MHz) | Channel Pair | Bandwidth | |
|---|---|---|---|---|---|
| **Provincial License ITC** | 1895.625 - 1896.875 | 1975.625 - 1976.875 | 1 Channels Duplex | 2 X 1.25 MHz | |
| | 1896.875 - 1898.125 | 1976.875 - 1978.125 | 1 Channels Duplex | 2 X 1.25 MHz | |
| | 1908.125 - 1909.375 | 1988.125 - 1989.375 | 1 Channels Duplex | 2 X 1.25 MHz | |
| | 3455.25 - 3465.75 | TDD | 3 Channels TDD | 3 X 3.5 MHz | (WiMAX) |
| | **IEEE- 802- 16d** | | | | |

Source MOC

(3) Multi Service Access Node (MSAN), FTTC Solution

MSAN is defined by Broadband Forum Technical Report TR101 and can provide POTS and xDSL services.

FTTC is established by using the MSAN component as shown in Figure 5.2.5-1. MSAN has a function to concentrate subscriber lines carried on metallic secondary cables and transport them to edge router in the IP network, and hand off onto the higher hierarchical networks. The edge router is located in the local exchange, while MSANs are deployed widely in the subscribers' network area and are linked by fiber optic with edge router. The line capacity of MSAN will be selected depending on the density of subscribers. It is important that the topological conditions be carefully studied so that the metallic secondary cables from MSAN can be laid up to the subscribers' premises easily and economically. MSAN disposition is so-called the star connection type, directly connecting to the edge router in the exchange.

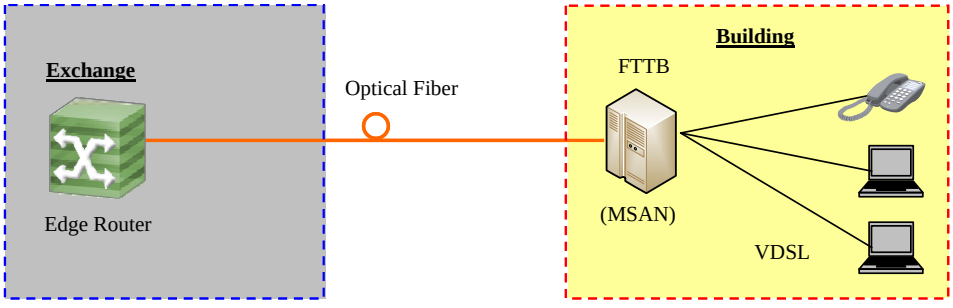



Source: JICA Study Team

Figure 5.2.5-1 Configuration of FTTC

(4) FTTB Solution

FTTB is established by using MSAN same as FTTC. MSAN is installed inside the building of subscribers as shown in Figure 5.2.5-2.




Source: JICA Study Team

Figure 5.2.5-2 Configuration of FTTB

### (5) FTTH Solutions

FTTH uses the passive optical network or PON system as shown in Figure 5.2.5-3. PON provides a broadband service to the subscribers with high speed data transmission. Single core optical fiber cable will be laid up to each subscriber's premises. Single optical core is fanned out up to 32 branches by optical splitter. PON can be provided for small businesses or residential houses while optical fiber cable can directly be fed to large buildings for higher-speed service called FTTB, as abovementioned.

In Iraq, provision of high speed data service is important to create more job opportunities although FTTB and FTTH demands are still small in Baghdad. Besides, FTTH is necessary in different aspects and can be deployed depending on the following reasons:

a) Frequent Power Outage

In Iraq, commercial power frequently cuts feeding due to insufficient power grid infrastructure. The cabinets for FTTC needs power supply whereas FTTH does not require power for the splitter (passive component), which is its advantage against FTTC.

b) Security Reason

Iraq is still unstable in terms of public securities experiencing frequent cases of theft. The splitters used for FTTH line distribution is physically very small in size and are not likely to be stolen.

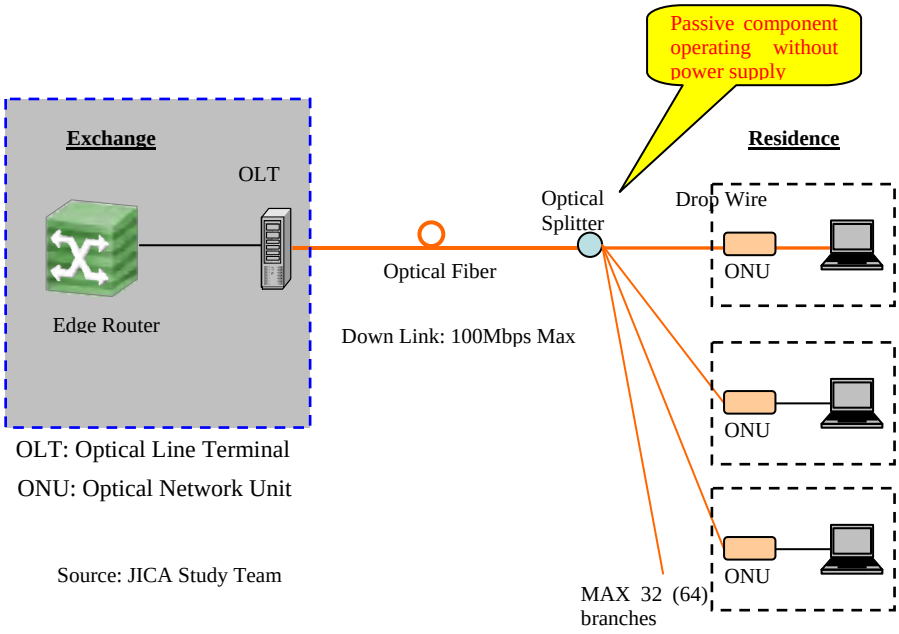



Figure 5.2.5-3 Configuration of FTTH

## 5.3 Discussion on the Technologies Proposed in the JETRO F/S

### 5.3.1 IP Communication System

There are two technologies that appeared in JETRO F/S Report. One is the DWDM and the other is MPLS. These technologies are adopted for the creation of NGN; however, the following points are required additionally:

a) Existing microwave radio transmission system that was completed through Japan's Grant Aid Program in 2010 can be integrated into nationwide backbone system as the backup for optic fiber.

b) GMPLS, which employs the advanced MPLS technology, can be deployed for the establishment of IP-based Network. Actually, ITPC has already launched the project planning of Automatic Switched Optical Network (ASON) in major cities like Baghdad and Basrah. ASON is often used interchangeably with GMPLS as it satisfies the requirements of ASON using GMPLS protocols developed by the IETF.

c) One of the technologies proposed in JETRO F/S Report is the IP-based soft switch that can work functionally, same as the circuit switch of PSTN. At present, this switching technology is being replaced by IMS in NGN that does not only function as soft switch but also deliver multi-media services. IMS is an essential component of NGN and is an architectural framework. It is also a key technology that enables control plane to be separated from transport and application plane in NGN.

### 5.3.2 Local Access Network

There are several methods of access networks currently available and are selected, taking into account the types of services, topographical, geographical and environmental aspects. JETRO F/S Report discussed the following three types of local access networks to provide for the establishment of IP-based telecommunication services:

a) FTTC Solution
b) FTTB Solution
c) FTTH Solution

Among the above methods, FTTC solution can play a dominant role followed by FTTB solution. FTTH application is minimal in supply number. Based on the various types of local access networks including wireless access solutions discussed in this Study, the following conclusions are presented:

a) FTTC prevails as an application of local access network considering initial investment cost and benefits. Optic fiber is installed from the local exchange to the line aggregation cabinet in the street while copper wire is laid from the cabinet to the premises of subscribers as last one mile solution to provide ADSL service. This method is beneficial to carriers/operators from the viewpoint of cost and benefit per line. However, it is essentially required to save the cabinet

from being stolen and to compensate for power failures occurring frequently. Thus. FTTC is provided with facilities for security and backup power supply. The construction of equipment shelter house is provided with fences and solar panels on its roof where MSAN equipment is accommodated.

b) FTTH is not likely to have an immediate high demand in Iraq. However, this solution will be adopted from different aspects such as power failure and theft. The optical splitter used in FTTH system is a passive component without requiring power supply and is physically small in size, which is unlikely to be stolen. Hence, FTTH can be properly installed in such areas with insufficient power grid infrastructure, and unfavorable security conditions. It is also noted that the provision of FTTH will not be large in quantities.

c) WiMAX can be constructed as scalable with small investment and is possible as first in hand service. It is one of the FWA widely used for last one -mile solution; however, it was found that the deployment of WiMAX has several obstacles in Iraq as mentioned before and causes difficulty in solving problems in local access network. Especially, WiMAX licensing is difficult to obtain. Currently MOC/SCIS have obtained four channels of TDD (5MHz) on 3.5GHz band for WiMAX services from Iraqi National Communication and CMC. However, those spectrums are exclusively for governmental. Purposes, not for public telecommunications and it is not easy to obtain further frequency spectrums since other operators of different sectors also compete for licensing WiMAX channels. In addition, MOC/SCIS and CMC are both governmental entities but operating under different organization and thus, there are many formalities and negotiation required for obtaining license for WIMAX frequency spectrum, which is a time consuming process.

# *Chapter 6*
# *Project Scope*

# CHAPTER 6 PROJECT SCOPE

## 6.1 Target Areas of Project

### 6.1.1 Target Areas

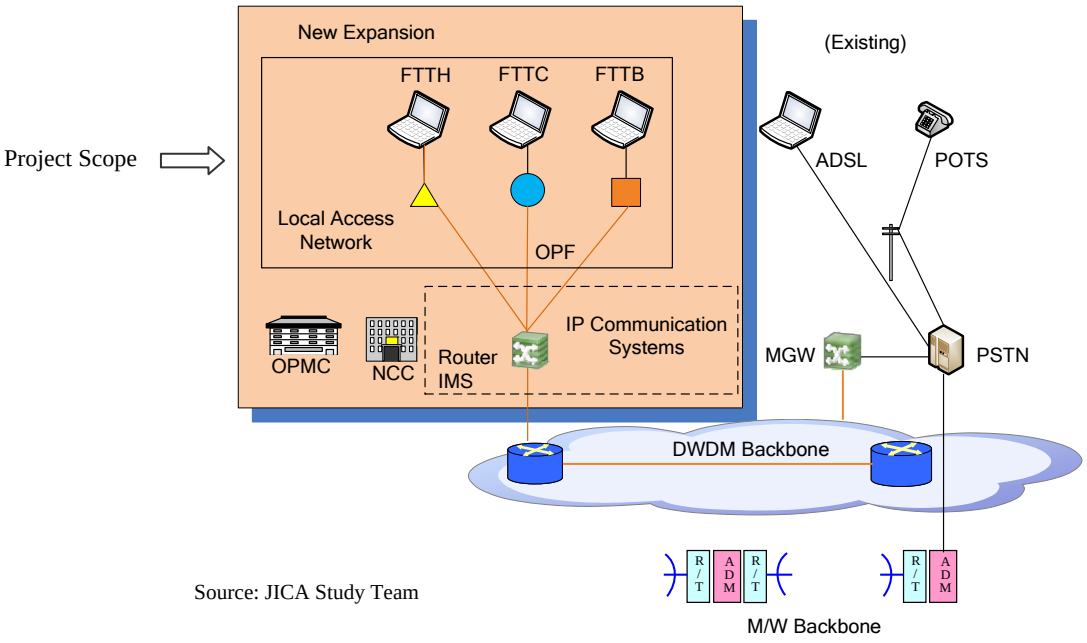
Baghdad, Basra and Mosul are the target areas of this project, selected as the first priority sites for improvement of the telecommunications infrastructure in MTDS. Upgrading and improvement for these three areas involve expanding the telephone lines in accordance with the discussions described in Section 3.3.2 (3), Required Expansion of Telephone Lines in Baghdad, Basra and Mosul.

### 6.1.2 Telephone Expansion in the Target Areas

The expansion of telephone lines in the target areas will involve provision of 200,000 lines for Baghdad, 30,000 lines for Basra and 56,000 lines for Mosul (286,000 lines total expansion). In order to realize this expansion, IP communication systems, as well as local access network and its affiliated facilities will be upgraded and reinforced as described in subsequent Section 6.2, Scope of Work.

## 6.2 Scope of Work

The scope of work of this project is illustrated in Figure 6.2-1 and described as follows:




Source: JICA Study Team

Figure 6.2-1 Project Scope of Work

(1) IP communication systems

IP communication systems functions as data transport on IP network and of switching under control of IMS core.

(2) Local Access Network

Local Access Network is composed of FTTC, FTTB and FTTH that can supply totally 286K lines. Each number of lines for FTTC, FTTB and FTTH comes from the break-down of FTTC, FTTB and FTTH mentioned in Annex 3-3-4-1 of JETRO F/S report. Table 6.2-1 shows the breakdown of Local Access Network for Baghdad, Mosul and Basra.

Table 6.2-1 Breakdown of Local Access Network

Unit: K lines

| | FTTB | FTTC | FTTH | Total 2 |
|---|---|---|---|---|
| Baghdad | 29.5 | 164 | 6.5 | 200 |
| Mosul | 2 | 53 | 1 | 56 |
| Basra | 2 | 27 | 1 | 30 |
| Total 1 | 33.5 | 244 | 8.5 | 286 |

Note: Figures of Total 2 are from MTDS. These figures are distributed among FTTB,C,and H in accordance with JETRO F/S Report.

Source: JICA Study Team

(3) New Communication Center (NCC)

NCC handles the increasing number of internet users derived from the expansion of broadband telephone lines of this project.

(4) Outside Plant Maintenance Center (OPMC)

OPMC is the maintenance center for optic fiber cables for the expansion of telephone lines under this project.

(5) Human Resource Development (HRD)

HRD program provides training on technologies introduced with the expansion of telephone lines under this project.

### 6.2.1 Necessity of the Component

(1) IP Communication Systems

In Iraq, the 2003 war cause havoc on the public telecommunications system. At present, the number of working exchanges has been recovering, but still requires further improvement of infrastructure to catch up with the global evolution of new technologies in telecommunications.

Under these circumstances, Iraq needs technological transition from the legacy PSTN to IP-based communication systems. Globally, since NGN is recently becoming popular, vendors need to shift their marketing from the legacy PSTN to NGN. In the future, it will become difficult to obtain maintenance spares for the existing legacy PSTN. Hence, MOC/ITPC is required to establish IP communication systems to cope with the new era of NGN technology.

### (2) Local Access Network

Outside plant consists of primary cables from the exchange main distribution frame (MDF) and secondary cables from cross-connection cabinets in the street. It also involves further extension of service to subscribers using drop wires. In Iraq, these existing cables are obsolete and were damaged during the recent war. The repair/maintenance works are not easy since materials are no longer easily available in the market. Moreover, repairing these old cables is not feasible because they will not be expected to last long after repairs. Therefore, a new local access network is required, taking the latest technological trend into account. Also, it should be compatible with the technologies of NGN in order to provide multimedia services to subscribers. Thus, the use of optic fiber cables will be selected instead of copper wires from the local exchange to FTTC cabinets, which are installed in streets that can aggregate subscribers' lines. Alternatively, it is directly connected to subscribers' premises using G-PON technology.

### (3) NCC

In Iraq, internet services which have been provided with dial-up connection will soon be reaching their maximum handling capacity. Thus, such internet facilities need upgrading and improvement to cope with the increasing number of internet users in Iraq. MOC/ITPC have been initiating construction of nationwide IP-based networks, making it possible to provide multi-media services including internet services. In order to handle the increasing number of internet users, construction of NCC is necessary, delivering fast and reliable services. The objectives of NCC are: (a) to provide customer support and information center regarding internet services, (b) to establish network operation and data center for ensuring high quality and reliable internet services, and (c) to promote professional ICT education and on-the-job training.

The land for NCC will be chosen from lands owned by MOC/ITPC.

### (4) OPMC

Regarding the issues derived from the current outside plant, there are three major problems, namely, (a) long hours of recovery, (b) frequently-occurring failures and (c) low calling completion. In order to solve these problems, the existing outside plant and maintenance system must be upgraded and improved.

Establishment of OPMC can contribute greatly in improving the quality of telecommunication services, enabling the sophisticated and effective maintenance. ITPC and SCIS intend to construct

a new technology platform of NGN. It is essential to build a new high-tech maintenance center in Baghdad where the optic fiber access network can be effectively maintained. The necessary tools, measuring equipment, maintenance vehicles and well-trained maintenance staff are deployed at the new OPMC. It can help not only for providing high-tech maintenance but also for establishing a training venue for outside plant facilities.

The land for OPMC will be chosen from lands owned by MOC/ITPC.

(5) HRD

Development of human resources is an essential aspect of operating a telecommunications system. ITPC has been carrying out excellent HRD programs in the past. However, MOC/ITPC need new and additional programs for its HRD training scheme since IP-based network technologies related to NGN will become part of their daily operation and maintenance works. From the viewpoint of this technological transition, new HRD schemes are required for the successful operation and maintenance of the new systems and facilities. Hence, HRD will be focusing on the new technologies that constitute IP-based networks, associated with other essential technologies on NGN. HRD is in principle intended for the engineers of ITPC/SCIS engaged in IP communication system. The participating trainees are expected to transfer their acquired knowledge and skills to other staff in their respective departments. The HRD scheme also includes supply of training provisions such as test bench, measuring equipment and tools.

### 6.2.2 Breakdown of Component

The breakdown of each component is reviewed and detailed in this section.

(1) IP Communication System

1) Configuration of IP Network

System configurations of IP communication are shown in Figure 6.2.2-3 and 6.2.2-4 for Baghdad, Figure 6.2.2-5 for Mosul and Figure 6.2.2-6 for Basra.

In the configuration of Baghdad, a total of 29 edge routers and six core routers are provided to deliver 200,000 subscriber lines. The configuration is so called star connection. Each core router aggregates IP packets from edge routers located in each local exchange, and transports them to higher hierarchical network connecting to the nationwide optic fiber backbone at the Sink and Al Mamoun exchanges. It is noted that the IMS core and billing system that can control IP communication systems are also installed at the Sink exchange. The detailed description on IMS core will follow in the subsequent sections.

Likewise, in the configuration of Mosul, four edge routers and one core router are provided to supply 56,000 subscriber lines. The configuration is similar to the star-connection for Baghdad.

Meanwhile for Basra, three edge routers and one core router are provided to supply 30,000 subscriber lines, with configuration which is also similar to that for Baghdad.

2) IP Network Equipment

IP communication system consists of four major entities such ad IMS core, core routers, edge routers and charging/billing system. Routers are provided with GMPLS/MPLS function.

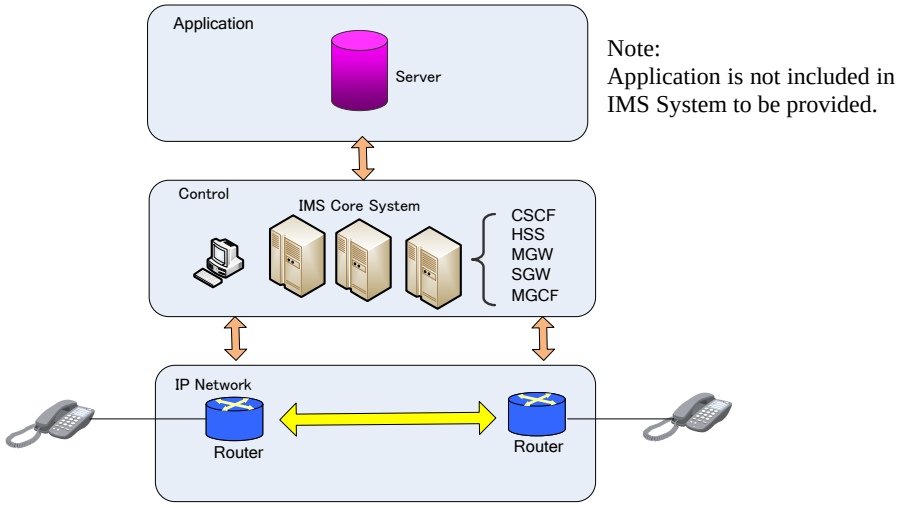
IMS core

IMS core is an essential part of the component that controls IP network in NGN as illustrated in Figure 6.2.2-1.

IMS core is deployed in Sink exchange, which is one of the core exchanges in Baghdad, and connects with legacy telephone lines through media gateway in IMS core. IMS core is composed of the following functional entities:

-Call Session Control Function (CSCF)
-Home Subscriber Server (HSS)
-Media Gateway (MGW)
-Signaling Gateway (SGW)
-Media Gateway Control Function (MGCF)

IMS core is a functional component as one system and some functions are built into one or plural hardware(s).




Source: JICA Study Team

Figure 6.2.2-1 IMS Core composed of Functional Entities

IMS core is a functional component as one system and some functions are built into one or plural hardware(s).

Core Router

GMPLS/MPLS Core Router connects to backbone optic network between core exchange and local exchange and further to the backbone optic fiber networks.

Edge Router

GMPLS/MPLS Edge Router is installed in each local exchange and connects to local access network for subscribers.

Charging/Billing System

Charging/Billing system has a function to centralize charge of IP subscriber call.

3) Quantities of IP Network Equipment

One set of edge router is installed in each local exchange while eight sets of core routers are installed in the core exchange. The locations of said exchanges in Baghdad are shown in Figure 6.2.2-2. IMS core and charging/billing systems are provided in the core exchange, Sink, in Baghdad. Table 6.2.2-1 shows the total quantities of IP equipment for 286,000 lines and the table 6.2.2-2, 6.2.2-3, 6.2.2-4 show the breakdown of quantities for individual exchange.

Table 6.2.2-1 Total Quantities of IP Equipment

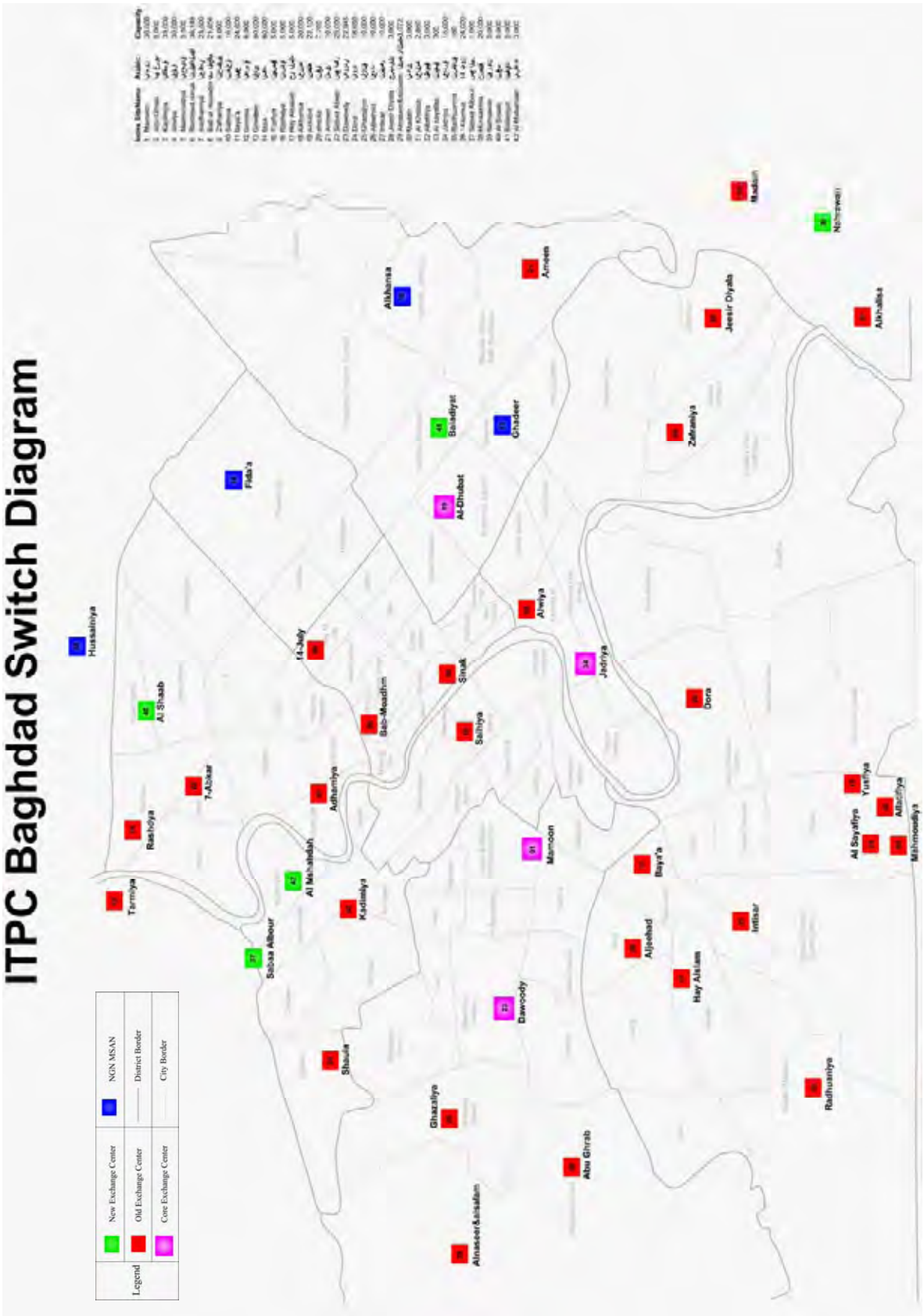
| IP Equipment | Quantity | Unit | Remarks |
|---|---|---|---|
| IMS core | 1 | system | Control function of IP Network |
| Core Router | 8 | set | Network switch |
| Edge Router | 36 | set | Network switch |
| Charging/Billing system | 1 | system | Charging and billing of subscriber call |

Source: JICA Study Team

Table 6.2.2-2 Breakdown Quantities of IP Network Equipment (Baghdad)

| Province | Exchange Name | Existing Exchange Capacity | Planned Expansion Lines | Router | |
|---|---|---|---|---|---|
| | | | | Core | Edge |
| Baghdad | Rasheed(Sink) | 71,148 | 10,000 | 2 | 1 |
| | Al Fadaa | 28,352 | 15,000 | | 1 |
| | Mamoun | 30,000 | 10,000 | 2 | 1 |
| | Al Adhmiyia | 20,000 | 6,000 | 1 | 1 |
| | Sub Abkar | 25,000 | 5,000 | | 1 |
| | Al Wiya | 30,000 | 6,000 | 1 | 1 |
| | Al Dhobat | 22,078 | 10,000 | | 1 |
| | Al Dora | 35,659 | 10,000 | | 1 |
| | 14-July | 24,000 | 10,000 | | 1 |
| | Al Muadham | 20,000 | 6,000 | | 1 |
| | Al Bayya | 23,998 | 10,000 | | 1 |
| | AL Daudi | 25,000 | 6,000 | | 1 |
| | Al Kanssa | 10,000 | 6,000 | | 1 |
| | Kadhmyia | 33,336 | 10,000 | | 1 |
| | Al Ucophia | 5,000 | | | |
| | Salihyia | 20,000 | 8,000 | | 1 |
| | Al Cabzalya | 10,000 | 8,000 | | 1 |
| | Al Zafania | 10,000 | 5,000 | | 1 |
| | Abugraib | 9,500 | 5,000 | | 1 |
| | Al Shoala | 10,000 | 5,000 | | 1 |
| | Al Jehad | 10,000 | 5,000 | | 1 |
| | Al Entetesara | 10,000 | 5,000 | | 1 |
| | Jadirya | 12,190 | 5,000 | | 1 |
| | Al Madaen | 3,000 | 5,000 | | 1 |
| | Hay al salam | 5,000 | 5,000 | | 1 |
| | AL Mahmodiya | 10,000 | 5,000 | | 1 |
| | Al Khlisa | 2,880 | 5,000 | | 1 |
| | Al Taremea | 6,000 | 5,000 | | 1 |
| | Al Gadia | 27,000 | 6,000 | | 1 |
| | Sameraa | 10,000 | | | |
| | Zaeiuna | 25,000 | | | |
| | Al Ameen | 10,000 | 3,000 | | 1 |
| | **Sub-total** | **594,141** | **200,000** | **6** | **29** |

Source: JICA Study Team




Source: MOC

Figure 6.2.2-2 ITPC Baghdad Switch Diagram

Table 6.2.2-3 Breakdown Quantities of IP Network Equipment (Mosul)

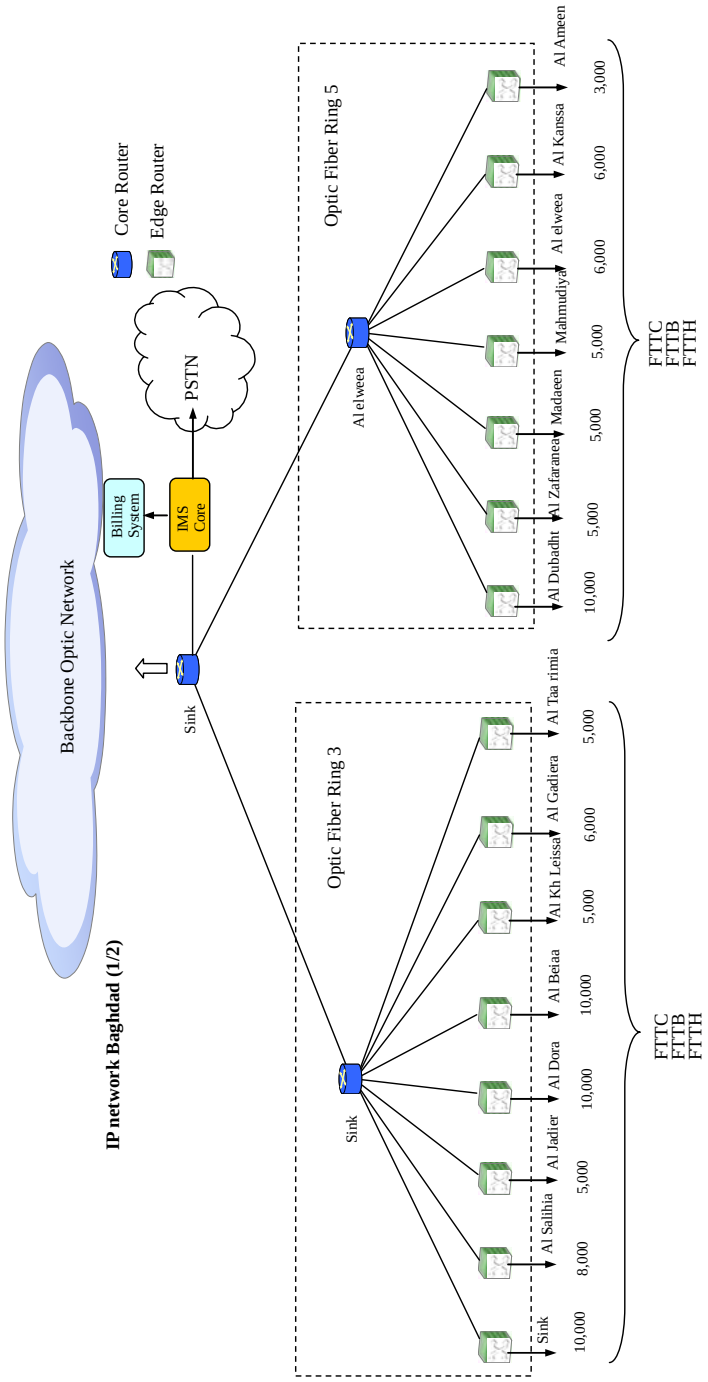
| Province | Exchange Name | Exsiting Exchange Capacity | Planned Expansion Lines | Router | |
|---|---|---|---|---|---|
| | | | | Core | Edge |
| Ninewa | Dawasa | 16,000 | 24,000 | | 1 |
| | Nainawa | 9,440 | 10,000 | 1 | 1 |
| | Al Zuhoor | 12,000 | 6,000 | | 1 |
| | Abu Tamman | 13,316 | | | |
| | Telafar | 4,000 | 16,000 | | 1 |
| | Al Hadbaa | 5,000 | | | |
| | Al Wahda | 5,000 | | | |
| | Hae Al Arabi | 5,000 | | | |
| | Al Markez | 5,000 | | | |
| | Zammer | 1,000 | | | |
| | Al Karama | 1,000 | | | |
| | Al Mansour | 1,008 | | | |
| | Al Rashidiya | 527 | | | |
| | Sengar | 3,000 | | | |
| | Al Alievadeia | 3,000 | | | |
| | Bashika | 3,000 | | | |
| | Telkafe | 3,000 | | | |
| | Rabiaa | 900 | | | |
| | Hadhar | 802 | | | |
| | Hammam Ali | 1,000 | | | |
| | Al Shekan | 930 | | | |
| | Makmor | 941 | | | |
| | Badosh | 207 | | | |
| | Al Shora | 575 | | | |
| | Rei Muun | 1,300 | | | |
| | **Sub-total** | **96,946** | **56,000** | **1** | **4** |

Source: JICA Study Team

Table 6.2.2-4 Breakdown Quantities of IP Network Equipment (Basra)

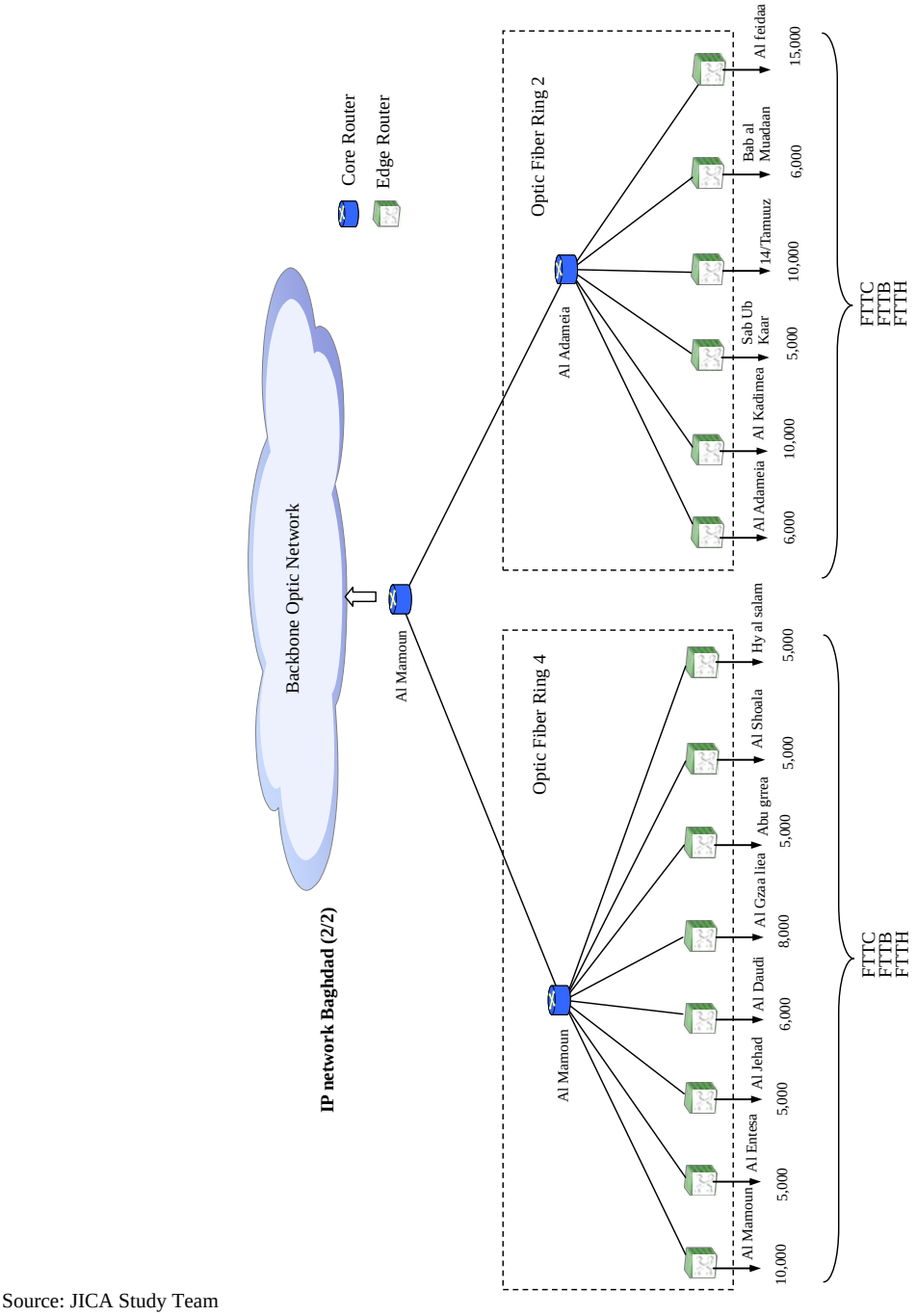
| Province | Exchange Name | Exsiting Exchange Capacity | Planned Expansion Lines | Router | |
|---|---|---|---|---|---|
| | | | | Core | Edge |
| Basrah | Al Ashar | 30,000 | 10,000 | 1 | 1 |
| | Al Andalus | 1,800 | 10,000 | | 1 |
| | Bab Zubair | 13,000 | 10,000 | | 1 |
| | Abo AI Qasib | 5,000 | | | |
| | Al Zubair | 5,000 | | | |
| | Al Qurna | 3,000 | | | |
| | Hamdan | 3,000 | | | |
| | Al Der | 3,000 | | | |
| | Um Qasur | 3,000 | | | |
| | Al Medaina | 3,000 | | | |
| | AL Hweir | 3,000 | | | |
| | Safwne | 1,000 | | | |
| | Al faw | 1,000 | | | |
| | Al Hartha | 3,000 | | | |
| | Shat Alaarab | 3,000 | | | |
| | **Sub-total** | **80,800** | **30,000** | **1** | **3** |

Source: JICA Study Team




Source: JICA Study Team

Figure 6.2.2-3 System Configuration (1) in Baghdad area




Source: JICA Study Team

Figure 6.2.2-4 System Configuration (2) in Baghdad area

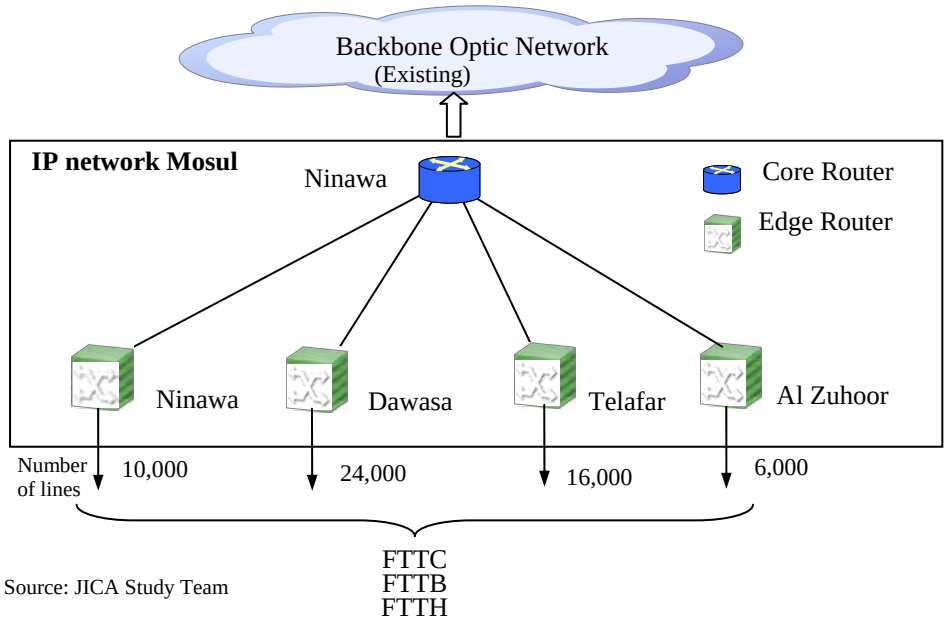



Figure 6.2.2-5 System Configuration in Mosul area

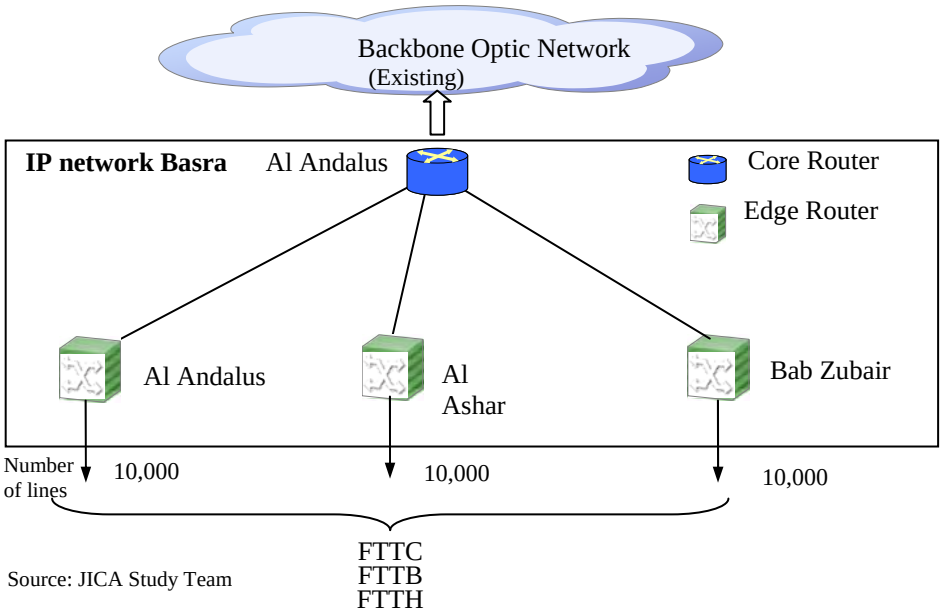



Figure 6.2.2-6 System Configuration in Basra area

(2) Local Access Network

1) Configuration of Local Access Network

Local access network will be established by such types of subscriber line access shown in Table 6.2.2-5. The typical system configuration is shown in Figure 6.2.2-7. FTTC cabinets are designed and provided at the target areas considering the population density and economical distances between the FTTC cabinet and the subscribers. FTTC cabinets will be connected to the edge router in the local exchange through 24-core optic fiber cable. These are installed inside the building to provide services principally to business subscribers. Meanwhile, FTTB cabinets functions fundamentally similar as FTTC cabinets, and are connected to the edge routers. FTTH is an optical fiber service with a single core optic fiber installed from the local exchange up to the subscribers' premises. The FTTH optic fiber line is terminated with the Optical Line Terminal (OLT) in the local exchange.

Table 6.2.2-5 Types of Local Access and Features

| Local Access Type | Services | Features |
|---|---|---|
| FTTC | ADSL, IP Phone, POTS | Broadband, High Speed, Construction Cost-effective |
| FTTB | VDSL, IP Phone, POTS | Broadband, High Speed, Applicable to Business |
| FTTH | G-PON, IP Phone | Optic Fiber Broadband Construction costs comparatively higher |

Source: JICA Study Team

2) Local Access Network Equipment

FTTC and FTTB cabinets have similar functions and are also referred to as multi-service access node (MSAN) composed of ADSL/VDSL ONU, sip access gateway, optical splitter and POTS splitter. FTTH consists of OLT, optical network terminal (ONT) and optical splitter. The quantities of these components are scalable according to the number of subscriber lines. Individual functions of components are described below:

FTTC

**ADSL ONU:**

ADSL ONU is housed in an FTTC cabinet and has same functions as VDSL ONU delivering ADSL services to the subscribers, as explained in section 5.2.5 (Local Access Network).

**Sip Access Gateway for FTTC:**

Sip access gateway for FTTC is accommodated in the FTTC cabinet and has same functions as that for FTTB.

**ADSL Modem:**

ADSL modem is a network equipment to be provided inside the premises of subscribers and transmits and receives to/from ONU in the FTTC cabinet.

**Optical Splitter:**

Optical splitter is an optical passive device to distribute a single optic fiber line to 32 lines and extends to the premises of subscriber.

**POTS Splitter:**

POTS splitter is a functional device that separates the voice portion from xDSL signal and is installed at both ends of ONU and xDSL Modem.

FTTB

**VDSL ONU:**

VDSL ONU is accommodated in an FTTB cabinet and functions as an aggregation of lines delivering VDSL services to the subscribers as explained in Section 5.2.5 - Local Access Network. It is the main component of the multi-service access node.

**Sip Access Gateway for FTTB:**

Sip access gateway for FTTB is accommodated in FTTB cabinet and functions as aggregation of POTS lines. It converts POTS to VOIP and SIP message packets that are transported to the edge router in the local exchange office. It is another main component of the multi-service access node.

**Optical Splitter:**

This component is the same as that used in FTTC

**POTS Splitter:**

This component is the same as that used in FTTC

FTTH

**OLT:**

OLT installed in the local exchange office, which is used to terminate optic fiber lines of GPON system. OLT transports IP packets to the edge router.

**ONT:**

ONT is an optical network equipment to be provided inside the premises of the subscriber. It transmits and receives packets to/from OLT located in the local exchange.

**Optical Splitter:**

This component is the same as that used in FTTC

3) FTTC Cabinet Additional Facilities

FTTC cabinet is accommodated inside the equipment shelter, enclosed with fences for security purposes. It is also provided with solar battery system for power outage.

4) Quantities of Local Access Network Equipment

Table 6.2.2-6 shows the total quantities of IP equipment while tables 6.2.2-7, 6.2.2-8, 6.2.2-9 show the breakdown of quantities for individual exchange. The quantities of individual components are calculated in conformity with the methods explained in the **References** paragraph under this section.

Table 6.2.2-6 Total quantities of Local Access Network Equipment

| Local Access Network Equipment | Quantity | unit | Remarks |
|---|---|---|---|
| VDSL ONU | 366 | set | Connecting with edge router in exchange and providing FTTB service |
| Sip Access Gateway for FTTB | 35 | set | Connecting old telephone signal to IP network |
| ADSL ONU | 1,930 | set | Connecting with edge router in exchange and providing FTTC service |
| Sip Access Gateway for FTTC | 249 | set | Connecting old telephone signal to IP network |
| OLT | 40 | set | Connecting with edge router in exchange and providing FTTH service |
| Solar Battery System | 249 | system | Supplying stable electric power to the outside cabinet for FTTC |
| Shelter including MDF & ODF | 249 | set | Protecting the outside cabinet for FTTC |
| VDSL Modem | 33,500 | pc | Supply only |
| ADSL Modem | 244,000 | pc | Supply only |
| ONT | 8,500 | pc | Supply only |

Source: JICA Study Team

Table 6.2.2-7 Breakdown for Local Access Network Equipment (Baghdad)

| Province | Exchange Name | Exsiting Exchange Capacity | Planned Expansion Lines | FTTB | | | FTTC | | | FTTH | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lines a) | VDSL ONU(96lines/ unit) | Sip Access Gateway (1000lines/ unit) | Lines b) | ADSL ONU (128lines/ unit) | Sip Access Gateway (1000lines/ unit) | Lines c) | OLT (10000lines/ unit) |
| Baghdad | Rasheed(Sink) | 71,148 | 10,000 | 3,000 | 32 | 3 | 6,000 | 47 | 6 | 1,000 | 1 |
| | Al Fadaa | 28,352 | 15,000 | 2,000 | 21 | 2 | 12,000 | 94 | 12 | 1,000 | 2 |
| | Mamoun | 30,000 | 10,000 | 2,000 | 21 | 2 | 7,000 | 55 | 7 | 1,000 | 1 |
| | Al Adhmiyia | 20,000 | 6,000 | 1,000 | 11 | 1 | 5,000 | 40 | 5 | | 1 |
| | Sub Abkar | 25,000 | 5,000 | 1,000 | 11 | 1 | 4,000 | 32 | 4 | | 1 |
| | Al Wiya | 30,000 | 6,000 | 1,000 | 11 | 1 | 5,000 | 40 | 5 | | 1 |
| | Al Dhobat | 22,078 | 10,000 | 1,500 | 16 | 2 | 8,000 | 63 | 8 | 500 | 1 |
| | Al Dora | 35,659 | 10,000 | 1,000 | 11 | 1 | 8,500 | 67 | 9 | 500 | 1 |
| | 14-July | 24,000 | 10,000 | 1,000 | 11 | 1 | 8,500 | 67 | 9 | 500 | 1 |
| | Al Muadham | 20,000 | 6,000 | 1,000 | 11 | 1 | 5,000 | 40 | 5 | | 1 |
| | Al Bayya | 23,998 | 10,000 | 1,000 | 11 | 1 | 8,500 | 67 | 9 | 500 | 1 |
| | AL Daudi | 25,000 | 6,000 | 1,000 | 11 | 1 | 5,000 | 40 | 5 | | 1 |
| | Al Kanssa | 10,000 | 6,000 | 1,000 | 11 | 1 | 5,000 | 40 | 5 | | 1 |
| | Kadhmyia | 33,336 | 10,000 | 1,000 | 11 | 1 | 8,500 | 67 | 9 | 500 | 1 |
| | Al Ucophia | 5,000 | | | | | | | | | |
| | Salihyia | 20,000 | 8,000 | 1,000 | 11 | 1 | 6,500 | 51 | 7 | 500 | 1 |
| | Al Cabzalya | 10,000 | 8,000 | 1,000 | 11 | 1 | 6,500 | 51 | 7 | 500 | 1 |
| | Al Zafania | 10,000 | 5,000 | 1,000 | 11 | 1 | 4,000 | 32 | 4 | | 1 |
| | Abugraib | 9,500 | 5,000 | 1,000 | 11 | 1 | 4,000 | 32 | 4 | | 1 |
| | Al Shoala | 10,000 | 5,000 | 1,000 | 11 | 1 | 4,000 | 32 | 4 | | 1 |
| | Al Jehad | 10,000 | 5,000 | 1,000 | 11 | 1 | 4,000 | 32 | 4 | | 1 |
| | Al Entetesara | 10,000 | 5,000 | 1,000 | 11 | 1 | 4,000 | 32 | 4 | | 1 |
| | Jadirya | 12,190 | 5,000 | 1,000 | 11 | 1 | 4,000 | 32 | 4 | | 1 |
| | Al Madaen | 3,000 | 5,000 | | | | 5,000 | 40 | 5 | | 1 |
| | Hay al salam | 5,000 | 5,000 | | | | 5,000 | 40 | 5 | | 1 |
| | AL Mahmodiya | 10,000 | 5,000 | 1,000 | 11 | 1 | 4,000 | 32 | 4 | | 1 |
| | Al Khlisa | 2,880 | 5,000 | | | | 5,000 | 40 | 5 | | 1 |
| | Al Taremea | 6,000 | 5,000 | | | | 5,000 | 40 | 5 | | 1 |
| | Al Gadia | 27,000 | 6,000 | 1,000 | 11 | 1 | 5,000 | 40 | 5 | | 1 |
| | Sameraa | 10,000 | | | | | | | | | |
| | Zaeiuna | 25,000 | | | | | | | | | |
| | Al Ameen | 10,000 | 3,000 | 1,000 | 11 | 1 | 2,000 | 16 | 2 | | 1 |
| | **Sub-total** | **594,141** | **200,000** | **29,500** | **321** | **30** | **164,000** | **1,301** | **164** | **6,500** | **30** |

Source: JICA Study Team

Table 6.2.2-8 Breakdown for Local Access Network Equipment (Mosul)

| Province | Exchange Name | Exsiting Exchange Capacity | Planned Expansion Lines | FTTB | | | FTTC | | | FTTH | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lines a) | VDSL ONU(96lines/ unit) | Sip Access Gateway (1000lines/ unit) | Lines b) | ADSL ONU (128lines/ unit) | Sip Access Gateway (1000lines/ unit) | Lines c) | OLT (10000lines/ unit) |
| Mosul (Ninewa) | Dawasa | 16,000 | 24,000 | 1,000 | 11 | 1 | 22,500 | 176 | 23 | 500 | 3 |
| | Nainawa | 9,440 | 10,000 | 500 | 6 | 1 | 9,500 | 75 | 10 | | 1 |
| | Al Zuhoor | 12,000 | 6,000 | 500 | 6 | 1 | 5,000 | 40 | 5 | 500 | 1 |
| | Abu Tamman | 13,316 | | | | | | | | | |
| | Telafar | 4,000 | 16,000 | | | | 16,000 | 125 | 16 | | 2 |
| | Al Hadbaa | 5,000 | | | | | | | | | |
| | Al Wahda | 5,000 | | | | | | | | | |
| | Hae Al Arabi | 5,000 | | | | | | | | | |
| | Al Markez | 5,000 | | | | | | | | | |
| | Zammer | 1,000 | | | | | | | | | |
| | Al Karama | 1,000 | | | | | | | | | |
| | Al Mansour | 1,008 | | | | | | | | | |
| | Al Rashidiya | 527 | | | | | | | | | |
| | Sengar | 3,000 | | | | | | | | | |
| | Al Alievadeia | 3,000 | | | | | | | | | |
| | Bashika | 3,000 | | | | | | | | | |
| | Telkafe | 3,000 | | | | | | | | | |
| | Rabiaa | 900 | | | | | | | | | |
| | Hadhar | 802 | | | | | | | | | |
| | Hammam Ali | 1,000 | | | | | | | | | |
| | Al Shekan | 930 | | | | | | | | | |
| | Makmor | 941 | | | | | | | | | |
| | Badosh | 207 | | | | | | | | | |
| | Al Shora | 575 | | | | | | | | | |
| | Rei Muun | 1,300 | | | | | | | | | |
| | **Sub-total** | **96,946** | **56,000** | **2,000** | **23** | **2** | **53,000** | **416** | **53** | **1,000** | **7** |

Source: JICA Study Team

Table 6.2.2-9 Breakdown for Local Access Network Equipment (Basra)

| Province | Exchange Name | Exsiting Exchange Capacity | Planned Expansion Lines | FTTB | | | FTTC | | | FTTH | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lines a) | VDSL ONU(96lines/ unit) | Sip Access Gateway (1000lines/ unit) | Lines b) | ADSL ONU (128lines/ unit) | Sip Access Gateway (1000lines/ unit) | Lines c) | OLT (10000lines/ unit) |
| Basrah | Al Ashar | 30,000 | 10,000 | 1,000 | 11 | 1 | 8,500 | 67 | 9 | 500 | 1 |
| | Al Andalus | 1,800 | 10,000 | | | | 10,000 | 79 | 10 | | 1 |
| | Bab Zubair | 13,000 | 10,000 | 1,000 | 11 | 1 | 8,500 | 67 | 9 | 500 | 1 |
| | Abo AI Qasib | 5,000 | | | | | | | | | |
| | Al Zubair | 5,000 | | | | | | | | | |
| | Al Qurna | 3,000 | | | | | | | | | |
| | Hamdan | 3,000 | | | | | | | | | |
| | Al Der | 3,000 | | | | | | | | | |
| | Um Qasur | 3,000 | | | | | | | | | |
| | Al Medaina | 3,000 | | | | | | | | | |
| | AL Hweir | 3,000 | | | | | | | | | |
| | Safwne | 1,000 | | | | | | | | | |
| | Al faw | 1,000 | | | | | | | | | |
| | Al Hartha | 3,000 | | | | | | | | | |
| | Shat Alaarab | 3,000 | | | | | | | | | |
| | **Sub-total** | **80,800** | **30,000** | **2,000** | **22** | **2** | **27,000** | **213** | **27** | **1,000** | **3** |

Source: JICA Study Team

5) Outside Plants

The outside plants for FTTC, FTTB and FTTH are included in this project according to the following scope of work. (See also Figure 7.1-2 under Section 7.1, Outline of Component)

FTTC

The 24-core optic fiber cables are laid from the local exchange to the FTTC cabinets.

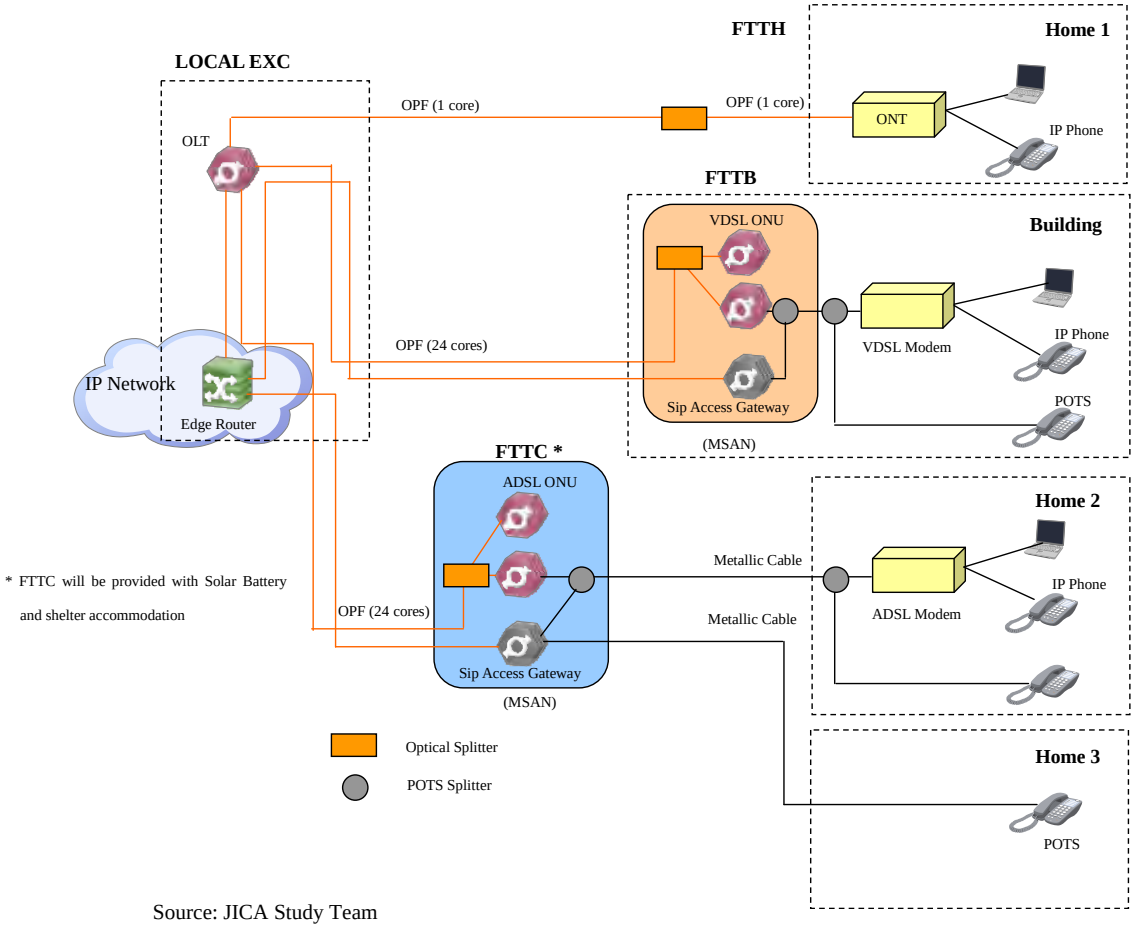
Copper wires are extended from the cabinets to closures located near the premises of subscribers. The connection from the closure to the subscriber's equipment is not included in the scope.

FTTB

The 24-core optic fiber cables are laid from the local exchange to FTTB cabinets installed inside the buildings. The connection from the cabinets to subscriber's equipment is not included in this scope.

FTTH

A single core optic fiber is laid from the local exchange to the optical splitter. The connection from the optical splitter to the subscriber's equipment is not included in this scope.




Source: JICA Study Team

Figure 6.2.2-7 System Configuration of Local Access Network

***References:***

The quantities of equipment installed for IP communication system and local access network shown in Table 6.2.2-1 and Table 6.2.2-6, respectively, are calculated as follows:

Planned Expansion Line

The number of planned expansion lines in each exchange is referred in Annex IV (Updated and Reviewed Fixed Telephone Expansion Plan by Phase 1,2,&3 in MTDS).

Lines for FTTB

The number of lines for FTTB is calculated from the number of FTTB sets with a capacity of 250 lines, and with a capacity of 500 lines mentioned in Annex 3-3-4-1 of the JETRO study.

For example, since eight FTTB sets with 250 lines and two FTTB sets with 500 lines are to be installed in Rasheed (Sink) according to Annex 3-3-4-1, the number of lines for FTTB in Rasheed (Sink) is calculated as:

$$8 \times 250 + 2 \times 500 = 3000 \text{ lines}$$

The number of other exchanges is calculated in the same manner.

VDSL ONU

A VDSL ONU has a capacity of 96 lines. Accordingly, the number of the VDSL modem for Rasheed(Sink) is calculated as:

$$3000 \div 96 \approx 32 \text{ sets}$$

Sip Access Gateway for FTTB

A sip access gateway has a capacity of 1000 lines. Accordingly, the number of the sip access gateway for FTTB in Rasheed (Sink) is calculated as:

$$3000 \div 1000 = 3 \text{ sets}$$

Lines for FTTC

The number of lines for FTTC is calculated same as the number of FTTB. Since 8 RU sets with a capacity of 500 lines and 2 RU sets with a capacity of 1000 lines are to be installed in Rasheed (Sink) according to the Annex3-3-4-1, the number of lines for FTTC in Rasheed (Sink) is calculated as;

$$8 \times 500 + 2 \times 1000 = 6000 \text{ lines}$$

The number of other exchange is calculated in the same manner.

ADSL ONU

An ADSL ONU has a capacity of 128 lines. Accordingly, the number of the ADSL ONU for Rasheed(Sink) is calculated as;

$$6000 \div 128 \approx 47 \text{ sets}$$

Sip Access Gateway for FTTC

A sip access gateway has a capacity of 1000 lines. Accordingly, the number of the sip access gateway for FTTC in Rasheed(Sink) is calculated as;

$$6000 \div 1000 = 6 \text{ sets}$$

Cabinet for FTTC

A cabinet is provided as per one (1) set of sip access gateway. The supply quantities are the same as Sip Access Gateway.

Solar Battery System for FTTC

Solar battery system is provided with one FTTC cabinet. The supply quantities are the same as that calculated for the sip access gateway.

Shelter including Fencing, MDF&ODF

Shelter, fencing and MDF&ODF are provided with solar battery system.

Lines for FTTH

The method of calculating the number of lines for FTTH is similar to that for determining the number of FTTB. Since two PON sets with a capacity of 500 lines are to be installed in Rasheed (Sink) according to Annex 3-3-4-1, the number of lines for FTTH in Rasheed (Sink) is calculated as:

$$500 \times 2 = 1000 \text{ lines}$$

OLT

An OLT has a capacity of 10,000 lines. FTTB and FTTC consist of 3,000 lines and 6,000 lines, respectively, while FTTH consists of 1,000 lines. Thus, the total quantity will be 10,000 lines. Hence, the number of OLT in Rasheed (Sink) is calculated as:

$$10000 \div 10000 = 1 \text{ set}$$

ADSL Modem

ADSL modem is provided with one (1) set as per FTTC line. Since the total number of FTTC lines are 244,000 as shown in Table 6.2-1 so The same quantities of ADSL modem are supplied. The installation of Modem is not included in this project and considered as a "Supply only item".

VDSL Modem

VDSL modem is provided with one (1) set as per FTTB line. Since the total number of FTTB lines are 33,500 as shown in Table 6.2-1 so The same quantities of VDSL modem are supplied. The installation of Modem is not included in this project and considered as a "Supply only item".

ONT

ONT is provided with one (1) set as per FTTH line. Since the total number of FTTH lines

are 8,500 as shown in Table 6.2-1 so The same quantities of ONT are supplied. The installation of OLT is not included in this project and considered as a “Supply only item”.

(3) OPMC

This component includes construction of an OPMC building and procurement of maintenance tools. An overview of OPMC is as follows.

- OPMC is a three-storey building and its size is approximately 30 m long and 50 m wide (total floor area 4,500 $m^2$)
- Store room for the construction and maintenance equipment is located at the ground floor
- Office room and restroom is at the 1st floor
- Training room and canteen is at the 2nd floor
- Outside space should be available for storing cables, poles and civil work materials as well as for parking lots during construction and repairing of vehicles
- OPMC management system for storing the plant maintenance and repair record is installed in the building.
- Size of the site for the building and outside spaces is approximately 100 m long and 100 m wide

(4) HRD

It is expected that HRD will facilitate the introduction of equipment and facilities procured under this project, and enhance ITPC/SCIS’s overall capabilities. Project training will be conducted in principle in Japan. Training course covers the following topics:

- IP network engineering
- Digital transmission engineering
- Outside plant engineering (including access network)
- Power plant engineering
- Traffic management
- Management & procurement

(5) NCC

In order to handle the increase of internet traffic in Iraq and provide a reliable internet service to subscribers, it is essential to enhance related facilities. The scope of work for this component is summarized below.

- Construction of NCC building

  The building is a three-storey structure with a size of approximately 12 m long and 18 m wide (total floor area 648$m^2$). Its ground floor is used for customer service purposes while its 1st floor is for network operation, data center and office rooms. Training room and canteen is

planned on the 2nd floor.

- Internet facilities
  - Internet satellite-based Earth Station
  - Servers for internet service operation
  - Router, Switching HUB and PC
  - DC Power Supply and DEG(50 kVA)
- ICT Training Facilities

### 6.2.3 Outline of Consultancy Service

Employment of a consultant is essential for the smooth implementation of the project and the transparency of procurement. An example of the "Terms of Reference (TOR)" for selecting consultants is discussed in the following section for reference.

(1) Scope of Consultancy Service

The consultancy services to be provided under this project shall be divided in two stages, namely, (1) Tendering Stage and (2) Procurement and Installation Stage.

1) Tendering Stage

The Consultant shall prepare a design report for the project and bidding documents for the construction contract. The consultant will also provide assistance to MOC in the preparation of bid evaluation report, conducting contract negotiation with successful bidder and preparation of contract documents.

a) The Consultant shall assist the Client in tendering procedures and in evaluation of the tenders submitted by the tenderers.

b) The Consultant shall assist the Client in negotiating with the tenderers and in awarding the Contract(s) to the successful tenderer.

2) Procurement and Installation Stage

The Consultant shall provide supervisory services for the Project to ensure that the works executed by the Contractor(s) under the Project are in compliance with the Contract(s) in coordination with the Client. The supervisory services shall include the following:

a) Inspection and approval of shop drawings and samples submitted by the Contractor.

b) Review and approval of design drawings and specifications.

c) Providing a representative and engineer(s) as necessary during the procurement and installation stage of the Project.

d) Carrying out a factory inspection and/or checking the factory inspection report of the equipment and materials procured for the Project.

e) Examining the materials, workmanship, and measurement and quantity in the Project as prescribed in the design documents.

f) Settling disputes or differences relating to the execution and progress of the procurement and installation of the equipment that may arise between the Client and the Contractor.

g) Issuing instructions where necessary to prevent delays in procurement and installation of the equipment.

h) Liaison with local authorities and other organizations other than the Client in order to minimize or avoid unnecessary delays or disputes.

i) Supervision of the Contractor's management of the marine and inland transportation of the equipment, security escort for the inland transportation, security guards for the sites and insurances to cover the works.

j) Review and approval of the Contractor's submissions, and negotiations with the Contractor on behalf of the Client when necessary.

k) Gathering and analyze the information of security situation in Iraq in order to give timely and appropriate instructions to the concerning parties.

l) Supervision of the Contractor's arrangement of the commissioning test and the operation and maintenance training for the Employer's engineers.

m) Providing administrative support for smooth implementation of the Project

n) Submission of reports as below.

- Design report
- Prequalification document and prequalification evaluation report
- Bid document and bid evaluation report
- Monthly/quarterly progress report during the construction stage
- Project Completion Report

(2) Required expertise and assignment schedule of experts to complete the above consulting services

The Consultants will be composed of both international (foreign) and local experts and an input of 685 Man-Months (337 person-months for international experts and 348 person-months for local experts) is required to fulfill the expected duties, assignments and responsibilities of the Consultant covering the length of 42 months in total.

Schedule of consultancy service is shown in Table 6.2.3-1.

Table 6.2.3-1 Schedule of Consultancy Service

| Ref. No. | Months of Consulting Services | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | M/M | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Calendar Years and Month | 2012 | | | | | | | | | | | | 2013 | | | | | | | | | 2014 | | | | | | | | | | | | | 2015 | | | | | | | | | | 2012 | 2013 | 2014 | 2015 | Total |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | | | | |
| | Professional Field | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A | Foreign Consulting Engineer | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Project Manager | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 9 | 9 | 7 | 4 | 29 |
| 2 | A Project Manager | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 10 | 12 | 9 | 39 |
| 3 | IP System Engineer(1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 9 | 6 | 10 | | 25 |
| 4 | IP System Engineer(2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 9 | 6 | 10 | | 25 |
| 5 | Billing System Engineer | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 | 5 | 10 | | 22 |
| 6 | Electrical Engineer | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 | 5 | 10 | 6 | 28 |
| 7 | Access Network Engineer (1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 | 5 | 10 | | 22 |
| 8 | Access Network Engineer (2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 | 5 | 10 | | 22 |
| 9 | Building Engineer (1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 | 5 | 6 | 9 | 27 |
| 10 | Building Engineer (2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 | 5 | 6 | 9 | 27 |
| 11 | Civil Work Engineer(1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 | 5 | 6 | | 18 |
| 12 | Civil Work Engineer(2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 | 5 | 5 | | 17 |
| 13 | Cost estimate | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | 3 | | | 8 |
| 14 | Home Support Engineer | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 9 | 9 | 6 | 28 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 100 | 83 | 111 | 43 | 337 |
| B | Local Engineer | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | IP System Engineer(1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 12 | | 24 |
| 2 | IP System Engineer(2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 12 | | 24 |
| 3 | Billing System Engineer | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 9 | | 21 |
| 4 | Electrical Engineer | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 10 | 6 | 28 |
| 5 | Access Network Engineer (1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 12 | | 24 |
| 6 | Access Network Engineer (2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 12 | | 24 |
| 7 | Access Network Engineer (3) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 10 | | 22 |
| 8 | Access Network Engineer (4) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 10 | | 22 |
| 9 | Access Network Engineer (5) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 8 | | 20 |
| 10 | Access Network Engineer (6) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 8 | | 20 |
| 11 | Building Engineer (1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 12 | | 24 |
| 12 | Building Engineer (2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 12 | 9 | 33 |
| 13 | Civil Work Engineer (1) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 10 | 9 | 31 |
| 14 | Civil Work Engineer (2) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | 4 | 10 | 9 | 31 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 112 | 56 | 147 | 33 | 348 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Foerign +Local | | | | 685 |

Source: JICA Study Team

(3) Employment of Local Consultants

It is difficult for foreign consultants to enter Iraq due to the present security situation in the country. Hence, foreign consultants will perform the major consultancy services such as the planning, detailed design work, site surveys and construction supervision works for the project in the neighboring countries (Jordan or Syria), until Iraq's security situation is much improved. The consultant shall employ local consultant to perform some components of the site survey, including supervision and conducting communications with the Iraqi side on behalf of the Consultant. Local consultants are shown in Table 6.2.3-2.

Table6.2.3-2 List of Local Consultants

| No. | Company Name | Established in | Turnover | No. of Employees | No. of Engineers | Location of HQ | Branch Office in Iraq |
|---|---|---|---|---|---|---|---|
| 1 | Alpha Tech Co. Ltd | 2004 | USD 3.2 mil | 23 | 12 | Baghdad | Bassra, Mosul, Kirkuk |
| 2 | Scientific Path Co.Ltd | 2005 | USD 4 mil | 20 | 10 | Baghdad | Bassra, Erbil |
| 3 | Al Masar Al Ilmi Co. Ltd | 2004 | USD 2.5 mil | 21 | 9 | Baghdad | Kirkuk |
| 4 | Al Karam Consultancy Co. Ltd. | 1992 | USD 5 mil | 18 | 11 | Baghdad | Kirkuk |
| 5 | Dal Al-Handasah | 1956 | - | 6,500 | - | Beirut | Baghdad, Samawa, Erbil |
| 6 | Khatib & Alami | 1959 | USD 37 mil | 1,000-5,000 | - | Beirut | Erbil |

Source: JICA Study Team

## 6.3 Cost Estimation

The capital cost for the project is estimated through its direct and indirect costs.

### 6.3.1 Direct Cost

The direct cost includes the following: (1) component mentioned in Section 6.2, (2) installation and test, (3) transportation and insurance, (4) civil construction, and (5) security guard. The component in Section 6.2 consists of the following: 1) IP communication system, 2) local access network, 3) OPMC, 4) HRD, and 5) NCC, as shown in Section 6.2.2.

The equipment cost of the IP communication system and local access network is estimated based on the estimated cost submitted by a manufacturer. The costs of OPMC, HRD, NCC and civil construction are based on the JETRO F/S report and other projects being implemented for the reconstruction of Iraq. The cost of transportation and insurance is set at 5% of total amount of components while the cost for the security guard is estimated at 10% of the sum of components cost, installation and test cost, transportation and insurance cost, and civil construction cost, in consideration of recent telecommunications projects and the present situation in Iraq.

### 6.3.2 Indirect Cost

The indirect cost estimation is conducted based on the following conditions and assumptions, referring to other projects being implemented in Iraq:

- Consultancy service cost is 7% of the direct cost.
- Project administration cost is 3% of the direct cost.
- Physical contingency is 20% of the sum of the direct cost, consultancy service cost and project administration cost.
- Price contingency for foreign currency is 1.3% per annum.

### 6.3.3 Capital Cost

The estimated capital cost for 286,000 lines in Baghdad, Basra and Mosul is shown in Table 6.3.3-1. Summary of the estimated capital cost is as follows:

Total: JPY 30,174 million
Equivalent Total: USD 370 million (Exchange rate: USD 1=JPY 81.55 as of Dec. 31, 2010)

Table 6.3.3-1 Capital Cost for 286k lines

| Items | | FC (Million JPY) | Equivalent (Million USD) | Remarks |
|---|---|---|---|---|
| 1.Direct Cost | | | | |
| (1)Component | a | **14,636** | **179** | |
| 1) IP Communication System | b | 2,762 | 34 | |
| 2) Local Access Network | c | 10,797 | 132 | (Baghdad,Basra,Mosul: 286k lines) |
| 3) Outside Plant Maintenance Center (OPMC) | d | 326 | 4 | |
| 4) Human Resource Development (HRD) | e | 351 | 4 | |
| 5) New Communication Center (NCC) | f | 400 | 5 | |
| (2)Installation and Test | g | 4,559 | 56 | IP com. System and Local Access network |
| (3)Transportation and Insurance | h | 732 | 9 | **5% of 'a'** |
| (4)Civil Construction | i | 450 | 6 | OPMC and NCC |
| (5)Security Guard | j | 2,038 | 25 | **10% of ('a'+'g'+'h'+'i')** |
| **Total 1** | k | **22,415** | **275** | |
| | | | | |
| 2.Indirect Cost | | | | |
| (1)Consultancy Service | l | **1,569** | **19** | **7% of 'k'** |
| (2)Project Administration | m | **672** | **8** | **3% of 'k'** |
| (3)Physical Contingencies | n | **4,931** | **60** | **20% of ('k'+'l'+'m')** |
| (4)Price Contingencies | o | **587** | **7** | **FC: 1.3% for 'k'** |
| **Total 2** | p | **7,759** | **95** | |
| | | | | |
| **Grand total** | | **30,174** | **370** | **k'+'p'** |

**Note**
1.Consultancy Services is 7% of the direct cost.
2.Project Administration cost is 3% of the direct cost.
3.Physical contingency is 20% of the direct cost, the consultancy service and the project administration in the indirect cost.
4.Price contingency is referred to soft loan project in Iraq as follows: Foreign currency (FC) is 1.3 % per annum.

Source: JICA Study Team

### 6.3.4 Breakdown of Each Component

Based on the quantity of equipment which is mentioned in Section 6.2.2, the price breakdown of each component is shown in Table 6.3.4-1, Table 6.3.4-2 and Table 6.3.4-3.

Table 6.3.4-1 Cost of IP communication system

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| IP Communication System | **IP Network Equipment** | | | | | |
| | IMS core | 1system | | 2,500,000 | 30,656 | Including software and hardware |
| | Core Router | 8 | 5,000 | 40,000 | 490 | |
| | Edge Router | 36 | 2,000 | 72,000 | 883 | |
| | Charging/Billing system | 1system | | 150,000 | 1,839 | |
| | **Total** | | | **2,762,000** | **33,869** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | IP Equipment | 1lot | | 276,200 | 3,387 | 10% of IP Equipment Cost |
| | **Total** | | | **276,200** | **3,387** | |
| Grand Total | | | | **3,038,200** | **37,256** | |

Source: JICA Study Team

Table 6.3.4-2 Cost of Local Access Network

Appendix 2 Breakdown of Local Access Network System Cost

Unit: 1000Yen

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| Local Access Network | **Local Access Network Equipment1** | | | | | |
| | VDSL ONU | 366 | 1,200 | 439,200 | 5,386 | FTTB for 33,500lines |
| | Sip Access Gateway for FTTB | 35 | 3,000 | 105,000 | 1,288 | |
| | ADSL ONU | 1,930 | 1,500 | 2,895,000 | 35,500 | FTTC for 244,000lines |
| | Sip Access Gateway for FTTC | 249 | 3,000 | 747,000 | 9,160 | |
| | OLT | 40 | 400 | 16,000 | 196 | FTTH for 8,500lines |
| | Solar Battery System | 249 | 1,500 | 373,500 | 4,580 | |
| | Shelter including MDF & ODF | 249 | 1,000 | 249,000 | 3,053 | |
| | **Subtotal (Local Access Equipment1)** | | | **4,824,700** | **59,162** | |
| | **Local Access Network Equipment2** | | | | | Supply only |
| | VDSL Modem | 33,500 | 5 | 167,500 | 2,054 | |
| | ADSL Modem | 244,000 | 5 | 1,220,000 | 14,960 | |
| | ONT | 8,500 | 10 | 85,000 | 1,042 | |
| | **Subtotal (Local Access Equipment2)** | | | **1,472,500** | **18,056** | |
| | | | | | | |
| | **Cabling material** | 1lot | | **4,500,000** | **55,181** | *1 |
| | | | | | | |
| | **Total** | | | **10,797,200** | **132,400** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | Local Access Equipment1 | 1lot | | 482,470 | 5,916 | 10% of Local Access Equipment1 Cost |
| | Cable Installation | 1lot | | 3,800,000 | 46,597 | *2 |
| | **Total** | | | **4,282,470** | **52,513** | |
| Grand Total | | | | **15,079,670** | **184,913** | |

Remarks
The amount is calculated as shown below.
*1:8,545,990kiloYen*286k lines/549k lines=4,500,000
8,545,990kilo Yen is sum of material cost for 1.Civil work, 2. Pole, 3. Metarllic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.
*2: 7,357,873kiloYen*286k lines/549k lines=3,800,000

Source: JICA Study Team

Table 6.3.4-3 Cost of OPMC, HRD and NCC

| Component | Breakdown | Quantity | Amount (1000JPY) | Amount (1000USD) |
|---|---|---|---|---|
| OPMC | Maintenance Tool and Equipment | 1lot | 326,000 | 3,998 |
| | OPMC Building (1500m2 x 3 floor =4,500m2) | 1lot | 390,000 | 4,782 |
| | Total | | 716,000 | 8,780 |
| HRD | Training Facilities | 1lot | 43,300 | 531 |
| | Training Cost for IP Telephone Network | 1lot | 308,000 | 3,777 |
| | Total | | 351,300 | 4,308 |
| NCC | Equipment and Facility | 1lot | 400,000 | 4,905 |
| | Communication Center Building (216m2 x 3 floor =648m2) | 1lot | 60,000 | 736 |
| | Total | | 460,000 | 5,641 |

Source: JICA Study Team

### 6.3.5 Case Combination of Target Areas

The capital cost for 286,000 lines is estimated as shown in Table 6.3-1. In this clause, costs for one and two of the three areas are estimated assuming the following seven cases for reference in order to flexibly correspond to changes in the scope of the project.

- Case-1: Baghdad, Basra and Mosul
- Case-2: Baghdad and Basra
- Case-3: Baghdad and Mosul
- Case-4: Basra and Mosul
- Case-5: Baghdad
- Case-6: Basra
- Case-7: Mosul

Table 6.3.5-1 shows a quantity summed up in the respective cases on the basis of that mentioned in

Section 6.2.2.

Table 6.3.5-1 Quantity for Each case

| Case | Target Area | | | Planned Expansion Lines | IP Communication Systems | | Local Access Network | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Router | | FTTB | | | FTTC | | | FTTH | |
| | | | | Lines a)+b)+c) | Core | Edge | Lines a) | VDSL ONU (96lines/unit) | Sip Access Gateway (1000lines /unit) | Lines b) | ADSL ONU (128lines/ unit) | Sip Access Gateway (1000lines /unit) | Lines c) | OLT |
| Case-1 | Baghdad | Basra | Mosul | 286,000 | 8 | 36 | 33,500 | 366 | 35 | 244,000 | 1,930 | 249 | 8,500 | 40 |
| Case-2 | Baghdad | Basra | | 230,000 | 7 | 32 | 31,500 | 343 | 32 | 191,000 | 1,514 | 195 | 7,500 | 33 |
| Case-3 | Baghdad | | Mosul | 256,000 | 7 | 33 | 31,500 | 344 | 33 | 217,000 | 1,717 | 221 | 7,500 | 37 |
| Case-4 | | Basra | Mosul | 86,000 | 2 | 7 | 4,000 | 45 | 5 | 80,000 | 629 | 82 | 2,000 | 10 |
| Case-5 | Baghdad | | | 200,000 | 6 | 29 | 29,500 | 321 | 30 | 164,000 | 1,301 | 167 | 6,500 | 30 |
| Case-6 | | Basra | | 30,000 | 1 | 3 | 2,000 | 22 | 2 | 27,000 | 213 | 28 | 1,000 | 3 |
| Case-7 | | | Mosul | 56,000 | 1 | 4 | 2,000 | 23 | 3 | 53,000 | 416 | 54 | 1,000 | 7 |

Source: JICA Study Team

Table 6.3.5-2 Capital Cost for Each Case

| Case | Target Area | | | Line | Cost | |
|---|---|---|---|---|---|---|
| | | | | (k lines) | (Million JPY) | Equivalent (Million USD) |
| Case-1 | Baghdad | Basra | Mosul | 286 | 30,174 | 370 |
| Case-2 | Baghdad | Basra | | 230 | 25,636 | 314 |
| Case-3 | Baghdad | | Mosul | 256 | 27,680 | 339 |
| Case-4 | | Basra | Mosul | 86 | 11,516 | 141 |
| Case-5 | Baghdad | | | 200 | 23,146 | 284 |
| Case-6 | | Basra | | 30 | 7,088 | 87 |
| Case-7 | | | Mosul | 56 | 9,174 | 112 |
| Note: USD 1= 81.55USD | | | | | | |

Source: JICA Study Team

The summary of the capital cost for each case is shown in Table 6.3.5-2. Cost for Case-1 refers to Table 6.3.3-1. Breakdown of cost for each case is attached in Appendix A.

Each case includes costs for OPMC, HRD, NCC, IMS core system and charging/billing system. Even if the number of lines is reduced to half, the cost is not similarly reduced to a half because the costs of OPMC, HRD, NCC, IMS core system and charging/billing system are differently estimated in each case.

## 6.4 Financial and Economic Analysis

### 6.4.1 Methodology and Basic Assumption

(1) Methodology

In conducting financial and economic analyses of the project, the financial and economic values of cost and benefit expressed by a discounted cash flow are compared. The internal rate of return (IRR), net present value (NPV) and benefit-cost ratio (B/C) are employed as key indicators in the evaluation. NPV can be expressed by the following formula:

$$NPV = \sum_{n=0}^{n} \left\{ \frac{B_n}{(1+r)^n} \right\} - \sum_{n=0}^{n} \left\{ \frac{C_n}{(1+r)^n} \right\}$$

Where: n = number of years of project life, Bn = benefit in year n, Cn= cost in year n, r = discount rate

IRR is the value of discount rate at which the value of NPV becomes 0.

(2) Basic Assumption

The following basic assumptions are made for the financial and economic analyses:

1) Starting Year of the Project
   The starting year of the project is assumed to be in 2012.

2) Project Life
   Project life, which is the period subjected to evaluation, is 18 years including four years of construction period from 2012 to 2015, and assuming expected lifetime (economic life) of seven years for the IP communication system and 14 years for other systems. For this reason, the replacement cost for the IP communication system is allocated on the 8th year (2022) after the completion of installation in 2014.

3) Price Escalation
   Price escalation during the construction period is considered at 1.3% for the foreign currency of the direct cost.

4) Handling of Interest on Loan
   As this analysis is conducted mainly for the purpose of calculating the IRR on gross capital, interest on loan is also excluded.

5) Exchange Rate
   The following exchange rates as of December 31, 2010 are adopted:

   USD 1 = JPY 81.55 = IQD 1,178.61, JPY 1 = IQD 14.45

   .

### 6.4.2 Financial Analysis

(1) Financial Cost

The financial cost consists of the capital cost (direct cost and indirect cost) and the operation and maintenance (O&M) cost.

1) Capital Cost

The capital cost of Case-1 (Total of 286,000 lines for Baghdad, Basra and Mosul) is shown in Table 6.4.2-1.

Table 6.4.2-1 Capital Cost (Financial Cost) (Unit: Mil JPY)

| Description | 286k lines (Baghdad, Basra and Mosul) |
|---|---|
| **1.Direct Cost** | |
| (1) Component | 14,636 |
| 1) IP Communication System | 2,762 |
| 2) Local Access Network | 10,797 |
| 3) Outside Plant Maintenance Center (OPMC) | 326 |
| 4) Human Resource Development (HRD) | 351 |
| 5) New Communication Center (NCC) | 400 |
| (2) Installation and Test | 4,559 |
| (3) Transportation and Insurance | 732 |
| (4) Civil Construction | 450 |
| (5) Security Guard | 2,038 |
| **Total 1** | **22,415** |
| **2. Indirect Cost** | |
| (1) Consultancy Services | 1,569 |
| (2) Project Administration | 672 |
| (3) Physical Contingency | 4,931 |
| (4) Project Contingency | 587 |
| **Total 2** | **7,759** |
| **Grand Total** | **30,174** |

Source: JICA Study Team

Disbursement of the capital cost during the implementation period of 2012 to 2015 is calculated using the allocation percentages shown in Table 6.4.2-2. The allocated disbursement is shown in Table 6.4.2-3.

Table 6.4.2-2 Disbursement of Capital Cost (percentage) (Unit: %)

| | 2012 | 2013 | 2014 | 2015 | Total |
|---|---|---|---|---|---|
| Component | - | 20 | 80 | - | 100 |
| Installation of equipment | - | | 90 | 10 | 100 |
| Transportation | - | - | 100 | - | 100 |
| Civil construction | - | 10 | 50 | 40 | 100 |
| Security guard | - | 20 | 70 | 10 | 100 |
| Consultancy services | 30 | 20 | 40 | 10 | 100 |
| Project Administration | - | 20 | 70 | 10 | 100 |
| Physical contingency | - | 20 | 70 | 10 | 100 |
| Project contingency | - | 20 | 70 | 10 | 100 |

Source: JICA Study Team

Table 6.4.2-3 Disbursement of Capital Cost (Unit: Mil. JPY)

| | 2012 | 2013 | 2014 | 2015 | Total |
|---|---|---|---|---|---|
| Component | 0 | 2,927 | 11,709 | 0 | 14,636 |
| Installation of equipment | 0 | 0 | 4,103 | 456 | 4,559 |
| Transportation | 0 | 0 | 732 | 0 | 732 |
| Civil construction | 0 | 45 | 225 | 180 | 450 |
| Security guard | 0 | 408 | 1,427 | 204 | 2,038 |
| Consultancy services | 471 | 314 | 628 | 157 | 1,569 |
| Project Administration | 0 | 134 | 470 | 67 | 672 |
| Physical contingency | 0 | 986 | 3,452 | 493 | 4,931 |
| Project contingency | 0 | 117 | 411 | 59 | 587 |
| **Total** | **471** | **4,932** | **23,156** | **1,616** | **30,174** |

Source: JICA Study Team

2) Operation and Maintenance (O&M) Cost

O&M cost is defined as incurred costs related to administration, marketing and sales, network operation, repair, and maintenance of the telecommunications system to be provided under this project from the start of its operation. The O&M cost is expected to decline starting from 2016 following the completion of the project. The amount of annual O&M cost is assumed at 10% of the capital cost for this study by referring to the Guidelines for the Economic Analysis of Telecommunications Projects, issued by the Economic and Development Resource Center in September 1997 (hereafter referred to "the Guidelines"), in which O&M cost is described as typically around 10% of the capital cost of the new investment.

### (2) Financial Benefit

The benefit of this project is estimated by calculating the net increase of benefit resulting from the increase of users for fixed telephones and internets in Baghdad, Basra and Mosul by newly developing 286,000 telephone lines.

1) Fees and Charges

Fees and charges of the telecommunication services as of 2010 are shown in Table 6.4.2-4. Subscription fee of internet services is not charged at present in order to increase the number of internet users. The monthly charge, which was USD 350 in 2007, has also been reduced to USD 25~30. MOC has the intention that the current fees and charges of internet services will be maintained in the future so that internet users can be widely and rapidly expanded.

Table 6.4.2-4 Fees and Charges for Fixed Telephones and Internets as of 2010

| Category | Fees/Charges |
|---|---|
| 1.Telephone Services | |
| Subscription fee | IQD 100,000 |
| Basic charge per month | IQD 500 |
| Local call per minute | IQD 5 |
| Toll call charge per minute | IQD 20 |
| International call charge per minute | IQD 500 |
| 2.Internet Services | |
| Subscription fee | USD 0 |
| Monthly charge | USD 30 |

Source: MOC

2) Expected Number of Calls

Expected increase in the number of calls after the completion of the project is estimated by the following assumptions, as shown in Table 6.4.2-5:

Table 6.4.2-5 Assumptions of Expected Number of Calls of the Project

| Description | Assumption |
|---|---|
| 1.Calling rate per line (Erl) | 0.2 |
| 2.Average holding time (sec) | 120 |
| 3.Call distribution for busy hour (10-11 a.m.) | |
| a)Local call | 70 % |
| b)Toll call | 25 % |
| c)International call | 5 % |
| 4.Call Completion Ratio (CCR) | |
| a)Local call | 99 % |
| b)Toll call | 65 % |
| c)International call | 25 % |
| 5.Average call duration | |
| a)Local call | 4 min. |
| b)Toll call | 4 min. |
| c)International call | 4 min. |

Source: MOC

The busy hour is set at one hour between 10:00 a.m. and 11:00 a.m. The number of calls during the busy hour is calculated as:

Number of call/hr = Calling rate per line (Erl) / Average holding time (hr)

= 0.2 (Erl)/ (120 sec/3,600 sec)

= 6

Thus, the total number of calls for the 286,000 lines is obtained as 1,716,000 calls/hr (=6 x 286,000). Based on the number of calls/hr (1,716,000 calls/hr), total effective calls/hr for each call category is calculated by multiplying the call distribution ratio and CCR.

The effective calls/year for each call category is obtained as shown in Table 6.4.2-6 assuming that the total call hours in one year is 2,400 hours (=8 hours x 300 days).

Table 6.4.2-6 Total Effective Calls per Year

| Call Category | Number of call/hr | CCR | Total effective calls /year |
|---|---|---|---|
| 1.Local call | 1,201,200 | 0.99 | 2,854,051,200 |
| 2.Toll call | 429,000 | 0.65 | 669,240,000 |
| 3.International call | 85,800 | 0.25 | 51,480,000 |
| Total | **1,716,000** | | **3,574,771,200** |

Source: JICA Study Team

3) Benefit of the Project

Benefit of the project is estimated as the incoming revenues from subscription fees and charges for the phone calls and internet services. Taking the present collection rate of fees and charges into consideration, collection rates for the analysis is assumed as follows:

- Collection rate of subscription fee: 100%
- Collection rate of charge for fixed telephone: 50%
- Collection rate of charge for internet: 50%

In addition, it is assumed that 100% of the total incoming revenue from call charges (local and international calls) is allocated to the revenue of this project, because full income brought by the expansion of the 286K lines is expected by the project. Total revenue of the project per year is calculated considering total effective calls given in Table 6.4.2-6 and the above assumptions. The result of calculation is shown in Table 6.4.2-7.

Table 6.4.2-7 Total Revenue of the Project per year (Unit: Mil IQD)

| Call Category | Revenue |
|---|---|
| 1. Fixed Telephones | |
| 1) Subscription fee | 28,600 |
| 2) Basic charge | 858 |
| 3) Local call | 28,540 |
| 4) Toll call | 26,770 |
| 5) International call | 51,480 |
| 2. Internet | 60,675 |
| **Total** | **196,923** |

Source: JICA Study Team

Note: Revenue of subscription fee=286,000x100,000(IQD/line) x1.0=28,600 Mil IQD
Revenue of basic charge=286,000x500(IQD/month) x12 x0.5=858 Mil IQD
Revenue of local call=2,854,051,200x4(min) x5(IQD/min) x0.5x1.0=28,540 Mil IQD
Revenue of toll call=669,240,000X4(min) x20(IQD/min) x0. 5x1.0=26,770 Mil IQD
Revenue of international call=51,480,000x4(min) x500(IQD/min) x0.5x1.0=51,480 Mil IQD
Revenue of internet=286,000 x30(USD) x12(month) x0.5 x 1,178.61=60,675Mil IQD

## (3) Calculation of Financial Internal Rate of Return (FIRR)

The calculation sheet of FIRR for Case-1 is shown in Table 6.4.2-8. NPV and B/C are obtained by using discount rate of 10.0%.

Table 6.4.2-8 Calculation Sheet of FIRR (Case-1 Baghdad, Basra and Mosul)

Case-1 Baghdad/Basra/Mosul (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 6,802 | 0 | 6,802 | 0 | 0 | 0 | -6,802 |
| 2 | 13 | 48,838 | 22,424 | 0 | 71,262 | 0 | 0 | 0 | -71,262 |
| 3 | 14 | 262,925 | 71,681 | 0 | 334,606 | 0 | 0 | 0 | -334,606 |
| 4 | 15 | 12,134 | 11,212 | 0 | 23,345 | 0 | 0 | 0 | -23,345 |
| 5 | 16 | 0 | 0 | 43,601 | 43,601 | 136,248 | 37,551 | 173,799 | 130,197 |
| 6 | 17 | 0 | 0 | 43,601 | 43,601 | 107,648 | 54,098 | 161,746 | 118,145 |
| 7 | 18 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 8 | 19 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 9 | 20 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 10 | 21 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 11 | 22 | 39,911 | 0 | 43,601 | 83,512 | 107,648 | 60,675 | 168,323 | 84,811 |
| 12 | 23 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 13 | 24 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 14 | 25 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 15 | 26 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 16 | 27 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 17 | 28 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 18 | 29 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |

| | |
|---|---|
| FIRR | 20.9% |
| NPV | 280,825 |
| PV(cost) | 565,788 |
| PV(benefit) | 846,612 |
| B/C | 1.50 |

Note: Capital Cost is converted to ID.
: Direct cost in 2022 is estimated for replacement of IP Communication System.

Source: JICA Study Team

The results of financial analysis for the other cases (Case-2 ~ Case-7) including that for Case-1 are summarized in Table 6.4.2-9 and detailed calculation is attached in Appendix B.

Table 6.4.2-9 Results of Financial Analysis

| Case | Target Area | FIRR (%) | NPV (Mil IQD) | B/C |
|---|---|---|---|---|
| Case-1 | Baghdad/Basra/Mosul | 20.9 | 280,825 | 1.50 |
| Case-2 | Baghdad/Basra | 19.3 | 198,185 | 1.41 |
| Case-3 | Baghdad/Mosul | 20.1 | 236,346 | 1.45 |
| Case-4 | Basra/Mosul | 14.4 | 38,304 | 1.18 |
| Case-5 | Baghdad | 18.1 | 153,633 | 1.35 |
| Case-6 | Basra | -2.0 | -46,712 | 0.66 |
| Case-7 | Mosul | 8.6 | -9,082 | 0.95 |

Source: JICA Study Team

### (4) Sensitivity Analysis

#### 1) Assumptions for Analysis

The sensitivity analysis is needed to identify project risks such as change of cost and revenue. The following three scenarios are considered as the project risks:

- Scenario 1: Capital cost is increased by +10%.
- Scenario 2: O&M cost is increased by +10%.
- Scenario 3: Revenue is decreased by −10% and -20%.

#### 2) Results of Analysis

Sensitivity analysis is carried out for Case-1 and the results are shown in Table 6.4.2-10.

Table 6.4.2-10 Results of Sensitivity Analysis for Case-1

| Scenario | | FIRR (%) | NPV (Mil IQD) | B/C |
|---|---|---|---|---|
| Base | | 20..9 | 280,825 | 1.50 |
| 1. Capital cost | +10% | 18.3 | 225,645 | 1.36 |
| 2. O&M cost | +10% | 20.2 | 258,886 | 1.44 |
| 3. Revenue | -10% | 18.0 | 196,163 | 1.35 |
| | -20% | 14.8 | 115,502 | 1.20 |

Source: JICA Study Team

### 6.4.3 Economic Analysis

(1) Methodology and Basic Assumption

In conducting economic analysis, the economic effect brought by the project is evaluated from the viewpoint of national economy. The basic assumptions for the analysis in terms of the project life, starting year of the project, price escalation, and handling of interest on loan are the same as those of the financial analysis.

1) Opportunity Cost of Capital

The opportunity cost of capital adopted as the reference value for the economic internal rate of return (EIRR) in most cases is between 10% and 12%. Here, it is assumed to be 10% as it is commonly applied in economic analysis.

2) Standard Conversion Factor (SCF)

In the economic analysis, the capital cost needs to be converted into economic price using an appropriate SCF. In this study, the SCF is assumed to be 0.8 by referring to the Guidelines.

(2) Economic Cost

The economic cost consists of the capital cost and O&M cost, which are calculated in the same way as in the financial analysis. However, the costs are adjusted to reflect the opportunity cost to the national economy and multiplied by SCF (=0.8) in the economic analysis although the financial analysis does not require such adjustment.

(3) Economic Benefit

To adjust revenue to benefit for the economic analysis, the financial benefit is multiplied by the following: 1) consumption tax, 2) economic valuation factor (EVF), and 3) SCF. For this study, these figures are assumed as follows:

1) Consumption tax : not in effect

2) EVF : 1.3 (as a typical EVF for telecommunications projects)

3) SCF : 0.8

Then, the economic benefit is obtained as:

= (financial benefit) x 1.0 x 1.3 x 0.8

= (financial benefit) x 1.04

## (4) Calculation of Economic Internal Rate of Return (EIRR)

The calculation sheet of EIRR for Case-1 is shown in Table 6.4.3-1. NPV and B/C are obtained by using a discount rate of 10.0%.

Table 6.4.3-1 Calculation Sheet of EIRR (Case-1)

Case-1 Baghdad/Basra/Mosul (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 5,441 | 0 | 5,441 | 0 | 0 | 0 | -5,441 |
| 2 | 13 | 39,070 | 17,939 | 0 | 57,009 | 0 | 0 | 0 | -57,009 |
| 3 | 14 | 210,340 | 57,345 | 0 | 267,685 | 0 | 0 | 0 | -267,685 |
| 4 | 15 | 9,707 | 8,969 | 0 | 18,676 | 0 | 0 | 0 | -18,676 |
| 5 | 16 | 0 | 0 | 34,881 | 34,881 | 141,698 | 39,053 | 180,751 | 145,869 |
| 6 | 17 | 0 | 0 | 34,881 | 34,881 | 111,954 | 56,262 | 168,216 | 133,335 |
| 7 | 18 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 8 | 19 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 9 | 20 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 10 | 21 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 11 | 22 | 31,929 | 0 | 34,881 | 66,810 | 111,954 | 63,102 | 175,056 | 108,246 |
| 12 | 23 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 13 | 24 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 14 | 25 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 15 | 26 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 16 | 27 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 17 | 28 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 18 | 29 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| | SCF | 0.8 | 0.8 | 0.8 | | 1.04 | 1.04 | | |

| | |
|---|---|
| EIRR | 28.7% |
| NPV | 427,847 |
| PV(cost) | 452,630 |
| PV(benefit) | 880,477 |
| B/C | 1.95 |

Source: JICA Study Team

The results of economic analysis for the other cases (Case-2 ~ Case-7) including that for Case-1 are summarized in Table 6.4.3-2 and detailed calculation is attached in Appendix B.

Table 6.4.3-2 Results of Economic Analysis

| Case | Target Area | EIRR (%) | NPV (Mil ID) | B/C |
|---|---|---|---|---|
| Case-1 | Baghdad/Basra/Mosul | 28.7 | 427,847 | 1.95 |
| Case-2 | Baghdad/Basra | 27.0 | 321,969 | 1.83 |
| Case-3 | Baghdad/Mosul | 27.8 | 370,631 | 1.89 |
| Case-4 | Basra/Mosul | 21.4 | 90,628 | 1.52 |
| Case-5 | Baghdad | 25.7 | 264,694 | 1.76 |
| Case-6 | Basra | 5.7 | -15,823 | 0.86 |
| Case-7 | Mosul | 15.6 | 32,471 | 1.23 |

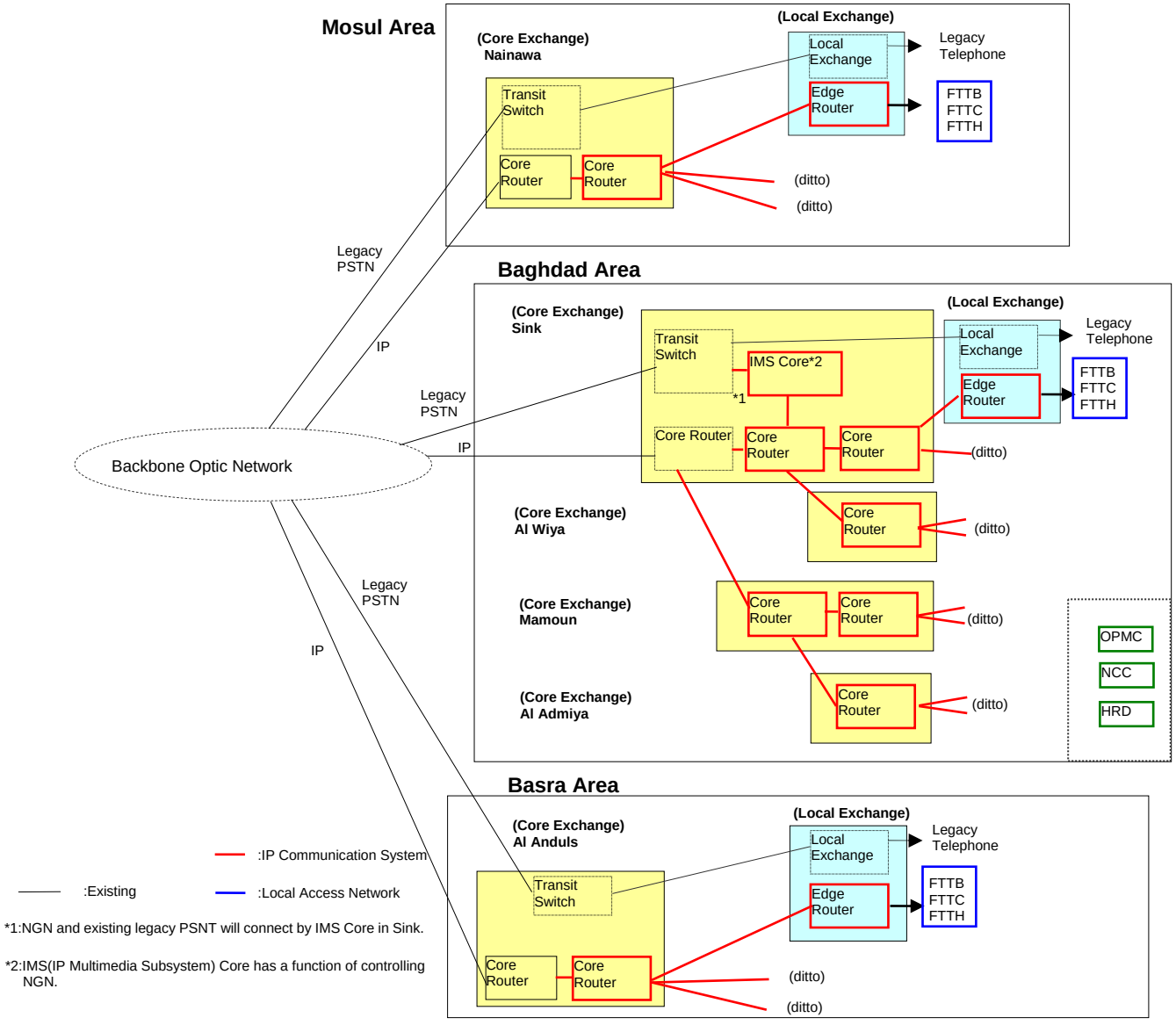
Source: JICA Study Team

# *Chapter 7*
# *Implementation Plan*

# CHAPTER 7 IMPLEMENTATION PLAN FOR THE PROJECT

## 7.1 Outline of Component

Outline of the components for the project is summarized in Figure 7.1-1. Of the components, IP communication system and 286,000 lines of local access network are the essential ones, which directly result to improvement of existing telecommunications and internet services and increase of teledensity in Iraq.

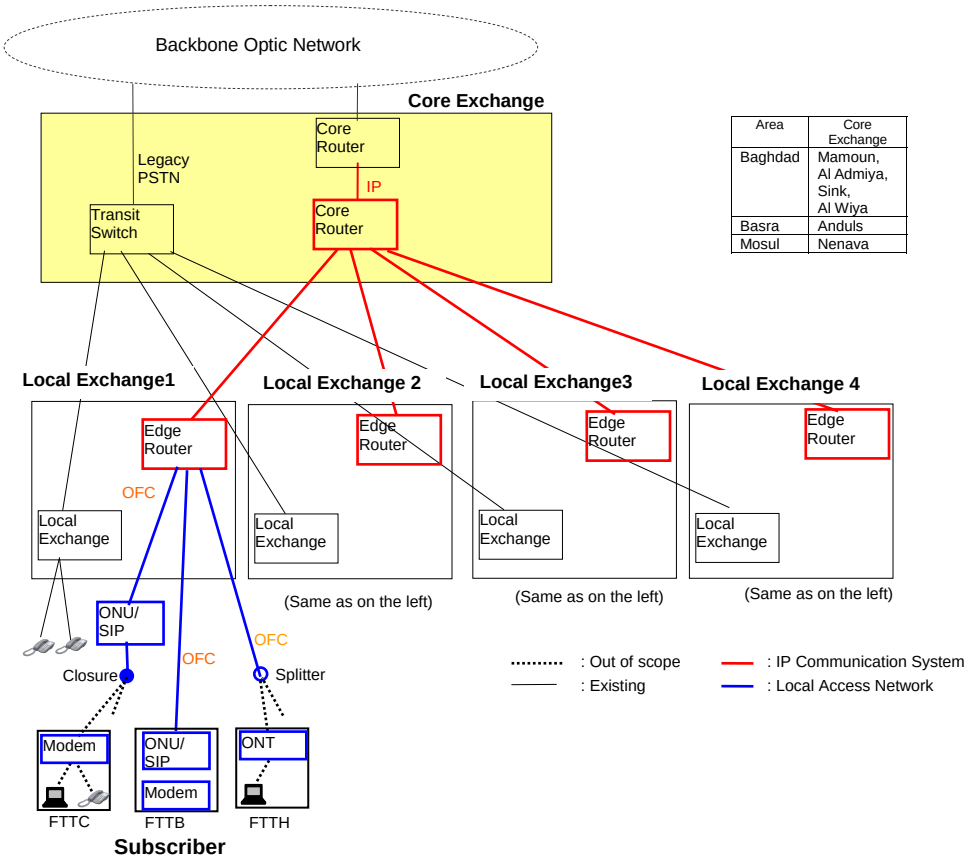



Source: JICA Study Team

Figure 7.1-1 Conceptual Diagram of Connection among Baghdad, Basra and Mosul

Core router will be installed in core exchange colored with yellow, and edge router in local exchange colored with blue. IMS core which is an essential part of the component that controls IP network in NGN is planned to be installed in Sink core exchange, which has a comparatively large capacity of lines and is located in the center of Baghdad.

Diagram of Figure 7.1-2 explains the demarcation of the scope between IP communication system and local access network. In this diagram, equipment to be included in the scope is indicated by red lines for IP communication system and blue lines for local access network.




Source: JICA Study Team

Figure 7.1-2 Demarcation of IP communication System and Local Access Network

### 7.1.1 Packaging of Project Components

The packaging of the project components is considered from the viewpoint of the nature of the respective components, and the following two packages are expected:

(1) For IP communication system, local access network, HRD and ICT training and internet facilities in NCC, procurement of equipment is the major portion of the scope of work. Furthermore, these components are closely related to each other, and required to be integrated in order to fulfill functions of fixed telephone line. At the same time, the manufacturer of the

equipment will conduct the personnel training for ITPC's and SCIS's engineers at the manufacturer's offices or factories in Japan. Accordingly, IP communication system, local access network and HRD are recommended to be under one contract package.

(2) For OPMC and NCC, civil and architectural work is the major scope of work. Accordingly, these components are under one contract package.

### 7.1.2 Sequence Plan of Installation

In order to commence system integration of IP communication system and local access network in Baghdad, Basra and Mosul as soon as the equipment is installed, the works in each area are planned to proceed simultaneously as shown in Table 7.1.2-1. This makes the implementation period shorter.

Table 7.1.2-1 Sequence Plan of Installation

| Area | Component | Sequence Plan of Installation | Note |
|---|---|---|---|
| Baghdad | IP communication system | | |
| | Local Access Network | | 200k lines |
| | OPMC/NCC building | | |
| Basra | IP communication system | | |
| | Local Access Network | | 30k lines |
| Mosul | IP communication system | | |
| | Local Access Network | | 56k lines |

Note: ∇ :Commencement of Installation ★ :Taking Over ▼ :Project Completion
:Installation/Construction :System Integration :Provisional Acceptance Test

Source: JICA Study Team

### 7.1.3 Procurement Plan of Equipment

Equipment such as router, core switch and server to be procured for IP network equipment and local access network can be selected mostly by quick design of manufacturers, which enables a relatively shorter period of time for procurement.

For the above, it is expected that the time necessary for the procurement of equipment is around six months.

On the other hand, it takes much time for system integration and acceptance test, with an expected duration of about seven months.

### 7.1.4 Implementation Schedule

Implementation schedule for the 286,000 lines including selection of consultant, detailed design by the Consultant and tendering is expected to be around 52 months in total. The required period for each stage is shown in Table 7.1.4-1.

Table 7.1.4-1 Implementation Schedule

| Stage | Period |
|---|---|
| 1.Selection of Consultant | 10 months |
| 2.Detailed Design | 11 months |
| 3.Tendering | 7 months |
| 4.Construction, Installation and Training | |
| 1) IP communication system and Local Access Network | 16 months |
| 2) OPMC and NCC | 23 months |
| 3) Human Resource Development | 6 months |

Source: JICA Study Team

Detailed implementation schedule is shown in Table7.1.4-2.

Implementation period of IP communication system and local access network for the 286,000 lines in Baghdad, Basra and Mosul is expected to be 16 months. However, it will be shortened to about eight months in case the target areas are limited to Basra and Mosul.

Table 7.1.4-2 Detailed Implementation Schedule

| Ref. No. | Months of Consulting Services | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Calendar Years and Month | 2011 | | | | | | | | | | | | 2012 | | | | | | | | | | | | 2013 | | | | | | | | | | | | 2014 | | | | | | | | | | | | 2015 | | | | | | | | | | | |
| | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **1** | **Selection of Consultant** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.1 | Signing of Loan Agreement(L/A) | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.2 | Selection of Consultant | | | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **2** | **Detailed Design by Consultant** | | | | | | | | | | | | | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | | | | | | | | | | | | | | | | | | | | |
| 2.1 | Signing of Contract with Consultant | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.2 | Detailed Design | | | | | | | | | | | | | ― | ― | ― | ― | ― | ― | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.3 | Preparation of Specifications | | | | | | | | | | | | | | | | | ― | ― | ― | ― | ― | ― | | | | | | | | | | | | | | | | | | | | |
| 2.4 | JICA's Approval | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | |
| **3** | **Tendering** | | | | | | | | | | | | | | | | | | | ― | ― | ― | ― | | | | | | | | | | | | | | | | | | | | |
| 3.1 | Tender Floating | | | | | | | | | | | | | | | | | | | ― | ― | | | | | | | | | | | | | | | | | | | | | | |
| 3.2 | Tender Evaluation | | | | | | | | | | | | | | | | | | | | | | ― | ― | | | | | | | | | | | | | | | | | | | |
| 3.3 | JICA's Approval | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | |
| 3.4 | Contract Negotiation | | | | | | | | | | | | | | | | | | | | | | | | | ― | | | | | | | | | | | | | | | | | |
| 3.5 | Signing of Contract | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | |
| 3.6 | JICA's Approval | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | |
| 3.7 | Effective Date of Contract | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | |
| **4** | **Construction, Installation Works and Training** | | | | | | | | | | | | | | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 4.1 | Package1 IP Communication system, Local Access Network and HRD | | | | | | | | | | | | | | | | | | | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | | | | | | | | | |
| 4.1.1 | Detailed Design by Contractor | | | | | | | | | | | | | | | | | | | ― | ― | ― | | | | | | | | | | | | | | | | | | | | |
| 4.1.2 | Check and Approval of Detailed Design | | | | | | | | | | | | | | | | | | | | ― | ― | ― | | | | | | | | | | | | | | | | | | | |
| 4.1.3 | Manufacturing of Equipment and Materials | | | | | | | | | | | | | | | | | | | | ― | ― | ― | ― | ― | ― | ― | | | | | | | | | | | | | | | |
| 4.1.4 | Factory Inspection Test | | | | | | | | | | | | | | | | | | | | | | | ― | ― | ― | ― | | | | | | | | | | | | | | | |
| 4.1.5 | Factory Training(HRD) | | | | | | | | | | | | | | | | | | | | | | | ― | ― | ― | ― | ― | ― | ― | | | | | | | | | | | | |
| 4.1.6 | Transportation of Equipment Materials | | | | | | | | | | | | | | | | | | | | | | | | ― | ― | ― | ― | | | | | | | | | | | | | | |
| 4.1.7 | Installation of Equipment and Mateirals | | | | | | | | | | | | | | | | | | | | | | | | | ― | ― | ― | ― | ― | ― | | | | | | | | | | | |
| 4.1.8 | System Integration | | | | | | | | | | | | | | | | | | | | | | | | | | | ― | ― | ― | ― | ― | | | | | | | | | | |
| 4.1.9 | Provisional Acceptance Test | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ― | ― | ― | ― | ― | | | | | | | | |
| 4.1.10 | Final Acceptance Test | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | |
| 4.2 | Packages2 OPMC and NCC Construction | | | | | | | | | | | | | | | | | | | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | |
| 4.2.1 | Detailed Design by Contractor | | | | | | | | | | | | | | | | | | | ― | ― | ― | ― | | | | | | | | | | | | | | | | | | | |
| 4.2.2 | Check and Approval of Detailed Design | | | | | | | | | | | | | | | | | | | | | | | ― | ― | ― | ― | | | | | | | | | | | | | | | |
| 4.2.3 | Construction Works | | | | | | | | | | | | | | | | | | | | | | | | | | | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | ― | |
| 4.2.4 | Final Acceptance Test | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | |
| 4.3 | Completion of Project | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |

Note: NCC: New Communication Center OPMC: Outside Plant Maintenance Center HRD:Human Resource Development

Source: JICA Study Team

### 7.1.5 Definition of Completion of Each Component

(1) IP communication system and Local access network

After installation of the equipment for IP communication system and local access network in Baghdad, Basra and Mosul, these will be integrated together to fulfill the following functions which are essential to fixed telephone lines:

- connection to existing PSTN subscribers
- connection to FTTC, FTTB and FTTH subscribers
- provide internet services
- charge according to call duration

The integrated equipment is then operated on a trial basis and checked repeatedly for system bug during the period of provisional acceptance test. Accordingly, from the viewpoint of the nature of the components, completion of the components is subject to final acceptance test by checking that the total system integration between IP communication system and local access network is proper.

(2) OPMC and NCC construction

For OPMC and NCC, civil and architectural works are the major scope of the components. Completion of the components should be subject to the completion of the respective buildings.

(3) HRD

Completion of HRD is subject to the following conditions:

- Completion of quantity inspection of training facilities to be provided by the contractor
- Completion of training propagated in Iraq by ITPC's or SCIS's instructors who are preliminary trained in Japan

## 7.2 Methodology of Installation and Construction

Works such as installation of equipment and construction of building in each component should be conducted in accordance with the following:

(1) IP Communication System

Equipment such as router and server for IP communication system should be installed in an air-conditioned location. In order to maintain the equipment easily, working space is required in front and at the back of the equipment.

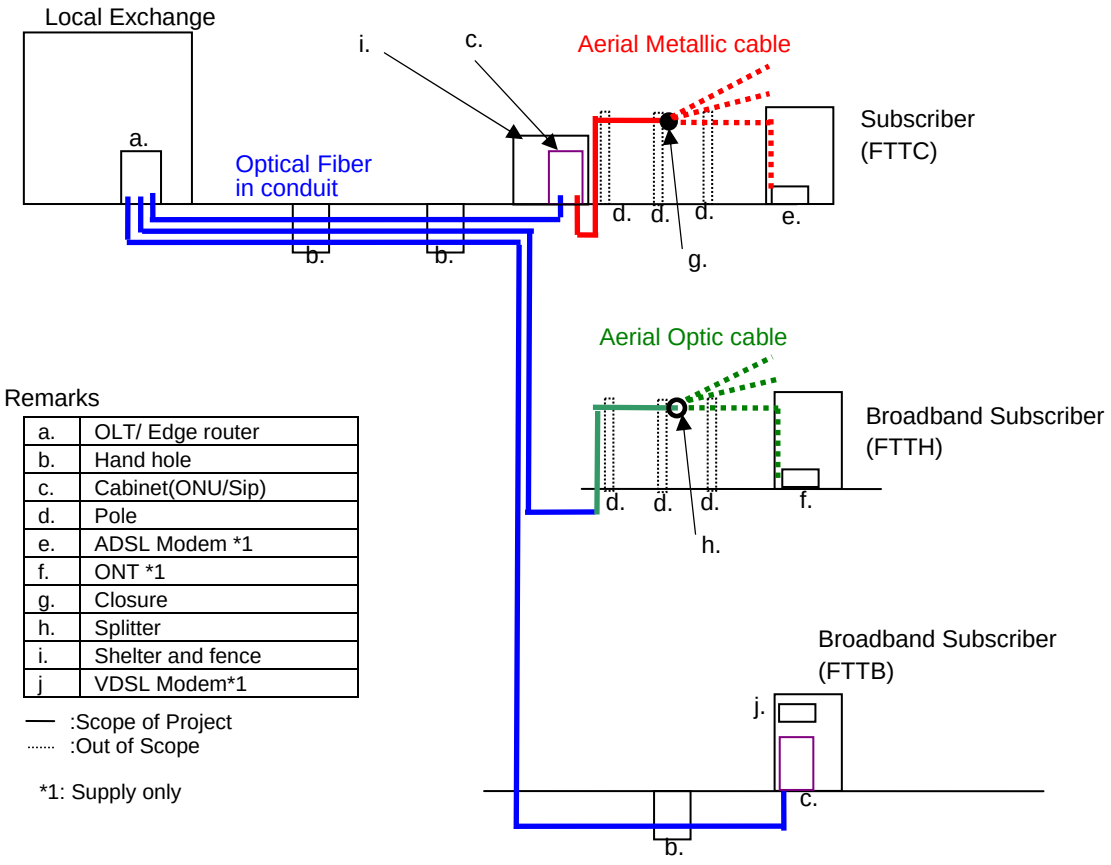
The cabinet for FTTC should be installed in a shelter which is surrounded by security fences in order to protect it from any theft and destruction. Furthermore, backup power supply such as solar power and battery should be provided in preparation for power outage.

The cabinet for FTTB, similar to the equipment for IP communication system, should be installed in an air-conditioned location in the building.

### (2) Local Access Network

Materials and equipment for local access network are mainly hand-hole, conduit, metallic cable, optical fiber cable and cabinet for FTTC and FTTB.

Installation methodology for materials and equipment of local access network is conceptually shown in Figure7.2-1.




Source: JICA Study Team

Figure 7.2-1 Installation Methodology of Local Access Network

### (3) NCC and OPMC

It is essential for NCC and OPMC to keep close intercommunication with other exchanges in order to take quick action against troubles of telephone or internet services. NCC and OPMC are

connected with other exchanges through ITPC's optic fiber network. For this reason, NCC and OPMC are recommended to be located near the optic fiber for DWDM ring network in Baghdad.

## 7.3 Financial Plan

The financing plan for the initial investment cost of the project is shown in Table 7.2-1. The total amount of the initial investment cost is financed by the Japanese government's ODA loan.

Table7.3-1: Financing Plan for Initial Investment Cost

| Financing Source | Ratio (%) | Financing Amount (Million Yen) | Financing Amount (Million IQD) |
|---|---|---|---|
| Japanese Government's ODA Loan | 100 | 30,174 | 436,014 |

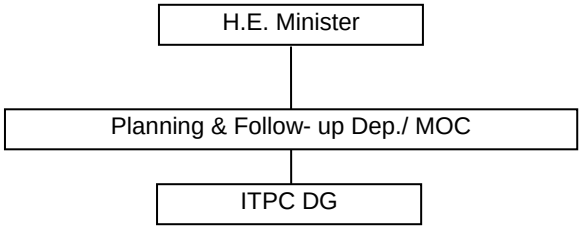
Source: JICA Study Team

## 7.4 Organization of Project Implementation

The executing agency of the project consists of ITPC, which is under the control of the administrative management agency of MOC. In addition to the executing agency, Project Management Team (PMT) will be separately organized soon after Loan Agreement. The PMT consisting of MOC/ITPC members who follow as a side job with their regular works will function under MOC's management till the completion of the project. After completion of the project, the PMT will be broken up, and Switching section and Network section of ITPC have major roles for arranging their staffs and necessary equipment as well as required budget for operation and maintenance.

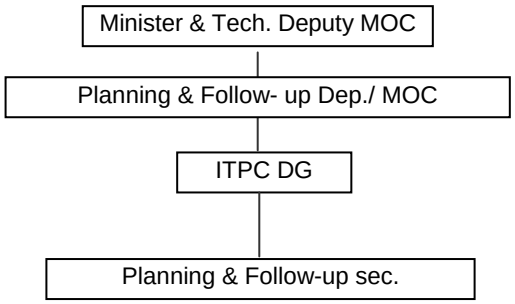
The organization of the executing agency for each stage is shown below.

(1) Responsible Organization up to Official Loan Request



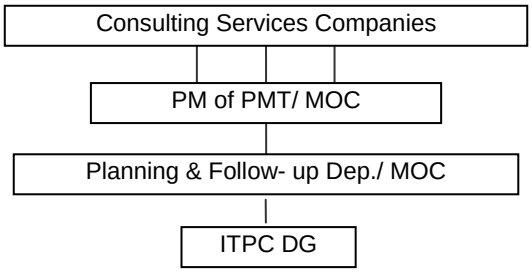

Source: MOC

(2) Responsible Organization after Official Loan Request up to Loan Agreement (E/N)



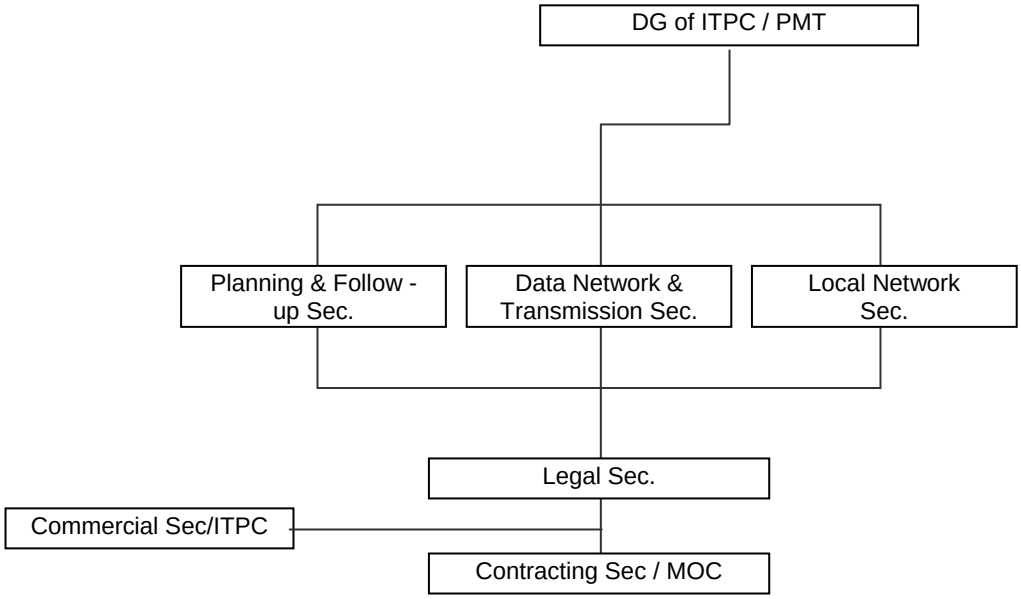

Source: MOC

(3) Responsible Organization during Consulting Stage (Basic Design and Detail Design)



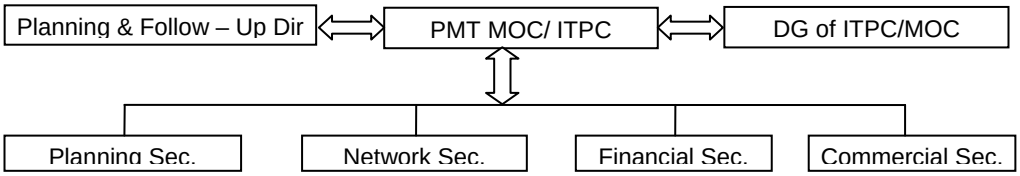

Source: MOC

(4) Responsible Organization during Bidding Stage (Pre-Qualification, Bidding and Contract)



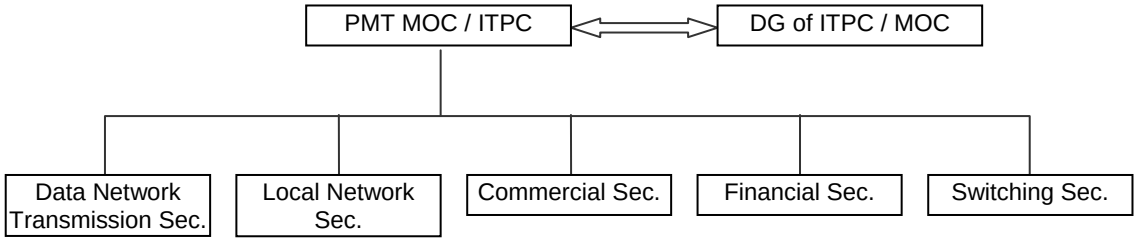

Source: MOC

(5) Responsible Organization during Project Implementation



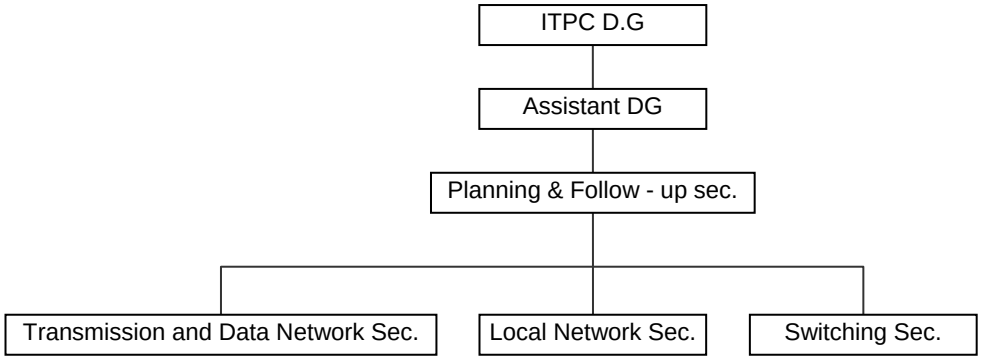

Source: MOC

(6) Responsible Organization for Maintenance after Project Completion



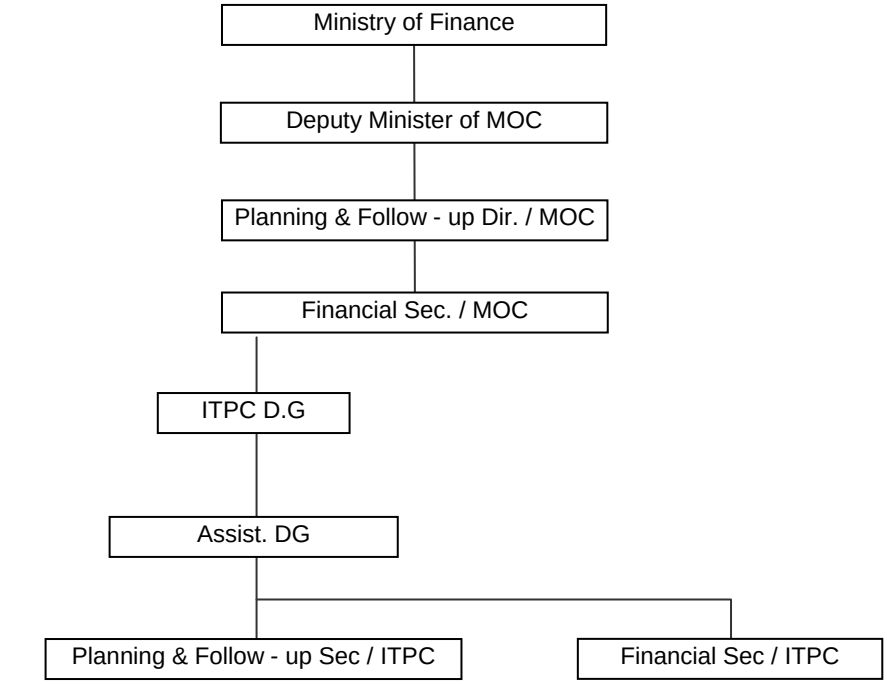

Source: MOC

(7) Responsible Organization for Operation after Project Completion




Source: MOC

(8) Responsible Organization for Commercial Issues (i.e. Repayment) after Project Completion




Source: MOC

# *Chapter 8*
# *Environmental and Social Considerations*

# CHAPTER 8 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

## 8.1 Legal Framework of Environmental and Social Considerations

### 8.1.1 Legislations and Organizations Related to Environmental and Social Considerations

(1) Legislations Related to Environmental and Social Considerations

Iraq has developed its national environmental governance and monitoring system since 1960s. Some of the environmental regulations and standards set up at that time are still in effect. After the constitution of the Ministry of Environment (MOE) in 2003, reform and/or improvement of the administrative organization and legislative framework is now proceeding.

The list of major relevant legislations on environmental and social considerations in Iraq is shown in Table 8.1.1-1.

Table 8.1.1-1: List of Legislations on Environmental and Social Considerations in Iraq

| Category | Title | Year |
|---|---|---|
| General | Law No. 79 for Protection and Improvement of Environment | 1986 |
| | Law No. 3 for Protection and Improvement of Environment | 1997 |
| | Modified Law of Protection and Improvement of Environment No. 3 of the year 1997 and No. 73 of the year 2001 | 2001 |
| | Law No. 27 for Protection and Improvement of the Environment | 2009 |
| | Environmental Instruction for Agricultural, Industrial and Public Service Projects | 1990 |
| Institution | CPA Order #44 for Establishing the Iraqi Ministry of Environment | 2003 |
| | Law No. 37 for Creation of MOE | 2008 |
| Air | Law No. 1 for Safety Instructions for the Use of Asbestos | 2002 |
| Water | Law No. 25 System of Rivers and Other Water Resources Protection (Include of 45 Pollutants) | 1967 |
| | The New Limits of the Regulation of the Protection of Rivers and Public Waters for a Year 1967 | 1967 |
| | Law No. 89 for Public Health (Drinking Water Provision, Sanitation and Environmental Monitoring) | 1981 |
| | Law No. 2 for Water System Protection | 2001 |
| | Standard No. 417 on Drinking Water and Analysis | 2001 |
| | Law No. 12 for Maintenance of Networks of Irrigation and Drainage | 1995 |
| Noise | Law No. 21 for Noise Prevention | 1966 |
| Solid Waste | Law No. 29 for Regulation of Landfills | 2009 |
| Radiation | Law No. 99 for Ionized Radiation | 1980 |
| Flora, Fauna & Biodiversity | Law No. 30 for Forest | 2009 |
| | Law No. 17 for Wild Animal Protection | 2010 |
| Land Use | Law No. 64 for Cities Land Use | 1965 |
| | Law No. 106 for Rangelands and Their Protection | 1965 |
| Work Condition | Act No. 71 promulgating the Labor Code (LC) | 1987 |

Source : JICA (2010) "Preliminary Environmental and Social Impact Assessment Baiji Refinery Upgrading Project"

JICA (2006) "The Feasibility Study on Baghdad Water Supply System Improvement Project Final Report"

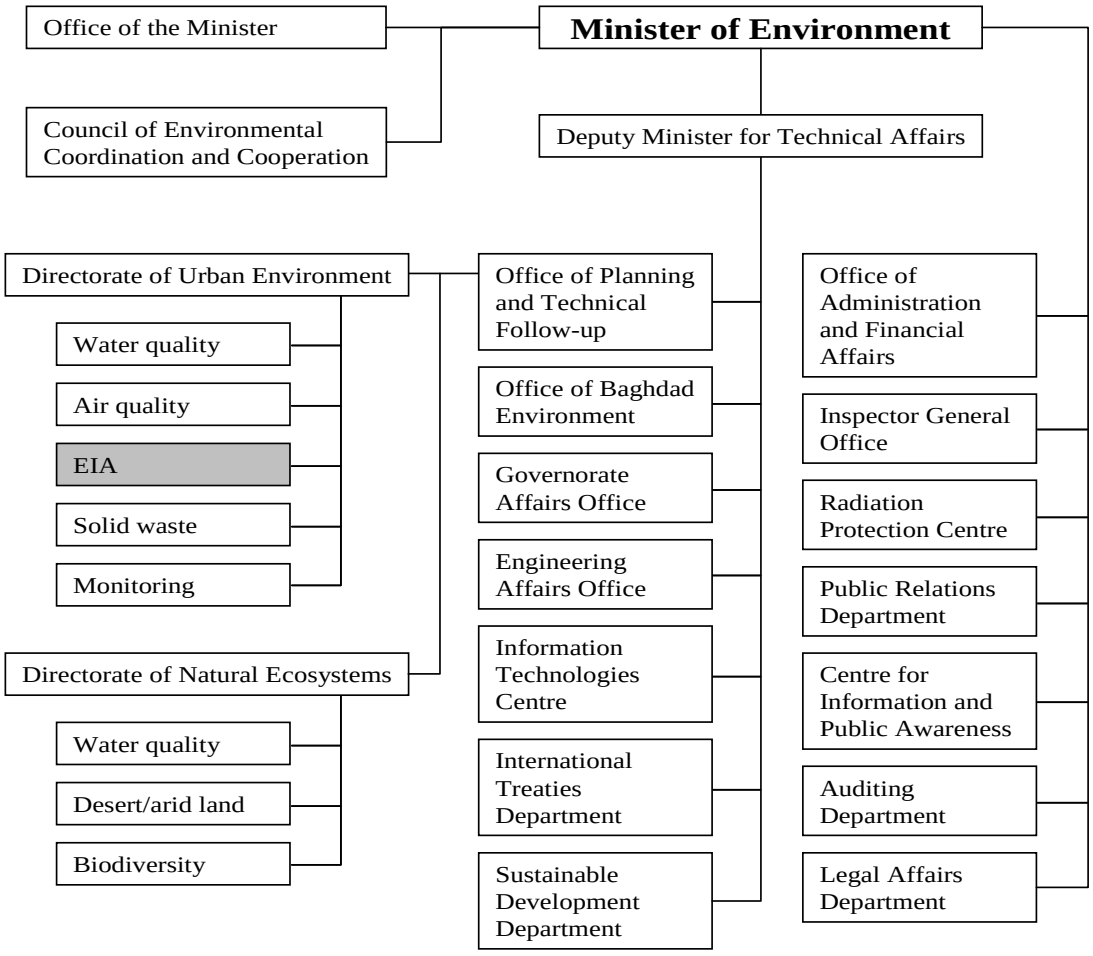
http://www.hammurabi-environment.com/iraqi-legislation.php

(2) Organizations Related to Environmental and Social Considerations

1) MOE

MOE, which was established in 2003, is the principal governmental agency responsible for environmental protection in Iraq. The resolution known as CPA Order #44 gave MOE the mandate to protect and conserve Iraq's environment, as well as protect the residents of Iraq from environmental pollutants and environmental risks to human health. The order further stated that MOE is responsible for integrating environmental concerns in other sectors, such as economic development, energy, transportation, agriculture, industry and trade. Other duties included the development of environmental policies and programs, as well as the creation and enforcement of environmental standards.

The organizational structure of MOE is presented in Figure 8.1.1-1. Issues related to environmental impact assessment (EIA) are to be administrated by the EIA Department, Directorate of Urban Environment.




Note: As of April 2005

Source: UNEP (2006) "Iraq Institutional Capacity Assessment Report"
http://postconflict.unep.ch/publications/ICA_iraq.pdf (cited on 11 November 2010)

Figure 8.1.1-1: Organization Chart of the Ministry of Environment

2) Ministry of Justice and Ministry of Finance

In Iraq, acquisition of private lands will be executed through negotiations with landowners. The Ministry of Justice will supervise expropriation of private land when necessary. On the other hand, the Ministry of Finance is the responsible body for management of governmental land.

3) Ministry of Communication (MOC) and Iraqi Telecommunication and Posts Company Services (ITPC)

MOC and ITPC have been designated as the counterpart agencies for the survey, and will be responsible for the implementation of environmental and social considerations activities related to the project.

It is confirmed that the Planning & Follow-up Directorate in MOC and the Planning Section in ITPC are the responsible sections for environmental consideration for the project. Similarly, the Legal Directorate in MOC and the Legal Section in ITPC are the responsible sections for social consideration (land acquisition) for the project.

### 8.1.2 Environmental Impact Assessment

Law No. 27 of 2009 for Protection and Improvement of the Environment provides the basis for the use and application of EIA to projects in Iraq. Article 2 of the law defines EIA as:

"studying and analyzing the environmental feasibility study for the proposed projects that their establishment or their activities may have impact on the mankind health and the safety of the environment in the present or in the future with aim of protecting it.."

Furthermore, Article 10 of the law stipulates that:

"The owner of any project before it starts development must assess the environmental impact that includes:

(a) Determination of positive and negative impacts of the project on the environment and the impact of the environment surrounding it;
(b) Proposed measures to prevent and address the causes of pollution in order to achieve compliance with environmental regulations and instructions;
(c) Emergency pollution cases and probability and the precautions to be taken to prevent their occurrence;
(d) Possible alternatives to the use of technology which is less harmful to the environment and the rational use of resources;
(e) To reduce waste and recycle or reuse it wherever possible; and
(f) To assess the environmental feasibility of the project and estimate the cost of pollution relative

to production."

However, this law does not address concrete requirements and/or procedures to conduct environmental assessment. According to JICA (2010)[1], the process and methodology for the EIA study and the applicable procedure for the evaluation and approval of the EIA are now being developed dedicatedly by the EIA Department of MOE.

From the result of discussion with MOC at Amman in December 2010, it is confirmed that legal formality of EIA will not be required for the project as the environmental impact caused by telecommunication project is generally insignificant.

Hence, the confirmation of environmental and social considerations for this study was conducted to meet the requirements of Law No. 27 of 2009 as well as JBIC (2002) "JBIC Guidelines for Confirmation of Environmental and Social Considerations". Moreover, this study report corresponds to the EIA report for the project.

### 8.1.3 Land Acquisition and Resettlement

In the Iraqi Constitution, which was adopted on October 15, 2005 through the people's referendum, Article 23 rules on the principle of land tenure as follows:

1) Private property is protected. The owner shall have the right to benefit, exploit and dispose of private property within the limits of the law.
2) Expropriation is not permissible except for the purposes of public benefit in return for just compensation, and this shall be regulated by law.
3) A. Every Iraqi shall have the right to own a property anywhere in Iraq. No others may possess immovable assets, except as exempted by law.
   B. Ownership of property for the purposes of demographic change is prohibited.

Therefore, if the project will require land acquisition, the proponent must provide just compensation to the owners of the land.

However, from the result of discussion with MOC at Amman in December 2010, it is confirmed that the project will not require any land acquisition and will not cause involuntary resettlement as the cables will be installed along the existing roads and OPMC and NCC will be constructed in the existing governmental land.

In case MOC will procure governmental land which belongs to the other ministry, it will require an approval by the Minister of Ministry of Finance. If MOC will procure the governmental land which belongs to other ministries, this issue will be discussed in Cabinet meeting and it takes around 6

[1] JICA (2010) "Preliminary Environmental and Social Impact Assessment Baiji Refinery Upgrading Project"

months for getting approval from Ministry of Finance.

## 8.2 Scoping for Environmental and Social Impact of the Project

In order to assess the likely significant environmental and social impacts, conceivable adverse impacts by the project were preliminary identified as shown in Table 8.2-1.

Table 8.2-1 Conceivable Adverse Environmental and Social Impacts by the Project (1/2)

| Item | | | Rating | Reasons |
|---|---|---|---|---|
| Social Environment | 1 | Involuntary resettlement | D | No involuntary resettlement will occur by the project as the optical fibers will be installed along the existing roads and OPCC/NCC will be constructed in the existing governmental land. |
| | 2 | Local economy such as employment and livelihood, etc | D | The livelihood of residents will not be adversely affected as no land acquisition will be required for the project. |
| | 3 | Land use and utilization of local resources | D | No impact is assumed by the project as the optical fibers will be installed along the existing roads and OPCC/NCC will be constructed in the existing governmental land. |
| | 4 | Social institutions such as regional severance | D | The project will not cause negative impact on social institution such as regional severance. |
| | 5 | Existing social infrastructures and services | D | The project will not adversely affect on existing social infrastructure. The project is expected to improve telecommunication service in the target areas. |
| | 6 | The poor, indigenous and ethnic people | D | The project will not affect on the poor, indigenous and ethnic people as no land acquisition will be required for the project. |
| | 7 | Misdistribution of benefit and damage | D | No impact is assumed by the project as the project will not bring about project-affected peoples who will lose land or whose livelihood will be adversely affected. |
| | 8 | Cultural heritage | D | No impact is assumed by the project as the optical fibers will be installed along the existing roads and OPCC/NCC will be constructed in the existing governmental land. |
| | 9 | Local conflicts of interest | D | No impact is assumed by the project as the project will not bring about project-affected peoples who will lose land or whose livelihood will be adversely affected. |
| | 10 | Water usage or water rights and communal rights | D | The project will not affect on water usage, water rights or communal rights. |
| | 11 | Sanitation | D | The project will not cause negative impact on sanitation. |
| | 12 | Hazards (risk), infectious diseases such as HIV/AIDS | C | Infectious diseases, such as HIV may be brought during construction phase due to immigration of workers. |
| | 13 | Accidents | C | Accident during construction phase may happen. |
| Natural Environment | 14 | Topography and geographical features | D | The project will not cause any large scale land conversion which will affect on topography and geographical features. |
| | 15 | Soil erosion | D | The project will not cause significant soil erosion. |
| | 16 | Groundwater | D | The project will not affect on groundwater. |
| | 17 | Hydrological situation | D | The project will not cause affect on hydrological situation such as flow regime of rivers. |
| | 18 | Coastal zone | D | The project will not affect on coastal zone. |
| | 19 | Flora, fauna and biodiversity | D | No impact is assumed by the project as the optical fibers will be installed along the existing roads and OPCC/NCC will be constructed in the existing governmental land. |
| | 20 | Meteorology | D | The project will not affect on climate. |
| | 21 | Landscape | D | The project will not construct any large scale structures which will affect on landscape. |
| | 22 | Global warming | B | Greenhouse gas will be discharged to some extent during construction phase due to construction machineries and vehicles. |

Rating: A: Serious impact is expected, B: Some impact is expected, C: Extent of impact is unknown, D: No impact is expected. IEE/EIA is not necessary.

Source: JICA Study Team

Table 8.2-1: Conceivable Adverse Environmental and Social Impacts by the Project (2/2)

| Item | | | Rating | Reasons |
|---|---|---|---|---|
| Pollution | 23 | Air pollution | B | Air pollutant such as $SO_2$, CO, $NO_2$, $PM_{10}$, TSP will temporary discharged during construction phase due to construction machineries and vehicles. |
| | 24 | Water Pollution | D | The project will not cause significant water pollution. |
| | 25 | Soil contamination | D | The project will not cause soil contamination. |
| | 26 | Waste | B | Construction residue soil and waste will be discharged in construction phase, though the volume of waste will be limited. |
| | 27 | Noise and vibration | B | Noise and vibration level will temporary increase during construction phase due to construction machineries and vehicles. |
| | 28 | Ground subsidence | D | The project will not cause ground subsidence. |
| | 29 | Offensive odor | D | The project will not cause offensive odor. |
| | 30 | Bottom sediment | D | The project will not affect on bottom sediment. |

Rating: A: Serious impact is expected, B: Some impact is expected, C: Extent of impact is unknown, D: No impact is expected. IEE/EIA is not necessary.

Source: JICA Survey Team

## 8.3 Environmental and Social Examination for the Project

As examined in the scoping matrix, the project which comprises of optical fiber installation and OPMC/NCC construction will not cause any significant environmental and social impact. The optical fiber network will be installed along the existing roads while OPMC/NCC will be constructed in the existing governmental land. Thus, the project will not require any land acquisition and will not affect any sensitive areas such as the protected areas, as listed in Table 8.3-1.

Table 8.3-1: Protected Areas in Iraq

| No. | Name | Designation | Status |
|---|---|---|---|
| 1 | Hawizeh Marshes | Wetlands of International Importance (Ramsar Site) | Designated |
| 2 | Nasiriya Marshes | National Protected Area | Recommended |
| 3 | Mesopotamia Marshlands | National Park | Proposed |
| 4 | Hor al Hammar Marshes | National Protected Area | Recommended |
| 5 | Shatra Marshes | National Protected Area | Recommended |
| 6 | Wadi Tharthar Lake and Marshes | National Protected Area | Recommended |
| 7 | Habbaniya Lake | National Protected Area | Recommended |
| 8 | Hor Suweicha Wetland | National Protected Area | Recommended |

Source: http://protectedplanet.net/

The adverse environmental and social impacts identified for the project are only typical and general impacts caused by any construction work as listed below. However, these impacts of the project will be temporary and insignificant in scale and extent:

- Infectious diseases, such as HIV, which might be transmitted due to immigration of construction workers;
- Congestion and traffic accidents which might happen due to construction work;

- Greenhouse gas which would be discharged to some extent due to construction machineries and vehicles;
- Air pollutants such as $SO_2$, CO, $NO_2$, $PM_{10}$, TSP which would be temporarily discharged due to construction machineries and vehicles;
- Construction residual soil and waste which would be discharged to some extent due to construction work; and
- Noise and vibrations which would be temporarily generated due to construction machineries and vehicles.

By considering the above-identified environmental and social impacts during the construction phase of the project, it is desirable for the proponent (MOC and ITPC) and/or contractor to take the following mitigation measures:

- Safety and sanitary education/training program for construction workers;
- Traffic regulation in the vicinity of the construction area when necessary;
- Appropriate operation and maintenance of construction machineries/vehicles; and
- Adequate recycling and/or disposal of construction residual soil and waste.

The proponent will be required to supervise and monitor the contractor for the adequate implementation of construction work and related activities.

## 8.4 Environmental Checklist for the Project

The environmental checklist for the project was preliminarily examined as shown in Table 8.4-1 by referring to JBIC (2002) "Guidelines for Confirmation of Environmental and Social Considerations".

This checklist will be modified and updated in accordance with the progress of project implementation.

Table 8.4-1 Preliminary Environmental Checklist for the Project

| Category | Environmental Item | Main Check Items | Yes/No | Confirmation of Environmental Considerations (Reason, Mitigation Measures) |
|---|---|---|---|---|
| 1 Permits and Explanation | (1) EIA and Environmental Permits | (a) Have EIA reports been already prepared in official process?<br>(b) Have EIA reports been approved by authorities of the host country's government?<br>(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?<br>(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government? | (a) N.A.<br>(b) N.A<br>(c) N.A.<br>(d) N.A. | (a)~(c) EIA report will not be required for the project. (This Survey report corresponds to the EIA report for the Project.)<br>(d) No other environmental permits will be necessary for the Project. |
| | (2) Explanation to the Local Stakeholders | (a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders?<br>(b) Have the comment from the stakeholders (such as local residents) been reflected to the project design? | (a) No<br>(b) No | (a),(b) The project contents and the potential impacts will be explained to the local stakeholders in D/D stage of the Project, when the concrete project design will be examined. |
| | (3) Examination of Alternatives | (a) Have alternative plans of the project been examined with social and environmental considerations? | (a) No | (a) The project is initially designed so as to minimize environmental and social impact by installing optical fiber along the existing roads. Alternative plan of the project would be examined in D/D stage if necessary. |
| 2 Pollution Control | (1) Water Quality | (a) Is there any possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? If the water quality degradation is anticipated, are adequate measures considered? | (a) No | (a) Soil runoff resulting from earthmoving activities by the project is assumed to be insignificant as installation of optical fiber will be implemented along the existing roads. |
| 3 Natural Environment | (1) Protected Areas | (a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas? | (a) No | (a) The project will not affect on the protected areas as installation of optical fiber will be implemented along the existing roads and OPMC/NCC will be constructed at the existing governmental land. |
| | (2) Ecosystem | (a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?<br>(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international | (a) No<br>(b) No<br>(c) N.A.<br>(d) N.A.<br>(e) No | (a)~(f) The project will not affect on ecosystem as installation of optical fiber will be implemented along the existing roads and OPMC/NCC will be constructed at the existing governmental land. |

| | | | | |
|---|---|---|---|---|
| | | treaties and conventions?<br>(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?<br>(d) Are adequate measures taken to prevent disruption of migration routes and habitat fragmentation of wildlife and livestock?<br>(e) Is there any possibility that the project will cause the negative impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystem due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered?<br>(f) In cases where the project site is located in undeveloped areas, is there any possibility that the new development will result in extensive loss of natural environments? | (f) No | |
| 3 Natural Environment | (3) Topography and Geology | (a) Is there any soft ground on the route of telecommunication lines that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed?<br>(b) Is there any possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides?<br>(c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff? | (a) No<br>(b) No<br>(c) No | (a)~(c) The project will not affect on topography and geology as installation of optical fiber will be implemented along the existing roads and OPMC/NCC will be constructed at the existing governmental land. |
| 4 Social Environment | (1) Resettlement | (a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?<br>(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?<br>(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?<br>(d) Are the compensations going to be paid prior to the resettlement?<br>(e) Are the compensation policies prepared in document?<br>(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? | (a) No<br>(b) N.A.<br>(c) N.A.<br>(d) N.A.<br>(e) N.A.<br>(f) N.A.<br>(g) N.A.<br>(h) N.A.<br>(i) N.A.<br>(j) N.A. | (a)~(j) The project will not cause involuntary resettlement as installation of optical fiber will be implemented along the existing roads and OPMC/NCC will be constructed at the existing governmental land. |

| | | | | |
|---|---|---|---|---|
| | | (g) Are agreements with the affected people obtained prior to resettlement?<br>(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?<br>(i) Are any plans developed to monitor the impacts of resettlement?<br>(j) Is the grievance redress mechanism established? | | |
| | (2) Living and Livelihood | (a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?<br>(b) Is there a possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary?<br>(c) Are the compensations for telecommunication lines given in accordance with the domestic law? | (a) No<br>(b) Yes<br>(c) N.A. | (a),(c) The project will not require land acquisition and will not affect on livelihoods of inhabitants as installation of optical fiber will be implemented along the existing roads and OPMC/NCC will be constructed at the existing governmental land.<br>(b) Infectious diseases may be brought during construction phase due to immigration of workers. Safety and sanitary education/training program will be implemented by the proponent and/or contractor. |
| | (3) Heritage | (a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws? | (a) No | (a) The project will not affect on local heritages as installation of optical fiber will be implemented along the existing roads and OPMC/NCC will be constructed at the existing governmental land. |
| | (4) Landscape | (a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken? | (a) No | (a) The project will not construct any large scale structures which will affect on landscape. |
| | (5) Ethnic Minorities and Indigenous Peoples | (a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?<br>(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected? | (a) N.A.<br>(a) Yes | (a),(b) The project will not cause negative impact on ethnic minorities and indigenous peoples as installation of optical fiber will be implemented along the existing roads and OPMC/NCC will be constructed at the existing governmental land. |
| | (6) Working Conditions | (a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?<br>(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?<br>(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a | (a) Yes<br>(b) Yes<br>(c) Yes<br>(d) Yes | (a) The proponent will follow the Act No. 71 of 1987 promulgating the Labor Code.<br>(b)~(d) The proponent will implement adequate safety and health considerations such as education/training program for construction workers, traffic regulation in the vicinity of construction area and appropriate operation and maintenance of construction machineries/vehicles. |

| | | | | |
|---|---|---|---|---|
| | | safety and health program, and safety training (including traffic safety and public health) for workers etc.?<br>(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents? | | |
| 5 Others | (1) Impacts during Construction | (a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?<br>(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?<br>(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? | (a) Yes<br>(b) N.A.<br>(c) N.A. | (a) The proponent and/or contractor will implement adequate measures to reduce impacts during construction such as appropriate operation and maintenance of construction machineries/vehicles and adequate recycling and/or disposal of construction residual soil and waste.<br>(b)~(c) Not applicable for the project. |
| | (2) Monitoring | (a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?<br>(b) What are the items, methods and frequencies of the monitoring program?<br>(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?<br>(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities? | (a) Yes.<br>(b) --<br>(c) Yes.<br>(d) N.A. | (a)~(b) The proponent will supervise and monitor the implementation of construction works and proposed mitigation measures.<br>(c) The Planning & Follow-up Dir. in MOC and the Planning Section in ITPC will be responsible for supervision and monitoring of construction works and proposed mitigation measures.<br>(d) Not applicable to the project. |
| 6 Note | Reference to Checklist of Other Sectors | (a) Where necessary, pertinent items described in the Road checklist should also be checked (e.g., projects including installation of electric transmission lines and/or electric distribution facilities). | (a) N.A. | (a) Not applicable to the project. |
| | Note on Using Environmental Checklist | (a) If necessary, the impacts to transboundary or global issues should be confirmed, (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming). | (a) N.A. | (a) Not applicable to the project. |

Source: JICA Survey Team

# *Chapter 9*
# *Effects of Project Implementation*

# CHAPTER 9 EFFECTS OF PROJECT IMPLEMENTATION

## 9.1 Guideline and Database

Telecommunications network provides public services like telephone, internet and opening of information through broadband transmission. The following items can be considered as the indicators, which measure the quality and reliability of the public network:

(1) Call completion ratio: ratio of successful connection per call attempt
(2) Number of telephone lines: number of actual available telephone lines
(3) Waiting applicants: number of applicants who have waited for line connections
(4) Teledensity: ratio of available telephone number per population
(5) Number of internet users

Baseline data for the above indicators in 2009 are given in Table 9.1-1.

Table 9.1-1:Baseline Data in 2009

| Indicator | | Status of 2009 | Expected Status in 2016 |
|---|---|---|---|
| Call completion ratio<br>(Related to Switching System) | | 99% (local)<br>30% (toll)<br>10% (international) | 100% (local)<br>50% (toll)<br>50% (international) |
| Number of telephone Lines<br>(Related to Switching System & Local Access Network) | Baghdad | 670k lines | 870k lines |
| | Basra | 100k lines | 130k lines |
| | Mosul | 117k lines | 173k lines |
| Waiting Applicants<br>(Related to Local Access Network) | | 282,000 | - |
| Teledensity<br>(Related to Switching System & Local Access Network) | | 6.1% | 15.59% (MTDS)<br>16.11% (The Study Team) |
| Number of Internet Users<br>(Related to Switching System & Local Access Network) | | 3,028 | 462,000 |

Source: MOC and the Study Team

Although above data as indicators have been recorded, MOC is requested to monitor and store

these indicators after implementation of the project in order to evaluate the corresponding effects.

## 9.2 Evaluation of Effects

Communications network represented by internet widely and directly affects society these days. The affected fields include commerce and business, health and education, government and its organizations, etc. The tendency of the effects of modern telecommunications network will be stronger than today in the near future. The following benefits to Iraqi society are considered after the implementation of the project:

- Acceleration of economic activities by reliable telecommunications network
- Improvement of security by high speed and large capacity network
- Enhancement of urban activities through metropolitan network
- Development of rural areas connected by telecommunications networks
- Creation of job opportunities related to computers and communications industry

# *Chapter 10*
# *Competitive Technology*

# CHAPTER 10 COMPETITIVE TECHNOLOGY

## 10.1 World Vendors for NGN

NGN is proposed for the project. Relevant technology and management control are necessary for the project to be completed successfully. Major vendors in the world related to NGN are listed below.

Table 10.1-1 Major Vendors for NGN

| Vendor Name | Origin | Company Brief |
|---|---|---|
| Alcatel-Lucent | France | One of the service providers worldwide providing solutions to deliver voice, data and video communication services to end users, including fixed, mobile and converged broadband networking, IP technologies, applications and services. |
| Ericsson | Sweden | One of the providers providing telecommunications equipment and related services to mobile and fixed network operators globally. 40 percent of all mobile calls are made through Ericsson's systems. And one of the companies worldwide that can offer end-to-end solutions for all major mobile communication standards. |
| Fujitsu | Japan | One of the providers of ICT-based business solutions for the global marketplace, which combines a worldwide corps of systems and services experts with computing and communications products and advanced microelectronics to deliver added value to customers. |
| NEC | Japan | One of the world's providers of Internet, broadband network and enterprise business solution dedicated to meeting the specialized needs of a diversified global base of customers. |
| Nokia Siemens Networks | Finland | One of the global providers of telecommunications services, which provides a portfolio of mobile, fixed and converged network technology, as well as consultancy and systems integration, deployment, maintenance and managed services. |
| Huawei | China | One of the providers worldwide, which has established end-to-end services in telecommunications network infrastructure, application and software, professional services and devices. |

Source: JICA Study Team

## 10.2 Technical Advantages of Japanese Vendors/Carries

Japanese vendors/carriers have extensive experiences and manufacturing know-how and skills to supply sophisticated NGN equipment based on technologies that have advantages compared to their foreign competitors.

1) High Security Product

Network security is essential for NGN. Japanese vendors/carriers have been researching on a high

security system that can be incorporated into IMS, a principal controlling function of NGN.

2) Establishment of Flexible Network

Japanese vendors/carriers have capability to design and realize such NGN as scalable and provide multi-services to the subscribers in cost-effective methods that are globally competitive.

3) Highly Attentive to Environment

Japanese vendors/carriers are highly attentive to environmental hazards. The materials and components are ecologically suited for the environment and will not affect Iraqi ecology and natural life. This manufacturing policy and strict standards are highly regarded by foreign countries.

4) Energy-saving Equipment

Japan has long been developing products with less energy consumption and high efficiency. This energy-saving technology is globally competitive because less energy consumption means savings on the running cost of the network system on the part of client(s).

5) IPv6 Technology

IPv6 technology is employed in NGN and Japan is one of the most advanced countries in this technology.

# *Chapter 11*
# *Conclusion and Recommendation*

# CHAPTER 11 CONCLUSIONS AND RECOMMENDATIONS

## 11.1 Conclusions

(1) Medium-Term Development Strategy (MTDS)

MTDS for planning for the period of 2010 to 2014 was formulated in the end of 2009 by MOC. It emphasizes the development of the following telecommunications infrastructure as high priorities:

1) Expansion of telecommunications network
2) Maintaining existing networks at current level in terms of quality

In order to achieve the above development, the following measures have been started and a budget of USD 216 million for the development was allocated:

1) Expand local access networks targeting more than 3 million subscribers,
2) Allocate budgets in order to maintain and rehabilitate existing telecommunications networks at the current level,
3) Make the number of waiting applicants zero, and
4) Enhance MOC organization by developing and strengthening human resources.

(2) Current Condition of Telecommunications Network

Present telecommunications network in Iraq is composed of three configurations, namely: 1) backbone transmission network, 2) switching system, and 3) local access network.

Backbone transmission network consists of two ways of communications, one is through DWDM and the other is through microwave radio network. DWDM is operating as the main backbone network, while microwave radio network functions as a backup of DWDM. Microwave network has been completed through Japan's grant aid project and World Bank aid from 2004 to 2010. DWDM will be fully operational by the end of March 2011. These two backbones can be operated as reliable backbone telecommunications networks in Iraq.

Backbone network and local access network are connected through exchange stations, which function for switching and distribution operations. Most of the existing switching equipment are legacy PSTN which can migrate to routers as a component of NGN. There are 397 exchanges in total over the whole country as of 2010 and Baghdad accounts for about 30% of the total telephone line capacity. Before the 2003 war, 27 local exchanges were available in Baghdad. However, around 11 exchanges that accommodated about 59% of the total subscriber telephone lines in Baghdad were destroyed. Now, 42 working exchanges in Baghdad were recovered to 42.

Local access networks have two types, namely, metallic cable type and optical fiber type. Metallic type is usually used for voice telephone as legacy system, while optical type is for data

transmission like IP-based communication for computers. These subscriber lines are installed between the nearest exchange station and each home and building.

### (3) Demand Forecast

The required expansion of telephone lines for all provinces in Iraq is forecasted to be 3,700,000 lines in 2016. To obtain those for Baghdad, Basra and Mosul in 2016, 3,700,000 lines have been broken down using the ratio of population in 2009 as shown in Table 11.1-1.

Table 11.1-1 Required Expansion for Baghdad, Basra and Mosul in City

| City | Population in City in 2009 | Ratio of population in 2009 | Required expansions in 2016 (K lines) | Requested expansion by MOC in 2009 (K lines) |
|---|---|---|---|---|
| 1. Baghdad | 6,250,000 | 22.9 % | 847 | 200 |
| 2. Basra | 1,200,000 | 4.4 % | 163 | 30 |
| 3. Mosul | 1,800,000 | 6.6 % | 244 | 56 |
| Total in three Cities | 9250,000 | 33.9 % | 1,254 | 286 |
| Total in Iraq | *27,295,573 | 100 % | 3,700 | - |

Source: MOC
(*) The populations of 3 Kurdistan provinces are excluded.

The forecasted expansions based on the target of teledensity in 2016 are remarkably higher than the requested numbers by MOC (200,000 lines for Baghdad, 30,000 lines for Basra and 56,000 lines for Mosul). It can be concluded that the requested expansion of 286,000 lines for Baghdad, Basra and Mosul is urgently required for implementation as early as possible to assist in the improvement of the existing telecommunications network, which is being seriously damaged, and to cope with the growing telephone and internet users. In addition, further expansions of the network are continuously needed in the telecommunications sector in Iraq in order to achieve the target of MTDS.

### (4) Applicable Technology of the Project

NGN is now taking the place of present legacy PSTN as it is now gradually difficult to repair the conventional PSTN due to the following reasons:

a) Manufacturer’s production of PSTN will soon be terminated and shift to IP-related products and thus, it would be later difficult to procure spares for repair.

b) Change of business models (transition from voice to data service) on the part of telecom operators/carriers

c) NGN recommendations issued by ITU-T and IETF

Due to the above situation, it will be inevitable to migrate from legacy PSTN to new IP technology-based network. Thus, MOC and telecom entities are urgently required to have schemes for establishing reliable and efficient nationwide IP networks, based on NTDS framework, in the ICT sector in Iraq.

## (5) Operation and Maintenance Structure

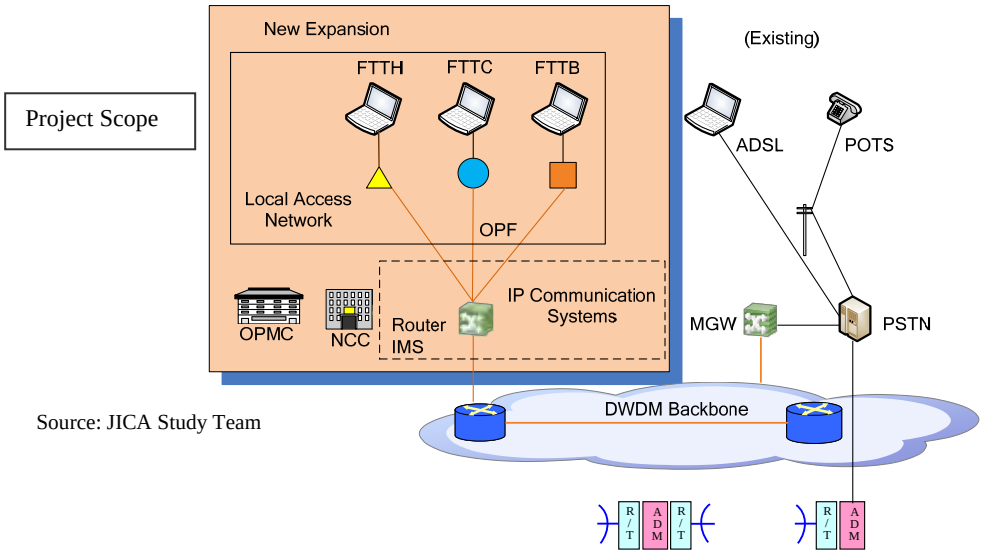
Communications sector in Iraq provides three services to the public, namely: telecommunications service, postal service and internet service.

Telecommunications and postal services are provided by ITPC, which is a state-owned and monopolized company under the control of the administrative management agency of MOC. Internet service is provided by SCIS, which is also a state-owned company. The regulatory authority is CMC which controls not only the communications sector but also broadcasting sector.

## (6) Project Scope and Cost

### 1) Project Scope

The following new expansion as illustrated in Figure 11.1-1 is necessary to be established for the improvement of the telecommunications network in Iraq. The project consists of five components as described below.




Source: JICA Study Team

Figure 11.1-1 Project Scope

- IP Communication Systems

IP communication systems are provided for Baghdad, Basra and Mosul. It is composed of IMS core, core routers and edge routers. IMS core is installed at a principal core exchange, the Sink exchange in Baghdad. The core router(s) is/are installed at the core exchange(s) while the edge routers are installed at the local exchanges. The core exchange is linked with the local exchanges via the existing optical fiber transmission system.

- Local Access Network

In terms of local access network, FTTC, FTTB and FTTH are to be adopted for the project. FTTC, FTTB and FTTH cover 244,000 lines, 33,500 lines and 8,500 lines, respectively, for a total of 286,000 lines for the project. The local access network provides broadband services to subscribers. Among the methods, FTTC plays a prevailing role followed by FTTB. FTTH has limited application intended for providing security and protection from power outage.

- New Communication Center (NCC)

NCC is constructed in order to handle the increase of internet traffic in Iraq and to reliably provide internet service to subscribers. The building has three storeys and is approximately 12 m by 18 m with a total floor area of 648 $m^2$.

- Outside Plant Maintenance Center (OPMC)

OPMC is constructed in order to provide operation and maintenance service for the new optic fiber cables and to serve as a training center as well. The building has three storeys and is approximately 30 m by 50 m with a total floor area of 4,500 $m^2$.

2) Project Cost

The summary of the capital cost for each case is shown in Table 11.1-2. Each case includes OPMC, HRD, NCC, IMS core system and charging/billing system. Even if the number of lines is reduced by half, the cost is not similarly reduced by half because the costs of OPMC, HRD, NCC, IMS core system and charging/billing system are differently estimated in each case.

Table 11.1-2 Capital Cost for Each Case

| Case | Target Area | | | Line | Cost | |
|---|---|---|---|---|---|---|
| | | | | (k lines) | (Million JPY) | Equivalent (Million USD) |
| Case-1 | Baghdad | Basra | Mosul | 286 | 30,174 | 370 |
| Case-2 | Baghdad | Basra | | 230 | 25,636 | 314 |
| Case-3 | Baghdad | | Mosul | 256 | 27,680 | 339 |
| Case-4 | | Basra | Mosul | 86 | 11,516 | 141 |
| Case-5 | Baghdad | | | 200 | 23,146 | 284 |
| Case-6 | | Basra | | 30 | 7,088 | 87 |
| Case-7 | | | Mosul | 56 | 9,174 | 112 |
| Note: USD 1= 81.55USD | | | | | | |

Source: JICA Study Team

3) Financial and Economic Analysis

Financial Analysis

The results of financial analysis for each case (Case-1 ~ Case-7) are summarized in Table 11.1-3.

Table 11.1-3 Results of Financial Analysis

| Case | Target Area | FIRR (%) | NPV (Mil IQD) | B/C |
|---|---|---|---|---|
| Case-1 | Baghdad/Basra/Mosul | 20.9 | 280,825 | 1.50 |
| Case-2 | Baghdad/Basra | 19.3 | 198,185 | 1.41 |
| Case-3 | Baghdad/Mosul | 20.1 | 236,346 | 1.45 |
| Case-4 | Basra/Mosul | 14.4 | 38,304 | 1.18 |
| Case-5 | Baghdad | 18.1 | 153,633 | 1.35 |
| Case-6 | Basra | -2.0 | -46,712 | 0.66 |
| Case-7 | Mosul | 8.6 | -9,082 | 0.95 |

Source: JICA Study Team

Economic Analysis

The results of economic analysis for each case (Case-1 ~ Case-7) are summarized in Table 11.1-4.

Table 11.1-4 Results of Economic Analysis

| Case | Target Area | EIRR (%) | NPV (Mil IQD) | B/C |
|---|---|---|---|---|
| Case-1 | Baghdad/Basra/Mosul | 28.7 | 427,847 | 1.95 |
| Case-2 | Baghdad/Basra | 27.0 | 321,969 | 1.83 |
| Case-3 | Baghdad/Mosul | 27.8 | 370,631 | 1.89 |
| Case-4 | Basra/Mosul | 21.4 | 90,628 | 1.52 |
| Case-5 | Baghdad | 25.7 | 264,694 | 1.76 |
| Case-6 | Basra | 5.7 | -15,823 | 0.86 |
| Case-7 | Mosul | 15.6 | 32,471 | 1.23 |

Source: JICA Study Team

### (7) Project Implementation

Implementation schedule for the 286,000 lines including pre-construction stage such as selection of consultant, detailed design and tendering is expected to be 52 months in total. The required period for each stage is shown in Table 11.1-5.

Table 11.1-5 Implementation Schedule

| Stage | Period |
|---|---|
| 1.Selection of Consultant | 10 months |
| 2.Detailed Design | 11 months |
| 3.Tendering | 7 months |
| 4.Construction, Installation and Training | |
| 1) IP communication system and Local Access Network | 16 months |
| 2) OPMC and NCC | 23 months |
| 3) Human Resource Development | 6 months |

Source: JICA Study Team

The implementation period of IP communication system and local access network will be shortened to about eight months in case the target areas only include Basra and Mosul.

(8) Environmental and Social Considerations

The adverse environmental and social impacts identified for the project are only typical and generally, such impacts are caused by carrying out any construction work. Moreover, these impacts of the project will be temporary and insignificant in terms of scale and extent.

By considering the identified environmental and social impacts during the construction phase of the project, it is desirable for the proponent (MOC and ITPC) and/or contractor to take the following mitigation measures:

- Safety and sanitary education/training program for construction workers;
- Traffic regulation in the vicinity of the construction area when necessary;
- Appropriate operation and maintenance of construction machineries/vehicles; and
- Adequate recycling and/or disposal of construction residual soil and waste.

## 11.2 Recommendations

(1) Early Implementation of the Project

The 2003 war in Iraq has damaged extensively its existing telecommunications infrastructure, causing the progress and development of Iraqi economy to lag behind its neighboring countries. Under these circumstances, MOC has released MTDS for 2010 to 2014 and pledged on the rehabilitation and improvement of the war-damaged infrastructure. MOC also intends to modernize and upgrade the whole outdated telecommunications network in association with its state-owned operators, ITPC and SCIS. In order to fulfill MOC's target above, it is strongly recommended to implement the project as early as possible by taking the following into account:

- Improvement and development of telecommunications network to catch up with the global transition from legacy PSTN to IP-based networks
- Creation of new business models derived from broadband services and paradigm shift from voice services to data services that IP-based networks can provide.

(2) Effective Management Organization of Iraqi during Implementation

Organization of an executing agency during project implementation is requested to fully fulfill its function. The organization varies by stages from design stage, bidding and contract stage, and implementation stage up to project completion. In order to keep the implementation schedule, it is recommended that the Iraqi government establishes an effective management organization dedicated to the project during each stage of the implementation.

The capabilities on relevant technologies and skills for project management are essential for carrying out the project because the NGN system needs high level of knowledge of system integration. It is essential to consider selecting a capable contractor as well as a competent consultant.

### (3) Human Resource Development (HRD)

HRD is an essential part of operating telecommunications system. ITPC has been carrying out excellent HRD programs. However, MOC/ITPC needs new and additional programs in its HRD training scheme since IP-based network technologies related to NGN will come to their daily operation and maintenance works. From the viewpoint of this technological transition, new HRD schemes are required for successful operation and maintenance of the new systems and facilities. Therefore, HRD should focus on the new technologies that constitute IP-based networks and associated with other essential technologies of NGN. HRD is, in principle, intended for the engineers of ITPC/SCIS engaged in the IP communication system. The participating trainees are also expected to transfer internally their acquired knowledge and skills to other staffs.

# *Appendices*

# *Appendix A*
# *Capital Cost for Each Case*

Table A-1 (1) Cost for Case1: Baghdad/Basra/Mosul

| Items | | FC (Million JPY) | Equivalent (Million USD) | Remarks |
|---|---|---|---|---|
| 1.Direct Cost | | | | |
| (1)Component | a | **14,636** | **179** | |
| 1) IP Communication System | b | 2,762 | 34 | |
| 2) Local Access Network | c | 10,797 | 132 | (Baghdad,Basra,Mosul: 286k lines) |
| 3) Outside Plant Maintenance Center (OPMC) | d | 326 | 4 | |
| 4) Human Resource Development (HRD) | e | 351 | 4 | |
| 5) New Communication Center (NCC) | f | 400 | 5 | |
| (2)Installation and Test | g | 4,559 | 56 | IP com. System and Local Access network |
| (3)Transportation and Insurance | h | 732 | 9 | **5% of 'a'** |
| (4)Civil Construction | i | 450 | 6 | OPMC and NCC |
| (5)Security Guard | j | 2,038 | 25 | **10% of ('a'+'g'+'h'+'i')** |
| **Total 1** | k | **22,415** | **275** | |
| | | | | |
| 2.Indirect Cost | | | | |
| (1)Consultancy Service | l | **1,569** | **19** | **7% of 'k'** |
| (2)Project Administration | m | **672** | **8** | **3% of 'k'** |
| (3)Physical Contingencies | n | **4,931** | **60** | **20% of ('k'+'l'+'m')** |
| (4)Price Contingencies | o | **587** | **7** | **FC: 1.3% for 'k'** |
| **Total 2** | p | **7,759** | **95** | |
| | | | | |
| **Grand total** | | **30,174** | **370** | **k'+'p'** |

**Note**
1.Consultancy Services is 7% of the direct cost.
2.Project Administration cost is 3% of the direct cost.
3.Physical contingency is 20% of the direct cost, the consultancy service and the project administration in the indirect cost.
4.Price contingency is referred to soft loan project in Iraq as follows: Foreign currency (FC) is 1.3 % per annum.

Source: JICA Study Team

Table A-1 (2) Cost of IP Communication system for Case1

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| IP Communication System | **IP Equipment** | | | | | |
| | IMS core | 1system | | 2,500,000 | 30,656 | Including software and hardware |
| | Core Router | 8 | 5,000 | 40,000 | 490 | |
| | Edge Router | 36 | 2,000 | 72,000 | 883 | |
| | Charging/Billing system | 1system | | 150,000 | 1,839 | |
| | **Total** | | | **2,762,000** | **33,869** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | IP Equipment | 1lot | | 276,200 | 3,387 | 10% of IP Equipment Cost |
| | **Total** | | | **276,200** | **3,387** | |
| Grand Total | | | | **3,038,200** | **37,256** | |

Source: JICA Study Team

Table A-1 (3) Cost of Local Access Network for Case1

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| Local Access Network | **Local Access Equipment1** | | | | | |
| | VDSL ONU | 366 | 1,200 | 439,200 | 5,386 | FTTB for 33,500lines |
| | Sip Access Gateway for FTTB | 35 | 3,000 | 105,000 | 1,288 | |
| | ADSL ONU | 1,930 | 1,500 | 2,895,000 | 35,500 | FTTC for 244,000lines |
| | Sip Access Gateway for FTTC | 249 | 3,000 | 747,000 | 9,160 | |
| | OLT | 40 | 400 | 16,000 | 196 | FTTH for 8,500lines |
| | Solar Battery System | 249 | 1,500 | 373,500 | 4,580 | |
| | Shelter including MDF & ODF | 249 | 1,000 | 249,000 | 3,053 | |
| | **Subtotal (Local Access Equipment1)** | | | **4,824,700** | **59,162** | |
| | **Local Access Equipment2** | | | | | Supply only |
| | VDSL Modem | 33,500 | 5 | 167,500 | 2,054 | |
| | ADSL Modem | 244,000 | 5 | 1,220,000 | 14,960 | |
| | ONT | 8,500 | 10 | 85,000 | 1,042 | |
| | **Subtotal (Local Access Equipment2)** | | | **1,472,500** | **18,056** | |
| | | | | | | |
| | **Cabling material** | 1lot | | **4,500,000** | **55,181** | *1 |
| | | | | | | |
| | **Total** | | | **10,797,200** | **132,400** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | Local Access Equipment1 | 1lot | | 482,470 | 5,916 | 10% of Local Access Equipment1 Cost |
| | Cable Installation | 1lot | | 3,800,000 | 46,597 | *2 |
| | **Total** | | | **4,282,470** | **52,513** | |
| Grand Total | | | | **15,079,670** | **184,913** | |

Remarks
The amount is calculated as shown below.
*1:8,545,990kiloYen*286k lines/549k lines=4,500,000
8,545,990kilo Yen is sum of material cost for 1.Civil work, 2. Pole, 3. Metarllic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.
*2: 7,357,873kiloYen*286k lines/549k lines=3,800,000
7,357,873kilo Yen is sum of installation cost for 1.Civil work, 2. Pole, 3. Metarllic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.

Source: JICA Study Team

Table A-2 (1) Cost for Case2: Baghdad/Basra

| Items | | FC (Million JPY) | Equivalent (Million USD) | Remarks |
|---|---|---|---|---|
| 1.Direct Cost | | | | |
| (1)Component | a | **12,478** | **153** | |
| 1) IP Communication System | b | 2,749 | 34 | |
| 2) Local Access Network | c | 8,652 | 106 | (Baghdad,Basra: 230k lines) |
| 3) Outside Plant Maintenance Center (OPMC) | d | 326 | 4 | |
| 4) Human Resource Development (HRD) | e | 351 | 4 | |
| 5) New Communication Center (NCC) | f | 400 | 5 | |
| (2)Installation and Test | g | 3,761 | 46 | IP com. System and Local Access network |
| (3)Transportation and Insurance | h | 624 | 8 | **5% of 'a'** |
| (4)Civil Construction | i | 450 | 6 | OPMC and NCC |
| (5)Security Guard | j | 1,731 | 21 | **10% of ('a'+'g'+'h'+'i')** |
| **Total 1** | k | **19,044** | **234** | |
| | | | | |
| 2.Indirect Cost | | | | |
| (1)Consultancy Service | l | **1,333** | 16 | **7% of 'k'** |
| (2)Project Administration | m | **571** | 7 | **3% of 'k'** |
| (3)Physical Contingencies | n | **4,190** | 51 | **20% of ('k'+'l'+'m')** |
| (4)Price Contingencies | o | **498** | 6 | **FC: 1.3% for 'k'** |
| **Total 2** | p | **6,592** | **81** | |
| | | | | |
| **Grand total** | | **25,636** | **314** | **k'+'p'** |

**Note**
1.Consultancy Services is 7% of the direct cost.
2.Project Administration cost is 3% of the direct cost.
3.Physical contingency is 20% of the direct cost, the consultancy service and the project administration in the indirect cost.
4.Price contingency is referred to soft loan project in Iraq as follows: Foreign currency (FC) is 1.3 % per annum.

Source: JICA Study Team

Table A-2 (2) Cost of IP Communication system for Case2

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| IP Communication System | **IP Equipment** | | | | | |
| | IMS core | 1system | | 2,500,000 | 30,656 | including installation and test |
| | Core Router | 7 | 5,000 | 35,000 | 429 | |
| | Edege Router | 32 | 2,000 | 64,000 | 785 | |
| | Charging/Biling system | 1system | | 150,000 | 1,839 | |
| | **Total** | | | **2,749,000** | **33,709** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | IP Equipment | | | 274,900 | 3,371 | 10% of IP Equipment Cost |
| | **Total** | | | **274,900** | **3,371** | |
| Grand Total | | | | **3,023,900** | **37,080** | |

Source: JICA Study Team

Table A-2 (3) Cost of Local Access Network for Case2

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| Local Access Network | **Local Access Equipment1** | | | | | |
| | VDSL ONU | 343 | 1,200 | 411,600 | 5,047 | FTTB for 31,500lines |
| | Sip Access Gateway for FTTB | 32 | 3,000 | 96,000 | 1,177 | |
| | ADSL ONU | 1,514 | 1,500 | 2,271,000 | 27,848 | FTTC for 191,000lines |
| | Sip Access Gateway for FTTC | 195 | 3,000 | 585,000 | 7,174 | |
| | OLT | 33 | 400 | 13,200 | 162 | FTTH for 7,500lines |
| | Solar Battery System | 195 | 1,500 | 292,500 | 3,587 | |
| | Shelter including MDF & ODF | 195 | 1,000 | 195,000 | 2,391 | |
| | **Subtotal (Local Access Equipment1)** | | | **3,864,300** | **47,386** | |
| | **Local Access Equipment2** | | | | | Supply only |
| | VDSL Modem | 31,500 | 5 | 157,500 | 1,931 | |
| | ADSL Modem | 191,000 | 5 | 955,000 | 11,711 | |
| | ONT | 7,500 | 10 | 75,000 | 920 | |
| | **Subtotal (Local Access Equipment2)** | | | **1,187,500** | **14,562** | |
| | | | | | | |
| | **Cabling material** | 1lot | | **3,600,000** | **44,145** | *1 |
| | | | | | | |
| | **Total** | 1lot | | **8,651,800** | **106,092** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | Local Access Equipment1 | 1lot | | 386,430 | 4,739 | 10% of Local Access Equipment1 Cost |
| | Cable Installation | 1lot | | 3,100,000 | 38,013 | *2 |
| | **Total** | | | **3,486,430** | **42,752** | |
| Grand Total | | | | **12,138,230** | **148,844** | |

Remarks
The amount is calculated as shown below.
*1: 8,545,990kiloYen*230k lines/549k lines=3,600,000
8,545,990kilo Yen is sum of material cost for 1.Civil work, 2. Pole, 3. Metarllic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.
*2:7,357,873kiloYen*230k lines/549k lines=3,100,000
7,357,873kilo Yen is sum of installation cost for 1.Civil work, 2. Pole, 3. Metarllic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.

Source: JICA Study Team

Table A-3 (1) Cost for Each Case3: Baghdad/Mosul

| Items | | FC (Million JPY) | Equivalent (Million USD) | Remarks |
|---|---|---|---|---|
| 1.Direct Cost | | | | |
| (1)Component | a | **13,463** | **165** | |
| 1) IP Communication System | b | 2,751 | 34 | |
| 2) Local Access Network | c | 9,635 | 118 | (Baghdad,Mosul: 256k lines) |
| 3) Outside Plant Maintenance Center (OPMC) | d | 326 | 4 | |
| 4) Human Resource Development (HRD) | e | 351 | 4 | |
| 5) New Communication Center (NCC) | f | 400 | 5 | |
| (2)Installation and Test | g | 4,107 | 50 | IP com. System and Local Access network |
| (3)Transportation and Insurance | h | 673 | 8 | **5% of 'a'** |
| (4)Civil Construction | i | 450 | 6 | OPMC and NCC |
| (5)Security Guard | j | 1,869 | 23 | **10% of ('a'+'g'+'h'+'i')** |
| **Total 1** | k | **20,562** | **252** | |
| | | | | |
| 2.Indirect Cost | | | | |
| (1)Consultancy Service | l | **1,439** | **18** | **7% of 'k'** |
| (2)Project Administration | m | **617** | **8** | **3% of 'k'** |
| (3)Physical Contingencies | n | **4,524** | **55** | **20% of ('k'+'l'+'m')** |
| (4)Price Contingencies | o | **538** | **7** | **FC: 1.3% for 'k'** |
| **Total 2** | p | **7,118** | **87** | |
| | | | | |
| **Grand total** | | **27,680** | **339** | **k'+'p'** |

**Note**
1.Consultancy Services is 7% of the direct cost.
2.Project Administration cost is 3% of the direct cost.
3.Physical contingency is 20% of the direct cost, the consultancy service and the project administration in the indirect cost.
4.Price contingency is referred to soft loan project in Iraq as follows: Foreign currency (FC) is 1.3 % per annum.

Source: JICA Study Team

Table A-3 (2) Cost of IP Communication system for Case3

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| IP Communication System | **IP Equipment** | | | | | |
| | IMS core | 1system | | 2,500,000 | 30,656 | including installation and test |
| | Core Router | 7 | 5,000 | 35,000 | 429 | |
| | Edge Router | 33 | 2,000 | 66,000 | 809 | |
| | Charging/Billing system | 1system | | 150,000 | 1,839 | |
| | **Total** | | | **2,751,000** | **33,734** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | IP Equipment | | | 275,100 | 3,373 | 10% of IP Equipment Cost |
| | **Total** | | | **275,100** | **3,373** | |
| Grand Total | | | | **3,026,100** | **37,107** | |

Source: JICA Study Team

Table A-3 (3) Cost of Local Access Network for Case3

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| Local Access Network | **Local Access Equipment1** | | | | | |
| | VDSL ONU | 344 | 1,200 | 412,800 | 5,062 | FTTB for 31,500lines |
| | Sip Access Gateway for FTTB | 33 | 3,000 | 99,000 | 1,214 | |
| | ADSL ONU | 1,717 | 1,500 | 2,575,500 | 31,582 | FTTC for 217,000lines |
| | Sip Access Gateway for FTTC | 221 | 3,000 | 663,000 | 8,130 | |
| | OLT | 37 | 400 | 14,800 | 181 | FTTH for 7,500lines |
| | Solar Battery System | 221 | 1,500 | 331,500 | 4,065 | |
| | Shelter including MDF & ODF | 221 | 1,000 | 221,000 | 2,710 | |
| | **Subtotal (Local Access Equipment1)** | | | **4,317,600** | **52,944** | |
| | **Local Access Equipment2** | | | | | Supply only |
| | VDSL Modem | 31,500 | 5 | 157,500 | 1,931 | |
| | ADSL Modem | 217,000 | 5 | 1,085,000 | 13,305 | |
| | ONT | 7,500 | 10 | 75,000 | 920 | |
| | **Subtotal (Local Access Equipment2)** | | | **1,317,500** | **16,156** | |
| | | | | | | |
| | **Cabling material** | 1lot | | **4,000,000** | **49,050** | *1 |
| | | | | | | |
| | **Total** | 1lot | | **9,635,100** | **118,150** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | Local Access Equipment1 | 1lot | | 431,760 | 5,294 | 10% of Local Access Equipment1 Cost |
| | Cable Installation | 1lot | | 3,400,000 | 41,692 | *2 |
| | **Total** | | | **3,831,760** | **46,987** | |
| Grand Total | | | | **13,466,860** | **165,136** | |

Remarks
The amount is calculated as shown below.
*1: 8,545,990kiloYen*256k lines/549k lines=4,000,000
8,545,990kilo Yen is sum of material cost for 1.Civil work, 2. Pole, 3. Metallic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.
*2:7,357,873kiloYen*256k lines/549k lines=3,400,000
7,357,873kilo Yen is sum of installation cost for 1.Civil work, 2. Pole, 3. Metallic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.

Source: JICA Study Team

Table A-4 (1) Cost of Each Case4: Basra/Mosul

| Items | | FC (Million JPY) | Equivalent (Million USD) | Remarks |
|---|---|---|---|---|
| 1.Direct Cost | | | | |
| (1)Component | a | **5,659** | **69** | |
| 1) IP Communication System | b | 1,374 | 17 | |
| 2) Local Access Network | c | 3,208 | 39 | (Basra,Mosul: 86k lines) |
| 3) Outside Plant Maintenance Center (OPMC) | d | 326 | 4 | |
| 4) Human Resource Development (HRD) | e | 351 | 4 | |
| 5) New Communication Center (NCC) | f | 400 | 5 | |
| (2)Installation and Test | g | 1,384 | 17 | IP com. System and Local Access network |
| (3)Transportation and Insurance | h | 283 | 3 | **5% of 'a'** |
| (4)Civil Construction | i | 450 | 6 | OPMC and NCC |
| (5)Security Guard | j | 778 | 10 | **10% of ('a'+'g'+'h'+'i')** |
| **Total 1** | k | **8,554** | **105** | |
| | | | | |
| 2.Indirect Cost | | | | |
| (1)Consultancy Service | l | **599** | **7** | **7% of 'k'** |
| (2)Project Administration | m | **257** | **3** | **3% of 'k'** |
| (3)Physical Contingencies | n | **1,882** | **23** | **20% of ('k'+'l'+'m')** |
| (4)Price Contingencies | o | **224** | **3** | **FC: 1.3% for 'k'** |
| **Total 2** | p | **2,962** | **36** | |
| | | | | |
| **Grand total** | | **11,516** | **141** | **k'+'p'** |

**Note**
1.Consultancy Services is 7% of the direct cost.
2.Project Administration cost is 3% of the direct cost.
3.Physical contingency is 20% of the direct cost, the consultancy service and the project administration in the indirect cost.
4.Price contingency is referred to soft loan project in Iraq as follows: Foreign currency (FC) is 1.3 % per annum.

Source: JICA Study Team

Table A-4 (2) Cost of IP Communication system for Case4

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| IP Communication System | **IP Equipment** | | | | | |
| | IMS core | 1system | | 1,200,000 | 14,715 | including installation and test |
| | Core Router | 2 | 5,000 | 10,000 | 123 | |
| | Edge Router | 7 | 2,000 | 14,000 | 172 | |
| | Charging/Billing system | 1system | | 150,000 | 1,839 | |
| | **Total** | | | **1,374,000** | **16,849** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | IP Equipment | 1Lot | | 137,400 | 1,685 | 10% of IP Equipment Cost |
| | **Total** | | | **137,400** | **1,685** | |
| Grand Total | | | | **1,511,400** | **18,533** | |

Source: JICA Study Team

Table A-4 (3) Cost of Local Access Network for Case4

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| Local Access Network | **Local Access Equipment1** | | | | | |
| | VDSL ONU | 45 | 1,200 | 54,000 | 662 | FTTB for 4,000lines |
| | Sip Access Gateway for FTTB | 5 | 3,000 | 15,000 | 184 | |
| | ADSL ONU | 629 | 1,500 | 943,500 | 11,570 | FTTC for 80,000lines |
| | Sip Access Gateway for FTTC | 82 | 3,000 | 246,000 | 3,017 | |
| | OLT | 10 | 400 | 4,000 | 49 | FTTH for 2,000lines |
| | Solar Battery System | 82 | 1,500 | 123,000 | 1,508 | |
| | Shelter including MDF & ODF | 82 | 1,000 | 82,000 | 1,006 | |
| | **Subtotal (Local Access Equipment1)** | | | **1,467,500** | **17,995** | |
| | **Local Access Equipment2** | | | | | Supply only |
| | VDSL Modem | 4,000 | 5 | 20,000 | 245 | |
| | ADSL Modem | 80,000 | 5 | 400,000 | 4,905 | |
| | ONT | 2,000 | 10 | 20,000 | 245 | |
| | **Subtotal (Local Access Equipment2)** | | | **440,000** | **5,395** | |
| | | | | | | |
| | **Cabling material** | 1lot | | **1,300,000** | **15,941** | *1 |
| | | | | | | |
| | **Total** | | | **3,207,500** | **39,332** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | Local Access Equipment1 | 1lot | | 146,750 | 1,800 | 10% of Local Access Equipment1 Cost |
| | Cable Installation | 1lot | | 1,100,000 | 13,489 | *2 |
| | Total | | | **1,246,750** | **15,288** | |
| Grand Total | | | | **4,454,250** | **54,620** | |

Remarks
The amount is calculated as shown below.
*1: 8,545,990kiloYen*86k lines/549k lines=1,300,000
8,545,990kilo Yen is sum of material cost for 1.Civil work, 2. Pole, 3. Metallic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.
*2:7,357,873kiloYen*86k lines/549k lines=1,100,000
7,357,873kilo Yen is sum of installation cost for 1.Civil work, 2. Pole, 3. Metallic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.

Source: JICA Study Team

Table A-5 (1) Cost of Each Case5: Baghdad

| Items | | FC (Million JPY) | Equivalent (Million USD) | Remarks |
|---|---|---|---|---|
| 1.Direct Cost | | | | |
| (1)Component | a | **11,305** | **139** | |
| 1) IP Communication System | b | 2,738 | 34 | |
| 2) Local Access Network | c | 7,490 | 92 | (Baghdad: 200k lines) |
| 3) Outside Plant Maintenance Center (OPMC) | d | 326 | 4 | |
| 4) Human Resource Development (HRD) | e | 351 | 4 | |
| 5) New Communication Center (NCC) | f | 400 | 5 | |
| (2)Installation and Test | g | 3,310 | 41 | IP com. System and Local Access network |
| (3)Transportation and Insurance | h | 565 | 7 | **5% of 'a'** |
| (4)Civil Construction | i | 450 | 6 | OPMC and NCC |
| (5)Security Guard | j | 1,563 | 19 | **10% of ('a'+'g'+'h'+'i')** |
| **Total 1** | k | **17,193** | **211** | |
| | | | | |
| 2.Indirect Cost | | | | |
| (1)Consultancy Service | l | **1,204** | **15** | **7% of 'k'** |
| (2)Project Administration | m | **516** | **6** | **3% of 'k'** |
| (3)Physical Contingencies | n | **3,783** | **46** | **20% of ('k'+'l'+'m')** |
| (4)Price Contingencies | o | **450** | **6** | **FC: 1.3% for 'k'** |
| **Total 2** | p | **5,953** | **73** | |
| | | | | |
| **Grand total** | | **23,146** | **284** | **k'+'p'** |

**Note**
1.Consultancy Services is 7% of the direct cost.
2.Project Administration cost is 3% of the direct cost.
3.Physical contingency is 20% of the direct cost, the consultancy service and the project administration in the indirect cost.
4.Price contingency is referred to soft loan project in Iraq as follows: Foreign currency (FC) is 1.3 % per annum.

Source: JICA Study Team

Table A-5 (2) Cost of IP Communication system for Case5

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| IP Communication System | **IP Equipment** | | | | | |
| | IMS core | 1system | | 2,500,000 | 30,656 | including installation and test |
| | Core Router | 6 | 5,000 | 30,000 | 368 | |
| | Edge Router | 29 | 2,000 | 58,000 | 711 | |
| | Charging/Billing system | 1system | | 150,000 | 1,839 | |
| | **Total** | | | **2,738,000** | **33,574** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | IP Equipment | | | 273,800 | 3,357 | 10% of IP Equipment Cost |
| | **Total** | | | **273,800** | **3,357** | |
| Grand Total | | | | **3,011,800** | **36,932** | |

Source: JICA Study Team

Table A-5 (3) Cost of Local Access Network for Case5

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| Local Access Network | **Local Access Equipment1** | | | | | |
| | VDSL ONU | 321 | 1,200 | 385,200 | 4,723 | FTTB for 29,500lines |
| | Sip Access Gateway for FTTB | 30 | 3,000 | 90,000 | 1,104 | |
| | ADSL ONU | 1,301 | 1,500 | 1,951,500 | 23,930 | FTTC for 164,000lines |
| | Sip Access Gateway for FTTC | 167 | 3,000 | 501,000 | 6,143 | |
| | OLT | 30 | 400 | 12,000 | 147 | FTTH for 6,500lines |
| | Solar Battery System | 167 | 1,500 | 250,500 | 3,072 | |
| | Shelter including MDF & ODF | 167 | 1,000 | 167,000 | 2,048 | |
| | **Subtotal (Local Access Equipment1)** | | | **3,357,200** | **41,167** | |
| | **Local Access Equipment2** | | | | | Supply only |
| | VDSL Modem | 29,500 | 5 | 147,500 | 1,809 | |
| | ADSL Modem | 164,000 | 5 | 820,000 | 10,055 | |
| | ONT | 6,500 | 10 | 65,000 | 797 | |
| | **Subtotal (Local Access Equipment2)** | | | **1,032,500** | **12,661** | |
| | | | | | | |
| | **Cabling material** | 1lot | | **3,100,000** | **38,013** | *1 |
| | | | | | | |
| | **Total** | | | **7,489,700** | **91,842** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | Local Access Equipment1 | 1lot | | 335,720 | 4,117 | 10% of Local Access Equipment1 Cost |
| | Cable Installation | 1lot | | 2,700,000 | 33,109 | *2 |
| | Total | | | **3,035,720** | **37,225** | |
| Grand Total | | | | **10,525,420** | **129,067** | |

Remarks
The amount is calculated as shown below.
*1: 8,545,990kiloYen*200k lines/549k lines=3,100,000
8,545,990kilo Yen is sum of material cost for 1.Civil work, 2. Pole, 3. Metallic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.
*2: 7,357,873kiloYen*200k lines/549k lines=2,700,000
7,357,873kilo Yen is sum of installation cost for 1.Civil work, 2. Pole, 3. Metallic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.

Source: JICA Study Team

Table A-6 (1) Cost of Each Case6: Basra

| Items | | FC (Million JPY) | Equivalent (Million USD) | Remarks |
|---|---|---|---|---|
| 1.Direct Cost | | | | |
| (1)Component | a | **3,570** | **44** | |
| 1) IP Communication System | b | 1,361 | 17 | |
| 2) Local Access Network | c | 1,132 | 14 | (Basra: 30k lines) |
| 3) Outside Plant Maintenance Center (OPMC) | d | 326 | 4 | |
| 4) Human Resource Development (HRD) | e | 351 | 4 | |
| 5) New Communication Center (NCC) | f | 400 | 5 | |
| (2)Installation and Test | g | 587 | 7 | IP com. System and Local Access network |
| (3)Transportation and Insurance | h | 179 | 2 | **5% of 'a'** |
| (4)Civil Construction | i | 450 | 6 | OPMC and NCC |
| (5)Security Guard | j | 479 | 6 | **10% of ('a'+'g'+'h'+'i')** |
| **Total 1** | k | **5,265** | **65** | |
| | | | | |
| 2.Indirect Cost | | | | |
| (1)Consultancy Service | l | **369** | **5** | **7% of 'k'** |
| (2)Project Administration | m | **158** | **2** | **3% of 'k'** |
| (3)Physical Contingencies | n | **1,158** | **14** | **20% of ('k'+'l'+'m')** |
| (4)Price Contingencies | o | **138** | **2** | **FC: 1.3% for 'k'** |
| **Total 2** | p | **1,823** | **22** | |
| | | | | |
| **Grand total** | | **7,088** | **87** | **k'+'p'** |

**Note**
1.Consultancy Services is 7% of the direct cost.
2.Project Administration cost is 3% of the direct cost.
3.Physical contingency is 20% of the direct cost, the consultancy service and the project administration in the indirect cost.
4.Price contingency is referred to soft loan project in Iraq as follows: Foreign currency (FC) is 1.3 % per annum.

Source: JICA Study Team

Table A-6 (2) Cost of IP Communication system for Case6

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| IP Communication System | **IP Equipment** | | | | | |
| | IMS core | 1system | | 1,200,000 | 14,715 | including installation and test |
| | Core Router | 1 | 5,000 | 5,000 | 61 | |
| | Edge Router | 3 | 2,000 | 6,000 | 74 | |
| | Charging/Billing system | 1system | | 150,000 | 1,839 | |
| | **Total** | | | **1,361,000** | **16,689** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | IP Equipment | | | 136,100 | 1,669 | 10% of IP Equipment Cost |
| | **Total** | | | **136,100** | **1,669** | |
| Grand Total | | | | **1,497,100** | **18,358** | |

Source: JICA Study Team

Table A-6 (3) Cost of Local Access Network for Case6

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| Local Access Network | **Local Access Equipment1** | | | | | |
| | VDSL ONU | 22 | 1,200 | 26,400 | 324 | FTTB for 2,000lines |
| | Sip Access Gateway for FTTB | 2 | 3,000 | 6,000 | 74 | |
| | ADSL ONU | 213 | 1,500 | 319,500 | 3,918 | FTTC for 27,000lines |
| | Sip Access Gateway for FTTC | 28 | 3,000 | 84,000 | 1,030 | |
| | OLT | 3 | 400 | 1,200 | 15 | FTTH for 1,000lines |
| | Solar Battery System | 28 | 1,500 | 42,000 | 515 | |
| | Shelter including MDF & ODF | 28 | 1,000 | 28,000 | 343 | |
| | **Subtotal (Local Access Equipment1)** | | | **507,100** | **6,218** | |
| | **Local Access Equipment2** | | | | | Supply only |
| | VDSL Modem | 2,000 | 5 | 10,000 | 123 | |
| | ADSL Modem | 27,000 | 5 | 135,000 | 1,655 | |
| | ONT | 1,000 | 10 | 10,000 | 123 | |
| | **Subtotal (Local Access Equipment2)** | | | **155,000** | **1,901** | |
| | | | | | | |
| | **Cabling material** | 1lot | | **470,000** | **5,763** | *1 |
| | | | | | | |
| | **Total** | | | **1,132,100** | **13,882** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | Local Access Equipment1 | 1lot | | 50,710 | 622 | 10% of Local Access Equipment1 Cost |
| | Cable Installation | 1lot | | 400,000 | 4,905 | *2 |
| | **Total** | | | **450,710** | **5,527** | |
| Grand Total | | | | **1,582,810** | **19,409** | |

Remarks
The amount is calculated as shown below.
*1: 8,545,990kiloYen*30k lines/549k lines=470,000
8,545,990kilo Yen is sum of material cost for 1.Civil work, 2. Pole, 3. Metallic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.
*2: 7,357,873kiloYen*30k lines/549k lines=400,000
7,357,873kilo Yen is sum of installation cost for 1.Civil work, 2. Pole, 3. Metallic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.

Source: JICA Study Team

Table A-7 (1) Cost of Each Case7: Mosul

| Items | | FC (Million JPY) | Equivalent (Million USD) | Remarks |
|---|---|---|---|---|
| 1.Direct Cost | | | | |
| (1)Component | a | **4,585** | **56** | |
| 1) IP Communication System | b | 1,363 | 17 | |
| 2) Local Access Network | c | 2,145 | 26 | (Mosul: 56k lines) |
| 3) Outside Plant Maintenance Center (OPMC) | d | 326 | 4 | |
| 4) Human Resource Development (HRD) | e | 351 | 4 | |
| 5) New Communication Center (NCC) | f | 400 | 5 | |
| (2)Installation and Test | g | 932 | 11 | IP com. System and Local Access network |
| (3)Transportation and Insurance | h | 229 | 3 | **5% of 'a'** |
| (4)Civil Construction | i | 450 | 6 | OPMC and NCC |
| (5)Security Guard | j | 620 | 8 | **10% of ('a'+'g'+'h'+'i')** |
| **Total 1** | k | **6,816** | **84** | |
| | | | | |
| 2.Indirect Cost | | | | |
| (1)Consultancy Service | l | **477** | **6** | **7% of 'k'** |
| (2)Project Administration | m | **204** | **3** | **3% of 'k'** |
| (3)Physical Contingencies | n | **1,499** | **18** | **20% of ('k'+'l'+'m')** |
| (4)Price Contingencies | o | **178** | **2** | **FC: 1.3% for 'k'** |
| **Total 2** | p | **2,358** | **29** | |
| | | | | |
| **Grand total** | | **9,174** | **112** | **k'+'p'** |

**Note**
1.Consultancy Services is 7% of the direct cost.
2.Project Administration cost is 3% of the direct cost.
3.Physical contingency is 20% of the direct cost, the consultancy service and the project administration in the indirect cost.
4.Price contingency is referred to soft loan project in Iraq as follows: Foreign currency (FC) is 1.3 % per annum.

Source: JICA Study Team

Table A-7 (2) Cost of IP Communication system for Case7

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| IP Communication System | **IP Equipment** | | | | | |
| | IMS core | 1system | | 1,200,000 | 14,715 | including installation and test |
| | Core Router | 1 | 5,000 | 5,000 | 61 | |
| | Edge Router | 4 | 2,000 | 8,000 | 98 | |
| | Charging/Billing system | 1system | | 150,000 | 1,839 | |
| | **Total** | | | **1,363,000** | **16,714** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | IP Equipment | 1Lot | | 136,300 | 1,671 | 10% of IP Equipment Cost |
| | **Total** | | | **136,300** | **1,671** | |
| Grand Total | | | | **1,499,300** | **18,385** | |

Source: JICA Study Team

Table A-7 (3) Cost of Local Access Network for Case7

| Components | Breakdown | Quantity | Unit Price (1000 JPY) | Amount (1000 JPY) | Equivalent (1000 USD) | Application |
|---|---|---|---|---|---|---|
| Local Access Network | **Local Access Equipment1** | | | | | |
| | VDSL ONU | 23 | 1,200 | 27,600 | 338 | FTTB for 2,000lines |
| | Sip Access Gateway for FTTB | 3 | 3,000 | 9,000 | 110 | |
| | ADSL ONU | 416 | 1,500 | 624,000 | 7,652 | FTTC for 53,000lines |
| | Sip Access Gateway for FTTC | 54 | 3,000 | 162,000 | 1,987 | |
| | OLT | 7 | 400 | 2,800 | 34 | FTTH for 1,000lines |
| | Solar Battery System | 54 | 1,500 | 81,000 | 993 | |
| | Shelter including MDF & ODF | 54 | 1,000 | 54,000 | 662 | |
| | **Subtotal (Local Access Equipment1)** | | | **960,400** | **11,777** | |
| | **Local Access Equipment2** | | | | | Supply only |
| | VDSL Modem | 2,000 | 5 | 10,000 | 123 | |
| | ADSL Modem | 53,000 | 5 | 265,000 | 3,250 | |
| | ONT | 1,000 | 10 | 10,000 | 123 | |
| | **Subtotal (Local Access Equipment2)** | | | **285,000** | **3,495** | |
| | | | | | | |
| | **Cabling material** | 1lot | | **900,000** | **11,036** | *1 |
| | | | | | | |
| | **Total** | | | **2,145,400** | **26,308** | |
| | | | | | | |
| | **Installation and Test** | | | | | |
| | Local Access Equipment1 | 1lot | | 96,040 | 1,178 | 10% of Local Access Equipment1 Cost |
| | Cable Installation | 1lot | | 700,000 | 8,584 | *2 |
| | **Total** | | | **796,040** | **9,761** | |
| Grand Total | | | | **2,941,440** | **36,069** | |

Remarks
The amount is calculated as shown below.
*1: 8,545,990kiloYen*56k lines/549k lines=900,000
8,545,990kilo Yen is sum of material cost for 1.Civil work, 2. Pole, 3. Metallic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.
*2: 7,357,873kiloYen*56k lines/549k lines=700,000
7,357,873kilo Yen is sum of installation cost for 1.Civil work, 2. Pole, 3. Metallic Cable and 4.Optical Fiber Cable to implement 549k lines shown in Appendix 3-4-3-2 of JETRO F/S report.

Source: JICA Study Team

# *Appendix B*
# *Financial and Economic Analysis*

# B-1 Financial Analysis for Each Case

Table B-1(1) FIRR for Case 1

Case-1 Baghdad/Basra/Mosul (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 6,802 | 0 | 6,802 | 0 | 0 | 0 | -6,802 |
| 2 | 13 | 48,838 | 22,424 | 0 | 71,262 | 0 | 0 | 0 | -71,262 |
| 3 | 14 | 262,925 | 71,681 | 0 | 334,606 | 0 | 0 | 0 | -334,606 |
| 4 | 15 | 12,134 | 11,212 | 0 | 23,345 | 0 | 0 | 0 | -23,345 |
| 5 | 16 | 0 | 0 | 43,601 | 43,601 | 136,248 | 37,551 | 173,799 | 130,197 |
| 6 | 17 | 0 | 0 | 43,601 | 43,601 | 107,648 | 54,098 | 161,746 | 118,145 |
| 7 | 18 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 8 | 19 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 9 | 20 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 10 | 21 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 11 | 22 | 39,911 | 0 | 43,601 | 83,512 | 107,648 | 60,675 | 168,323 | 84,811 |
| 12 | 23 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 13 | 24 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 14 | 25 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 15 | 26 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 16 | 27 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 17 | 28 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |
| 18 | 29 | 0 | 0 | 43,601 | 43,601 | 107,648 | 60,675 | 168,323 | 124,722 |

| | |
|---|---|
| FIRR | 20.9% |
| NPV | 280,825 |
| PV(cost) | 565,788 |
| PV(benefit) | 846,612 |
| B/C | 1.50 |

Source: JICA study team

Table B-1(2) FIRR for Case 2

Case-2 Baghdad/Basra (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 5,779 | 0 | 5,779 | 0 | 0 | 0 | -5,779 |
| 2 | 13 | 41,714 | 19,051 | 0 | 60,765 | 0 | 0 | 0 | -60,765 |
| 3 | 14 | 222,935 | 60,900 | 0 | 283,834 | 0 | 0 | 0 | -283,834 |
| 4 | 15 | 10,537 | 9,525 | 0 | 20,062 | 0 | 0 | 0 | -20,062 |
| 5 | 16 | 0 | 0 | 37,044 | 37,044 | 109,570 | 30,337 | 139,908 | 102,864 |
| 6 | 17 | 0 | 0 | 37,044 | 37,044 | 86,570 | 43,491 | 130,061 | 93,017 |
| 7 | 18 | 0 | 0 | 37,044 | 37,044 | 86,570 | 48,794 | 135,365 | 98,321 |
| 8 | 19 | 0 | 0 | 37,044 | 37,044 | 86,570 | 48,794 | 135,365 | 98,321 |
| 9 | 20 | 0 | 0 | 37,044 | 37,044 | 86,570 | 48,794 | 135,365 | 98,321 |
| 10 | 21 | 0 | 0 | 37,044 | 37,044 | 86,570 | 48,794 | 135,365 | 98,321 |
| 11 | 22 | 39,723 | 0 | 37,044 | 76,767 | 86,570 | 48,794 | 135,365 | 58,598 |
| 12 | 23 | 0 | 0 | 37,044 | 37,044 | 86,570 | 48,794 | 135,365 | 98,321 |
| 13 | 24 | 0 | 0 | 37,044 | 37,044 | 86,570 | 48,794 | 135,365 | 98,321 |
| 14 | 25 | 0 | 0 | 37,044 | 37,044 | 86,570 | 48,794 | 135,365 | 98,321 |
| 15 | 26 | 0 | 0 | 37,044 | 37,044 | 86,570 | 48,794 | 135,365 | 98,321 |
| 16 | 27 | 0 | 0 | 37,044 | 37,044 | 86,570 | 48,794 | 135,365 | 98,321 |
| 17 | 28 | 0 | 0 | 37,044 | 37,044 | 86,570 | 48,794 | 135,365 | 98,321 |
| 18 | 29 | 0 | 0 | 37,044 | 37,044 | 86,570 | 48,794 | 135,365 | 98,321 |

| | |
|---|---|
| FIRR | 19.3% |
| NPV | 198,185 |
| PV(cost) | 482,735 |
| PV(benefit) | 680,920 |
| B/C | 1.41 |

Source: JICA study team

Table B-1(3) FIRR for Case 3

Case-3 Baghdad/Mosul (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 6,238 | 0 | 6,238 | 0 | 0 | 0 | -6,238 |
| 2 | 13 | 44,960 | 20,571 | 0 | 65,531 | 0 | 0 | 0 | -65,531 |
| 3 | 14 | 240,925 | 65,761 | 0 | 306,685 | 0 | 0 | 0 | -306,685 |
| 4 | 15 | 11,236 | 10,286 | 0 | 21,522 | 0 | 0 | 0 | -21,522 |
| 5 | 16 | 0 | 0 | 39,998 | 39,998 | 121,956 | 32,671 | 154,627 | 114,630 |
| 6 | 17 | 0 | 0 | 39,998 | 39,998 | 96,356 | 47,097 | 143,454 | 103,456 |
| 7 | 18 | 0 | 0 | 39,998 | 39,998 | 96,356 | 54,310 | 150,667 | 110,669 |
| 8 | 19 | 0 | 0 | 39,998 | 39,998 | 96,356 | 54,310 | 150,667 | 110,669 |
| 9 | 20 | 0 | 0 | 39,998 | 39,998 | 96,356 | 54,310 | 150,667 | 110,669 |
| 10 | 21 | 0 | 0 | 39,998 | 39,998 | 96,356 | 54,310 | 150,667 | 110,669 |
| 11 | 22 | 39,752 | 0 | 39,998 | 79,750 | 96,356 | 54,310 | 150,667 | 70,917 |
| 12 | 23 | 0 | 0 | 39,998 | 39,998 | 96,356 | 54,310 | 150,667 | 110,669 |
| 13 | 24 | 0 | 0 | 39,998 | 39,998 | 96,356 | 54,310 | 150,667 | 110,669 |
| 14 | 25 | 0 | 0 | 39,998 | 39,998 | 96,356 | 54,310 | 150,667 | 110,669 |
| 15 | 26 | 0 | 0 | 39,998 | 39,998 | 96,356 | 54,310 | 150,667 | 110,669 |
| 16 | 27 | 0 | 0 | 39,998 | 39,998 | 96,356 | 54,310 | 150,667 | 110,669 |
| 17 | 28 | 0 | 0 | 39,998 | 39,998 | 96,356 | 54,310 | 150,667 | 110,669 |
| 18 | 29 | 0 | 0 | 39,998 | 39,998 | 96,356 | 54,310 | 150,667 | 110,669 |

| | |
|---|---|
| FIRR | 20.1% |
| NPV | 236,346 |
| PV(cost) | 520,128 |
| PV(benefit) | 756,474 |
| B/C | 1.45 |

Source: JICA study team

Table B-1(4) FIRR for Case 4

Case-4 Basra/Mosul (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 2,597 | 0 | 2,597 | 0 | 0 | 0 | -2,597 |
| 2 | 13 | 19,253 | 8,560 | 0 | 27,813 | 0 | 0 | 0 | -27,813 |
| 3 | 14 | 98,627 | 27,364 | 0 | 125,991 | 0 | 0 | 0 | -125,991 |
| 4 | 15 | 5,725 | 4,280 | 0 | 10,005 | 0 | 0 | 0 | -10,005 |
| 5 | 16 | 0 | 0 | 16,641 | 16,641 | 40,970 | 12,093 | 53,062 | 36,422 |
| 6 | 17 | 0 | 0 | 16,641 | 16,641 | 32,370 | 17,608 | 49,978 | 33,338 |
| 7 | 18 | 0 | 0 | 16,641 | 16,641 | 32,370 | 18,245 | 50,615 | 33,974 |
| 8 | 19 | 0 | 0 | 16,641 | 16,641 | 32,370 | 18,245 | 50,615 | 33,974 |
| 9 | 20 | 0 | 0 | 16,641 | 16,641 | 32,370 | 18,245 | 50,615 | 33,974 |
| 10 | 21 | 0 | 0 | 16,641 | 16,641 | 32,370 | 18,245 | 50,615 | 33,974 |
| 11 | 22 | 19,854 | 0 | 16,641 | 36,495 | 32,370 | 18,245 | 50,615 | 14,120 |
| 12 | 23 | 0 | 0 | 16,641 | 16,641 | 32,370 | 18,245 | 50,615 | 33,974 |
| 13 | 24 | 0 | 0 | 16,641 | 16,641 | 32,370 | 18,245 | 50,615 | 33,974 |
| 14 | 25 | 0 | 0 | 16,641 | 16,641 | 32,370 | 18,245 | 50,615 | 33,974 |
| 15 | 26 | 0 | 0 | 16,641 | 16,641 | 32,370 | 18,245 | 50,615 | 33,974 |
| 16 | 27 | 0 | 0 | 16,641 | 16,641 | 32,370 | 18,245 | 50,615 | 33,974 |
| 17 | 28 | 0 | 0 | 16,641 | 16,641 | 32,370 | 18,245 | 50,615 | 33,974 |
| 18 | 29 | 0 | 0 | 16,641 | 16,641 | 32,370 | 18,245 | 50,615 | 33,974 |

| | |
|---|---|
| FIRR | 14.4% |
| NPV | 38,304 |
| PV(cost) | 217,526 |
| PV(benefit) | 255,830 |
| B/C | 1.18 |

Source: JICA study team

Table B-1(5) FIRR for Case 5

Case-5 Baghdad (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 5,219 | 0 | 5,219 | 0 | 0 | 0 | -5,219 |
| 2 | 13 | 37,839 | 17,204 | 0 | 55,043 | 0 | 0 | 0 | -55,043 |
| 3 | 14 | 200,958 | 54,995 | 0 | 255,953 | 0 | 0 | 0 | -255,953 |
| 4 | 15 | 9,642 | 8,602 | 0 | 18,245 | 0 | 0 | 0 | -18,245 |
| 5 | 16 | 0 | 0 | 33,446 | 33,446 | 95,278 | 25,458 | 120,736 | 87,290 |
| 6 | 17 | 0 | 0 | 33,446 | 33,446 | 75,278 | 36,490 | 111,768 | 78,322 |
| 7 | 18 | 0 | 0 | 33,446 | 33,446 | 75,278 | 42,430 | 117,708 | 84,262 |
| 8 | 19 | 0 | 0 | 33,446 | 33,446 | 75,278 | 42,430 | 117,708 | 84,262 |
| 9 | 20 | 0 | 0 | 33,446 | 33,446 | 75,278 | 42,430 | 117,708 | 84,262 |
| 10 | 21 | 0 | 0 | 33,446 | 33,446 | 75,278 | 42,430 | 117,708 | 84,262 |
| 11 | 22 | 39,564 | 0 | 33,446 | 73,010 | 75,278 | 42,430 | 117,708 | 44,698 |
| 12 | 23 | 0 | 0 | 33,446 | 33,446 | 75,278 | 42,430 | 117,708 | 84,262 |
| 13 | 24 | 0 | 0 | 33,446 | 33,446 | 75,278 | 42,430 | 117,708 | 84,262 |
| 14 | 25 | 0 | 0 | 33,446 | 33,446 | 75,278 | 42,430 | 117,708 | 84,262 |
| 15 | 26 | 0 | 0 | 33,446 | 33,446 | 75,278 | 42,430 | 117,708 | 84,262 |
| 16 | 27 | 0 | 0 | 33,446 | 33,446 | 75,278 | 42,430 | 117,708 | 84,262 |
| 17 | 28 | 0 | 0 | 33,446 | 33,446 | 75,278 | 42,430 | 117,708 | 84,262 |
| 18 | 29 | 0 | 0 | 33,446 | 33,446 | 75,278 | 42,430 | 117,708 | 84,262 |

| | |
|---|---|
| FIRR | 18.1% |
| NPV | 153,633 |
| PV(cost) | 437,149 |
| PV(benefit) | 590,782 |
| B/C | 1.35 |

Source: JICA study team

Table B-1(6) FIRR for Case 6

Case-6 Basra (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 1,600 | 0 | 1,600 | 0 | 0 | 0 | -1,600 |
| 2 | 13 | 12,352 | 5,268 | 0 | 17,620 | 0 | 0 | 0 | -17,620 |
| 3 | 14 | 59,586 | 16,840 | 0 | 76,426 | 0 | 0 | 0 | -76,426 |
| 4 | 15 | 4,141 | 2,634 | 0 | 6,776 | 0 | 0 | 0 | -6,776 |
| 5 | 16 | 0 | 0 | 10,242 | 10,242 | 14,292 | 4,879 | 19,171 | 8,929 |
| 6 | 17 | 0 | 0 | 10,242 | 10,242 | 11,292 | 6,364 | 17,656 | 7,414 |
| 7 | 18 | 0 | 0 | 10,242 | 10,242 | 11,292 | 6,364 | 17,656 | 7,414 |
| 8 | 19 | 0 | 0 | 10,242 | 10,242 | 11,292 | 6,364 | 17,656 | 7,414 |
| 9 | 20 | 0 | 0 | 10,242 | 10,242 | 11,292 | 6,364 | 17,656 | 7,414 |
| 10 | 21 | 0 | 0 | 10,242 | 10,242 | 11,292 | 6,364 | 17,656 | 7,414 |
| 11 | 22 | 19,666 | 0 | 10,242 | 29,909 | 11,292 | 6,364 | 17,656 | -12,252 |
| 12 | 23 | 0 | 0 | 10,242 | 10,242 | 11,292 | 6,364 | 17,656 | 7,414 |
| 13 | 24 | 0 | 0 | 10,242 | 10,242 | 11,292 | 6,364 | 17,656 | 7,414 |
| 14 | 25 | 0 | 0 | 10,242 | 10,242 | 11,292 | 6,364 | 17,656 | 7,414 |
| 15 | 26 | 0 | 0 | 10,242 | 10,242 | 11,292 | 6,364 | 17,656 | 7,414 |
| 16 | 27 | 0 | 0 | 10,242 | 10,242 | 11,292 | 6,364 | 17,656 | 7,414 |
| 17 | 28 | 0 | 0 | 10,242 | 10,242 | 11,292 | 6,364 | 17,656 | 7,414 |
| 18 | 29 | 0 | 0 | 10,242 | 10,242 | 11,292 | 6,364 | 17,656 | 7,414 |

| | |
|---|---|
| FIRR | -2.0% |
| NPV | -46,712 |
| PV(cost) | 136,491 |
| PV(benefit) | 89,779 |
| B/C | 0.66 |

Source: JICA study team

Table B-1(7) FIRR for Case 7

Case-7 Mosul (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 2,068 | 0 | 2,068 | 0 | 0 | 0 | -2,068 |
| 2 | 13 | 15,693 | 6,815 | 0 | 22,507 | 0 | 0 | 0 | -22,507 |
| 3 | 14 | 77,955 | 21,783 | 0 | 99,738 | 0 | 0 | 0 | -99,738 |
| 4 | 15 | 4,844 | 3,407 | 0 | 8,251 | 0 | 0 | 0 | -8,251 |
| 5 | 16 | 0 | 0 | 13,256 | 13,256 | 26,678 | 7,213 | 33,891 | 20,635 |
| 6 | 17 | 0 | 0 | 13,256 | 13,256 | 21,078 | 10,395 | 31,473 | 18,217 |
| 7 | 18 | 0 | 0 | 13,256 | 13,256 | 21,078 | 11,880 | 32,958 | 19,702 |
| 8 | 19 | 0 | 0 | 13,256 | 13,256 | 21,078 | 11,880 | 32,958 | 19,702 |
| 9 | 20 | 0 | 0 | 13,256 | 13,256 | 21,078 | 11,880 | 32,958 | 19,702 |
| 10 | 21 | 0 | 0 | 13,256 | 13,256 | 21,078 | 11,880 | 32,958 | 19,702 |
| 11 | 22 | 19,695 | 0 | 13,256 | 32,952 | 21,078 | 11,880 | 32,958 | 7 |
| 12 | 23 | 0 | 0 | 13,256 | 13,256 | 21,078 | 11,880 | 32,958 | 19,702 |
| 13 | 24 | 0 | 0 | 13,256 | 13,256 | 21,078 | 11,880 | 32,958 | 19,702 |
| 14 | 25 | 0 | 0 | 13,256 | 13,256 | 21,078 | 11,880 | 32,958 | 19,702 |
| 15 | 26 | 0 | 0 | 13,256 | 13,256 | 21,078 | 11,880 | 32,958 | 19,702 |
| 16 | 27 | 0 | 0 | 13,256 | 13,256 | 21,078 | 11,880 | 32,958 | 19,702 |
| 17 | 28 | 0 | 0 | 13,256 | 13,256 | 21,078 | 11,880 | 32,958 | 19,702 |
| 18 | 29 | 0 | 0 | 13,256 | 13,256 | 21,078 | 11,880 | 32,958 | 19,702 |

| | |
|---|---|
| FIRR | 8.6% |
| NPV | -9,082 |
| PV(cost) | 174,655 |
| PV(benefit) | 165,572 |
| B/C | 0.95 |

Source: JICA study team

# B-2 Sensitive Analysis of FIRR for Case-1

Table B-2(1) Sensitive Analysis:

Case-1 Baghdad/Basra/Mosul Sensitive : Capital +10% (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 7,482 | 0 | 7,482 | 0 | 0 | 0 | -7,482 |
| 2 | 13 | 53,722 | 24,666 | 0 | 78,388 | 0 | 0 | 0 | -78,388 |
| 3 | 14 | 289,217 | 78,849 | 0 | 368,066 | 0 | 0 | 0 | -368,066 |
| 4 | 15 | 13,347 | 12,333 | 0 | 25,680 | 0 | 0 | 0 | -25,680 |
| 5 | 16 | 0 | 0 | 47,962 | 47,962 | 136,248 | 37,551 | 173,799 | 125,837 |
| 6 | 17 | 0 | 0 | 47,962 | 47,962 | 107,648 | 54,098 | 161,746 | 113,785 |
| 7 | 18 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 8 | 19 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 9 | 20 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 10 | 21 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 11 | 22 | 39,911 | 0 | 47,962 | 87,872 | 107,648 | 60,675 | 168,323 | 80,450 |
| 12 | 23 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 13 | 24 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 14 | 25 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 15 | 26 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 16 | 27 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 17 | 28 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 18 | 29 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |

| | |
|---|---|
| FIRR | 18.3% |
| NPV | 225,645 |
| PV(cost) | 620,968 |
| PV(benefit) | 846,612 |
| B/C | 1.36 |

Source: JICA study team

Table B-2(2) Sensitive Analysis:

Case-1 Baghdad/Basra/Mosul Sensitive: O&M Cost +10% (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 6,802 | 0 | 6,802 | 0 | 0 | 0 | -6,802 |
| 2 | 13 | 48,838 | 22,424 | 0 | 71,262 | 0 | 0 | 0 | -71,262 |
| 3 | 14 | 262,925 | 71,681 | 0 | 334,606 | 0 | 0 | 0 | -334,606 |
| 4 | 15 | 12,134 | 11,212 | 0 | 23,345 | 0 | 0 | 0 | -23,345 |
| 5 | 16 | 0 | 0 | 47,962 | 47,962 | 136,248 | 37,551 | 173,799 | 125,837 |
| 6 | 17 | 0 | 0 | 47,962 | 47,962 | 107,648 | 54,098 | 161,746 | 113,785 |
| 7 | 18 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 8 | 19 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 9 | 20 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 10 | 21 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 11 | 22 | 39,911 | 0 | 47,962 | 87,872 | 107,648 | 60,675 | 168,323 | 80,450 |
| 12 | 23 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 13 | 24 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 14 | 25 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 15 | 26 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 16 | 27 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 17 | 28 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |
| 18 | 29 | 0 | 0 | 47,962 | 47,962 | 107,648 | 60,675 | 168,323 | 120,361 |

1.1

| | |
|---|---|
| FIRR | 20.2% |
| NPV | 258,886 |
| PV(cost) | 587,726 |
| PV(benefit) | 846,612 |
| B/C | 1.44 |

Source: JICA study team

Table B-2(3) Sensitive Analysis:

Case-1 Baghdad/Basra/Mosul Sensitive : Revenue -10% (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 6,802 | 0 | 6,802 | 0 | 0 | 0 | -6,802 |
| 2 | 13 | 48,838 | 22,424 | 0 | 71,262 | 0 | 0 | 0 | -71,262 |
| 3 | 14 | 262,925 | 71,681 | 0 | 334,606 | 0 | 0 | 0 | -334,606 |
| 4 | 15 | 12,134 | 11,212 | 0 | 23,345 | 0 | 0 | 0 | -23,345 |
| 5 | 16 | 0 | 0 | 43,601 | 43,601 | 122,623 | 33,795 | 156,419 | 112,817 |
| 6 | 17 | 0 | 0 | 43,601 | 43,601 | 96,883 | 48,688 | 145,572 | 101,970 |
| 7 | 18 | 0 | 0 | 43,601 | 43,601 | 96,883 | 54,607 | 151,491 | 107,889 |
| 8 | 19 | 0 | 0 | 43,601 | 43,601 | 96,883 | 54,607 | 151,491 | 107,889 |
| 9 | 20 | 0 | 0 | 43,601 | 43,601 | 96,883 | 54,607 | 151,491 | 107,889 |
| 10 | 21 | 0 | 0 | 43,601 | 43,601 | 96,883 | 54,607 | 151,491 | 107,889 |
| 11 | 22 | 39,911 | 0 | 43,601 | 83,512 | 96,883 | 54,607 | 151,491 | 67,978 |
| 12 | 23 | 0 | 0 | 43,601 | 43,601 | 96,883 | 54,607 | 151,491 | 107,889 |
| 13 | 24 | 0 | 0 | 43,601 | 43,601 | 96,883 | 54,607 | 151,491 | 107,889 |
| 14 | 25 | 0 | 0 | 43,601 | 43,601 | 96,883 | 54,607 | 151,491 | 107,889 |
| 15 | 26 | 0 | 0 | 43,601 | 43,601 | 96,883 | 54,607 | 151,491 | 107,889 |
| 16 | 27 | 0 | 0 | 43,601 | 43,601 | 96,883 | 54,607 | 151,491 | 107,889 |
| 17 | 28 | 0 | 0 | 43,601 | 43,601 | 96,883 | 54,607 | 151,491 | 107,889 |
| 18 | 29 | 0 | 0 | 43,601 | 43,601 | 96,883 | 54,607 | 151,491 | 107,889 |

| | |
|---|---|
| FIRR | 18.0% |
| NPV | 196,163 |
| PV(cost) | 565,788 |
| PV(benefit) | 761,951 |
| B/C | 1.35 |

Source: JICA study team

Table B-2(4) Sensitive Analysis:

Case-1 Baghdad/Basra/Mosul Sensitive : Revenue -20% (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 6,802 | 0 | 6,802 | 0 | 0 | 0 | -6,802 |
| 2 | 13 | 48,838 | 22,424 | 0 | 71,262 | 0 | 0 | 0 | -71,262 |
| 3 | 14 | 262,925 | 71,681 | 0 | 334,606 | 0 | 0 | 0 | -334,606 |
| 4 | 15 | 12,134 | 11,212 | 0 | 23,345 | 0 | 0 | 0 | -23,345 |
| 5 | 16 | 0 | 0 | 43,601 | 43,601 | 108,998 | 30,040 | 139,039 | 95,437 |
| 6 | 17 | 0 | 0 | 43,601 | 43,601 | 86,118 | 43,279 | 129,397 | 85,796 |
| 7 | 18 | 0 | 0 | 43,601 | 43,601 | 86,118 | 48,540 | 134,658 | 91,057 |
| 8 | 19 | 0 | 0 | 43,601 | 43,601 | 86,118 | 48,540 | 134,658 | 91,057 |
| 9 | 20 | 0 | 0 | 43,601 | 43,601 | 86,118 | 48,540 | 134,658 | 91,057 |
| 10 | 21 | 0 | 0 | 43,601 | 43,601 | 86,118 | 48,540 | 134,658 | 91,057 |
| 11 | 22 | 39,911 | 0 | 43,601 | 83,512 | 86,118 | 48,540 | 134,658 | 51,146 |
| 12 | 23 | 0 | 0 | 43,601 | 43,601 | 86,118 | 48,540 | 134,658 | 91,057 |
| 13 | 24 | 0 | 0 | 43,601 | 43,601 | 86,118 | 48,540 | 134,658 | 91,057 |
| 14 | 25 | 0 | 0 | 43,601 | 43,601 | 86,118 | 48,540 | 134,658 | 91,057 |
| 15 | 26 | 0 | 0 | 43,601 | 43,601 | 86,118 | 48,540 | 134,658 | 91,057 |
| 16 | 27 | 0 | 0 | 43,601 | 43,601 | 86,118 | 48,540 | 134,658 | 91,057 |
| 17 | 28 | 0 | 0 | 43,601 | 43,601 | 86,118 | 48,540 | 134,658 | 91,057 |
| 18 | 29 | 0 | 0 | 43,601 | 43,601 | 86,118 | 48,540 | 134,658 | 91,057 |

| | |
|---|---|
| FIRR | 14.8% |
| NPV | 111,502 |
| PV(cost) | 565,788 |
| PV(benefit) | 677,290 |
| B/C | 1.20 |

Source: JICA study team

# B-3 Economic Analysis for Each Case

Table B-3(1) EIRR for Case 1

Case-1 Baghdad/Basra/Mosul (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 5,441 | 0 | 5,441 | 0 | 0 | 0 | -5,441 |
| 2 | 13 | 39,070 | 17,939 | 0 | 57,009 | 0 | 0 | 0 | -57,009 |
| 3 | 14 | 210,340 | 57,345 | 0 | 267,685 | 0 | 0 | 0 | -267,685 |
| 4 | 15 | 9,707 | 8,969 | 0 | 18,676 | 0 | 0 | 0 | -18,676 |
| 5 | 16 | 0 | 0 | 34,881 | 34,881 | 141,698 | 39,053 | 180,751 | 145,869 |
| 6 | 17 | 0 | 0 | 34,881 | 34,881 | 111,954 | 56,262 | 168,216 | 133,335 |
| 7 | 18 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 8 | 19 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 9 | 20 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 10 | 21 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 11 | 22 | 31,929 | 0 | 34,881 | 66,810 | 111,954 | 63,102 | 175,056 | 108,246 |
| 12 | 23 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 13 | 24 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 14 | 25 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 15 | 26 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 16 | 27 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 17 | 28 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| 18 | 29 | 0 | 0 | 34,881 | 34,881 | 111,954 | 63,102 | 175,056 | 140,175 |
| | SCF | 0.8 | 0.8 | 0.8 | | 1.04 | 1.04 | | |

| | |
|---|---|
| EIRR | 28.7% |
| NPV | 427,847 |
| PV(cost) | 452,630 |
| PV(benefit) | 880,477 |
| B/C | 1.95 |

Source: JICA study team

Table B-3(2) EIRR for Case 2

Case-2 Baghdad/Basra (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 4,623 | 0 | 4,623 | 0 | 0 | 0 | -4,623 |
| 2 | 13 | 33,371 | 15,241 | 0 | 48,612 | 0 | 0 | 0 | -48,612 |
| 3 | 14 | 178,348 | 48,720 | 0 | 227,067 | 0 | 0 | 0 | -227,067 |
| 4 | 15 | 8,430 | 7,620 | 0 | 16,050 | 0 | 0 | 0 | -16,050 |
| 5 | 16 | 0 | 0 | 29,635 | 29,635 | 113,953 | 31,551 | 145,504 | 115,869 |
| 6 | 17 | 0 | 0 | 29,635 | 29,635 | 90,033 | 45,230 | 135,263 | 105,628 |
| 7 | 18 | 0 | 0 | 29,635 | 29,635 | 90,033 | 50,746 | 140,779 | 111,144 |
| 8 | 19 | 0 | 0 | 29,635 | 29,635 | 90,033 | 50,746 | 140,779 | 111,144 |
| 9 | 20 | 0 | 0 | 29,635 | 29,635 | 90,033 | 50,746 | 140,779 | 111,144 |
| 10 | 21 | 0 | 0 | 29,635 | 29,635 | 90,033 | 50,746 | 140,779 | 111,144 |
| 11 | 22 | 31,778 | 0 | 29,635 | 61,414 | 90,033 | 50,746 | 140,779 | 79,366 |
| 12 | 23 | 0 | 0 | 29,635 | 29,635 | 90,033 | 50,746 | 140,779 | 111,144 |
| 13 | 24 | 0 | 0 | 29,635 | 29,635 | 90,033 | 50,746 | 140,779 | 111,144 |
| 14 | 25 | 0 | 0 | 29,635 | 29,635 | 90,033 | 50,746 | 140,779 | 111,144 |
| 15 | 26 | 0 | 0 | 29,635 | 29,635 | 90,033 | 50,746 | 140,779 | 111,144 |
| 16 | 27 | 0 | 0 | 29,635 | 29,635 | 90,033 | 50,746 | 140,779 | 111,144 |
| 17 | 28 | 0 | 0 | 29,635 | 29,635 | 90,033 | 50,746 | 140,779 | 111,144 |
| 18 | 29 | 0 | 0 | 29,635 | 29,635 | 90,033 | 50,746 | 140,779 | 111,144 |
| | SCF | 0.8 | 0.8 | 0.8 | | 1.04 | 1.04 | | |

| | |
|---|---|
| EIRR | 27.0% |
| NPV | 321,969 |
| PV(cost) | 386,188 |
| PV(benefit) | 708,157 |
| B/C | 1.83 |

Source: JICA study team

Table B-3(3) EIRR for Case 3

Case-3 Baghdad/Mosul (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 4,990 | 0 | 4,990 | 0 | 0 | 0 | -4,990 |
| 2 | 13 | 35,968 | 16,457 | 0 | 52,425 | 0 | 0 | 0 | -52,425 |
| 3 | 14 | 192,740 | 52,608 | 0 | 245,348 | 0 | 0 | 0 | -245,348 |
| 4 | 15 | 8,989 | 8,228 | 0 | 17,217 | 0 | 0 | 0 | -17,217 |
| 5 | 16 | 0 | 0 | 31,998 | 31,998 | 126,835 | 33,978 | 160,813 | 128,814 |
| 6 | 17 | 0 | 0 | 31,998 | 31,998 | 100,211 | 48,981 | 149,192 | 117,194 |
| 7 | 18 | 0 | 0 | 31,998 | 31,998 | 100,211 | 56,483 | 156,693 | 124,695 |
| 8 | 19 | 0 | 0 | 31,998 | 31,998 | 100,211 | 56,483 | 156,693 | 124,695 |
| 9 | 20 | 0 | 0 | 31,998 | 31,998 | 100,211 | 56,483 | 156,693 | 124,695 |
| 10 | 21 | 0 | 0 | 31,998 | 31,998 | 100,211 | 56,483 | 156,693 | 124,695 |
| 11 | 22 | 31,802 | 0 | 31,998 | 63,800 | 100,211 | 56,483 | 156,693 | 92,894 |
| 12 | 23 | 0 | 0 | 31,998 | 31,998 | 100,211 | 56,483 | 156,693 | 124,695 |
| 13 | 24 | 0 | 0 | 31,998 | 31,998 | 100,211 | 56,483 | 156,693 | 124,695 |
| 14 | 25 | 0 | 0 | 31,998 | 31,998 | 100,211 | 56,483 | 156,693 | 124,695 |
| 15 | 26 | 0 | 0 | 31,998 | 31,998 | 100,211 | 56,483 | 156,693 | 124,695 |
| 16 | 27 | 0 | 0 | 31,998 | 31,998 | 100,211 | 56,483 | 156,693 | 124,695 |
| 17 | 28 | 0 | 0 | 31,998 | 31,998 | 100,211 | 56,483 | 156,693 | 124,695 |
| 18 | 29 | 0 | 0 | 31,998 | 31,998 | 100,211 | 56,483 | 156,693 | 124,695 |
| | SCF | 0.8 | 0.8 | 0.8 | | 1.04 | 1.04 | | |

| | |
|---|---|
| EIRR | 27.8% |
| NPV | 370,631 |
| PV(cost) | 416,103 |
| PV(benefit) | 786,733 |
| B/C | 1.89 |

Source: JICA study team

Table B-3(4) EIRR for Case 4

Case-4 Basra/Mosul (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 2,077 | 0 | 2,077 | 0 | 0 | 0 | -2,077 |
| 2 | 13 | 15,403 | 8,560 | 0 | 23,963 | 0 | 0 | 0 | -23,963 |
| 3 | 14 | 78,902 | 21,891 | 0 | 100,793 | 0 | 0 | 0 | -100,793 |
| 4 | 15 | 4,580 | 3,424 | 0 | 8,004 | 0 | 0 | 0 | -8,004 |
| 5 | 16 | 0 | 0 | 13,312 | 13,312 | 42,609 | 12,576 | 55,185 | 41,872 |
| 6 | 17 | 0 | 0 | 13,312 | 13,312 | 33,665 | 18,313 | 51,977 | 38,665 |
| 7 | 18 | 0 | 0 | 13,312 | 13,312 | 33,665 | 18,975 | 52,639 | 39,327 |
| 8 | 19 | 0 | 0 | 13,312 | 13,312 | 33,665 | 18,975 | 52,639 | 39,327 |
| 9 | 20 | 0 | 0 | 13,312 | 13,312 | 33,665 | 18,975 | 52,639 | 39,327 |
| 10 | 21 | 0 | 0 | 13,312 | 13,312 | 33,665 | 18,975 | 52,639 | 39,327 |
| 11 | 22 | 15,883 | 0 | 13,312 | 29,196 | 33,665 | 18,975 | 52,639 | 23,443 |
| 12 | 23 | 0 | 0 | 13,312 | 13,312 | 33,665 | 18,975 | 52,639 | 39,327 |
| 13 | 24 | 0 | 0 | 13,312 | 13,312 | 33,665 | 18,975 | 52,639 | 39,327 |
| 14 | 25 | 0 | 0 | 13,312 | 13,312 | 33,665 | 18,975 | 52,639 | 39,327 |
| 15 | 26 | 0 | 0 | 13,312 | 13,312 | 33,665 | 18,975 | 52,639 | 39,327 |
| 16 | 27 | 0 | 0 | 13,312 | 13,312 | 33,665 | 18,975 | 52,639 | 39,327 |
| 17 | 28 | 0 | 0 | 13,312 | 13,312 | 33,665 | 18,975 | 52,639 | 39,327 |
| 18 | 29 | 0 | 0 | 13,312 | 13,312 | 33,665 | 18,975 | 52,639 | 39,327 |
| | SCF | 0.8 | 0.8 | 0.8 | | 1.04 | 1.04 | | |

| | |
|---|---|
| EIRR | 21.4% |
| NPV | 90,628 |
| PV(cost) | 175,436 |
| PV(benefit) | 266,063 |
| B/C | 1.52 |

Source: JICA study team

Table B-3(5) EIRR for Case 5

Case-5 Baghdad (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 4,175 | 0 | 4,175 | 0 | 0 | 0 | -4,175 |
| 2 | 13 | 30,271 | 13,763 | 0 | 44,034 | 0 | 0 | 0 | -44,034 |
| 3 | 14 | 160,766 | 43,996 | 0 | 204,762 | 0 | 0 | 0 | -204,762 |
| 4 | 15 | 7,714 | 6,882 | 0 | 14,596 | 0 | 0 | 0 | -14,596 |
| 5 | 16 | 0 | 0 | 26,757 | 26,757 | 99,090 | 26,476 | 125,566 | 98,809 |
| 6 | 17 | 0 | 0 | 26,757 | 26,757 | 78,290 | 37,949 | 116,239 | 89,482 |
| 7 | 18 | 0 | 0 | 26,757 | 26,757 | 78,290 | 44,127 | 122,417 | 95,660 |
| 8 | 19 | 0 | 0 | 26,757 | 26,757 | 78,290 | 44,127 | 122,417 | 95,660 |
| 9 | 20 | 0 | 0 | 26,757 | 26,757 | 78,290 | 44,127 | 122,417 | 95,660 |
| 10 | 21 | 0 | 0 | 26,757 | 26,757 | 78,290 | 44,127 | 122,417 | 95,660 |
| 11 | 22 | 31,651 | 0 | 26,757 | 58,408 | 78,290 | 44,127 | 122,417 | 64,009 |
| 12 | 23 | 0 | 0 | 26,757 | 26,757 | 78,290 | 44,127 | 122,417 | 95,660 |
| 13 | 24 | 0 | 0 | 26,757 | 26,757 | 78,290 | 44,127 | 122,417 | 95,660 |
| 14 | 25 | 0 | 0 | 26,757 | 26,757 | 78,290 | 44,127 | 122,417 | 95,660 |
| 15 | 26 | 0 | 0 | 26,757 | 26,757 | 78,290 | 44,127 | 122,417 | 95,660 |
| 16 | 27 | 0 | 0 | 26,757 | 26,757 | 78,290 | 44,127 | 122,417 | 95,660 |
| 17 | 28 | 0 | 0 | 26,757 | 26,757 | 78,290 | 44,127 | 122,417 | 95,660 |
| 18 | 29 | 0 | 0 | 26,757 | 26,757 | 78,290 | 44,127 | 122,417 | 95,660 |
| | SCF | 0.8 | 0.8 | 0.8 | | 1.04 | 1.04 | | |

| | |
|---|---|
| EIRR | 25.7% |
| NPV | 264,694 |
| PV(cost) | 349,719 |
| PV(benefit) | 614,413 |
| B/C | 1.76 |

Source: JICA study team

Table B-3(6) EIRR for Case 6

Case-6 Basra (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 1,280 | 0 | 1,280 | 0 | 0 | 0 | -1,280 |
| 2 | 13 | 9,881 | 4,215 | 0 | 14,096 | 0 | 0 | 0 | -14,096 |
| 3 | 14 | 47,669 | 13,472 | 0 | 61,141 | 0 | 0 | 0 | -61,141 |
| 4 | 15 | 3,313 | 2,107 | 0 | 5,420 | 0 | 0 | 0 | -5,420 |
| 5 | 16 | 0 | 0 | 8,194 | 8,194 | 14,863 | 5,075 | 19,938 | 11,744 |
| 6 | 17 | 0 | 0 | 8,194 | 8,194 | 11,743 | 6,619 | 18,363 | 10,169 |
| 7 | 18 | 0 | 0 | 8,194 | 8,194 | 11,743 | 6,619 | 18,363 | 10,169 |
| 8 | 19 | 0 | 0 | 8,194 | 8,194 | 11,743 | 6,619 | 18,363 | 10,169 |
| 9 | 20 | 0 | 0 | 8,194 | 8,194 | 11,743 | 6,619 | 18,363 | 10,169 |
| 10 | 21 | 0 | 0 | 8,194 | 8,194 | 11,743 | 6,619 | 18,363 | 10,169 |
| 11 | 22 | 15,733 | 0 | 8,194 | 23,927 | 11,743 | 6,619 | 18,363 | -5,564 |
| 12 | 23 | 0 | 0 | 8,194 | 8,194 | 11,743 | 6,619 | 18,363 | 10,169 |
| 13 | 24 | 0 | 0 | 8,194 | 8,194 | 11,743 | 6,619 | 18,363 | 10,169 |
| 14 | 25 | 0 | 0 | 8,194 | 8,194 | 11,743 | 6,619 | 18,363 | 10,169 |
| 15 | 26 | 0 | 0 | 8,194 | 8,194 | 11,743 | 6,619 | 18,363 | 10,169 |
| 16 | 27 | 0 | 0 | 8,194 | 8,194 | 11,743 | 6,619 | 18,363 | 10,169 |
| 17 | 28 | 0 | 0 | 8,194 | 8,194 | 11,743 | 6,619 | 18,363 | 10,169 |
| 18 | 29 | 0 | 0 | 8,194 | 8,194 | 11,743 | 6,619 | 18,363 | 10,169 |
| | SCF | 0.8 | 0.8 | 0.8 | | 1.04 | 1.04 | | |

| | |
|---|---|
| EIRR | 5.7% |
| NPV | -15,823 |
| PV(cost) | 109,193 |
| PV(benefit) | 93,370 |
| B/C | 0.86 |

Source: JICA study team

Table B-3(7) EIRR for Case 7

Case-7 Mosul (Unit: million IQD)

| | Year | Capital Cost | | O&M Cost | Total Cost | Revenue | | | Net Financial Benefit |
|---|---|---|---|---|---|---|---|---|---|
| | | Construction Cost | Indirect Cost | | | Telephone | Internet | Total | |
| 1 | 2012 | 0 | 1,654 | 0 | 1,654 | 0 | 0 | 0 | -1,654 |
| 2 | 13 | 12,554 | 5,452 | 0 | 18,006 | 0 | 0 | 0 | -18,006 |
| 3 | 14 | 62,364 | 17,427 | 0 | 79,791 | 0 | 0 | 0 | -79,791 |
| 4 | 15 | 3,875 | 2,726 | 0 | 6,601 | 0 | 0 | 0 | -6,601 |
| 5 | 16 | 0 | 0 | 10,605 | 10,605 | 27,745 | 7,502 | 35,247 | 24,642 |
| 6 | 17 | 0 | 0 | 10,605 | 10,605 | 21,921 | 10,811 | 32,732 | 22,127 |
| 7 | 18 | 0 | 0 | 10,605 | 10,605 | 21,921 | 12,356 | 34,277 | 23,672 |
| 8 | 19 | 0 | 0 | 10,605 | 10,605 | 21,921 | 12,356 | 34,277 | 23,672 |
| 9 | 20 | 0 | 0 | 10,605 | 10,605 | 21,921 | 12,356 | 34,277 | 23,672 |
| 10 | 21 | 0 | 0 | 10,605 | 10,605 | 21,921 | 12,356 | 34,277 | 23,672 |
| 11 | 22 | 15,756 | 0 | 10,605 | 26,361 | 21,921 | 12,356 | 34,277 | 7,915 |
| 12 | 23 | 0 | 0 | 10,605 | 10,605 | 21,921 | 12,356 | 34,277 | 23,672 |
| 13 | 24 | 0 | 0 | 10,605 | 10,605 | 21,921 | 12,356 | 34,277 | 23,672 |
| 14 | 25 | 0 | 0 | 10,605 | 10,605 | 21,921 | 12,356 | 34,277 | 23,672 |
| 15 | 26 | 0 | 0 | 10,605 | 10,605 | 21,921 | 12,356 | 34,277 | 23,672 |
| 16 | 27 | 0 | 0 | 10,605 | 10,605 | 21,921 | 12,356 | 34,277 | 23,672 |
| 17 | 28 | 0 | 0 | 10,605 | 10,605 | 21,921 | 12,356 | 34,277 | 23,672 |
| 18 | 29 | 0 | 0 | 10,605 | 10,605 | 21,921 | 12,356 | 34,277 | 23,672 |
| | SCF | 0.8 | 0.8 | 0.8 | | 1.04 | 1.04 | | |

| | |
|---|---|
| EIRR | 15.6% |
| NPV | 32,471 |
| PV(cost) | 139,724 |
| PV(benefit) | 172,195 |
| B/C | 1.23 |

Source: JICA study team

# *Appendix C*
# *Site Survey Photos*

# Site Survey Photos

## 1. Purpose

In order to evaluate and analyze the present conditions of switching equipment and outside plant, site survey has been made during November 28 to December 27 in 2010. The survey sites are Baghdad, Bassra and Mosul which are most related the Project.

## 2. Survey Sites

Survey sites were selected as showing Table below from viewpoint of nearer from the center of the city. 8 switching stations were visited out of total 42 stations in Baghdad, 5 stations out of 22 in Basra, and 5 stations out of 43 in Mosul. Typical photos at each site are attached which are basically edited by switching equipment, telephone distribution frame, power battery and outside plant.

Switching Stations Surveyed

| Baghdad | Basra | Mosul |
|---|---|---|
| 1) Al Dubadht<br>2) Al Rasheed (Sink)<br>3) Al Mamoum<br>4) Al Salihia<br>5) Al Kadimea<br>6) Al Jadieria<br>7) Al Fediaa(Sadeer)<br>8) Al Dawudi | 1) Al Ashar<br>2) Al Andalus<br>3) Bab zubair<br>4) Al Qiblah<br>5) Al Hartha | 1) Domiz(Somer)<br>2) Al Wahda<br>3) Al Hadbaa<br>4) Tammam<br>5) Dawasa |

DWDM Transmission Rack

DWDM Server

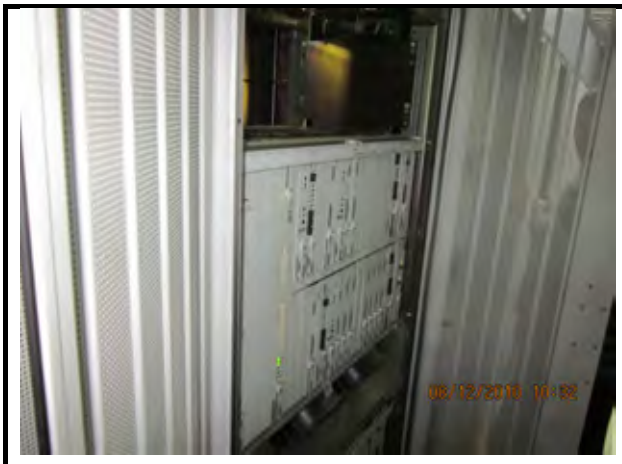
DWDM Digital Distribution Frame (DDF)

DWDM Rectifier and Battery

Cable Joint in the Street

Cable Jointing Work

| Site | Al Dubadht Exchange Station in Baghdad | |
|---|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | | JICA |
| | | NIPPON KOEI |



Exchange Control Rack

DWDM Rack

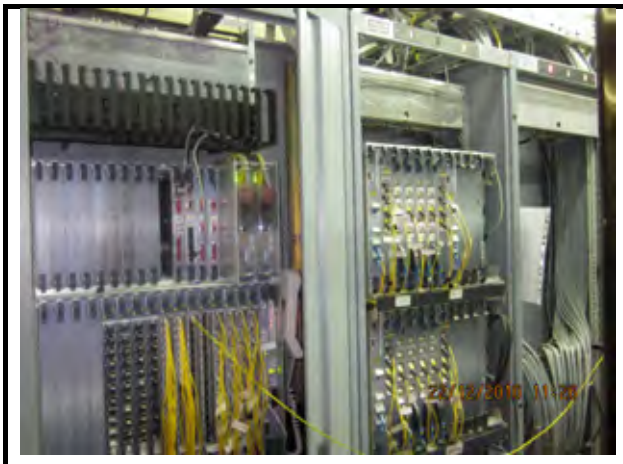
DWDM DDF

DWDM Batteries

Telephone Cables along the Street

Telephone Distribution Box

| Site | Al Rasheed Exchange Station in Baghdad | |
|---|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | | JICA |
| | | NIPPON KOEI |



DWDM Rack


Lucent Local Exchange Work station

Main Distribution Frame (MDF)

Lucent Local Exchange Batteries


Cable Closure inside Man Hole filled with Water

Telephone Distribution Box

| Site | Al Mamoum Exchange Station in Baghdad | |
|---|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | | JICA |
| | | NIPPON KOEI |

Lucent Local Exchange Rack

DWDM Rack

MDF Rack

Local Exchange Batteries

Telephone Distribution Box

Plastic Pipe prepared for
Cable Installation at Road Crossing

| Site | Al Saliha Exchange Station in Baghdad | |
|---|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | | JICA |
| | | NIPPON KOEI |

DWDM Rack

Lucent Local Exchange Rack

MDF Rack

Lucent Exchange Batteries

Telephone Pole

Telephone Cabinet

| Site | Al Kakimea Exchange Station in Baghdad | |
|---|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | | JICA |
| | | NIPPON KOEI |

ZTE Local Exchange

ZTE International Work Station

MDF Rack

DWDM Batteries

Telephone Cabinet

Cables inside Man Hole

| Site | Al Jadieria Exchange Station in Baghdad | |
|---|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | | JICA |
| | | NIPPON KOEI |

Exchange Signaling Rack

Exchange Subscriber Rack

Alcatel Exchange DDF

Alcatel Exchange Battery

Telephone Cabinet

Broken Cables

| Site | Al Feidaa (Sadeer) Exchange Station in Baghdad |
|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | JICA / NIPPON KOEI |

Quicktel Local Exchange Rack

ZTE Local Exchange Rack

Quctel Transit Exchange DDF

Qucktel Transit Exchange Batteries

Telephone Distribution Box

Cable Maintenance Work

| | |
|---|---|
| **Site** | **Al Dawudi Exchange Station in Baghdad** |
| **Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq** | **JICA** / **NIPPON KOEI** |

Alcatel Transit Exchange Rack

Alcatel Transit Exchange Work Station

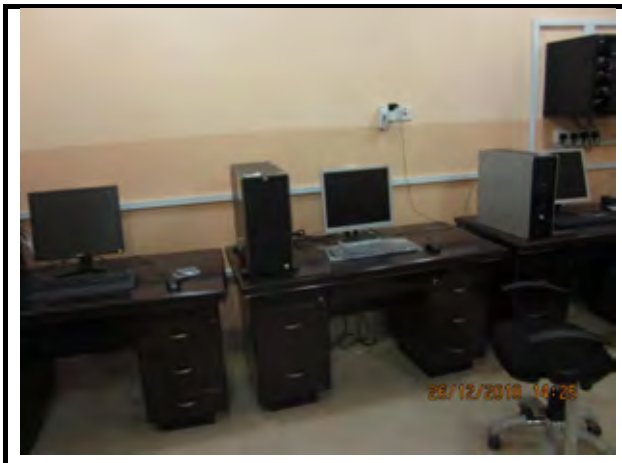
DDF Rack

Alcatel Local Exchange Batteries

Cables Crossing a Small River over Small Bridge

Cable cut along a Street

| Site | Al Ashar Exchange Station in Basra |
|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | JICA / NIPPON KOEI |



Next Generation Network (NGN) Work Station

Optical Project Rack

MDF Rack

Optical Project Batteries

Cable Joint on the Street

Telephone Cabinet

| Site | Al Andalus Exchange Station in Basra | |
|---|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | | JICA<br>NIPPON KOEI |

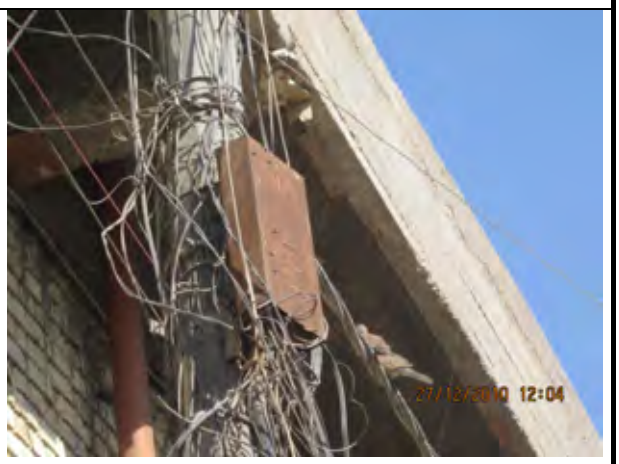
ZTE Local Exchange Rack ( 10,000 lines)

ZTE local Exchange Rack (3,000 lines)

MDF Rack


ZTE Local Exchange Batteries

Telephone Cabinet



Telephone Distribution Box

| Site | Bab Zubair Exchange Station in Basra |
|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | JICA / NIPPON KOEI |

ZTE Local Exchange Rack

ZTE Local Exchange Work station

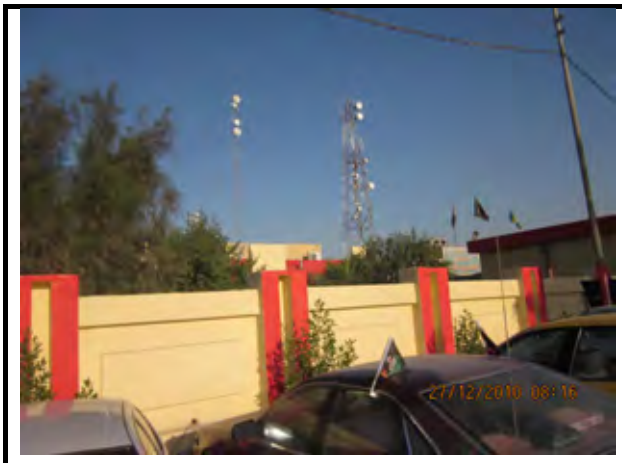
MDF Rack

ZTE Local Exchange Batteries

Telephone Cabinet

Cable Cut on the Street

| Site | Al Qiblah Exchange Station in Basra |
|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | JICA / NIPPON KOEI |



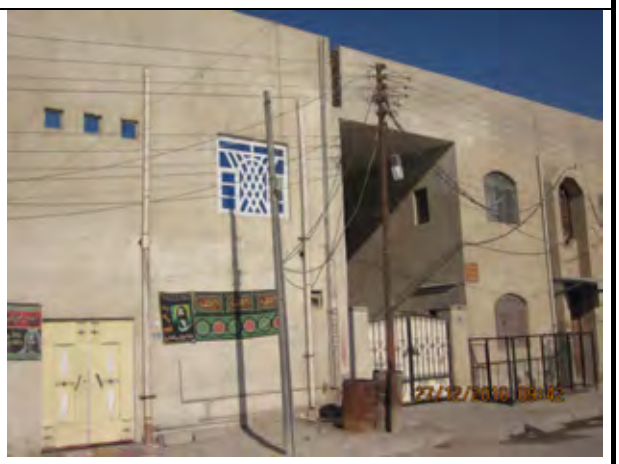
Switching Station Building

ZTE Local Exchange Rack

MDF Rack

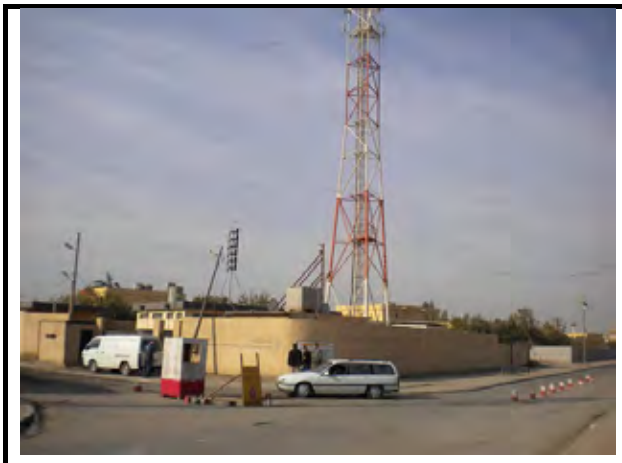
ZTE Local Exchange Batteries

Telephone Cabinet



Telephone Pole

| Site | Al Hartha Exchange Station in Basra | |
|---|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | | JICA<br>NIPPON KOEI |



Switching Station Building

Local Exchange Rack

Subscriber MDF and Cable Rack

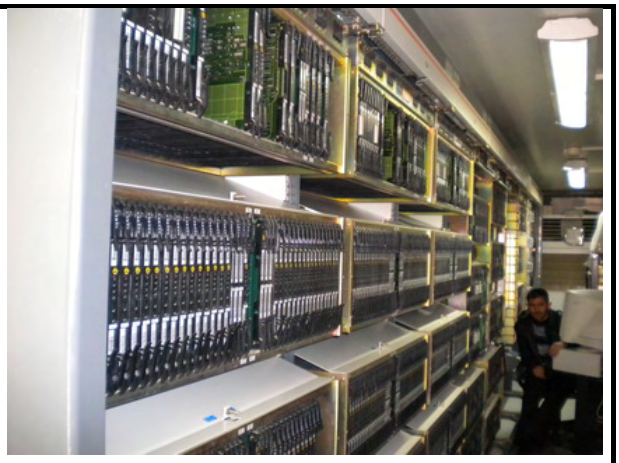
Exchange Batteries

Telephone Cabinet

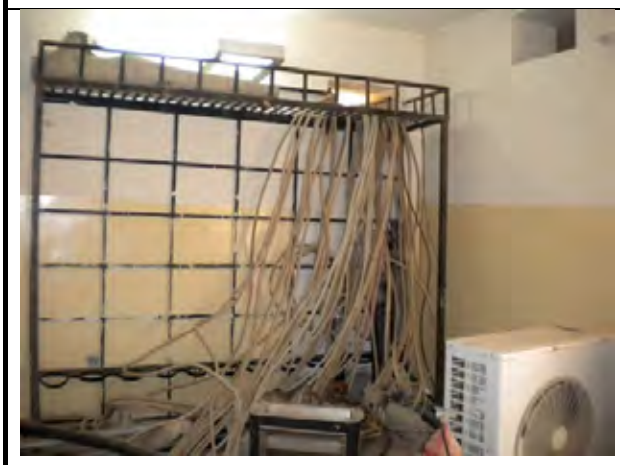
Telephone Pole with Distribution Box

| Site | Domiz Exchange Station in Mosul | |
|---|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | | JICA |
| | | NIPPON KOEI |

Switching Station Building



Alcatel Exchange Rack



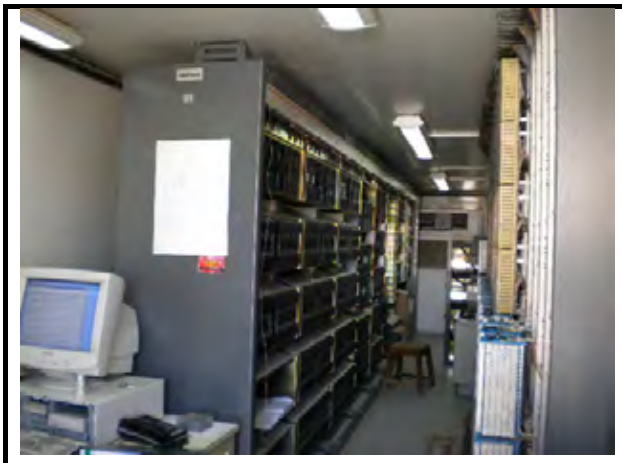
MDF Rack

Alcatel Exchange Batteries

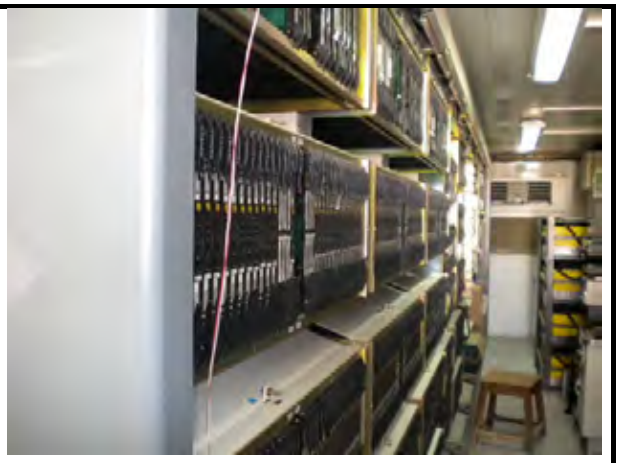
Leaned Telephone Pole

Telephone Cabinet

| | |
|---|---|
| **Site** | **Al Wahda Exchange Station in Mosul** |
| **Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq** | **JICA** / **NIPPON KOEI** |



Local Exchange Racks



Alcatel Exchange Racks

MDF Cable Rack

Alcatel Exchange Batteries

Telephone Cabinet

Cable Manhole

| | |
|---|---|
| **Site** | **Al Hadbaa Exchange Station in Mosul** |
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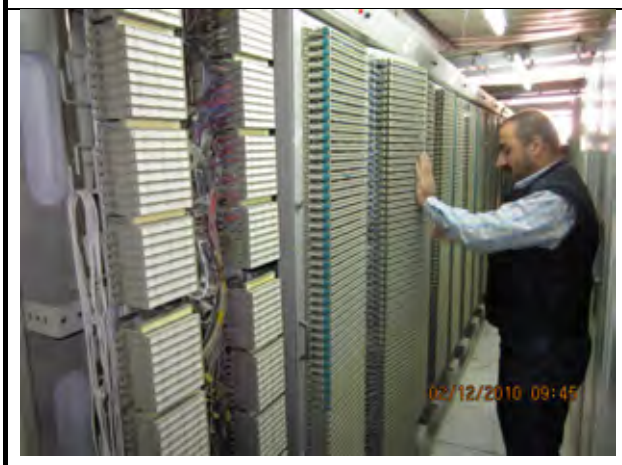
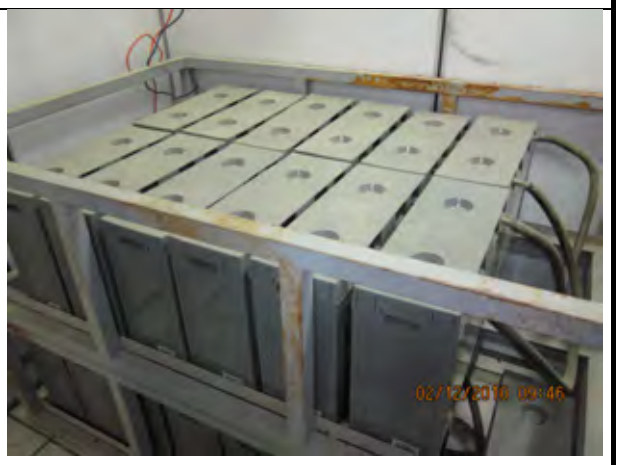
ZTE Exchange Container

ZTE Exchange Rack



ZTE Exchange DDF



ZTE Exchange Batteries

Cable Jointing Works inside Manhole

Cables inside Manhole

| | |
|---|---|
| **Site** | **Abu Tammam Exchange Station in Mosul** |
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DWDM Rack

Local Exchange Rack

NGN Multi-Service Access Nodes (MSAN)

Alcatel Local Exchange DDF

Cable Joint in the Street

Telephone Cable Maintenance works on the Street

| Site | Dawasa Exchange Station in Mosul | |
|---|---|---|
| Preparatory Survey on the Construction and Development of Telecommunications Network for Major Provinces in Iraq | | JICA |
| | | NIPPON KOEI |