

Fig - 5.3.6-1 RADIO/MUX Room (3F) Planned Installation Place (IR/ITE Center)

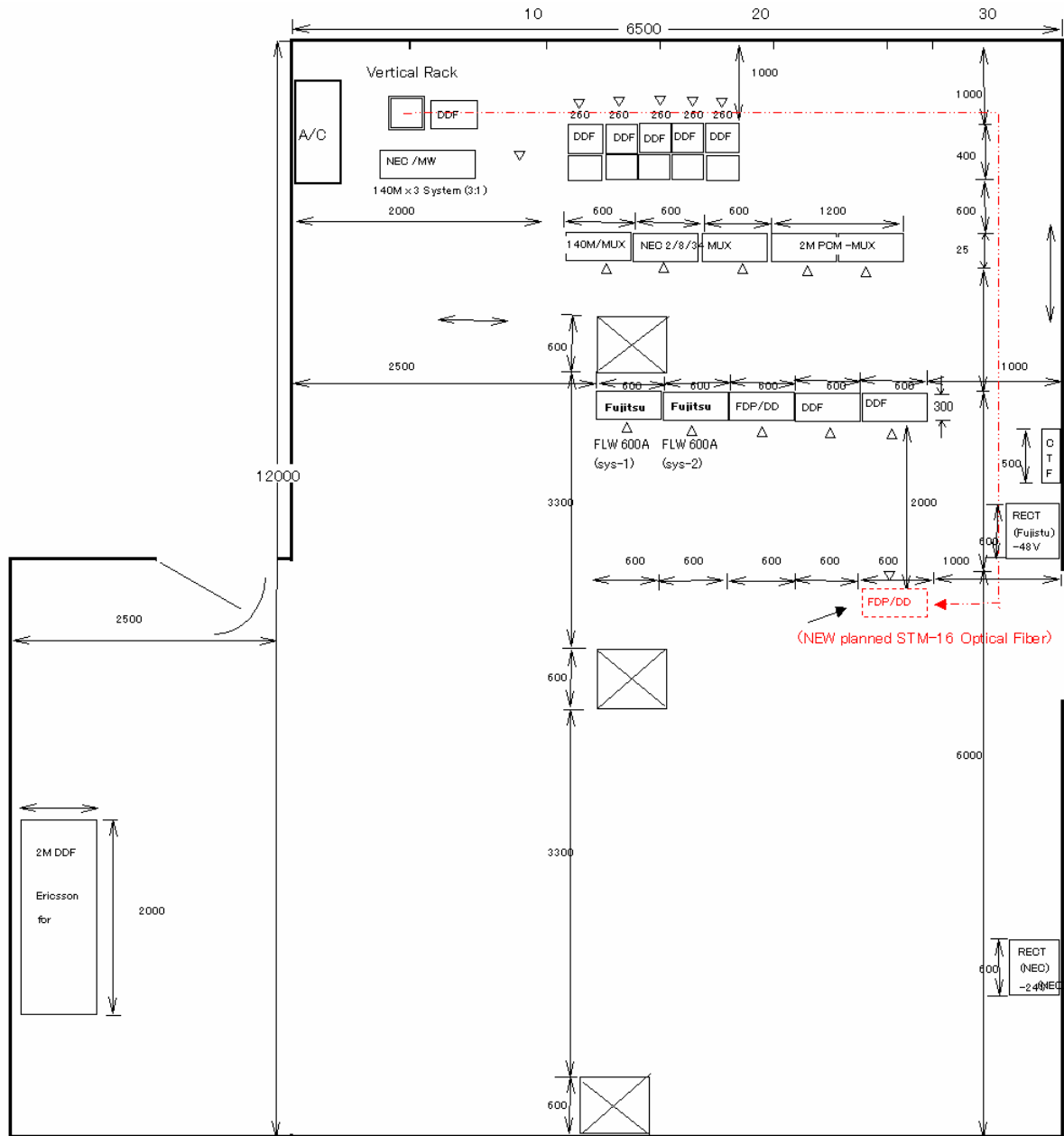


Fig . 5.3.6-2 RADIO/MUX ROOM Planned Installation Place (FILWOHA Center)

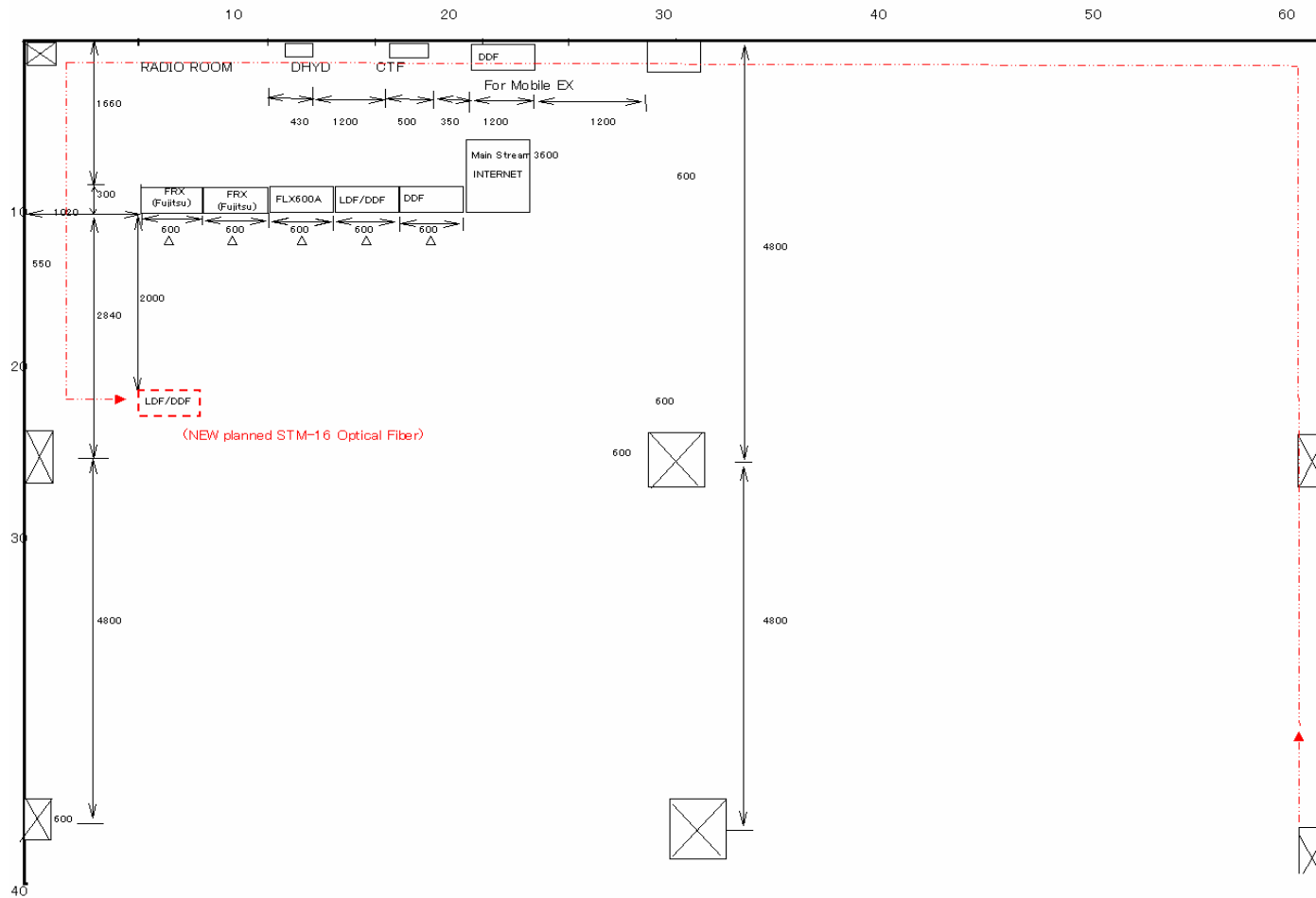


Fig . 5.3.6-3 RADIO/MUX ROOM (2F) Planned Installation Place (NEFAS SILK)

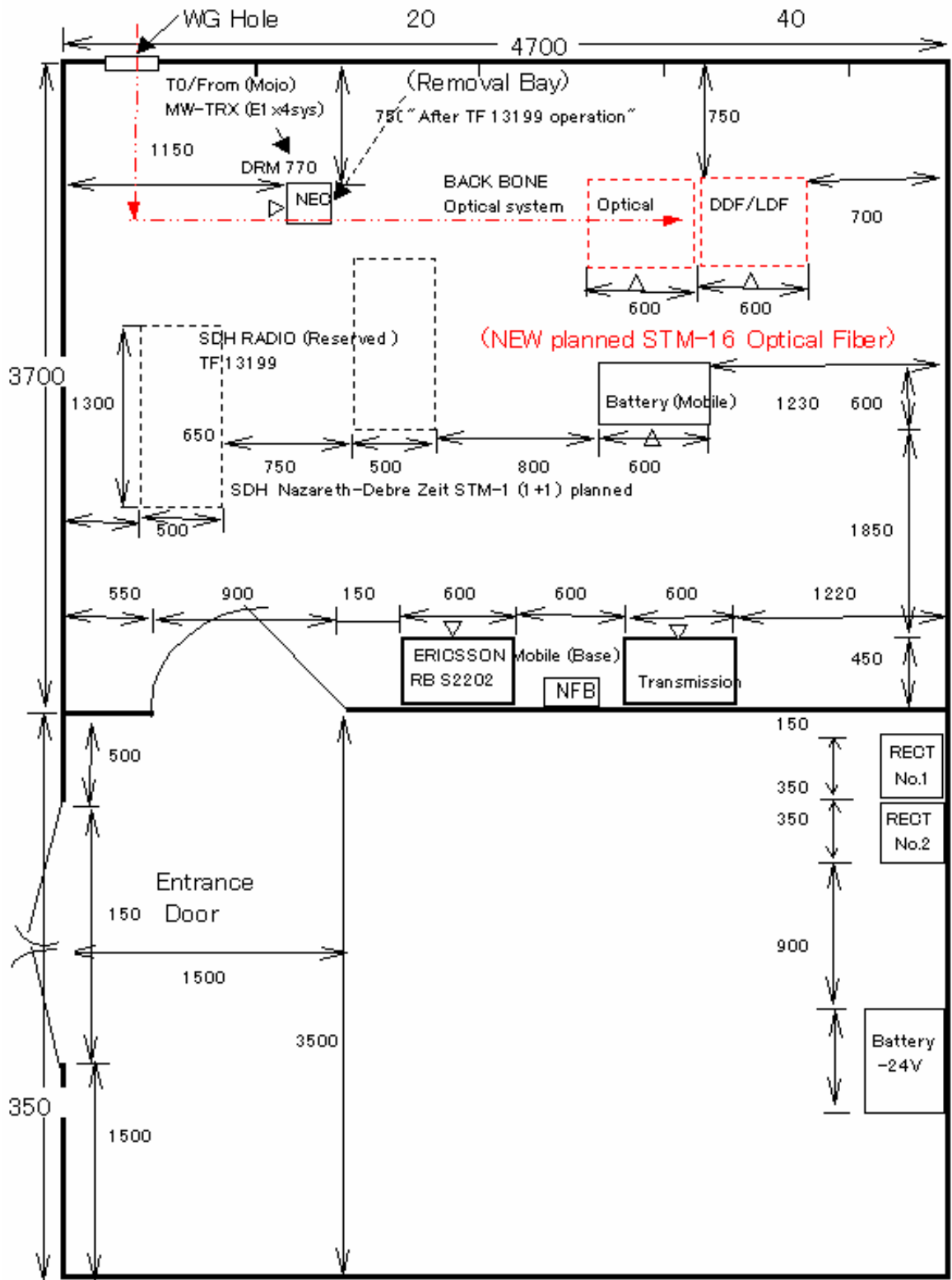


Fig. 5.3.6.-4 RADIO/MUX / POWER ROOM Planned Installation Place (Debre Zeit)

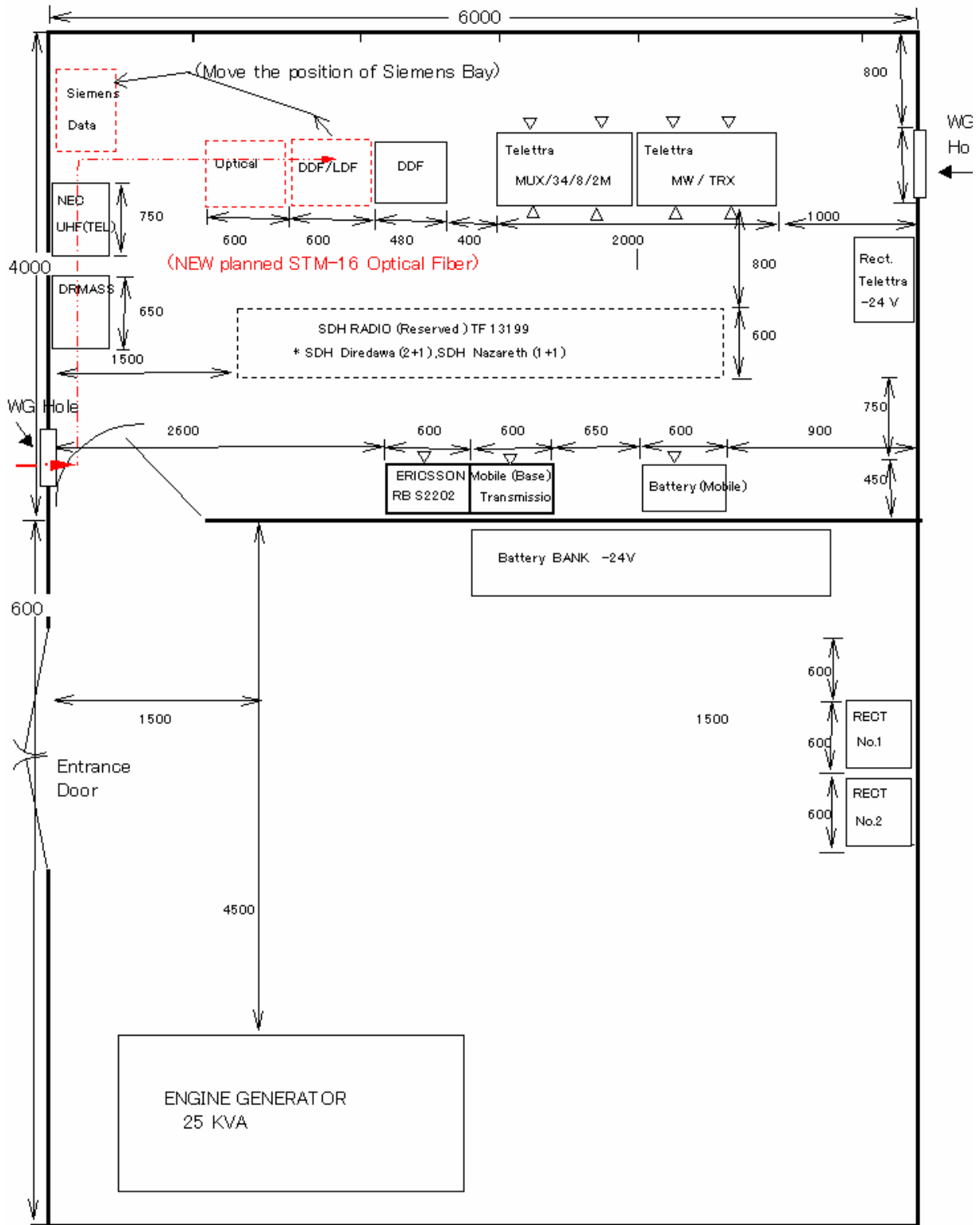


Fig. 5.3.6-5 RADIO/MUX ROOM Planned Installation Place

(ADAMA WEST NW Rep.)

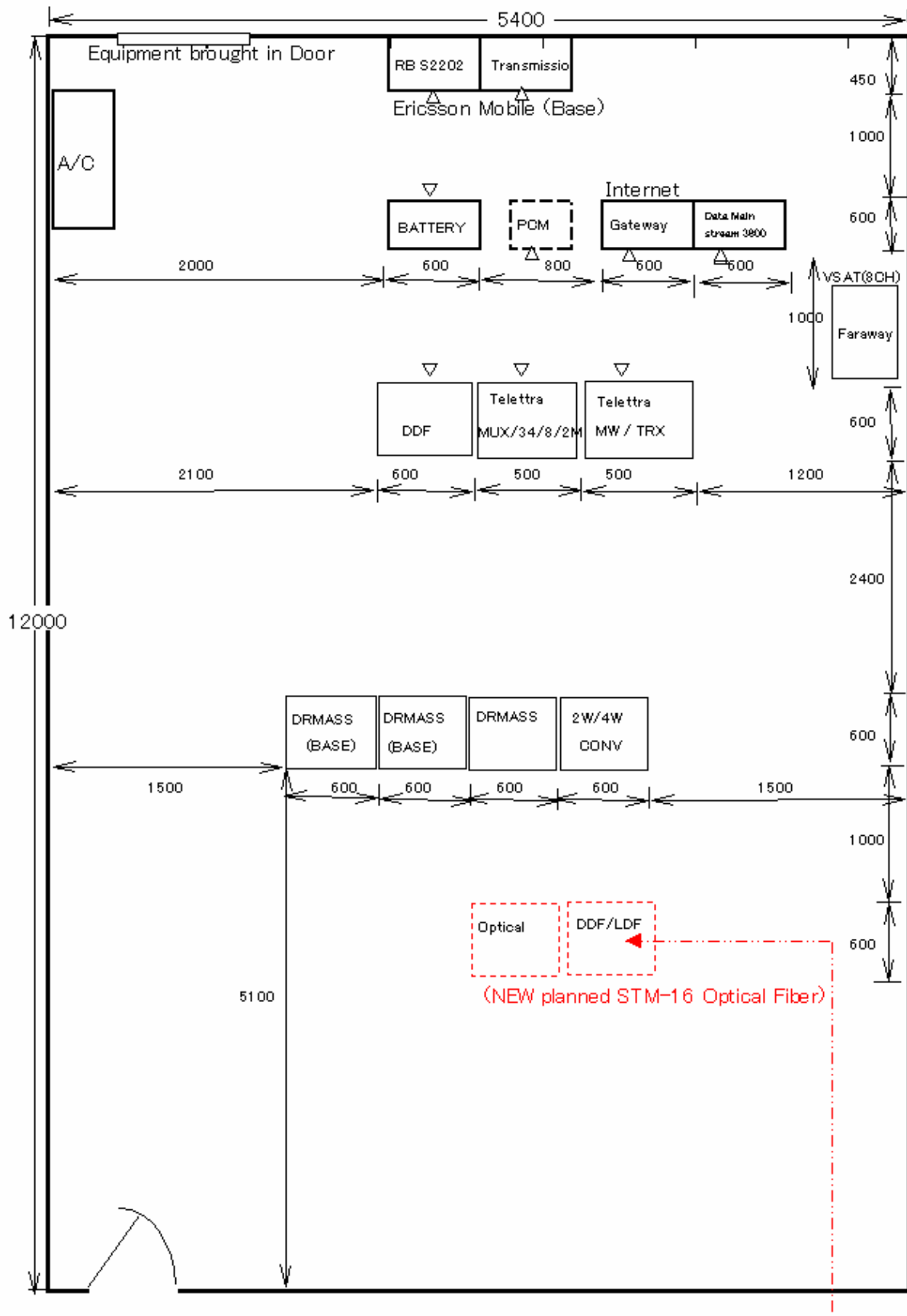


Fig. 5.3.6-6 Radio/Mux Room Planned Installation Place (Nazareth P.C.)

Table5.3.1 (1/2) STM-16 OPTICAL SYSTEM (AA-Nazareth) (US\$=120Yen)

Item	Description	Unit Price (yen)	AA(IR/ITE)	AA(Fiwaha)	AA(Nefas Silk)	DEBRE ZEIT	ADAMA West	NAZRETH	TOTAL
A.	Foreign Currency Part (STM-16 Multiplexer)								
1.	Rack & Power Distribution Panel								
1.1	ETSI rack (2200H x 600W x 300D mm) with PWR Distribution Panel		1			1	1	1	4
2.	O/E Converter Unit								
2.1	Shelf with Common		1			1	1	1	4
2.2	Optical interface unit		2			4	4	2	12
3.	Tributary interface unit								
3.1	STM-1 channel unit								
	Interface Unit for STM-1 Opt.(S1.1.& L1.1 2ch)		8			8	8	8	32
	Interface Unit for STM-1 Electrical (S1.1.& L1.1 2ch)		8			8	8	8	32
3.2	Low order VC crossconnect Unit (TSI,5G)					1			1
3.3	2M channel unit (Interface unit for E1 (42ch))					1			1
4.	Documentation								
4.1	Instruction manual		1			1	1	1	4
5.	Network Management System								
5.1	SDH Local management terminal		1						1
6.	Miscellaneous								
6.1	FC-FC optical cord, standard type (10m)		4			8	8	4	24
6.2	Telephone set for OW		1			1	1	1	4
7.	Distribution frame								
7.1	Distribution frame (LDF)		1	1	1	1	1	1	6
7.2	Distribution frame (DDF)		1			1	1	1	4
8.	Spare Unit		1						1
9.	Test Equipment		1						1
10.	Installation Material		1						1
11.	Installation Work		1						1
			SUB TOTAL PRICE (A)						

Table 5.3.1 (2/2) Optical & Material List (AA-Nazareth)

Item	Description	Unit	Quantity
B.	Foreign Currency Part (Optical Fiber & Material)		
1.	Civil work		
1.1	M.H Construction (Pieces) (S-2)	ea	70
1.2	ϕ 100 mm PCV 6 DUCT (m)	m	12,600
1.3	Road reinstatement work (0.7 m x distance)	m2	8,820
1.4	HDPE Sub-duct . 3 ways	m	12,600
2.	CABLE WORK		
1.1	8.0m(H)-200(D) Concrete Pole (Pieces)	ea	1,708
1.2	Stay (30SW) (Pieces)	ea	171
1.3	Optical Cable 24C (For duct) (km) 1310nm SM (Ribbon type)	km	12.6
1.4	Optical Cable 24C (For Aerial) (km) 1310nm SM (Ribbon type)	km	85.4
1.5	Optical Cable 24C Closer (For Duct) (Pieces)	ea	5
1.6	Optical Cable 24C Closer (For Aerial) (Pieces)	ea	25
1.7	O/F - 1C Cord (with One side connector) 15m (Pieces)	ea	240
1.8	O/F Cable Connection BOX (48C) (Pieces)	ea	2
1.9	O/F Cable Connection BOX (96C) (Pieces)	ea	4
3.	Transportation		
3.1	Inland Transportation	ea	1
3.2	Custom clearance	ea	1
4.	TAX	ea	1
5.	Spare Installation Material		
5.1	8.0m(H)-200(D) Concrete Pole (Pieces)	ea	40
5.2	Stay (30SW) (Pieces)	ea	24
5.3	Optical Cable 24C (For duct) (km) 1310nm SM (Ribbon type)	km	4.0
5.4	Optical Cable 24C (For Aerial) (km) 1310nm SM (Ribbon type)	km	12.0
5.5	Optical Cable 24C Closer (For Duct) (Pieces)	ea	2
5.6	Optical Cable 24C Closer (For Aerial) (Pieces)	ea	5
5.7	O/F - 1C Cord (with One side connector) 15m (Pieces)	ea	10
5.8	O/F Cable Connection BOX (48C) (Pieces)	ea	0
5.9	O/F Cable Connection BOX (96C) (Pieces)	ea	0
6.	Test Equipment	ea	1
7.	Installation Tool	ea	1
	Sub-Total		

6. OPERATION AND MAINTENANCE

6.1 Operation and Maintenance Organization for the Existing Facilities

(1) Operation and Maintenance Organization for the Transmission Facilities

(Microwave Transmission System)

Operation and maintenance of the transmission facilities in the objective area is carried out by the Regional center (Region Primary Center) of the ETC. In this case, the Addis Ababa IR/ITE station becomes the control station, and Regional Primary Center in charge of each microwave repeater station will carry out maintenance and operation of their respective area.

(2) Operation and Maintenance Organization for Cable Plant

Operation and maintenance of the cable plant in the objective area is carried out by the regional center (Region Primary Center) of the ETC. In this case, the maintenance center for outside plant in Addis Ababa becomes the control station, and Region Primary Centers in charge of cable plant share the work of carrying out maintenance and operation of their respective area.

Maintenance work is at present carried out mainly on copper cables, and optical fiber cable is installed only in a part of the junction links in Addis Ababa City.

6.2 Operation and Maintenance of the Backbone (New O/F Backbone)

Ethiopia has no experience in operating and maintaining of optical backbone link of the project between Addis Ababa and Nazareth. Especially the maintenance of cable plant needs to be reinforced, to improve the stability and efficiency of the equipment.

(1) Operation and Maintenance System for Transmission Equipment

Operation and maintenance for the transmission facilities of the Optical Fiber backbone system will be carried out by the regional center (Region Primary Center) of ETC. In this case, the Addis Ababa IR/ITE station will become the control station, and Region Primary Centers in charge of each microwave repeater station will carry out maintenance and operation of the objective section.

a) Measures to reinforce primary fault response (fast recovery)

In case of a circuit fault occurred, Local Network Management system that F/S team plans to introduce in this project allows an automatic or remote switchover to back-up system of this backbone transmission system, which is equipped with redundancy configuration.

F/S team plans to introduce the Local Network Management system in the IR/ITE station, which is the network control station for Addis Ababa.

It would be the best way that if the IR/ITE network control station works 24 hours a day to recover the line, and then commands the station in charge of maintaining the site of the fault (Region Primary Center and the like) to ensure smooth secondary fault response (repair work) after the primary fault response (system switch-over to the back-up).

b) Measures to reinforce (line fault repair)

The fault repair of the transmission system will be done mainly by the replacement of the faulty cards. The diagnosis of the fault will be done in IR/ITE center through the network management center.

The site repair work will be done by the site staff in accordance with the instruction of the IR/ITE as well as the alarms given at site.

(2) Operation and Maintenance System of the Optical Fiber Cable Portion

The repair work task force of the optical fiber cable system will be established in OPMC of Addis Ababa, which is planned as one of the key projects of the short-term plan (by year 2005/6) of M/P upon the order from the transmission maintenance office, which detects the system failure and switch-over the system to the back-up through the Network Management system.

The task force team is responsible on the maintenance of this backbone O/F system, AA junction rings as well as the spur O/F links around Addis Ababa, and shall be furnished with the related measuring equipment, tools, materials and vehicles.

6.3 Operation and Maintenance Staff (New Backbone)

In consideration of the maintenance and operation work mentioned under 6.2 above; F/S team recommends the operation and maintenance staff as given in Table 6.3.1.

Table 6.3.1 The Required Operation and Maintenance Staff

Type of Staff	Transmission	Cable Plant	Total
1) Engineers	1	(1)	2
2) Technicians	2	(2)	4
3) General Workers		(3)	3

Maintenance staff of cable plant is to be organized as a part of OPMC.

6.4 Operation and Maintenance Instrument (New Backbone)

In consideration of the maintenance and operation work mentioned under 6.2 above; F/S team recommends of the following instrument in place.

Table 6.4.1 The Required Operation and Maintenance Instrument

Type of Instrument	Transmission Facilities	Cable Plant	Total
1) Measuring Instrument	(Included in the equipment cost)	(Included in the equipment cost)	N/A
2) Special tools	(Included in the equipment cost)	(Included in the equipment cost)	N/A
3) Special vehicles (Bucket cars)	N/A	1 (inclusive in OPMC)	1
4) Maintenance car	N/A	2 (inclusive in OPMC)	2

6.5 Training for Maintenance Staff

Trainings are required for the Maintenance staff of Transmission facilities and cable plant until the completion of the project. During detail design stage, corresponding regional center has to nominate personnel who will be in charge of maintenance. Training should be carried out for detection of fault points and recovery of cable faults. Maintenance training is to be applied on the transmission maintenance staff. Since it will be the responsibility for the contractor, or manufacturer to provide these trainings, they should be included in the contract with the contractor.

Training consist of three category

- 1) Overseas technical training (option) : approximately three week
- 2) Local training (mandatory) : approximately one week
- 3) On-the-job training (mandatory) : proper timing in installation work

7. IMPLEMENTATION PLAN (TENTATIVE)

7.1 Installation Schedule

Table 7.1 shows a schedule for the execution of this project. As shown in this schedule, engineering services including a field survey, detailed design and creation of bidding documents, bidding, evaluation of tenders, etc. will be done by a consultant.

7.2 Organization for the Project Implementation

For the implementation of the project, hiring foreign consultant for detail design and supervision as well as selection of foreign contractor will be required. Project and Technical Planning Division should establish a project team with selection of members from divisions of Telecom Infrastructure Development Department.

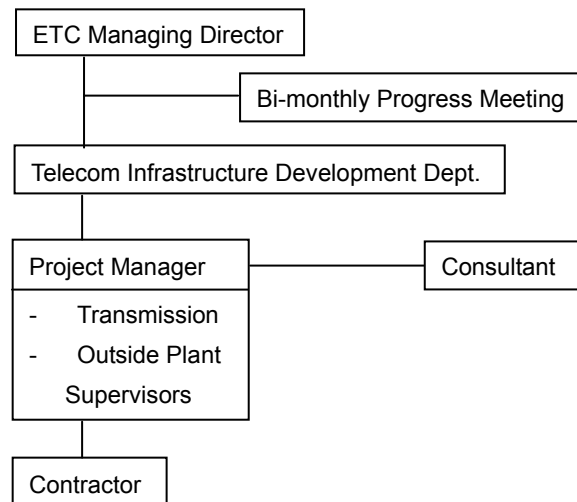


Figure 7.1 Organization for Project Implementation

ETC's project management group is responsible for;

- 1) Detailed design of the project assisted by the consultant.
- 2) Implementation of ETC's obligatory works.
- 3) Check and approval on the construction/installation drawings and local sub-contractors assisted by consultant.
- 4) Semi-monthly progress report to H.Q.
- 5) Weekly project site progress meeting.
- 6) Bimonthly overall project progress meeting held at H.Q.
- 7) Daily project site supervision and site instructions to the contractor.
- 8) Witness to progress check, site test and acceptance test.
- 9) Issuance of the authorization to pay.
- 10) Handing over of the completed project to O/M division.

- 11) Receiving the technology transfer from the consultant and the contractor.
- 12) Promote the project implementation progress by giving the solution to site problems.

7.3 ETC Obligation

In the execution of this project, the ETC will be responsible for carrying out the following items:

- 1) Application for and obtainment of various permissions
 - Permission of city offices or the responsible government agency with regards to the cable duct laying work, pole election, and aerial cable installation work.
- 2) Payment of the road occupation tax and road reinstatement cost for the communications equipment (installation of poles and ducts)
- 3) Customs clearing of equipment and materials including import tax exemption measures.
- 4) Various permissions and approvals required for the construction work of this project
- 5) Securing of space to install equipment as shown in 5.3 (4) or securing of a suitable alternative space by removal/moving of unnecessary equipment.
- 6) Power supply for the relevant equipment (securing of commercial power supply).

8. PROJECT COST ESTIMATION

The total cost necessary for this project is 3.0 million US dollars (Foreign aid expense). According to the responsibilities of donor country and Ethiopia described before, expenses on the donor country and Ethiopia sides are estimated as shown below on the following conditions.

8.1 Initial Investment

The project's initial investment cost required for the construction of backbone transmission link is described in Table 8.1 Project Cost Estimate. In addition, costs required for work items of the ETC in this project are listed in Table 8.2 Expenditure Plan (Ethiopia side expenses).

Table 8.1 Estimated Project Cost (Donor Country Side Cost) (unit : US\$1,000)

Project Cost	Transmission	Outside Plant	Total
(1) Construction Cost	662	1,846	2,508
(2) Others	-	-	457
Total cost	-	-	2,965

Note: Direct Cost of Outside plant includes 357,100 US\$ (Local currency portion)

The project cost was estimated on the following conditions.

- a) Construction work will be conducted by contractors based on the turnkey system, according to the specific design and bidding specifications prepared under supervision of consultants.
- b) The procurement cost of materials and equipment are estimated using the FOB prices. Therefore, marine transportation costs and insurance expenses needed for transportation between donor country and Djibouti Port (the Republic of Djibouti). Land transportation costs and insurance expenses between Djibouti Port and Addis Ababa/Nazareth will be separately estimated.
- c) Costs occurring in Ethiopia (materials/equipment costs, domestic transportation cost, wages for locally hired construction workers, etc.) are calculated in US dollars. In this case, currency exchange rate shall be 1US\$=8.56 Birr.
- d) Maintenance (spare) parts costs are calculated on conditions that they will be retained for three years.
- e) All costs are calculated using prices in 2002 and no price escalation is taken into account.

8.2 Expenditure Plan

Expenses for each year in the early stage of the project, under the above-mentioned conditions, are shown in Table 8.2 Expenditure Plan.

Table 8.2 Estimated Project Cost (Ethiopian Side Cost) (unit : US\$1,000)

Project Cost	Transmission	Outside Plant	Total
1. Road reinstatement	0	238	238
2. Pole installation	0	0	0
3. Building	0	0	0
Total Cost	0	238	238

8.3 Maintenance and Operating Cost

Costs required for maintenance and operation of telecommunications systems are provided as direct costs and indirect costs.

These costs are composed of labor cost, facility maintenance vehicle running cost, and maintenance parts/materials procurement cost, and other general costs.

Table 8.3 shows the maintenance and operating costs of each technical category.

In addition, insurance expenses for constructed facilities are required, which account for approximately 0.1% of the total book price of all equipment and facilities constructed under this project, according to the ETC's current insurance system.

Table 8.3 Maintenance and Operating Cost (unit : US\$)

Year	Transmission	Outside Plant	Total
2005/06	10,995	70,666	81,660
2006/07	10,995	70,666	81,660
2007/08	10,995	70,666	81,660
2008/09	10,995	70,666	81,660
2009/10	10,995	70,666	81,660
2010/11	14,659	94,221	108,880
2011/12	14,659	94,221	108,880
2012/13	14,659	94,221	108,880
2013/14	14,659	94,221	108,880
2014/15	14,659	94,221	108,880
2015/16	14,659	94,221	108,880
2016/17	18,324	117,776	136,100
2017/18	18,324	117,776	136,100
2018/19	18,324	117,776	136,100
2019/20	18,324	117,776	136,100
2020/21	18,324	117,776	136,100
合計	234,550	1,507,531	1,742,081

9. PROJECT EVALUATION

The national backbone transmission network spreads out from Addis Ababa in a star-shaped pattern, and is primarily made up of microwave systems. The increase in traffic due to the spread of fixed and mobile phone services, and especially the insufficient capacity of the existing backbone transmission system extending from Addis Ababa to Nazareth via the Mt. Furi relay station is highlighted in the Master Plan. Lack of transmission route capacity will form a bottleneck in the development of the communications network, and so requires immediate action.

Implementing this project will not only eliminate the line capacity problems on the section covered (Addis Ababa to Nazareth), but is also expected to significantly improve reliability of the backbone transmission system, as diversionary lines will be created for the existing transmission routes extending to the south and east. This ranked as a high-profit project within the Master Plan.

9.1 Financial Analysis

9.1.1 Basic Assumptions for Financial Analysis

This section uses a financial analysis to check the profitability of this project. The prerequisite conditions used in the evaluation will be confirmed with ETC staff during on-site surveys.

The financial evaluation has not dealt with nominal change of value such as inflation and currency exchange rate fluctuation to reveal essential viability of the Project.

In the sense, Net present value and Internal rate of return are typical means as the evaluation tool under the appraisal prerequisite, for the Project.

- a) Fiscal Year
1, July - 30, June
- b) Project Appraisal Period
2003/04 – 2019/20 (17 years)
- c) Fixed Price Base

Financial Projections have been done in 2002 constant price. In this mean, All costs shall be fixed at 2002 level. This price level, which was estimated to be the standard market price in 2002 will be adopted for all costs, such as construction costs and operating costs.

- d) Exchange Rate
US\$1.00 = Biro 8.56 (August 2002)
US\$1.00 = Yen 120.0 (August 2002)

- e) Long Term Loan
Interest rate : 8.0%

Repayment : 20 times over 10 years
Fixed principal payment

Grace period : non

f) Revenue collecting ratio

The expected collecting ratio is set as following Table 9.1-1.

Table 9.1-1 The Expected Collecting Ratio

Year	Revenue Collecting Ratio
2005/06 - 2006/07	90%
2006/07 – 2010/11	85%
2011/12 - 2015/16	85%
2016/17 - 2019/20	80%

g) Corporate Income Tax

30% of ETC's net taxable income.

h) Insurance

The cost for insurance was assumed to be approximately 0.1% of the book value of Equipment & Facilities costs in each project year based on the current insurance system.

i) Depreciation

Full value of all asset items is depreciated without remaining salvage value, over the estimated useful lives of these assets. Depreciation is provided as following Table 9.1-2;

Table 9.1-2 Depreciation Method

Items	Depreciation method
Buildings	2.5%
<i>Plant</i>	
Exchange & Switching Equipment	5.0%
Radio & Transmission Equipment, VoIP	7.0%
Cable & Subscriber Network	8.0%
Air-conditioning plant, office facilities	20.0%
Motor Vehicles and others	20.0%

j) Working Capital

The amount of Working capital is assumed to be the following for each year of operation.

Account Receivable	:	Sales Revenue for 2 months
Account Payable	:	Operating costs for 2 month

9.1.2 Investment Plan

The total investment cost for this project is calculated using 2002 prices. The results are shown below.

(1) Total Investment Cost

The total investment cost can be summarised in Table 9.1-3.

Table 9.1-3 Total Investment Cost Unit : US\$ 1,000

Items	Foreign	Local	TOTAL
Transmission Installation	1,766	980	2,746
Engineering Service	388	69	457
Total	2,154	1,049	3,203

(2) Expenditure Schedule

The total investment cost is disbursed in each project year of construction period as shown in Table 9.1-4.

Table 9.1-4 Expenditure Schedule Unit : US\$ 1,000

Items	YEAR		TOTAL
	2003/04	2004/05	
Equipment & Facilities	652	2,094	2,746
Pre-operation cost	100	100	200
Engineering service	176	281	457
Initial Working Capital	0	147	147
Interest during construction	39	164	203
Total	967	2,786	3,752

9.1.3 Revenue Distribution Ratio

The revenue for this project was calculated by multiplying the total revenue by the share of the facility balance. The share was set at 1.6% as the contributing ratio to the entire trunk transmission network. Expected revenue calculated under the aforementioned conditions is

shown in Table 9.1-5. The following revenues are those obtained through the operation of the telecommunication network established under the project. The revenues are deemed as the operating income of the project.

Table 9.1-5 Total Annual Revenue

Unit : USD\$1,000

Year	Annual Revenue
2005/06	1,259
2006/07	1,351
2007/08	1,427
2008/09	1,502
2009/10	1,584
2014/15	1,993
2019/20	2,366

Table 9.1-6 Revenue Forecast

PROJECT YEAR	2005/06	2006/07	2007/08	2008/09	2009/2010	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SUBSCRIBER															
TOTAL SUBSCRIBER (Fixed phone)	444,000	511,600	539,300	567,000	594,700	622,400	655,220	688,040	720,860	753,680	786,500	819,320	852,140	884,960	917,780
Addis Ababa	389,500	404,560	419,620	434,680	449,740	464,800	483,990	503,180	522,370	541,560	560,750	579,940	599,130	618,320	637,510
Region 2	28,700	32,560	36,420	40,280	44,140	48,000	53,150	58,300	63,450	68,600	73,750	78,900	84,050	89,200	94,350
Region 5	25,800	30,340	34,880	39,420	43,960	48,500	52,450	56,400	60,350	64,300	68,250	72,200	76,150	80,100	84,050
Region 6		44,140	48,380	52,620	56,860	61,100	65,630	70,160	74,690	79,220	83,750	88,280	92,810	97,340	101,870
REVENUE (Fixed phone)															
REVENUE PER SUBSCRIBER : USD	157	155	153	151	150	146	146	146	146	146	146	146	146	146	146
COLLECTING RATIO	90.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	80.0%	80.0%	80.0%	80.0%
ALLOTMENT CHARGE RATIO	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%	1.6%
Revenue from Fixed phone	988	1,061	1,104	1,146	1,194	1,216	1,280	1,344	1,408	1,472	1,536	1,506	1,567	1,627	1,687
TOTAL SUBSCRIBER (Mobile phone)															
TOTAL SUBSCRIBER (Mobile phone)	135,252	154,664	174,076	193,489	212,901	232,313	248,209	264,104	280,000	295,895	311,791	337,115	362,440	387,764	413,089
Addis Ababa	100,000	113,691	127,381	141,072	154,762	168,453	177,385	186,316	195,248	204,179	213,111	228,396	243,681	258,967	274,252
Bahir Dar	16,000	16,564	17,128	17,693	18,257	18,821	20,994	23,167	25,339	27,512	29,685	32,867	36,050	39,232	42,415
Nazareth	0	3,803	7,606	11,408	15,211	19,014	21,224	23,434	25,644	27,854	30,064	33,300	36,537	39,773	43,010
Assela	4,000	4,299	4,598	4,898	5,197	5,496	6,135	6,774	7,413	8,052	8,691	9,627	10,562	11,498	12,433
Harar	6,000	6,519	7,038	7,557	8,076	8,595	9,408	10,221	11,035	11,848	12,661	13,785	14,909	16,033	17,157
Dire Dawa	9,252	9,788	10,325	10,861	11,398	11,934	13,063	14,192	15,321	16,450	17,579	19,140	20,701	22,261	23,822
REVENUE (Mobile Phone)															
REVENUE PER SUBSCRIBER : USD	283	280	277	275	274	265	264	264	264	263	263	262	261	261	261
COLLECTING RATIO	90.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	85.0%	80.0%	80.0%	80.0%	80.0%
ALLOTMENT CHARGE RATIO	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%
Revenue from Mobile phone	271	290	323	356	390	412	438	466	495	521	549	556	596	637	679
TOTAL REVENUE (x 1,000 USD)	1,259	1,351	1,427	1,502	1,584	1,628	1,718	1,811	1,903	1,993	2,085	2,062	2,162	2,264	2,366

9.1.4 Operation Expenses

The direct operation costs do not include interest payment and depreciation. The annual operation and maintenance (O&M) costs will be increased due to the increase of number of terminals.

Table 9.1-7 Annual (O&M) Costs

Unit : US\$ 1,000

Year	Total (O&M) cost
2005/06	378
2010/11	488
2014/15	598
2019/20	710

Note: 30% of net sales revenue

9.1.5 Financial Analysis

The purpose of the financial analysis is to measure and assess the financial viability of the priority projects under the above mentioned conditions and assumptions.

The financial soundness of the project will be assessed through the projection of the expected Profit/Loss and Cash Flow statement, etc. The result of this financial analysis is detailed in the output sheets that are attached to the annex.

- a) Income Statement (Table 9.1-9)
- b) Cash flow Statement (Table 9.1-10)
- c) Balance Sheet (Table 9.1-11)

The summary of the result of financial analysis is shown in Table 9.1-8.

Table 9.1-8 Result of Financial Analysis

UNIT : 1,000 USD

ITEM	PROJECT	ITEM	PROJECT
TOTAL INVESTMENT	3,752	CORPORATE INCOME TAX PROJECT TOTAL (AVERAGE ANNUAL)	4,447 296
PROJECT FUNDING EQUITY(OWN CAPITAL)	1,244	NET PROFIT PROJECT TOTAL (AVERAGE ANNUAL)	10,376 692
DEBT(LONG TERM LOAN)	2,508		
TOTAL	3,752	CASH FLOW DURING OPERATION PROJECT TOTAL (AVERAGE ANNUAL)	9,698 647
SALES REVENUE PROJECT TOTAL (AVERAGE ANNUAL)	27,114 1,808	EXPECTED PROJECT RETURN IRROI IRROE	29.87% 33.85%
OPERATING COSTS,INTEREST & DEPRECIATION PROJECT TOTAL (AVERAGE ANNUAL)	12,290 819	PAYOUT PERIOD (for Equity)	3.29 Yrs

Table 9.1-9 Income Statement

UNIT: 1000 USD

PROJECT YEAR	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
NET SALES REVENUE	1,259	1,351	1,427	1,502	1,584	1,628	1,718	1,811	1,903	1,993	2,085	2,062	2,162	2,264	2,366	27,114
OPERATING COSTS	378	405	428	450	475	488	515	543	571	598	625	619	649	679	710	8,134
INTEREST (LT/ST-LOAN)	186	166	145	125	105	85	65	45	25	5	0	0	0	0	0	953
DEPRECIATION	288	288	288	288	288	196	196	196	196	196	196	196	196	196	0	3,203
PROFIT BEFORE TAX	408	492	566	638	716	858	941	1,026	1,111	1,194	1,263	1,248	1,317	1,389	1,656	14,824
CORPORATION TAX	122	148	170	191	215	257	282	308	333	358	379	374	395	417	497	4,447
PROFIT AFTER TAX	286	345	396	447	501	601	659	718	777	836	884	873	922	972	1,159	10,376

Table 9.1-10 Cash Flow Statement

EXPECTED PROJECT RETURN : 33.85% (IRROE)

UNIT: 1000 USD

PROJECT YEAR	2003/04 -2	2004/05 -1	2005/06 1	2006/07 2	2007/08 3	2008/09 4	2009/10 5	2010/11 6	2011/12 7	2012/13 8	2013/14 9	2014/15 10	2015/16 11	2016/17 12	2017/18 13	2018/19 14	2019/20 15	TOTAL
SOURCE OF FUND																		
CASH FROM OPERATION	0	0	573	632	683	734	789	797	855	914	974	1,032	1,080	1,069	1,118	1,168	1,159	13,579
EQUITY	315	929	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,244
LONG-TERM LOAN	652	1,856	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,508
SHORT-TERM LOAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL SOURCE OF FUND	967	2,785	573	632	683	734	789	797	855	914	974	1,032	1,080	1,069	1,118	1,168	1,159	17,332
APPLICATION OF FUND																		
TELECOM. FACILITIES (National Backbone Transmission, etc)	652	2,094	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,746
P/O COST,ENGINEER.SERVICE	276	381	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	657
WORKING CAPITAL INCREASE	0	147	11	9	9	10	5	11	11	11	11	11	-3	12	12	12	0	276
INTEREST DURING CONSTRUCTION	39	164	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	203
SUB-TOTAL	967	2,785	11	9	9	10	5	11	11	11	11	11	-3	12	12	12	0	3,882
REPAYMENT (LT/ST - LOAN)	0	0	251	251	251	251	251	251	251	251	251	251	0	0	0	0	0	2,508
TOTAL APPLICATION OF FUND	967	2,785	262	260	260	260	256	261	262	262	261	262	-3	12	12	12	0	6,390
CASH SURPLUS	0	0	312	373	424	474	533	535	594	653	712	770	1,083	1,058	1,106	1,156	1,159	10,942
CASHFLOW	-315	-929	312	373	424	474	533	535	594	653	712	770	1,083	1,058	1,106	1,156	1,159	9,698

Table 9.1-11 Balance Sheet

UNIT: USD1000

PROJECT YEAR	2003/04 -2	2004/05 -1	2005/06 1	2006/07 2	2007/08 3	2008/09 4	2009/10 5	2010/11 6	2011/12 7	2012/13 8	2013/14 9	2014/15 10	2015/16 11	2016/17 12	2017/18 13	2018/19 14	2019/20 15
ASSETS																	
CURRENT ASSETS	0	0	312	684	1,108	1,582	2,115	2,650	3,244	3,896	4,609	5,379	6,462	7,520	8,626	9,783	10,942
FIXED ASSETS	967	3,606	3,606	3,318	3,031	2,743	2,455	2,168	1,972	1,776	1,579	1,383	1,187	991	795	599	403
LESS DEPRECIATION	0	0	288	288	288	288	288	196	196	196	196	196	196	196	196	196	0
NET FIXED ASSET	967	3,606	3,318	3,031	2,743	2,455	2,168	1,972	1,776	1,579	1,383	1,187	991	795	599	403	403
ACCOUNT RECEIVABLE	0	210	225	238	250	264	271	286	302	317	332	347	344	360	377	394	394
TOTAL ASSETS	967	3,815	3,855	3,952	4,101	4,301	4,554	4,908	5,321	5,793	6,324	6,914	7,797	8,675	9,603	10,580	11,739
LIABILITIES																	
CURRENT LIABILITIES	0	251	251	251	251	251	251	251	251	251	251	0	0	0	0	0	0
FIXED LIABILITY	652	2,257	2,006	1,756	1,505	1,254	1,003	752	502	251	0	0	0	0	0	0	0
ACCOUNT PAYABLE	0	63	68	71	75	79	81	86	91	95	100	104	103	108	113	118	118
TOTAL LIABILITY	652	2,571	2,325	2,078	1,831	1,584	1,335	1,089	843	597	350	104	103	108	113	118	118
EQUITY																	
PAID-IN SHARE CAPITAL	315	1,244	1,244	1,244	1,244	1,244	1,244	1,244	1,244	1,244	1,244	1,244	1,244	1,244	1,244	1,244	1,244
RETAINED EARNINGS	0	0	286	630	1,026	1,473	1,974	2,574	3,234	3,952	4,729	5,565	6,449	7,323	8,245	9,217	10,376
SHORT-TERM LOAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL EQUITY	315	1,244	1,530	1,875	2,271	2,717	3,218	3,819	4,478	5,196	5,974	6,809	7,694	8,567	9,489	10,462	11,621
LIABILITIES & EQUITY	967	3,815	3,855	3,952	4,101	4,301	4,554	4,908	5,321	5,793	6,324	6,914	7,797	8,675	9,603	10,580	11,739

9.1.6 Major Financial Indicators

The major financial indicators in each operation year will be calculated. Each indicator is obtained from the following formula:

- Net Profit on Equity on Sales Revenue

$$\text{Profit before tax} / \text{Equity (Paid in share capital)}$$

- Debt Service Coverage Ratio

$$(\text{Net profit after tax} + \text{Depreciation} + \text{Interest}) / (\text{Repayment} + \text{Interest})$$

- Profit Break Even Point

$$(\text{OPC} + \text{D} + \text{I}) / \text{r} \times 100$$

- Cash Break Even Point

$$((\text{OPC} + \text{D} + \text{I}) + (\text{R} - \text{D}) / (1 - \text{G}) + \text{WCI}) / \text{r} \times 100$$

where, OPC : Operating Costs

r : Sales revenue at each project year

R : Repayment of Long-term Loan

D : Depreciation

I : Interest on Long-term Loan

g : Tax rate

WCI : Working Capital Increase

Table 9.1-12 Major Financial Index

Items	2005/06	2007/08	2010/11	2015/16	2019/20
Net profit on Equity	22.95%	31.81%	48.26%	71.06%	93.17%
Dept Service Coverage Ratio	1.74	2.09	2.62	-	-
Profit Break Even Point	53	50	42	39	30
Cash Break Even Point	50	47	47	26	30

9.1.7 Sensitivity Analysis

The effects on the profitability of the projects by the charges of conditions assumed in this financial analysis have been analysed. The changes of conditions (variable factors) and their variable ranges have been assumed as follows:

a) Total Investment Cost

+20% and -20% of the fluctuation of the Total Investment Cost at the construction stage excluding Interest during construction and Initial Working Capital.

b) Sales Revenue

+20% and -20% of the fluctuation of the sales revenue in each project year.

c) O&M cost

+20% and -20% of the fluctuation of the O&M cost in each project year.

d) Long - Term Loan condition

The result of the sensitivity analysis is summarised in Table 9.1-13.

Table 9.1-13 The Result of the Sensitivity Analysis

Variable factor	Variation	FIRROI (%)	FIRROE (%)
Total Investment	+ 20%	25.29	26.15
	Base	29.87	33.85
	- 20%	36.31	47.90
Sales Revenue	+ 20%	35.06	41.07
	Base	29.87	33.85
	- 20%	24.34	26.14
O/M cost	+ 20%	27.55	37.00
	Base	29.87	33.85
	- 20%	32.12	30.61
L-T Loan condition	Interest: 4.0%	-	38.97
	Base Interest: 8.0%	-	33.85
	Interest: 12.0%	-	29.59
	Interest: 20.0%	-	22.98

9.1.8 Result of Financial Analysis

This project is an expansion project for the most important (Addis Ababa to Nazareth) section of the Ethiopian backbone transmission system. In the Master Plan includes plans for a rapid increase in the number of subscribers over the 5 years from 2003/04 to 2007/08, but does not provide capacity capable of handling the increased traffic arising from new subscribers on existing transmission systems. Continuing to operate using the current capacity will result in lower call completion rates than at present. There is therefore an immediate need for expansion of the transmission systems corresponding to the core transmission infrastructure.

The results of the financial evaluation show high profitability with an FIRROE of 33.85%. Looking at the balance of payments situation, the financial position is positive over the entire period, and there is no need to inject supplementary funds to cover fund deficits.

The payout period for the capital of **US\$1,244,000** required in the initial investment (Equity portion) is **3.29 years**. A cash flow of **US\$9,698,000** is yielded throughout the operating period, with **FIRROI at 29.87% and FIRROE at 33.85%**. These IRR values suggest that the project will stand financially feasible coupled with the high returns assumed that the project can be operated without financial difficulty. This FIRROE is attained because the equity accounts for 33.16% of total Investment Costs and anticipated sales revenues are sufficient to maintain the stable operation.

Note should be made of the fact that FIRROE values are largely affected by changes in the percentage of equity in the total cost of investment.

The Cash Break Even Point for each fiscal year is lower than 50.0%. The Profit Break Even Point for each fiscal year of the project is lower than 53.0%. Debt Service Coverage Ratio for each fiscal year is more than approx. 1.74 or higher. These levels point to a sound situation in terms of profits and funds.

These above mentioned findings indicate that the project has sufficient investment potential and that the conditions on the loans recently applied for are appropriate for the type of the project, strongly benefiting its investment potential.

The importance of this project within the Master Plan is confirmed based on the results above. As mentioned in Chapter 8 (Sector Business Strategy) of the Master Plan, ETC operation is not possible without cross subsidies if the rollout target is to be achieved. The implementation of cross subsidies therefore requires the implementation of a high-profit project. This project is anticipated to form one of the projects supporting cross subsidies. The evaluation results indicate sufficient profitability when viewed for the project alone, and show sufficient repayment ability even if high-interest long-term loans are used. However, the role demanded of this project is to “create as much surplus as possible to support low-profitability projects”. In order to achieve this, it is therefore desirable to utilize low-interest ODA loans (soft loans) or foreign grant aid.

9.2 Economic Evaluation

Telecommunication is almost universally recognised as an avenue for raising living standards and a key element of economic development. Thus telecommunication projects have an impact on individual and social welfare. As economic activity should be expanded on a national scale, telecommunications is acquiring strategic importance for growth and development. The telecommunication in Ethiopia, however, is prevented to become mature mainly due to the national treasury problems for development on large scale.

It is clear that there will be adequate demand for the telecommunication service in Ethiopia as the empirical evidence indicates that people place value on using telecommunications. In these circumstances, Government of Ethiopia has come to reconsider ways and means for the improvement of the telecommunication systems. More widely scaled services are to be provided by Ethiopia Telecommunication sector to satisfy the nation’s needs. The necessity for planning new telecommunication networks is thus raised.

The economic appraisal is undertaken to ascertain the overall impact of the project on the Ethiopia’s economy. The Financial Analysis prepared was made from the viewpoint of an

investor, whereas the Economic Analysis is made from that of a government decision concerned with broader economic development objectives of the country.

(1) Economic Benefit

Economic Benefit of the project will be divided into direct and indirect benefits, which will be assessed separately.

1) Direct Benefit

The direct benefit of these projects lays its importance in the economic value. Sales revenue in economic value to be generated by the Master Plan are estimated, based on investigation results concerning historical tariff level.

One problem concerns how the difference between mobile phone and fixed phone charges should be considered. In the current charge system, mobile phone charges are three times those for fixed phones. Subscribers accept the higher charges since mobile phones have the added value of allowing calls to be made on the move. However, the spread of fixed phones is not so advanced in developing countries, and in many cases, subscribers requiring a phone purchase a mobile phone. These subscribers simply require a means of communication, and would be happy with either a mobile or fixed phone. In this case, the cost of one call is the same for either. For fixed phones at least, the consumer surplus here arises as the cost difference with mobile phones.

2) Indirect Benefit

The improvement of Telecommunication networks will contribute a great deal to the improvement of the national well being not simply in the form of economic benefit but also in term of social benefit.

Such indirect benefits conceivable are:

For Nations:

- Greater ease in emergency access to medical institutions
- Improved emergency communication, leading to upgrading and diversification of government and private services.
- Economic effects to enhance business activities.
- Increase in employment opportunities, improvement in security, etc.

For Ethiopia Telecommunication Sector:

- Nation-wide expansion of telecommunications service.
- Improvement of telecommunications service.
- Rapid innovation in telecommunications.
- Simplification of network management.

- Creating new services.

With the combination of above effects, national economic growth is promoted.

Implementing the Master Plan involves no factors that will negatively affect Ethiopian society. The transfer of control from benefits to costs is therefore not considered.

(2) Economic Cost

For the economic costs, the following items must be considered.

1) Initial Investment Costs for Implementation of the Projects

The Equipment and Facilities costs, Engineering services costs, Pre-operation costs and Initial working capital will be necessary as the initial cost for the economic value.

2) Operating and Maintenance Costs

As the operating and maintenance costs, the staff costs, general expenses and insurance charges are required. These expenses must be analysed economically considering their economic values.

3) Items of Transfer

The tax imposed on ETC is an actual expenditure for ETC. However, looking at the tax from a social perspective, it is only a transfer of cash from ETC to the government. Since it does not require resources, it will not be considered a cost.

For the imposed on ETC is an actual expenditure for ETC. However, looking at the tax from a social perspective, it is only a transfer of cash from ETC to the government. Since it does not require any resources, it will not be considered a cost.

For the same reason, the insurance to be paid to domestic companies is a transfer item and therefore is excluded from the cost.

(4) Economic Parameters

The financial value projected in the Financial Analysis will be converted to the economic value using the following factors.

1) Foreign Exchange Premium (FEP)

The foreign exchange premium used was that obtained by canvassing the black market dollar rate in Addis Ababa. Under normal circumstances, the standard conversion factor is calculated from the figure for imports and exports, the FEP being the inverse of the resulting figure, however where a black market dollar rate exists, this is used for the FEP because it is deemed to reflect market prices more accurately.

2) Premium of Economic Factor

The financial values of costs items presented in 'Financial Evaluation' will be divided into local and foreign currencies. Although the value of national parameter is not announced the Government of Ethiopia, the value is set up for the project with the assumption that socio-economic environment in the country will reach the average level of the African region. Then the economic values will be calculated using the value of national parameters (premium of economic value) as shown below:

- Construction**	0.73
- Unskilled Labor**	0.50
- Working Capital*	1.00
- Foreign Exchange Premium*	1.03

*: Estimated by study team

** : These shadow price ratios were obtained in Uganda

The factor for construction is applied to all locally source equipment and services and the factor for unskilled labour is applied to all local labour.

(5) Economic Analysis

Economic evaluation is more conceptual approach than the financial evaluation with the assumption that economic evaluation employs perspective of society while financial evaluation is based on business entity's perspective. Therefore, Economic benefit and cost are not directly related to actual monetary flow.

1) Determination of Economic Direct Benefit

As clear from the example of neighbouring Uganda, the recent rapid growth in mobile phone use is transforming subscriber values with regard to telephones. In many countries the number of mobile phones already exceeds that of fixed phones, and what was once one phone per household is now becoming one per person.

In Bangladesh, under similar socio-economic conditions to those Ethiopia will be experiencing in 2020, the number of mobile phones had outstripped that of fixed phones by 2002. Despite mobile calling charges three times those of fixed phones, subscriber numbers are growing. Seen in terms of a social phenomenon, this means that Bangladeshis wanted a means of communication so much they were willing to pay triple the phone charges to obtain one.

In Addis Ababa, public payphones are limited, and so there are cases of subscriber phones being lent out illegally in front of stores. The charge for these is Brr0.75 for 6 minutes. Considering these two situations, *Economic Benefit Streams 1* is calculated with charges that

Ethiopians are willing to pay being the same as for mobile phones, i.e. three times that for fixed phones.

Cost fluctuations due to changes in the exchange rate were next considered. The charge system for fixed phones has remained the same since charges were revised in 1993. However, comparing the exchange rates for 2001/02 with 1996/97 shows a change of approximately 30%. An **Economic Benefit Stream 2** is calculated with this as the consumer surplus latent within the charge system.

The total economic benefits are summarised as shown in Table 9.2-1.

Table 9.2-1 Economic Benefit Streams

Unit: US\$1,000

<i>Year</i>	<i>Financial Benefit Stream</i>	<i>Economic Benefit Streams 1</i>	<i>Economic Benefit Streams 2</i>
2005/06	1,399	2,657	1,524
2006/07	1,589	3,019	1,732
2007/08	1,678	3,189	1,829
2008/09	1,766	3,356	1,925
2009/10	1,863	3,540	2,031
2014/15	2,345	4,455	2,556
2019/20	2,958	5,620	3,224

Source: Study Team

2) Economic Cost Streams

The total investment and O&M costs in each project year described in Table 9.2-2 for Economic Analysis. The costs are converted into the economic cost using value of national parameter (Shadow premium)

(3) Assessment of Result of Economic Analysis

EIRR during the economic life span for the Base cases are calculated using the economic benefit and costs. EIRR, the measures to assess the economic viability, are summarised as shown in Table 9.2-2.

Table 9.2-2 Economic Analysis

Unit: US\$ 1,000

Year	INVESTMENT	O&M COST	Total Cost	Benefit Stream 1	Cash Flow 1	Benefit Stream 2	Cash Flow 2
2003/04	886		886		(886)		(886)
2004/05	2,460		2,460		(2,460)		(2,460)
2005/06		276	276	2,657	2,381	1,524	1,248
2006/07		296	296	3,019	2,723	1,732	1,436
2007/08		312	312	3,189	2,877	1,829	1,517
2008/09		329	329	3,356	3,027	1,925	1,596
2009/10		347	347	3,540	3,193	2,031	1,684
2010/11		356	356	3,638	3,282	2,087	1,731
2011/12		376	376	3,841	3,465	2,203	1,827
2012/13		397	397	4,047	3,650	2,322	1,925
2013/14		417	417	4,253	3,836	2,440	2,023
2014/15		436	436	4,455	4,019	2,556	2,120
2015/16		457	457	4,661	4,204	2,674	2,217
2016/17		452	452	4,898	4,446	2,810	2,358
2017/18		474	474	5,136	4,662	2,946	2,472
2018/19		496	496	5,378	4,882	3,085	2,589
2020/21		518	518	5,620	5,102	3,224	2,706
	3,346	5,938	9,284	61,688	52,404	35,388	26,104

Source: Study Team

Table 9.2-3 Net Present Value (Discount Rate 12%)

ITEMS	Benefit Stream 1	Benefit Stream 2
Cost (C)	4,716,000	4,716,000
Benefit (B)	25,275,000	14,499,000
B – C	20,559,000	9,783,000
B / C	5.36	3.07
EIRROI	68.64%	40.70%

Source: Study Team

The EIRR for the project based on incremental cash flows as a result of the project has been calculated at *68.64percent or 40.70percent*. The project is expected to benefit the economy through higher economic activity, due to improved telecommunications facilities, which are difficult to quantify. In previous telecommunications projects worldwide, economic returns have been relatively high under conservative assumptions for consumer surplus and with no account taken of external benefits.

Moreover, the Project benefits have been distributed widely, with significant shares being realised by rural and other low-income communities; if Government of Ethiopia were weighted for social objectives, EIRR would, therefore, exceed those calculated. This project is expected to realise a similar EIRR.

The evaluation results above show that the project has high profitability and offers significant financial benefit. Furthermore, it can be seen that the conditions used in the evaluation results fit well with the project and firmly support the investment efficiency.

Supporting the Rural Development project by generating profit through the implementation of this project is an effective way of fulfilling the current responsibility for rural development demanded of ETC by the government.

The future role of ETC in the Ethiopian communications sector is described in the Master Plan as shown below.

“At the present development stage in Ethiopia, total transfer of the communications sector to the private sector is not feasible from the standpoint of national security and the spread of a universal service. Regarding the division of roles between the government and private sector, a business model is proposed in which the private sector operates mobile phone services and the ISP business, and the government provides basic communications services (fixed phone service, international communications, maintenance and operation of national backbone, and rural development), and the implementation of this model is recommended. Ultimately, ETC will carry out the functions of an asset company.”

Considering the role of this project based on this concept, it is confirmed that it has an important position in building the business foundation for ETC.

10. RECOMMENDATIONS

In order to take full benefits of the project, supports by Ethiopian Government as well as self- development efforts will be important. The followings are recommended coupled with the implementation of the Project.

10.1 Arrangement of STM-1 Connection with the Existing Network

In the project of the backbone, large-capacity optical links with STM-16 system are introduced. Interfaces with the existing facilities are uniformly designed at STM-1 level since interfaces of STM-16 will be too large for the connections to the existing network. As planned in the Eighth 5-year development plan of ETC, ETC intends to develop the backbone system by STM-1 level. It is recommended that ETC should continue to apply the policy to all projects for backbone development.

10.2 Loop Configuration of Existing Transmission Network

For the integration with the existing network and secure reliable operation and maintenance with increasing traffic demands, loop configuration should be considered by introduction of facilities of cross-connections with the existing links. There are many SDH microwave transmission links without loop configuration. It is expected that these links may be configured as a loop for reliable and speedy operation of the backbone network, where economically justifiable.

10.3 Prompt Replacement of Analogue Link (Sebesibe Washa – Shashemene)

To make full use of and to take full benefits of large capacity STM-16 system, the analogue link from Sebesibe Washa routing to the southern region should promptly be replaced. By the replacement, construction of back-up transmission link to the southern region to Moyale will complete.