

5-3 Basic Design

5-3-1 Site Selection and Transmission Plan

- (1) Sites for PEOs, PCOs and radio repeater stations are selected as shown in the guide map of Basic Design-5. Elevation and coordinates of each site are given in the table of Basic Design-4.

The study on the propagation path profiles of the radio hops involved proves that the sites selected can satisfy the basic design criteria mentioned previously.

As for the location of the radio repeater stations, however, final decision will be made through discussion with NTC, based on the findings of the field survey to be carried out at the time of the detail design, i.e., the next stage of this Project.

- (2) Radio transmission network to connect each station is given in Basic Design-1.

5-3-2 Radio Frequency Plan

- (1) To achieve effective use of frequencies, 2 GHz band will be used for this telecommunication network, in accordance with the CCIR Rec.283-4.
- (2) Actual allocation of the frequency will be made at the stage of the detail design, after investigation and study of interference problem, if any.

5-3-3 Subscriber Cable Plan

One PCO will be installed in each city, with the initial capacity of 6 lines. The number of lines to be installed actually will be determined in the detail design. The capacity of lead-in cables to PCO is designed to be 30 lines to cope with the increase of important subscribers.

5-3-4 Power Plant Plan

Commercial power availability and future plans for the PCO and radio repeater station sites are shown below:

Site	Capacity of Generator	Power Consumption	Remarks	Future Plan
Ilam	100 KW x 1 Diesel Engine Generator	Unknown.	Not Reliable.	33 KV Power transmission line for Anarmani-Ilam is under construction.
Phidim	130 KVA x 2 Hydro Power	130 KW	Night time only. Reliable.	No future plan.
Taplejung	125 KW x 1 Hydro Power	70 KW	Night time only. Reliable.	No future plan.
Biratnagar	10 MVA x 2	797 MWH	Night time only.	Multifuel 26 MW generator is to be constructed in Doubi.
Murebas	No commercial power.	-	-	No future plan.
Terhathum	100 KW x 1 Hydro Power	Unknown.	Night time only.	No future plan.
Ghyampetole	No commercial power.	-	-	No future plan.
Ramche	No commercial power.	-	-	No future plan.
Chainpur	No commercial power.	-	-	11 KV transmission line from Khandbari is to be constructed.
Khandbari	250 KW x 1 Hydro Power	160 KW	Not reliable.	No future plan.
Bhojpur	250 KW x 1 Hydro Power	150 KW	Night time only. Reliable.	No future plan.
Rajbiraj	33 KV being imported from India.	140 MWH	Night time only. Reliable.	33 KV transmission line for Rahan-Rajbiraj is

					under construction.
Rotaha	No commercial power.	-	-		No future plan.
Gaighat	No commercial power.	-	-		33 KV transmission line for Lahan-Jharjhare, 11 KV line for Jharjhare-Gaighat is under construction.
Guranse	No commercial power.	-	-		No future plan.
Diktel	No commercial power.	-	-		No future plan.
Kabre	No commercial power.	-	-		No future plan.
Okhaldhunga	125 KW x 1 Hydro Power	90 KW	Night time only. Reliable.		No future plan.
Rumjhatar	Supplied from Okhaldhunga.	Unknown.	Night time only. Reliable.		No future plan.
Salleri	200 KW x Hydro Power Reliable.	Unknown.	Night time only.		Addition of 200 KW being planned.

The basic plan for power plant is designed, taking into account the abovementioned conditions.

(1) Power Plants in Existing Stations

1) Biratnagar Station

Capacity of the existing power plant in Biratnagar Station is not large enough to cover the requirement of this Project. In addition, power plant itself is overaged and deteriorated, except for storage batteries.

For this Project, therefore, a new power plant must be installed.

In Biratnagar City, commercial power is supplied from the large capacity generator of the Power Supply Corporation, by high tension transmission line. Seemingly this may prove the stable power supply. According to the field investigation results, however, the existing standby diesel engine generator records more than 700 hours operation in half a year. This means that the available commercial power is not stable. Hence, as the backup power source for the commercial power, diesel engine generator should be of dual standby system.

Therefore, full floating system power plant consisting of the following is to be installed for this station. (Refer to Basic Design-3, Figure 4-1.)

a) Automatic voltage regulator

To automatically regulate the commercial power voltage fluctuation into 5% as it now ranges from +10% to -20%, to supply stable power to telecommunication load.

b) Standby diesel engine generator

Standby diesel engine generator composed of 2 units of generator automatically starts operation when commercial power failure or voltage fluctuation exceeding the range from +10% to -20% takes place and stops operation when the power supply is restored to the normal state. 2 units of diesel engine generator are designed to automatically operate alternately.

c) Rectifying equipment

To convert a.c. input current to d.c. current to carry out floating/equalizing charge of storage batteries and to supply stable d.c. current of -48 ± 5 volt to telecommunication equipment.

d) Storage battery

To function as the backup power source in case of a.c. current stop due to commercial power failure or rectifier failure.

2) Rajbiraj Station

The existing power plant was installed in 1989 and can supply d.c. current within the range of 44-52.8 volt and

48±5 volt. Its capacity is enough to cover the requirement of the telecommunication equipment under this Project. (Refer to Basic Design-3, Figure 4-2.)

3) Aitabare Station

The existing power plant is of solar battery system. To cope with the shortage of solar battery capacity, diesel engine generator and rectifying equipment were installed additionally to meet the immediate needs. Even in the dry season, diesel engine generator is put to operation everyday for one hour, to cover the insufficient charging of solar batteries. In other words, available power is not reliable. In addition, diesel engine generator and rectifying equipment are both overaged and deteriorated, and not applicable, as they are, for this Project.

In view of the above, the power system is to be modified as follows (Refer to Basic Design-3, Figure 4-3):

a) Solar battery

Solar batteries are to be increased in capacity.

b) Solar battery control panel

To be replaced with the control panel for combined system having the undermentioned functions:

- Function to receive d.c. current from solar battery and to charge storage batteries.
- Function to regulate output voltage and to feed required power to telecommunication equipment.
- Function to detect storage battery voltage and to send out seizing signal to diesel engine generator.
- Function to protect storage battery from over charging.

c) Diesel engine generator

To be replaced with diesel engine generator capable of automatic start/stop with the seizing signal from solar battery control panel.

d) Rectifying equipment

To be replaced with the rectifying equipment having a function of constant voltage charging for storage battery recovery, with d.c. current from diesel engine

generator, in addition to crobar protection function.

e) Storage battery

Existing storage batteries are to be used as they are.

(2) Power Plant in New Stations

1) Phidim, Taplejung and Bhojpur

In the service areas of Phidim, Taplejung and Bhojpur, capacity of the generator of the commercial power is not large enough to cover the power consumption of this Project. At midnight, however, relatively stable power is available.

For these stations, therefore, combined power system by solar battery and commercial power is to be employed, utilizing commercial power at midnight only. The system designed consists of the following:

a) Rectifying equipment

To have a function of automatic start/stop with seizing signal from solar battery control panel or by timer.

b) Solar battery

To convert solar energy into electrical energy, i.e., d.c. current.

c) Solar battery control panel

Control panel for combined power system having the undermentioned functions is installed:

- To charge storage batteries by receiving d.c. current from solar battery.
- To supply required power to telecommunication equipment, regulating output voltage.
- To send out seizing signal by detecting storage battery voltage and specific gravity of electrolyte.
- To protect storage batteries from over charging.

d) Storage battery

To store electrical power generated by solar battery, and supply necessary power to telecommunication equipment at night time when solar energy is not

available. A pilot cell is equipped with specific gravity detector in order to measure the remaining battery capacity by detecting specific gravity variation.

2) Gaighat

Being no commercial power is available in this area, solar battery power system is adopted. PCO in Gaighat is accessible by vehicle, and the adoption of the combined system by solar battery and diesel engine generator is considered. The system consists of the following (Refer to Basic Design-3, Figure 4-5).

a) Solar battery

To convert solar energy into electrical energy, i.e., d.c. current.

b) Solar battery control panel

Control panel for combined power system having the undermentioned functions is installed:

- To carry out storage battery charging with d.c. current from solar battery.
- To regulate output voltage of the power to be supplied to telecommunication equipment.
- To detect storage battery voltage and specific gravity of electrolyte and send out seizing signal to the diesel engine generator.
- To protect storage batteries from over charging.

c) Diesel engine generator

Diesel engine generator capable of automatic start/stop with the seizing signal from solar battery control panel is installed.

d) Rectifying equipment

Rectifying equipment having the function of constant voltage charging for storage battery recovery, with d.c. current received from diesel engine generator, in addition to crobar protection function, is installed.

e) Storage batteries

To store electrical power generated by solar battery, and supply necessary power to telecommunication equipment at night time when solar energy is not available. A pilot cell is equipped with specific gravity detector in order to measure remaining battery capacity by detecting specific gravity variation.

3) Other PCOs and Radio Repeater Stations

The sites other than the above can be divided into two: areas where commercial power supplied is not reliable as depending on the hydro power plant of small capacity, and not available for this Project, and the areas where no commercial power is available at all.

In addition, these sites are accessible only on foot, and delivery of equipment, fuel, etc. is very difficult.

In view of the above, solar battery system consisting of the following is to be introduced. (Refer to Basic Design-3, Figure 4-7.)

a) Solar battery

To convert solar energy into electrical energy, i.e., d.c. current.

b) Solar battery control panel

Control panel having the undermentioned functions is installed:

- To charge storage batteries with d.c. current from solar battery.
- To regulate output voltage of the power to be supplied to telecommunication equipment.
- To observe the remaining battery capacity by detecting storage battery voltage and specific gravity of electrolyte.
- To protect storage batteries from over charging.

c) Storage battery

To store electrical power generated by solar battery, and supply necessary power to telecommunication equipment at night time when solar energy is not

available. A pilot cell is equipped with specific gravity detector to measure the remaining battery capacity by detecting the specific gravity variation.

Table 5-2 presents the power supply system at each site, together with its location.

Site	Power Supply System	Location
Aitabare	Combined system by solar battery/ diesel engine generator	Hill
Phidim	Combined system by solar battery/ commercial power	Hill
Taplejung	Combined system by solar battery/ commercial power	Hill
Biratnagar	Full floating system (dual standby E/G)	Terai
Terhathum	Solar battery system	Hill
Chainpur	Solar battery system	Hill
Khandbari	Solar battery system	Hill
Bhojupur	Solar battery system	Hill
Rajbiraj	Existing power system	Hill
Gaighat	Combined system by solar battery/ diesel engine generator	Valley
Diktel	Solar battery system	Hill
Okhaldunga	Solar battery system	Hill
Rumjhatar	Solar battery system	Hill
Salleri	Solar battery system	Hill
Radio repeater stations (all)	Solar battery system	Hill

5-3-5 Supervision/Control of Telecommunication Network

Each PEO is required to carry out the remote supervision and control of the transmission and power supply facilities in radio repeater stations and PCOs in its service area, as well as associated facilities.

Items covered by the remote supervisory and control system are:

- (1) Supervision of transmitting/receiving equipment with alarm system.
- (2) Identification of transmitting/receiving equipment under operation (working or standby).
- (3) Detection of faulty circuit.
- (4) Detection of power supply failure.
- (5) Switching-over from the failed working transmitting/receiving equipment to standby equipment.
- (6) Start/Stop control of diesel engine generator.

5-3-6 Facility Layout Plan

- (1) Facilities of PEOs (except the power plant for Biratnagar), and of Aitabare Radio Repeater Station are to be installed in the respective existing station buildings.
- (2) Power plant for Biratnagar and facilities of Aitabare Radio Repeater Station and of PCOs are to be installed in new station buildings to be constructed by NTC.
- (3) Necessary floor space for transmission and power supply facilities is given in Basic Design-2.
- (4) Site layout for each station of this Project is given in Basic Design-2.

5-3-7 Burdens of the Japanese Government and of the Nepalese Government

Burdens to be borne by the Japanese and Nepalese Governments in connection with the materialization of this Project are as described below.

(1) Burden of the Japanese Government under Grant Aid

- Transmission facilities necessary for PEOs, radio repeater stations, and PCOs (antenna system including tower, etc.).
- Power supply facilities necessary for PEOs (except Rajbiraj), radio repeater stations and PCOs.
- Outside plant facilities necessary for PEOs and PCOs.
- Measuring equipment, tools, spare parts, etc., as well as operation manuals, necessary for operation and maintenance of the system completed.

(2) Burden of the Nepalese Government

- To procure sites for radio repeater stations (except Aitabare), and PCOs, and to construct station buildings to install necessary facilities therein.
- To extend the power room of the existing Biratnagar PEO building to accommodate the power plant expansion.
- To carry out commercial power cable lead-in work.
- To execute ground leveling and back filling at sites, cleaning of buildings, etc. prior to the start of the installation/construction works by the Japanese side.
- To provide access roads to, and gates, fences, etc. for, the sites, where necessary.
- To install terminal equipment at subscriber's premises.
- To provide a warehouse and a space at Biratnagar to accommodate equipment and materials necessary for the construction works.
- To remove existing HF radio system facilities.

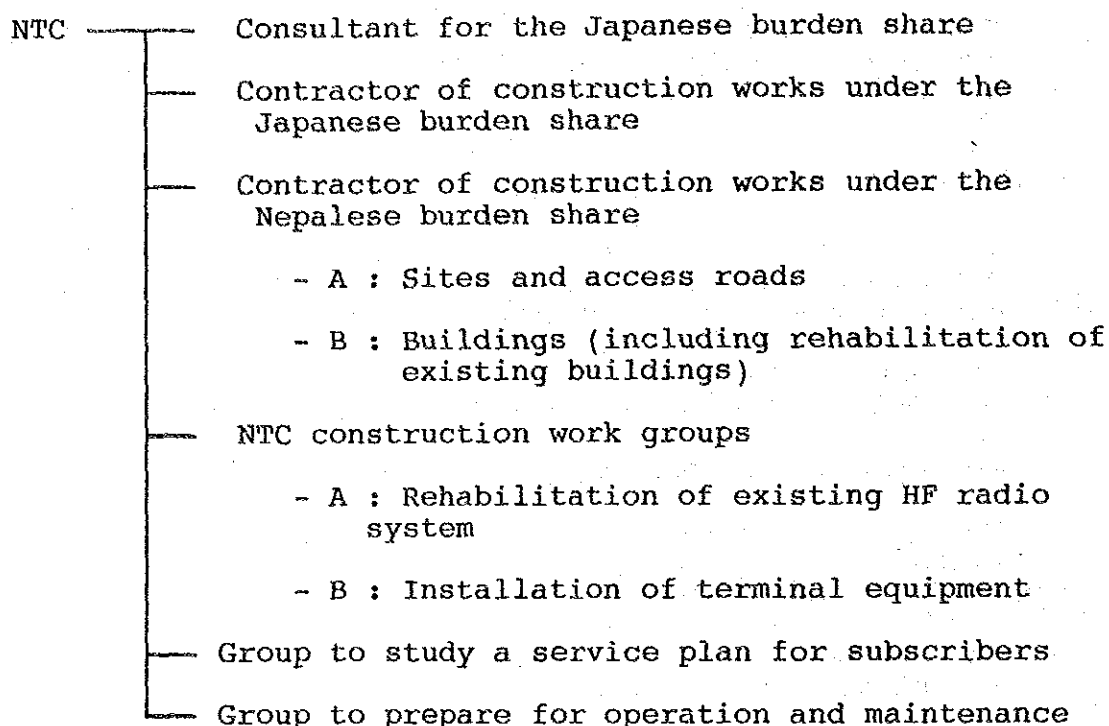
5-3-8 Remarks on His Majesty's Burden

- (1) New buildings should be constructed by NTC at the locations designated on Basic Design-2.
- (2) Due consideration should be paid in designing the premises of new station buildings so that construction works for the objective telecommunication facilities and the maintenance thereof after completion will not be hindered in any way.

5-4 Implementation Plan

5-4-1 Basic Plan

In view of the formalities of the Japan's grant aid and the burden share on each side, establishment of the undermentioned organization is recommended:



The operation and maintenance of the rural telephone network in Nepal realized under the 7th Five Year Plan are now satisfactorily under way. From this fact, it can be said that NTC is sufficiently equipped with the organization, technology, manpower, and management necessary for the implementation of this Project.

5-4-2 Construction Conditions and Items to be Observed

Due to poor road condition in the objective areas, necessary equipment and materials under this Project will have to be transported on foot, except for some sites. In case the work is started in rainy season, due care should be exercised with respect to the delivery of sands and gravel to be collected from the river side for construction work.

New building construction is scheduled to be completed by the Nepal side prior to the commencement of the works by the Japanese side.

Building construction schedule and other related matters should be discussed between NTC and a Consultant of the Japanese side deliberately.

Items to be taken into consideration during the construction/ installation works are:

- (1) Utmost attention should be paid to transport and custody of equipment, so that the electronic part of the equipment can be free from deterioration due to humidity.
- (2) In case any damage is found on the equipment packing during transport or custody, the subject equipment should be inspected visually before mounting or installing. If there is any fear of damage, be sure to confirm the satisfactory performance of the equipment.
- (3) After installation of panels for transmission equipment, the transmission room, as well as the panels themselves, should be cleaned carefully, putting things in order, before proceeding to equipment installation so that the equipment can be protected from dust and rubbish.
- (4) As for pole and new guy installation positions, approval of the relevant organizations and/or land owners must be obtained through negotiation.
- (5) Technology transfer to NTC maintenance staff should be made with respect to as many items as possible during the construction work, so that they can cope with any matter in operation and maintenance of the completed system.

5-4-3 Construction and Supervision Plan

According to the formalities of Japan's grant aid, all the procedures from contract signing (both for consulting service and project implementation) after signing of Exchange of Note, up to the disbursements of the fund must be completed in one single fiscal year ending March 31.

On the other hand, this Project is to be implemented by both the Japanese and Nepalese sides, with their respective burden shares. That is, this is a joint work between Nepal and Japan. In order to ensure smooth completion of this Project, close coordination should be achieved among the relevant groups and organizations. In view of the above, a deliberate plan will have to be made by NTC and the Consultant for the Japanese portion, through thorough discussions before starting work, concerning basic technical items, implementation schedule, etc. Further, all through the period from the equipment/material procurement to final completion, close coordination and liaison should be maintained between the parties,

so as to effectuate timely adjustment of the whole schedule to meet the actual progress.

The flow of the Project implementation procedures is outlined below:

(1) Signing of Exchange of Notes

Exchange of Notes (E/N) on the grant aid for this Project will be signed between His Majesty's Government and the Government of Japan.

(2) Banking Arrangement

His Majesty's Government will appoint a Japanese bank from among Japanese foreign exchange banks approved by the Japanese Government, for disbursements of grant aid under the E/N.

(3) Contract with Consultant

His Majesty's Government will select a Consultant (Japanese consultants only are eligible) for design and supervision of this Project. The contract concluded with the Consultant thus appointed will become effective subject to the approval of the Japanese Government.

(4) Field Survey and Preparation of Tender Documents

The Consultant selected by His Majesty's Government will carry out the field investigation with respect to transmission facilities including ancillary facilities and outside plant in all the objective sites of this Project. Based on the field investigation findings, basic designs and the draft tender documents will be prepared. The tender documents will be finalized subject to the approval of His Majesty's Government.

(5) Tender Evaluation and Conclusion of Implementation Contract

The Consultant will execute the evaluation of tenders offered to select the first ranking tenderer, in compliance with the evaluation method and criteria approved by His Majesty's Government. Contract negotiation will be started with the first ranking tenderer, after obtaining JICA's approval, for clarification and finalization of contractual matters. Contract documents will be prepared after clarification, in accordance with the JICA's guideline on contract document preparation. The Consultant will assist His Majesty's Government in these works. The Contract will come into force subject to approval of the Japanese Government.

(6) Examination of Installation Drawings

On behalf of His Majesty's Government, the Consultant will examine the installation drawings submitted by the Contractor for approval of His Majesty's Government.

(7) Witness to Factory Inspection

Prior to shipping of the equipment and materials to be supplied by the Contractor, the Consultant will witness the factory inspection to confirm their compliance with the contracted specifications in mechanic and electrical characteristics, as well as in quantity. The Contractor will proceed to their shipping after obtaining the Consultant's approval.

(8) Construction/Installation Work Supervision

The Consultant will check the implementation schedule submitted by the Contractor, and give instructions and directions where necessary. During the construction/installation works, the Consultant will visit the work sites periodically to supervise the work progress and performance.

(9) Delivery of Completed System

The Consultant will witness the acceptance tests and examine the as-built drawings (documents). When the test and examination results prove that the completed system satisfies the tender specifications, and the quantities of spare parts, measuring equipment, operation manuals, etc. are in compliance with the those prescribed in the Contract Documents, the Consultant will recommend His Majesty's Government to accept the system.

5-4-4 Procurement Plan

Main equipment and materials for transmission facilities, etc. necessary for realization of this Project will be procured in Japan and/or other industrialized countries since they are difficult to obtain in the Kingdom of Nepal or her neighboring countries. On the other hand, building materials, such as cement, reinforcing bars, etc. are obtainable in the Kingdom of Nepal. In the following are listed the materials to be procured in the Kingdom of Nepal:

a. Fuel

Gasoline, diesel engine oil, lubrication oil.

b. Building materials

Cement, reinforcing bars, sand, gravel, crushed stones, frame materials (lumber, plywood boards, flat plates, etc.)

5-4-5 Implementation Schedule

This Project will be implemented following the undermentioned schedule:

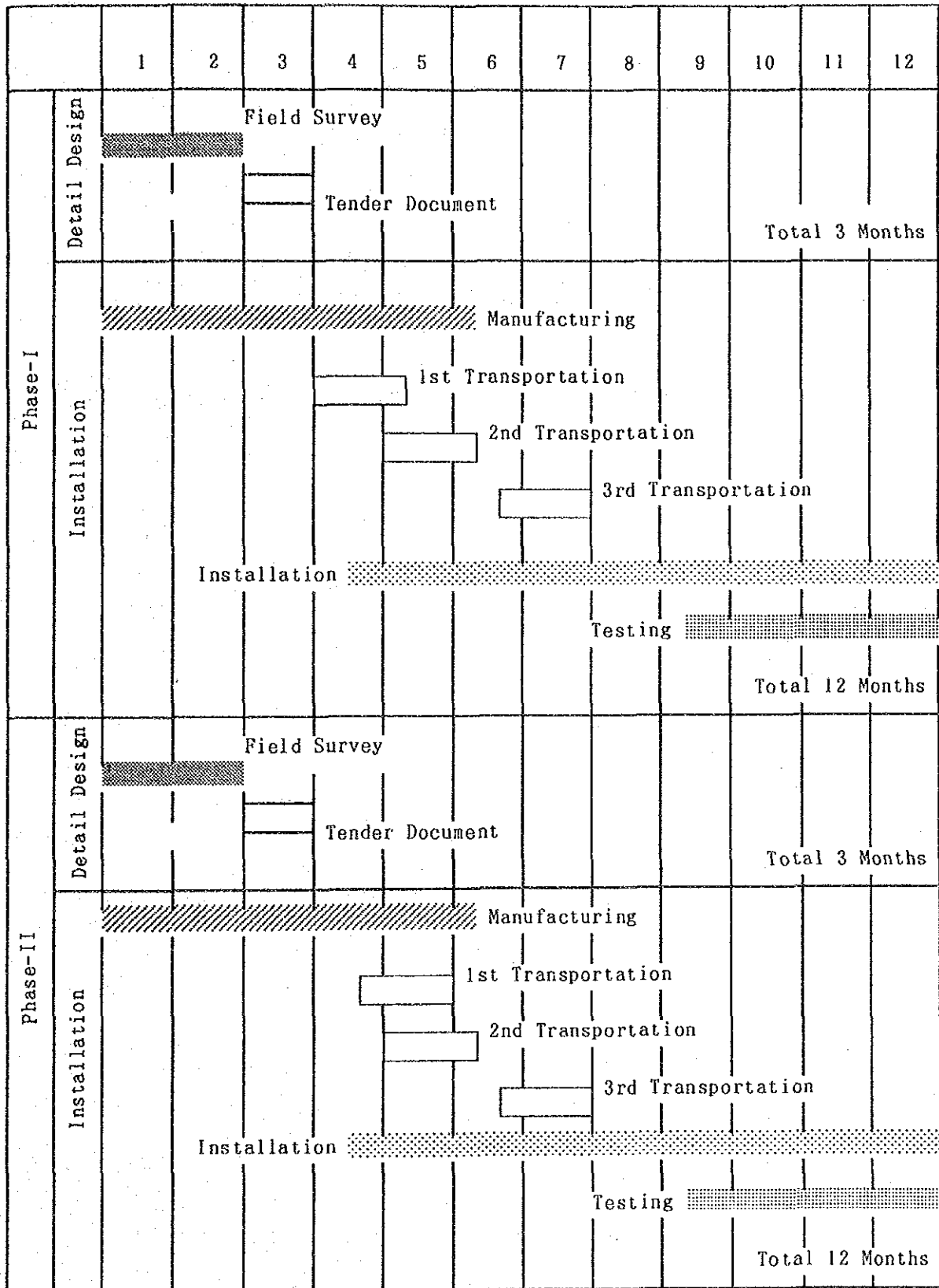
After signing of the Exchange of Note by and between the Government of Japan and His Majesty's Government of the Kingdom of Nepal, His Majesty's Government will select a Japanese Consultant, and the Consultant agreement will be concluded with the selected Japanese Consultant for design and supervision

The Consultant will prepare the detail design and tender documents for the facilities which fall under the Japanese Government's burden share. Tenders will then be invited. The Successful Tenderer selected through tender evaluation will make contract with His Majesty's Government for construction of the tendered system, and proceed to the construction/installation works.

The construction period will be divided into two phases, in view of the location of, and natural environment in, the objective areas, as well as the contents and size of His Majesty's burden share. The Phase-I is to cover the telecommunication network in 02 zone, and Phase-II, 03 zone. The provisional implementation work time schedule is given in Table 5-3. 3 months are estimated for installation designs and 12 months for procurement and construction work for each zone.

As for the facilities under His Majesty's burden share, their detail design, tender documents, procurement, and supervision works are to be carried out by the staff of NTC including those in the special organization for implementation of this Project.

Table 5-3 Provisinal Implementation Work Time Schedule



CHAPTER 6

PROJECT EVALUATION AND CONCLUSION

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6-1 Effects of Project Implementation

The expected effects of the implementation of this Project are twofold: the direct effect of the introduction of toll telephone service in the non-telephone service area, and the indirect and multiplied effect on social, economic, regional, administrative and medical sectors.

These expected effects and benefits of the Project are outlined below:

(1) Direct Effect

The telecommunication service in the objective area, i.e., the Eastern Development Region, is still in the preliminary stage: the telephone service is available only in Ilam, Dhankuta and major cities in the Terai plain, and the telegram service by the outdated HF radio system is available in some cities in the mountainous area. As mentioned in Section 3-2 (4), this service is based on the time-sharing system and its use is extremely limited. Moreover, communication to Kathmandu and other cities will have to be made via the operator of its Parent Exchange Office.

Under this Project, all these outdated and deteriorated facilities will be replaced with up-to-date digital communication facilities. Worthy of special mention is that the real time communication will be realized for all the services. The inhabitants in this area will come to have access to both domestic and international telephone services for the first time. The initial installation under this Project will cover the provision of public telephone service through installation of PCOs and the accommodation of important subscribers, such as Governmental and social utility institutions, with the capacity of 6 connections per city. The system can be expanded easily up to 30 connections per city in the future by NTC. That is, the telephone service can be expanded to the inhabitants of the surrounding areas.

As mentioned previously, this Project aims at the installation of toll telephone facilities for high priority subscribers. The transmission system provided will constitute a part of the backbone system connecting PEOs and major cities. After the materialization of MARTS which NTC is now planning to introduce, the telephone service can be expanded, based on this backbone system, further to remote towns and villages. To sum up, remarkable effect can be expected from this investment.

(2) Indirect Effect

The improvement of telecommunication network is indispensable for social and economic development of the Kingdom of Nepal. Particularly in the areas where road networks are not yet to be established, development of the regional telephone network to connect zone and district capitals and economic and commercial centers is a pressing need.

The telecommunication network completed by this Project will realize the real time communication, with which distribution system will be modernized remarkably, since it permits speedy communication with the market. Remote farmers and manufacturers who can negotiate the prices and quantities of their products with the market before shipping can expect great benefits from this system.

Impact on regional development is also great. Efficiency in administrative service for regional development can be enhanced, with prompt transmission of instructions and inquiries to remote organizations scattered over the country.

At the time of the severe disaster due to an earthquake in the Eastern Nepal district in 1988, it took about one month before the sufferers were identified, due to the poor telecommunication service. The improvement of telecommunication system will lead to improvement of confidence of the public in the Government's administrative management.

The magnified effects of the implementation of this Project are summarized below:

- To achieve efficiency in regional administrative service through speedy transmission of instructions and inquiries, etc., serving for getting much more confidence of people in the Government.
- To upgrade social welfare through improvement in emergency medical service, etc.
- To promote regional economy, mainly based on agriculture and forestry, through modernization of distribution system, and increase in employment opportunities.
- To develop tourism in the Eastern Region which has hitherto been kept undeveloped due to lack of modernized communication service, through introduction of up-to-date communication service including international communication service.

(3) Benefits

The number of telephone connections under this Project is 66, including PCOs in 11 cities. As mentioned in Section 6-1, the transmission system introduced by this Project will provide a base for expansion of service to the surrounding areas.

That is, the direct benefit of this Project will be extended to 77,000 people in 11 objective cities. However, when the system is expanded to the surrounding 9 district, 1,621,000 inhabitants will benefit from this Project. That is, nearly 10% of the total population of the Kingdom of Nepal will be able to enjoy the benefit of this Project.

The governmental offices and public utility institutions who will benefit from this Project will amount to 44, about 10% of the 395 offices and institutions in the objective areas.

6-2 Conclusion

To provide telecommunication service with newly constructed facilities will give a variety of impacts on social and economic activities in and around the area concerned. Therefore, the implementation of this Project will be fully justifiable, in view of the current telecommunications status in the Kingdom of Nepal, particularly the inadequate service in the Eastern Region.

To conclude, the materialization of this Project will not only contribute to the rehabilitation and improvement of the regional telephone network in the Kingdom of Nepal, but also to the national development which His Majesty's Government is now vigorously promoting, and the desired cooperation effect can fully be achieved.

6-3 Recommendation

In order to ensure the satisfactory implementation of this Project, studies must be made with respect to some critical matters.

In the following are presented the matters to be noted and the recommendations on them:

- (1) This Project consists of two portions: one to be materialized by the Japan's grant aid and the other by His Majesty's Government. Technical compatibility and coordination in time schedule are a key to successful completion of this Project. Close communication and collaboration should be made as follows by and between the staff concerned of both parties:
 - 1) After signing of E/N by both the Governments, His Majesty's Government will procure fund for his burden, as soon as possible.
 - 2) Prior to the commencement of the construction/installation works, meetings should be held between the parties to exchange views and information concerning the basic items and the schedule of works to be undertaken by the Nepal side. On the basis of the discussion results, a minute plan to cover the whole project should be elaborated.
 - 3) Prior to the commencement of the works by the Japanese side, all the works to be done by the Nepalese side should have been completed.
- (2) Coordination with Other Projects

NTC is planning to implement MARTS almost in parallel to this Project. Each project should complement the other in full coordination, to achieve the desired effect of investment.

Therefore, data on MARTS, such as introduction schedule, implementation schedule, the number of necessary circuits, technical interface requirements, floor space plan, etc. for the areas of 02 & 03 should be forwarded to the Consultant of this Project.

ANNEXES

ANNEX - 1

STAFF LINEUP OF BASIC DESIGN STUDY TEAM

Annex 1 Staff Lineup of Basic Design Study Team

Duty-in-charge	Name	Affiliated to
Team Leader	Kazuyoshi YAMAMOTO	Section chief, International Cooperation, division, Communication Policy Bureau, Ministry of Posts and Telecommunications
Grant Aid	Takumi MATSUDA	Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs
Network Planning Chief of Consultant	Yasuo NAGASAKI	Telecommunication Division The Nippon Telecommunications Consulting Co., Ltd.
Radio and transmission Systems	Kanji TAKAYAMA	do
Radio and Transmission Systems	Nobuyuki SUETSUGU	do
Outside Plant	Yoshiaki KOBAYASHI	do
Civil	Teruhiro TAHARA	do
Power System	Isamu TAKAHASHI	do

ANNEX-2

STAFF LINEUP OF DRAFT FINAL STUDY TEAM

Annex 2 Staff Lineup of Draft Final Study Team

Duty-in-charge	Name	Affiliated to
Team Leader	Shoichi ITO	Deputy Director Trunk Communications Division, Radio Department, Telecommunications Bureau, Ministry of Posts and Telecommunications
Grant Aid	Motonobu NISHIMURA	Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs
Network Planning Chief of Consultant	Yasuo NAGASAKI	Telecommunication Division The Nippon Telecommunications Consulting Co., Ltd.
Radio and Transmission Systems	Kanji TAKAYAMA	do

ANNEX - 3

ITINERARY OF BASIC DESIGN STUDY TEAM

Annex 3 Itinerary of Basic Design Study Team

27	Nov.	'90	(Tue)	Movement (Tokyo to Bangkok)
28	"	"	(Wed)	Arrival in Kathmandu Courtesy visit to JICA Office
29	"	"	(Thu)	Courtesy visit to Japanese Embassy and HMG/NTC Submission of Inception Reports
30			(Fri)	Explanation/discussion on Inception Reports
1	Dec.		(Sat)	Preparation for site survey
2	"		(Sun)	Preparation for site survey and Data arrangement
3	"		(Mon)	Movement (Kathmandu to Birantnagar)
4	"		(Tue)	Site survey
5	"		(Wed)	Movement (Biratnagar to Kathmandu) (Study Team A) Site survey (Study Team B,C)
6	"		(Thu)	Explanation/discussion on draft minutes and signing (Study Team A) Site survey (Study Team B,C)
7	"		(Fri)	Meeting with Japanese Embassy and JICA (Study Team A) Site survey (Study Team B,C)
8	"		(Sat)	Movement (Kathmandu to Bangkok) (Mr. K. YAMAMOTO and Mr. T. MATSUDA) Site survey (Study Team A,B,C)
9	"		(Sun)	Movement (Bangkok to Tokyo) (Mr. K. YAMAMOTO and Mr. T. MATSUDA) Data collection (Study Team A) Site survey (Study Team B,C)
10	"		(Mon)	Data collection (Study Team A) Site survey (Study Team B,C)
11	"		(Tue)	do
12	"		(Wed)	do
13	"		(Thu)	do
14	"		(Fri)	do

15	Dec.	'90	(Sat)	Movement (Kathmandu to Biratnagar) (Study Team A) Site survey (Study Team B,C)
16	"	"	(Sun)	Site survey (Study Team A,B,C)
17	"	"	(Mon)	do
18	"	"	(Tue)	do
19	"	"	(Wed)	do
20	"	"	(Thu)	do
21	"	"	(Fri)	do
22	"	"	(Sat)	Movement (Kathmandu to Bangkok) (Study Team A,B,C)
23	"	"	(Sun)	do
24	"	"	(Mon)	Preparation for Meeting
25	"	"	(Tue)	Meeting with HMG/NTC
26	"	"	(Wed)	Explanation/discussion on technical note and signing Meeting with Japanese Embassy and JICA Preparation for return
27	"	"	(Thu)	Leaving from Kathmandu
28	"	"	(Fri)	Arrival in Tokyo

ANNEX-4

ITINERARY OF DRAFT FINAL STUDY TEAM

Annex 4 Itinerary of Draft Final Study Team

17	Apr.	'91	(Wed)	Movement (Tokyo to Bangkok)
18	"	"	(Thu)	Arrival in Kathmandu Courtesy visit to JICA Office
19	"	"	(Fri)	Courtesy visit to Japanese Embassy and NTC Submission of Draft Final Reports
20	"	"	(Sat)	Preparation for Meeting
21	"	"	(Sun)	Courtesy visit to HMG Meeting with NTC
22	"	"	(Mon)	Meeting with HMG/NTC
23	"	"	(Tue)	do
24	"	"	(Wed)	Explanation/discussion on draft minutes and signing Reporting with Japanese Embassy and JICA
25	"	"	(Thu)	Leaving from Kathmandu
26	"	"	(Fri)	Arrival in Tokyo

ANNEX - 5

MINUTES OF DISCUSSIONS, 1990

MINUTES OF DISCUSSIONS

ON

INCEPTION REPORT

FOR

BASIC DESIGN STUDY

ON

THE RURAL TELECOMMUNICATIONS NETWORK EXPANSION PROJECT

IN

THE KINGDOM OF NEPAL

In response to the request by His Majesty's Government, the Government of Japan decided to conduct a Basic Design Study (hereinafter referred to as "the Study") on "the Rural Telecommunications Network Expansion Project" (hereinafter referred to as "the Project") and entrusted the Study to the Japan International Cooperation Agency (JICA). JICA sent the Study Team headed by Mr. Kazuyoshi YAMAMOTO, Leader for Section chief of International Cooperation Division, Communications Policy Bureau, Ministry of Posts & Telecommunications to the Kingdom of Nepal from 27th November to 9th December, 1990.

The Study Team had a series of discussions on the Project with the officials concerned of His Majesty's Government headed by Mr. B.R. Pandey, General Manager of Nepal Telecommunications Corporation and conducted the field survey in 02 and 03 areas shown in ANNEX-III.

As a result of the discussion, both parties agreed to recommend to their respective Government authorities that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

Kathmandu 6th December, 1990

山本 一吉

Kazuyoshi YAMAMOTO
Leader,
Basic Design Study Team
JICA

B.R. Pandey

Bhoop Raj PANDEY
General Manager of Nepal
Telecommunications Corporation

- ATTACHMENT -

1. Objective of the Project

The objective of the Project is to improve the present conditions of rural telecommunications services in the rural areas and to support consequently the social and economic development, as well as promotion of social welfare for the people and stabilization of their lives.

2. Organizations

(1) Responsible Organization: Ministry Of Communications(MOC)

(2) Executing Organization : Nepal Telecommunications Corporation
(NTC)

3. Objective Area

The Study will cover 11 cities whereto construct Public Call Offices (hereinafter called "PCOs"), including the survey at the candidate sites for radio repeater stations to connect these cities with the existing exchanges.

The Study will cover the following cities:

<u>Area</u>	<u>Zone</u>	<u>Site of Public Call Offices (PCOs)</u>
02	Mechi	1. Phidim
		2. Taplejung
	Koshi	3. Terhathum
		4. Bhojpur
		5. Chainpur
		6. Khandbari
03	Sagarmatha	1. Gaighat
		2. Diktel
		3. Okhaldhunga
		4. Rumjhatar
		5. Salleri
<u>Total</u>		11 cities

4. The Project consists of the following components

(1) Installation of the digital line-of-sight radio system (DRS) to serve all the subscribers consisting of:

- 1) DRS facilities including digital multiplexer, power supply and antenna facilities at existing exchanges, repeater stations and PCOs.
- 2) Antenna supporting structures (towers and masts) required at the repeater stations and PCOs.
- 3) Voice frequency cables between PCOs and distribution points.
- 4) Drop wires, internal wires in subscribers' premises, and telephone sets.

(2) Construction of supporting facilities necessary for the DRS installation consisting of:

- 1) Securing of land for the sites.
- 2) Provision of access to the sites.
- 3) Buildings.

(3) Provision of necessary facilities including equipment for operation and maintenance required for the DRS network consisting of:

- 1) Tools and test equipment required for normal maintenance work.
- 2) Spares.

5. His Majesty's Government will take necessary measures listed in ANNEX I on condition that the Grant Aid be extended to the Project.

6. Nepal Telecommunication Corporation is responsible for the administration and execution of the Project.

Bl 47

7. The Study Team will convey to the Government of Japan desire of His Majesty's Government that the former takes necessary measures to cooperate by providing the items listed in ANNEX II within the scope of the Japanese Economic Cooperation Programme in Grant form.
8. His Majesty's Government has understood the Japan's Grant Aid System explained by the Study Team, which includes the principle that a Japanese consultant firm and a Japanese contractor be used for the implementation.
9. His Majesty's Government requested that the major feature of the system be based on telephone demand, future expansion requirement, and experience of NTC gained in operation and maintenance of existing rural system in NEPAL.

BR 4

ANNEX I UNDERTAKING BY HIS MAJESTY'S GOVERNMENT

1. To secure all the sites.
2. To clear, level and reclaim the sites prior to commencement of the construction.
3. To undertake incidental outdoor works such as fencing and gate:
4. To provide the access required to the sites prior to commencement of the construction.
5. To provide the following facilities for Rajbiraj, Biratnagar, Ilam and Bhadrapur.
 - (1) Buildings
 - (2) Towers
5. To bear commissions to the Japanese foreign exchange bank for banking services based upon the Banking Arrangement.
7. To exempt customs duties and to take necessary measures for customs clearance of the materials and equipment brought for the Project at the port of disembarkation.
8. To accord Japanese Nationals whose services are required for the implementation of the Project such facilities as may be necessary for their entry into His Majesty's Government and stay therein for the performance of their work.
9. To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant.

BZ 4

10. To bear all the expenses other than those to be borne by the Grant, necessary for implementation of the Project, as well as for the transportation.

Be: 4

ANNEX II UNDERTAKING BY THE GOVERNMENT OF JAPAN

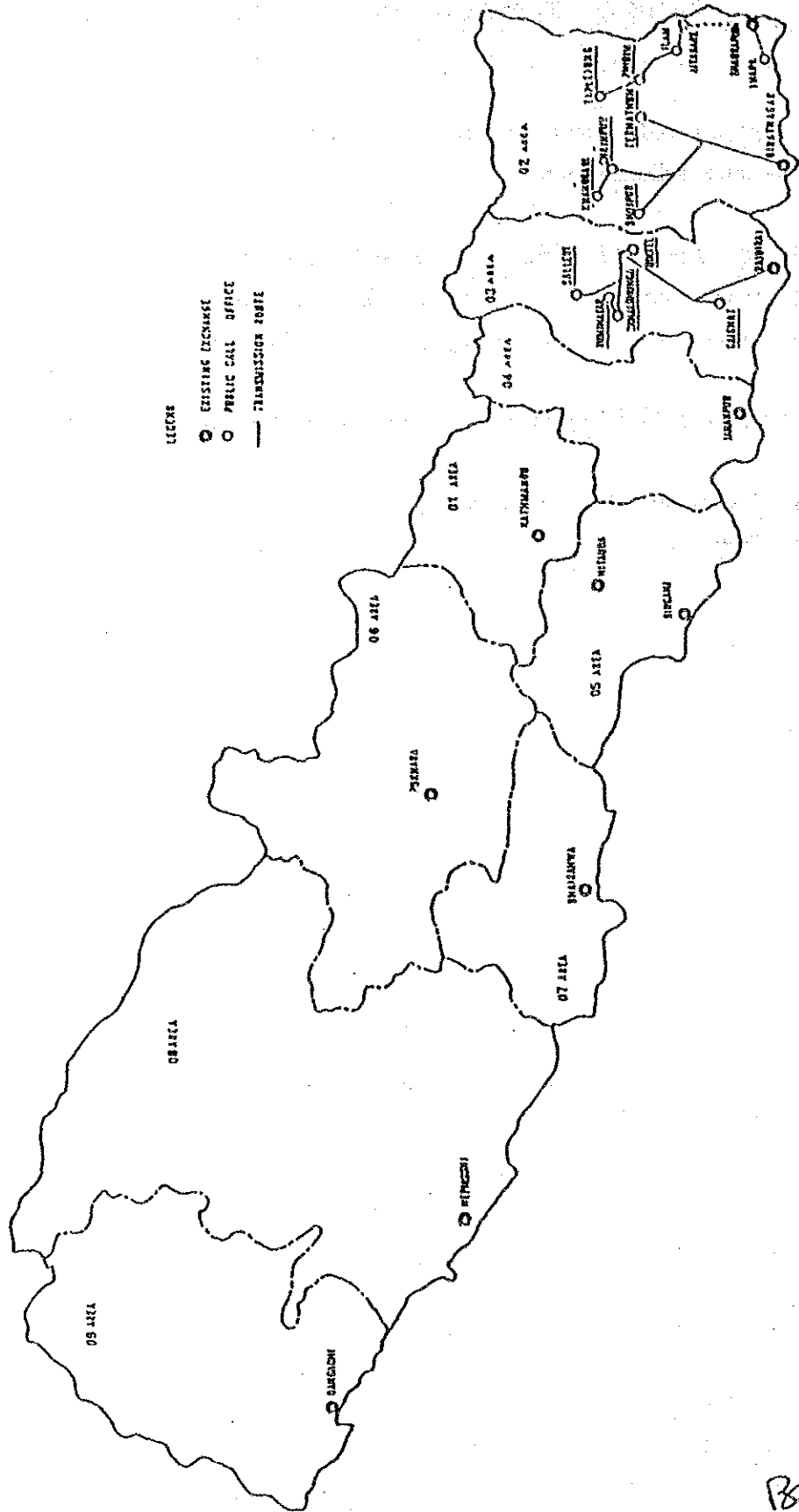
1. To install following components for establishment of the DRS network to serve the subscribers:
 - (1) DRS facilities for all the DRS stations.
 - (2) Power supply equipment for all the DRS stations.
 - (3) Subscribers cable facilities for all the PCOs.

2. To supply following items for normal operation and maintenance work:
 - (1) Tools and test equipment.
 - (2) Spares.

Be d

THE RURAL TELECOMMUNICATIONS NETWORK EXPANSION PROJECT

(02 AND 03 AREAS)



Box 4

ANNEX - 6

TECHNICAL NOTE, 1990

*Technical Note
for
Japan Grant Aid Project*

(The Rural Telecommunications Network Expansion Project)

The following technical matters have been confirmed by the both parties, Nepal Telecommunications Corporation and JICA Basic Design Study Team.

1. Transmission Facilities

- a) The point to point digital radio system is to be installed. The radio frequency is 2GHz band.
- b) The transmission system is to have the cold stand-by system.
- c) NTC requested that the N.W. Europe parameter (CCIR Rep. 338-5) shall be adopted for designing the fading margin of the system.
- d) NTC requested to consider to include 2 x 2 Mbit terminations and 6 to 30 subscribers terminations in each 11 FCO sites.

2. Cable and Outside Plant Facilities

2-1 The basic design of outside plant is to satisfy the undermentioned requirements.

- a) Subscriber line loss distribution : 8 dB, standard.
- b) D.C. loop resistance : Subscriber line 1500 ohms.
: Inter-office tie cable 1200 ohms.
- c) To install cable is mainly by the self-supporting type aerial cable system.
- d) The type of poles are steel type and/or panza mast.

The existing public power supply poles will be used, in case of availability.

2-2 The Inter-office tie cable between the transmission room and the switching room will be provided by this project at the parent exchange stations.

3. Power Supply Facilities

3-1 Installation Location

The Power Supply Facilities of all sites except Rajbiraj will be provided by this project.

The stations where AC Mains is available, AC Mains lead-in facilities will be provided by NTC.

3-2 System Selection

The power supply system at all sites are shown in ANNEX-1.

3-3 Holding Time of Battery

- a) Stations where Full-Floating System is applied : 8 Hours
- b) Stations where Solar Power System is applied : 15 Days
- c) Stations where Combined Power System is applied : 5 Days

3-4 Data of Solar Radiation

The data of Solar Radiation at the three (3) areas (Tarai Area, Valley Area and Hill Area) shown in ANNEX-2 is to be applied.

4. Building Facilities

The new buildings of 11 Public Call Offices and the all radio repeater stations will be provided by NTC by JULY, 1992.

5. Site Survey Results

As a result of site survey carried out from 3rd December '90 to 23rd December '90 in 02 and 03 Area, the following items need to be considered:

5-1 Transmission Matter

- a) The survey team has found some problems at Chhintapu site so it is necessary to re-check map study in order to find another appropriate site.
- b) NTC also requested to consider other radio repeater sites at some places in order to eliminate access difficulty and ensure coverage of the wide area.

5-2 Power Matter

- a) DC Power will be supplied from the existing power supply system for exchange system at Rajbiraj station.
- b) The following items need to modify at Ilam station
 - i The existing solar system is to supply solely to the exchange system.
 - ii New power system is to be combined system (Solar Cell & Engine). And this new system will supply power to new transmission system and existing transmission system.

- c) Newly installed power system is to be separated circuit from the existing power system at Biratnagar station because it is not enough capacity for supply to new radio system and an old type equipment.
However, the building of new power system will be provided by NTC because of not enough space for installation of new equipment in the existing power room. *ym*

Kathmandu 26th December, 1990

M. Nagasaki
M. NAGASAKI
Basic Design Study Team
JICA

G. S. Bohra
G. S. BOHRA
Deputy General Manager
NTC

ANNEX-1

POWER SUPPLY SYSTEM

<u>Name of Site</u>	<u>Grade of Site</u>	<u>Availability of AC Mains</u>	<u>Power Supply System</u>
Ilam	R/S PCO	NO	Solar/EG Combined
Phidim	R/S PCO	YES(COMBINED)	Solar/AC Combined
Taplejung	PCO	NO	Solar System
Biratnagar	Parent EX.	YES	F-F System (Dual EG)
Terhathum	PCO	NO	Solar System
Chainpur	R/S PCO	NO	Solar System
Khandhari	PCO	NO	Solar System
Bhojpur	PCO	NO	Solar System
Rajbiraj	Parent EX.	YES	Existing
Gaighat	PCO	NO	Solar System
Diktel	PCO	NO	Solar System
Okhaldhunga	R/S PCO	NO	Solar System
Rumjhatar	PCO	NO	Solar System
Salleri	PCO	NO	Solar System
All Repeater Station	R/S	NO	Solar System

ANNEX-2

DISTRIBUTION OF SOLAR RADIATION

(Langley/day)

	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEP	OCT	NOV	DEC	AVG.
HILLS	270	280	320	380	430	400	370	380	340	340	310	280	342
VALLEY	240	300	380	430	450	430	410	400	400	380	310	280	368
TERAI	330	370	420	440	520	500	470	450	400	420	340	300	413

gn *J.S.B.*

ANNEX-7

MINUTES OF DISCUSSIONS, 1991


MINUTES OF DISCUSSIONS
ON
THE RURAL TELECOMMUNICATIONS NETWORK EXPANSION PROJECT
IN
THE KINGDOM OF NEPAL

In response to the request by His Majesty's Government, the Government of Japan has decided to conduct a Basic Design Design Study (hereinafter referred to as "the Study") on "The Rural Telecommunications Network Expansion Project" (hereinafter referred to as "the Project"), and entrusted the Study to the Japan International Cooperation Agency (JICA). JICA sent the Study Team headed by Mr. Kazuyoshi YAMAMOTO, Leader for Section chief of International Cooperation Division, Communications Policy Bureau, Ministry of Posts & Telecommunications, to the Kingdom of Nepal from 27th November to 9th December, 1990.

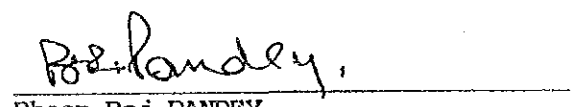
As a result of the study, JICA prepared a draft final report and dispatched a draft final report explanation team headed by Mr. Shoich ITO, Ministry of Posts and Telecommunications to explain and discuss it with the officials concerned of His Majesty's Governments headed by Mr. B.R. Pandey, General Manager of Nepal Telecommunications Corporation from 17th April to 26th April, 1991.

Both parties had a series of discussions on the report and have agreed to recommend to their respective Government that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

Kathmandu, 24th April, 1991



Shoich ITO
Leader,
Basic Design Study Team
JICA



Bhoop Raj PANDEY
General Manager,
Nepal Telecommunications Corporation

Attachment

1. The Nepalese side has agreed to the basic design proposed in the Draft Final Report.
2. The Nepalese side has understood Japan's grant aid system and confirmed that the necessary measures will be taken by the Nepalese side to meet with the Minutes of Discussions on The Rural Telecommunications Network Expansion Project in the Kingdom of Nepal signed on 19th December, 1990 as shown in Annex.
3. It has been confirmed that land acquisition and new buildings of 11 Public Call Offices and all the radio repeater stations will be provided by the Nepalese side by July, 1992 for 02 Area, and by July 1993 for 03 Area.
4. The Nepalese side also ensures the provision of necessary budget for the adequate personnel services, operation and maintenance expenses of the objective facilities in the Project.
5. The Final Report (10 copies in English) on the Project will be submitted to the Nepalese side by the end of June, 1991.

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R.R.

Annex

(Minutes of Discussions on The Rural Telecommunications
Network Expansion Project)

Dated

19th December, 1990

MINUTES OF DISCUSSIONS
ON
INCEPTION REPORT
FOR
BASIC DESIGN STUDY
ON
THE RURAL TELECOMMUNICATIONS NETWORK EXPANSION PROJECT
IN
THE KINGDOM OF NEPAL

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Kathmandu 6th December, 1990

山本 一吉
Kazuyoshi YAMAMOTO
Leader,
Basic Design Study Team
JICA

B.R. Pandey
Bhoop Raj PANDEY
General Manager of Nepal
Telecommunications Corporation

- ATTACHMENT -

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RR

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BR 4

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BC 4

10. To bear all the expenses other than those to be borne by the Grant, necessary for implementation of the Project, as well as for the transportation.

ANNEX II UNDERTAKING BY THE GOVERNMENT OF JAPAN

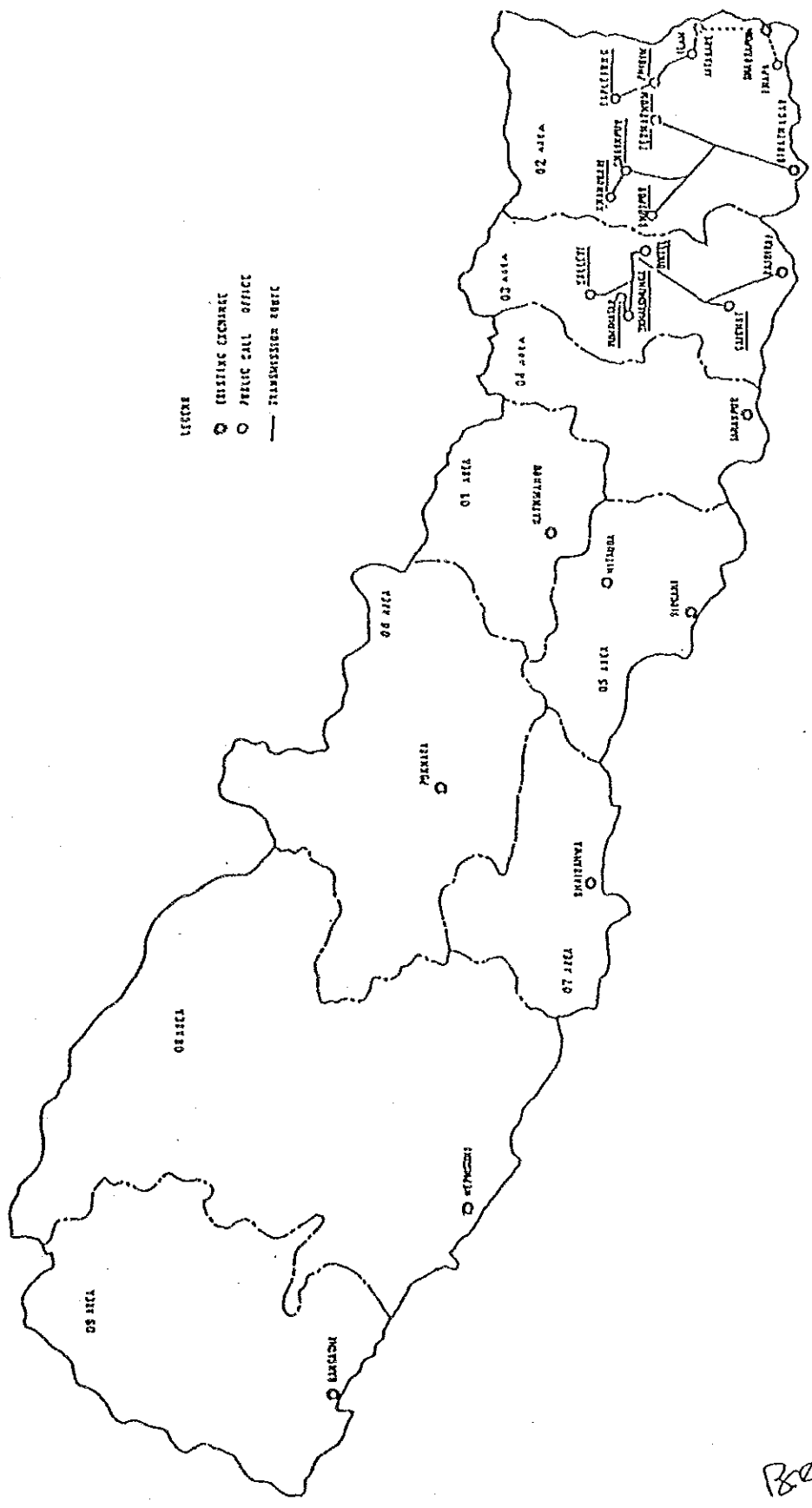
1. To install following components for establishment of the DRS network to serve the subscribers:
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2. To supply following items for normal operation and maintenance work:
 - (1) Tools and test equipment.
 - (2) Spares.

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THE RURAL TELECOMMUNICATIONS NETWORK EXPANSION PROJECT

(02 AND 03 AREAS)



B22 47

ANNEX - 8

NAMES OF OFFICIALS INVOLVED

Annex 8 Names of Officials Involved

1. NPC

Mr. Ram Prasad SHARMA Advisor

2. MINISTRY

Ministry of Finance

Dr. T. N. PANT Joint Secretary

Mr. Bhupal Man SHAKYA Under Secretary

Mr. Jeevan BASKOTA Section Officer

National Planning Commission Secretariat

Mr. S. L. SHRESTHA Under Secretary

Ministry of Works & Transport

Mr. Bharati SHARMA Project Director

Department of Hydrology & Meteorology

Mr. P. B. SHRESTHA Chief Meteorologist

Nepal Electricity Authority

Mr. T. B. PRADHANANG Director in Chief of
Distribution

3. Ministry of Communications

Mr. Kali Prasad RIJAL Acting Secretary

Mr. Uttam Lal SHRESTHA Joint Secretary

Mr. Mukanda P. ACHARYA Under Secretary

Mr. Prahlad POKHREL Section Officer

4. Nepal Telecommunications Corporation

Mr. Bhoop Raj PANDEY General Manager

Mr. Ramesh NEPALI Deputy General Manager

Mr. G. S. BOHRA Deputy General Manager
(Member)

Mr. N. S. PATHIK Manager of Project
Implementation Department

Mr. C. P. BHATTARAI	International System Manager
Mr. K. K. KAFLE	Manager, Kathmandu Regional Office
Mr. S. P. PRADHANANG	Manager of Rural Telecommunications Project (Member)
Mr. B. R. KANEL	Manager of Long Distance (Member)
Mr. R. K. TULADHAR	Director of T.T.C.
Mr. P. R. SHAKYA	Chief of Internal Audit
Mr. H. KARMACHARYA	Manager, Billing Project
Mr. K. B. SHAH	Manager of Material Management Department
Mr. B. R. PRADHANANG	Financial Controller
Mr. H. K. BHATTARAI	Sr. Exp. Engineer, Rural Telecom. Project (Member)
Mr. R. HALDER	Manager of Planning (Member)
Mr. M. PRADHAN	Planning Engineer (Counterpart)
Mr. S. BAJRACHARYA	Engineer, Rural Telecom. Project (Counterpart)
Mr. K. N. REGMI	Exe. Engineer (Civil)
Mr. B. P. SRIVSTAV	Engineer (Civil)
Mr. B. P. SHRESTHA	Engineer (Civil)
Mr. B. R. SHRESTHA	Manager of Eastern Regional Office
Mr. A. SHAH	Exe. Engineer
Mr. S. P. S. ADHIKARI	Transmission Eng. (Counterpart)
Mr. Y. N. ACHARYA	A s s . E n g i n e e r (Counterpart)
5. World Bank	
Mr. Alberto Cruzat	Financial Analyst

ANNEX - 9

LIST OF COLLECTED DATA

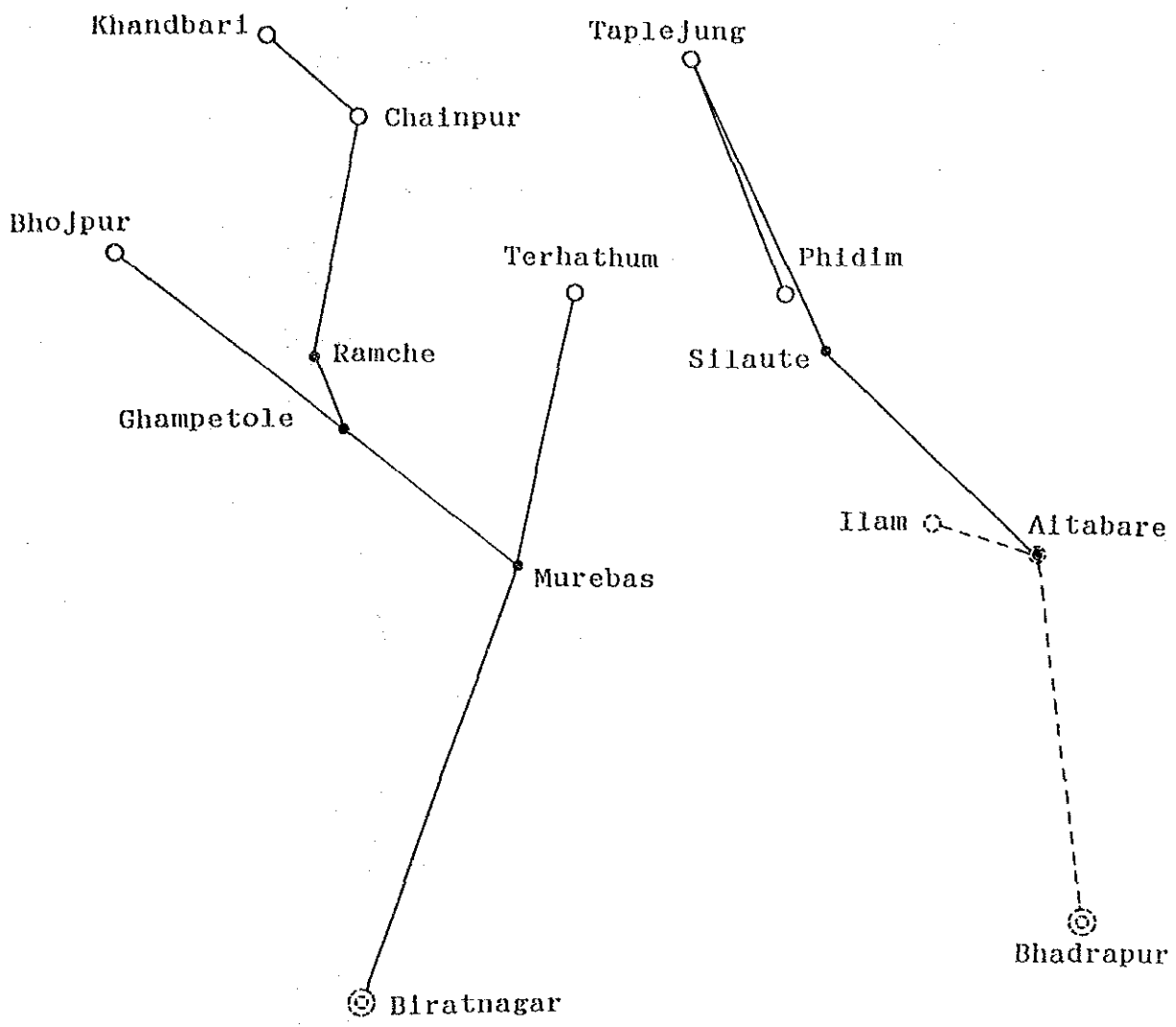
Annex 9 List of collected Data.

1. STATISTICAL YEAR BOOK OF NEPAL 1989
(National Planning Commission Secretarist)
2. Policy Approaches To Development Issues
(National Planning Commission Secretarist)
3. Programme For Fulfillment of Basic Needs (1985-2000)
(National Planning Commission Secretarist)
4. The Seventh Plan 1985-1990 Part-1
(National Planning Commission Secretarist)
5. Maintaining Structural Reforms and Managing Public Resources
(March 30, 1990 Document of the World Bank)
6. Social Sector Strategy Review (Volume I & II)
(April 19, 1990 Document of the World Bank)
7. Relieving Poverty in a Resource-Scarce Economy (Volume I & II)
(August 15, 1990 Document of the World Bank)
8. Climatological Records of NEPAL (1983-1984, 1985-1986)
(Ministry of Water Resources, Department of Hydorology and Meteorology)
9. ANNUAL REPORT 1986/87, 1988/89
(NEPAL TERECOMMUNICATIONS CORPORATION)
10. COMPARATIVE BALANCE SHEET OF NTC AS ON MID JULY 1985 - 1989
11. Site Survey Report of Mechi Zone
12. Site Survey Report of Koshi and Mechi Zone
- 13 .Site Survey Report of District Head-Quarters and Associated Repeaters of Udaypur, Okhaldhunga, Solukhumbu and Khotang
(Sagarmatha Zone)
14. FINANCIAL PERFORMANCE INDICATORS
15. TWENTIETH ANNUAL REPORT (1988-1989)
(RASTRIYA BEEMA SANSTHAN, NATIONAL INSURANS CORPORATION)

BASIC DESIGN

BASIC DESIGN - 1

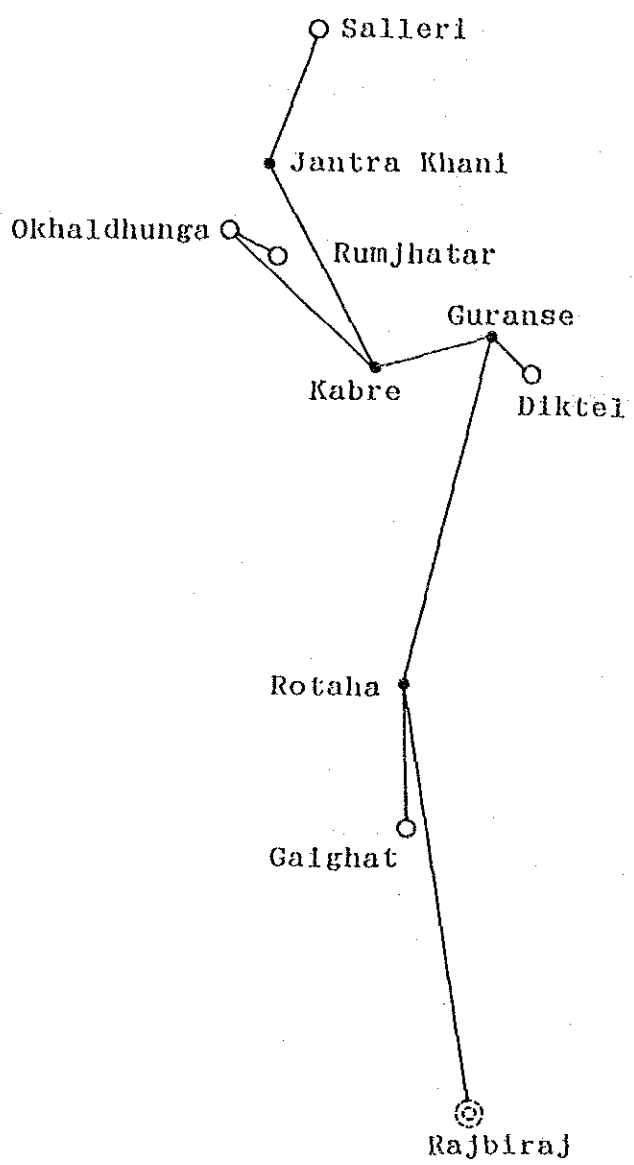
TRANSMISSION ROUTE PLAN



LEGEND

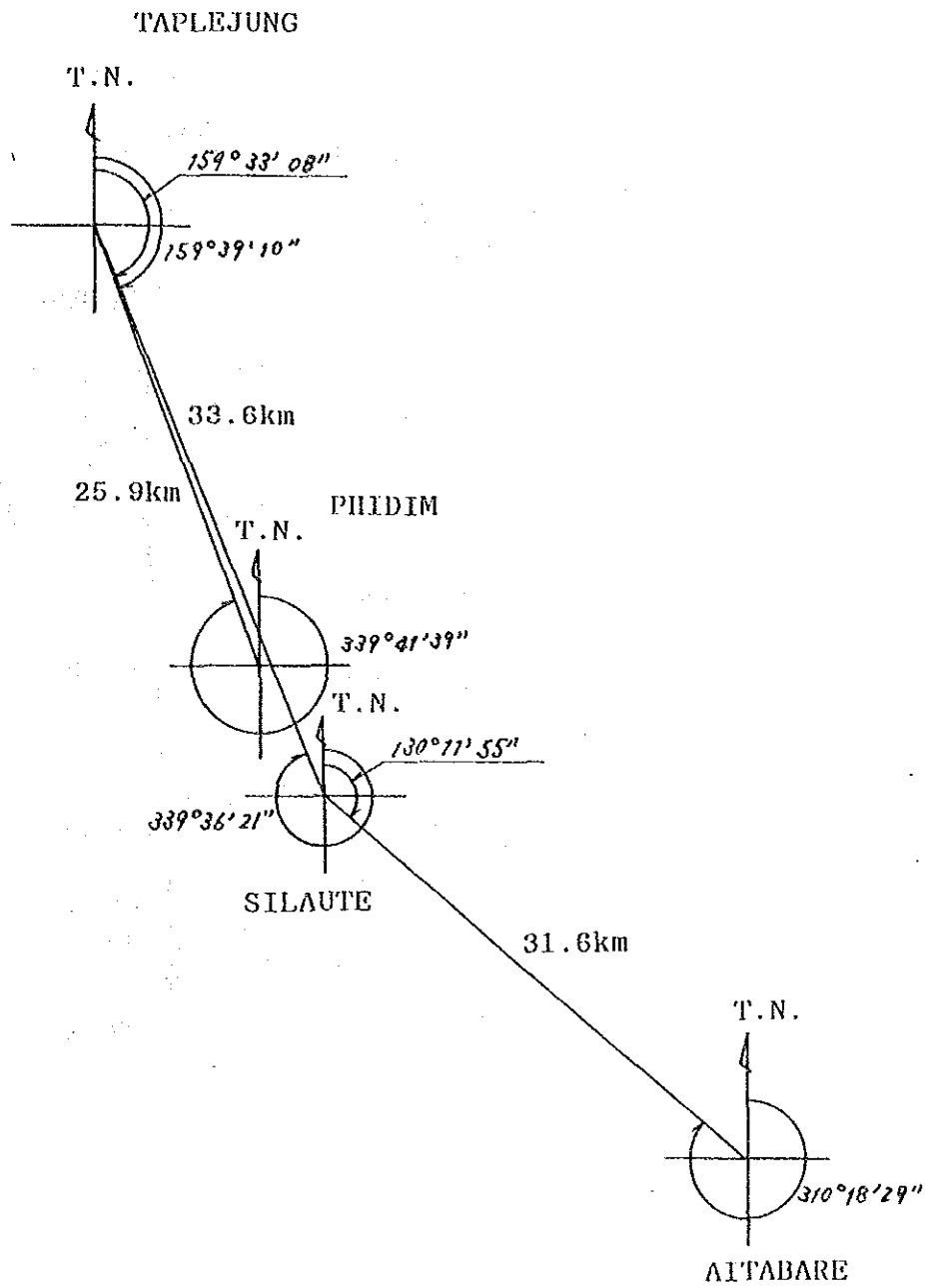
- ⊙ : Existing Parent Exchange Site
- : PCO Site
- ◌ : Existing PCO Site
- : Repeater Station
- ⊛ : Existing Repeater Station

TRANSMISSION ROUTE PLAN	
SITE NAME	02 AREA
SCALE : -	FIGURE-1-1 (1/5)
UNIT : -	

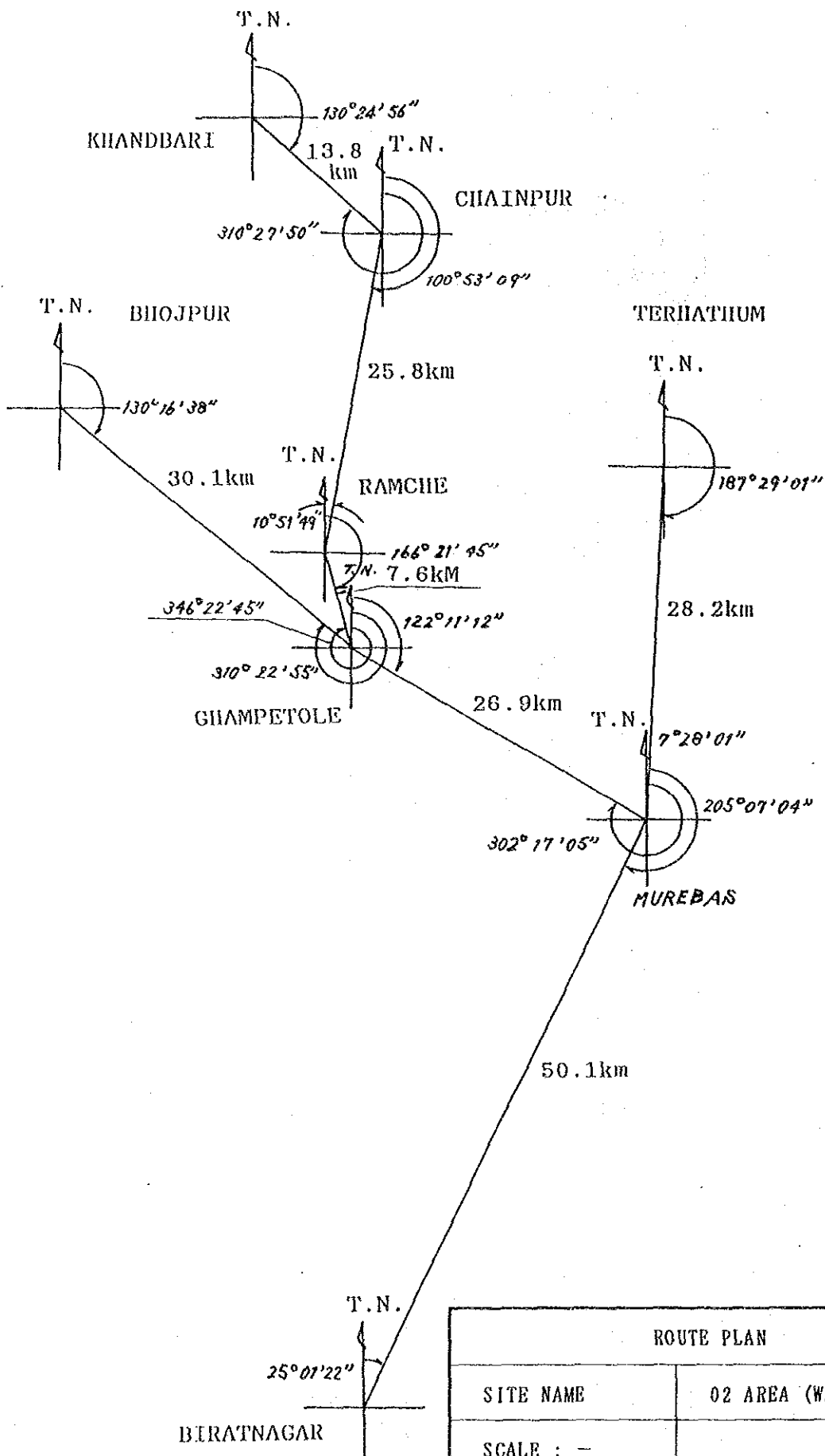


- ⊙ LEGEND
- ⊙ : Existing Parent Exchange Site
 - : PCO Site
 - : Repeater Station

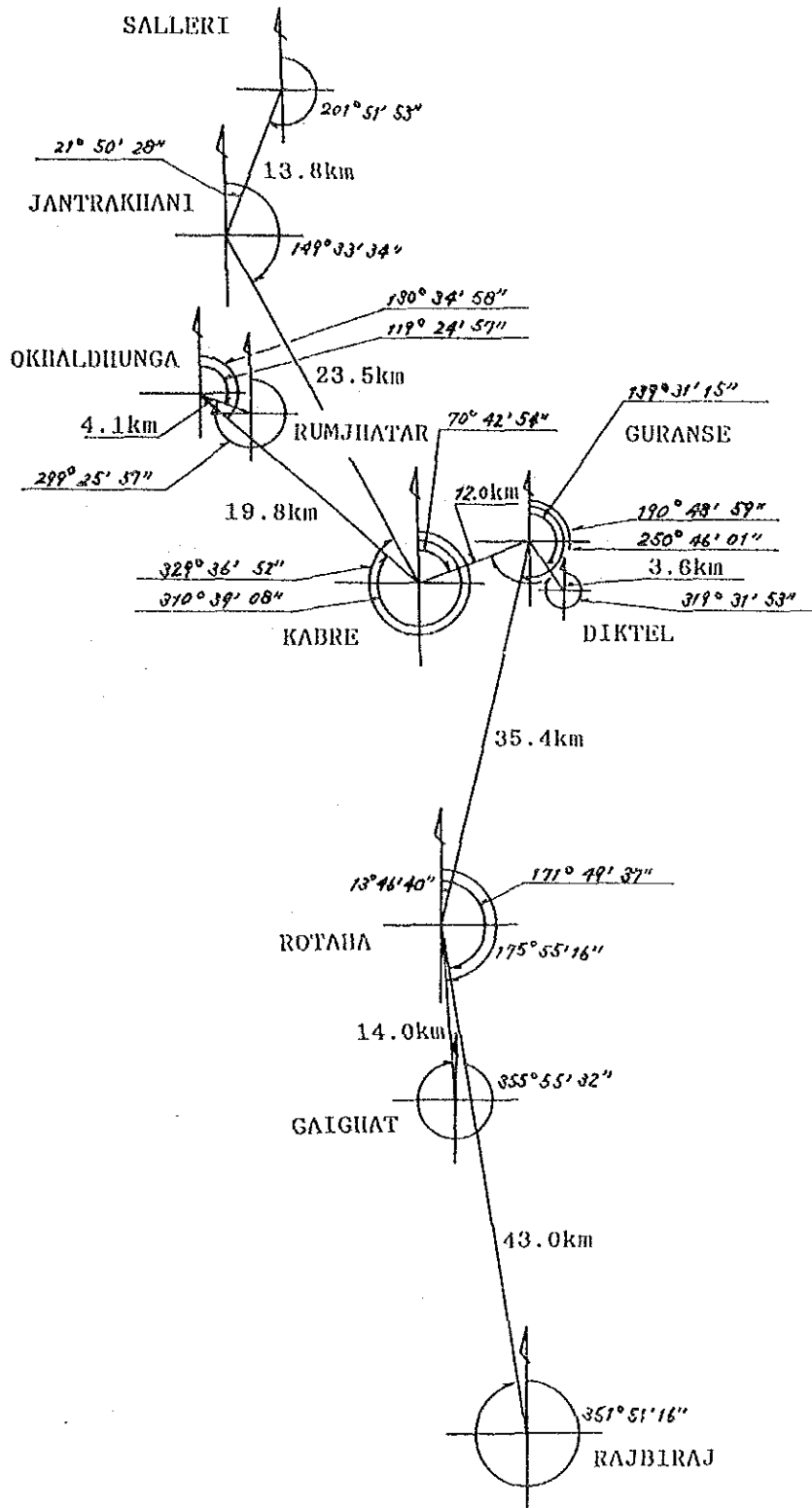
TRANSMISSION ROUTE PLAN	
SITE NAME	03 AREA
SCALE : -	FIGURE-1-2 (2/5)
UNIT : -	



ROUTE PLAN	
SITE NAME	02 AREA (EAST)
SCALE :	FIGURE-1-3 (3/5)
UNIT :	



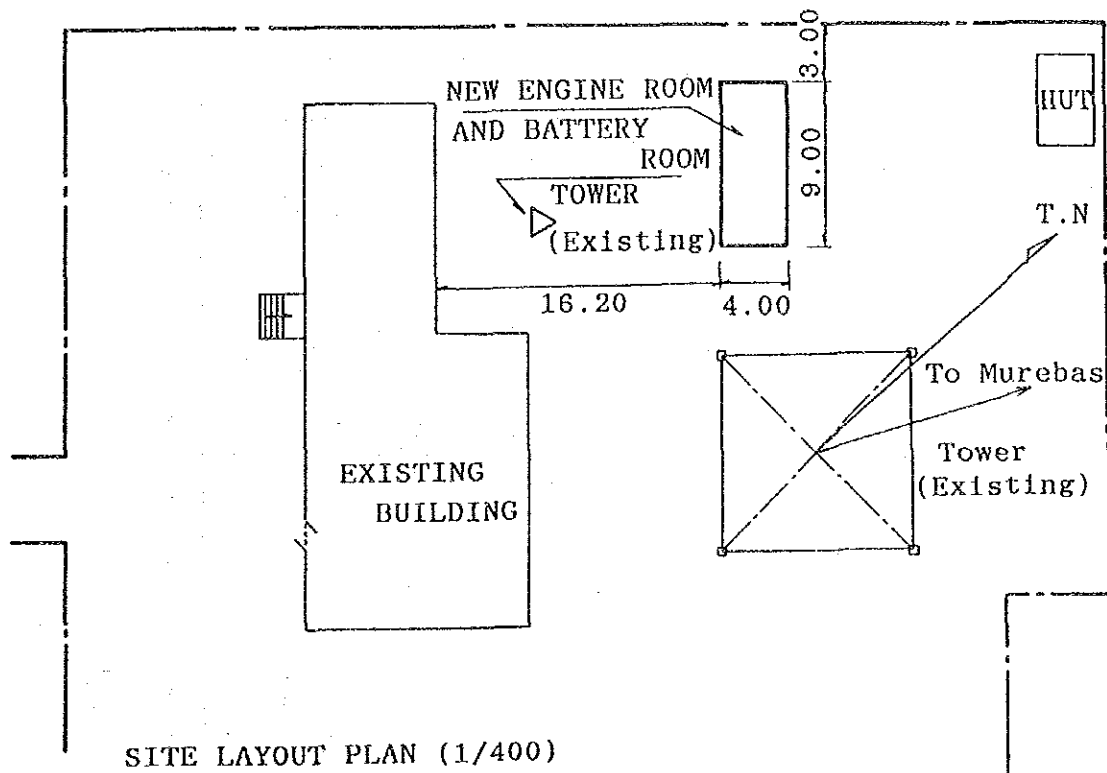
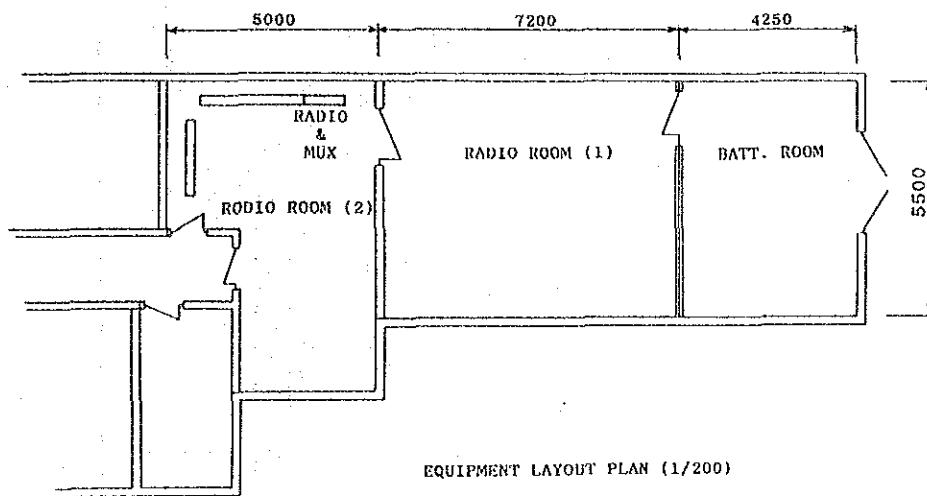
ROUTE PLAN	
SITE NAME	02 AREA (WAST)
SCALE : -	FIGURE-1-4 (4/5)
UNIT : -	



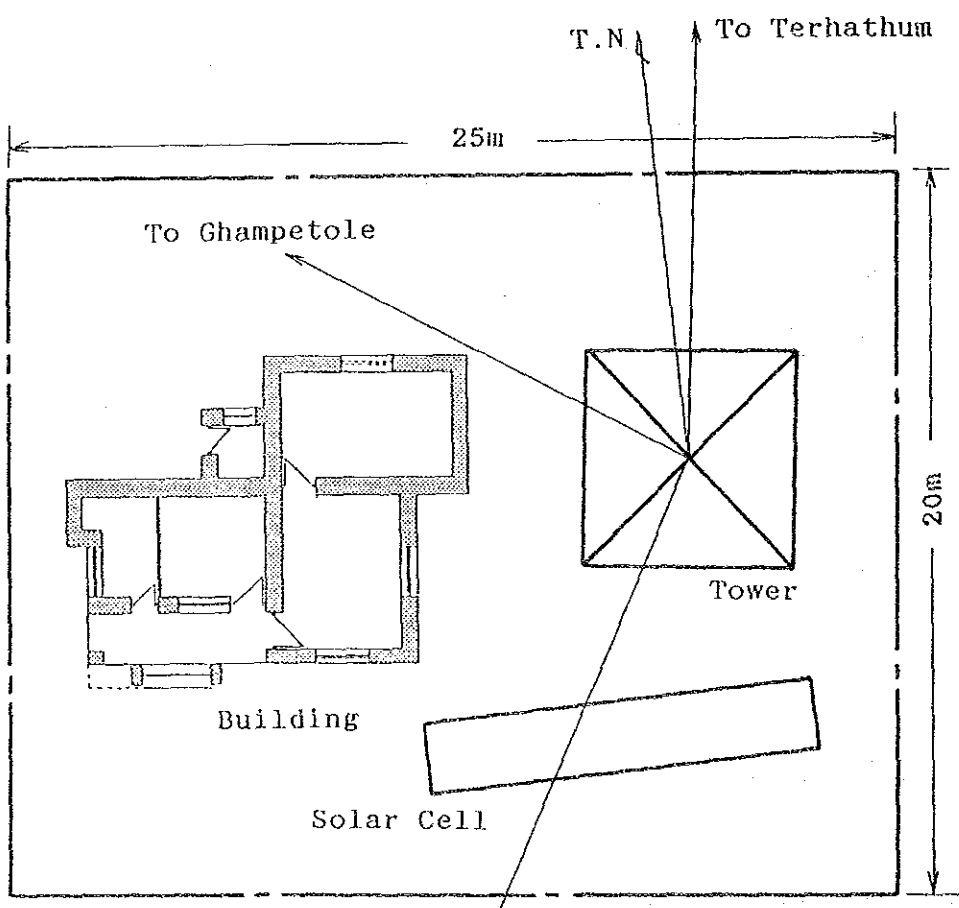
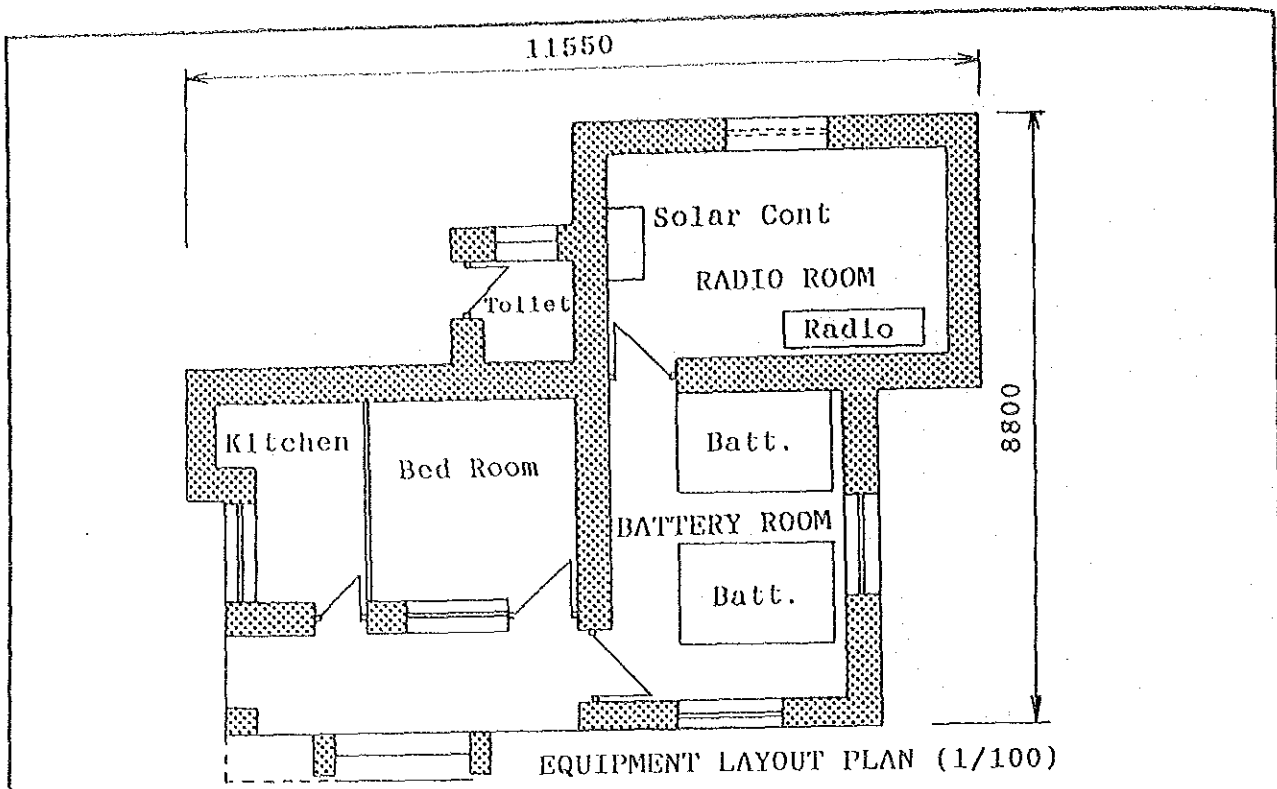
ROUTE PLAN	
SITE NAME	03 AREA
SCALE :	FIGURE-1-5 (5/5)
UNIT :	

BASIC DESIGN - 2

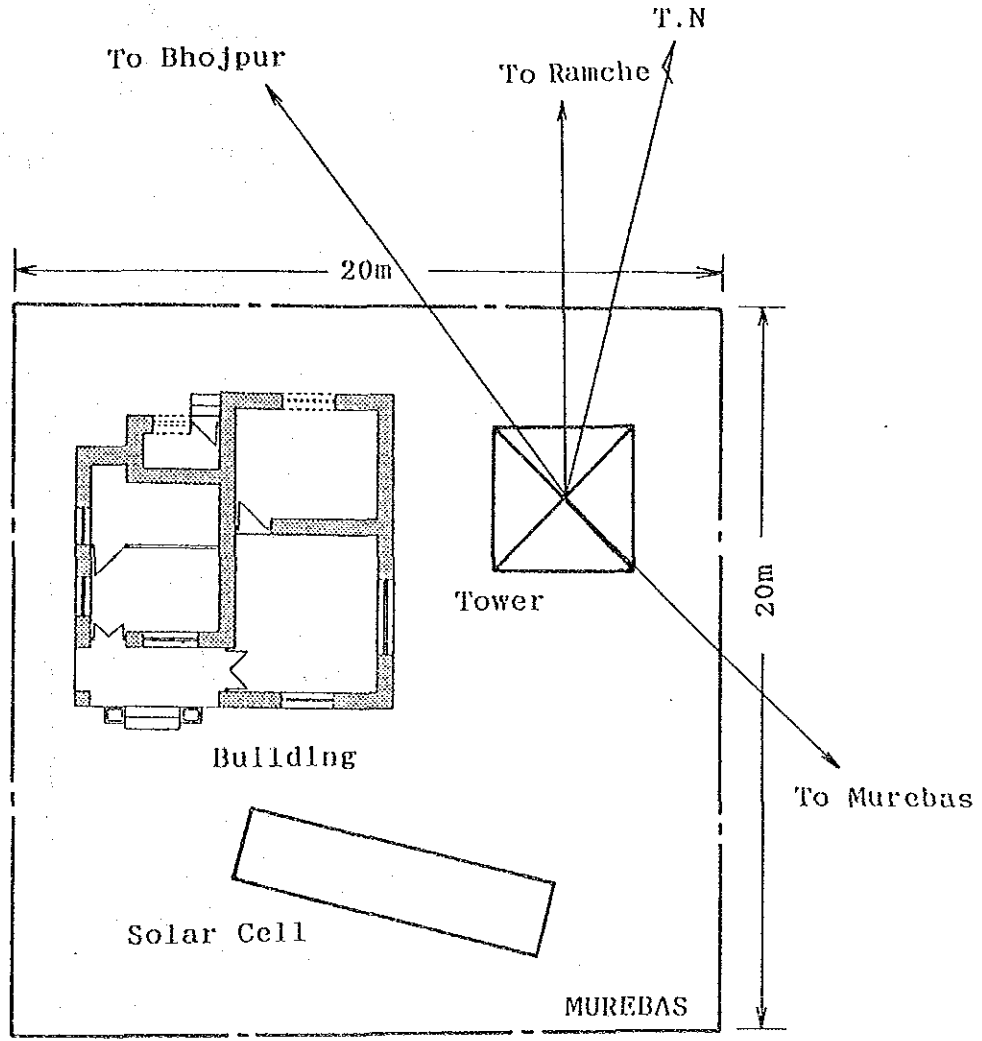
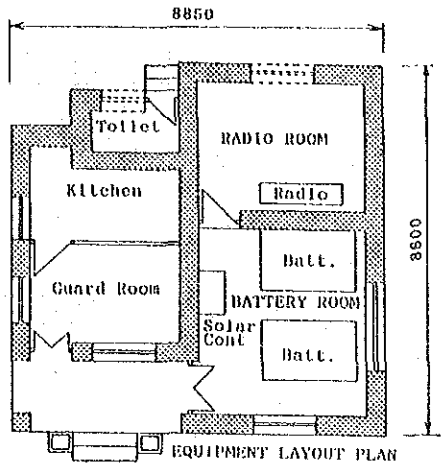
SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN



SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	BIRATNAGAR
SCALE : -	FIGURE-2-1 (1/23)
UNIT :	

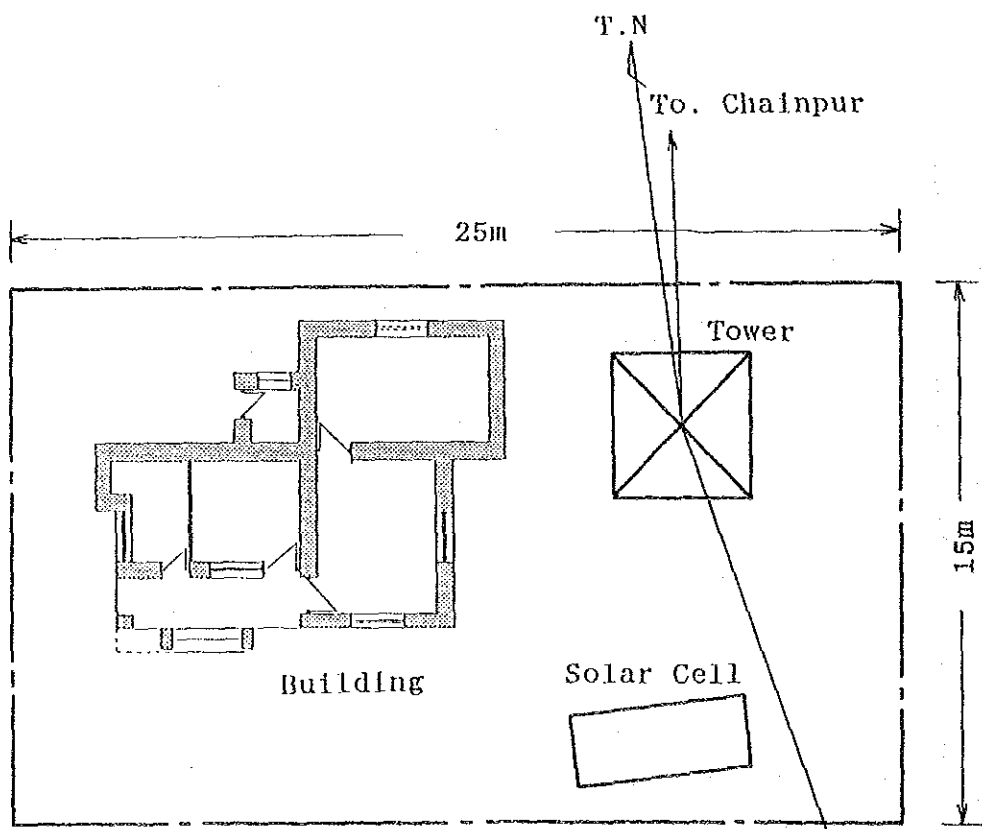
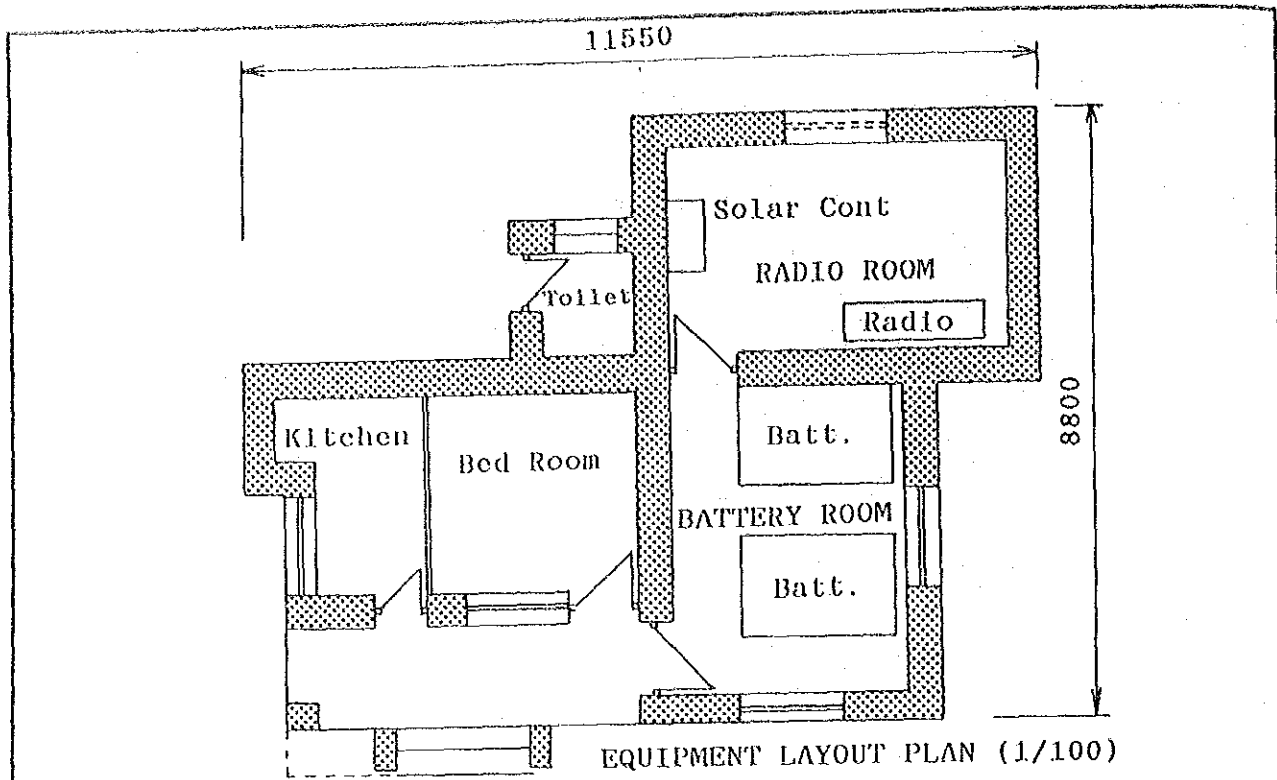


SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	MUREBAS
SCALE : -	FIGURE-2-2 (2/23)
UNIT :	



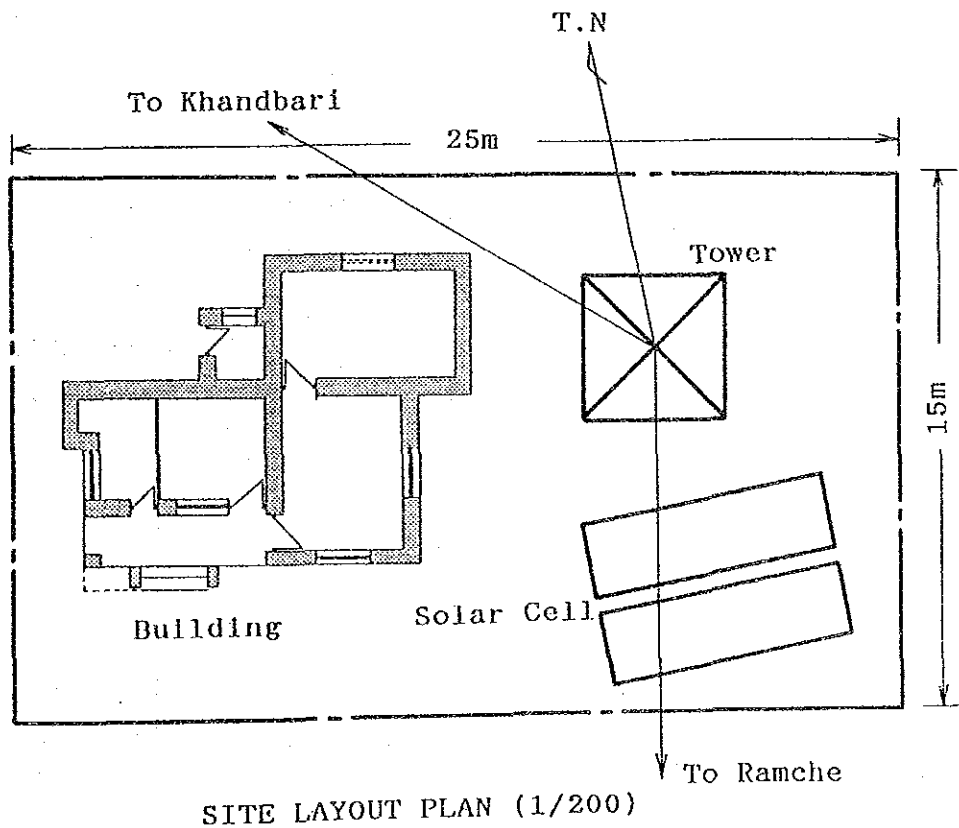
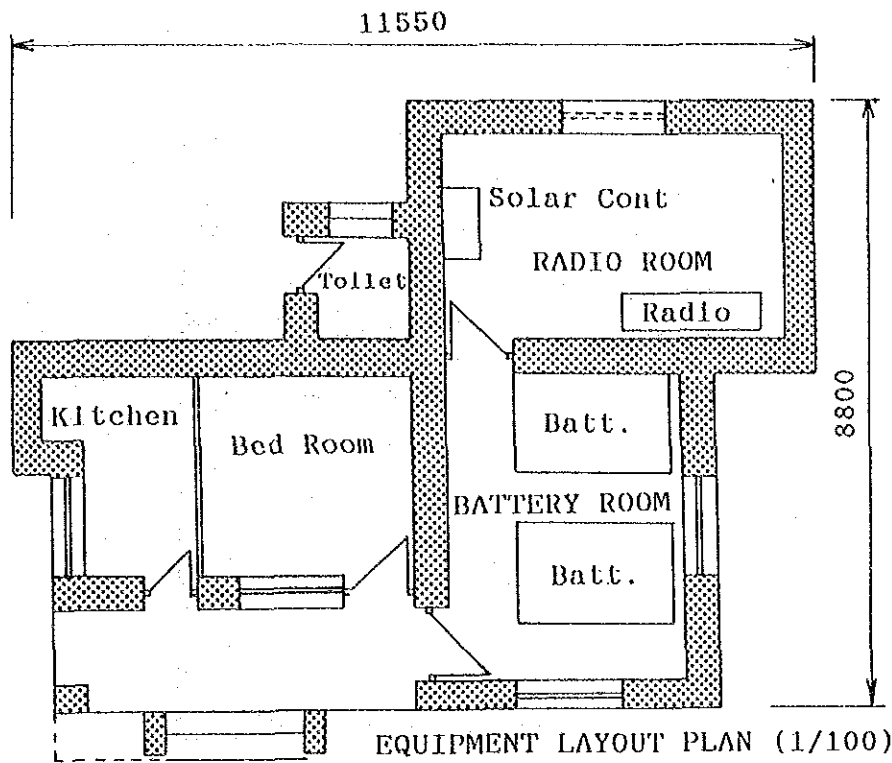
SITE LAYOUT PLAN (1/200)

SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	GHAMPETOLE
SCALE :	FIGURE-2-3 (3/23)
UNIT :	

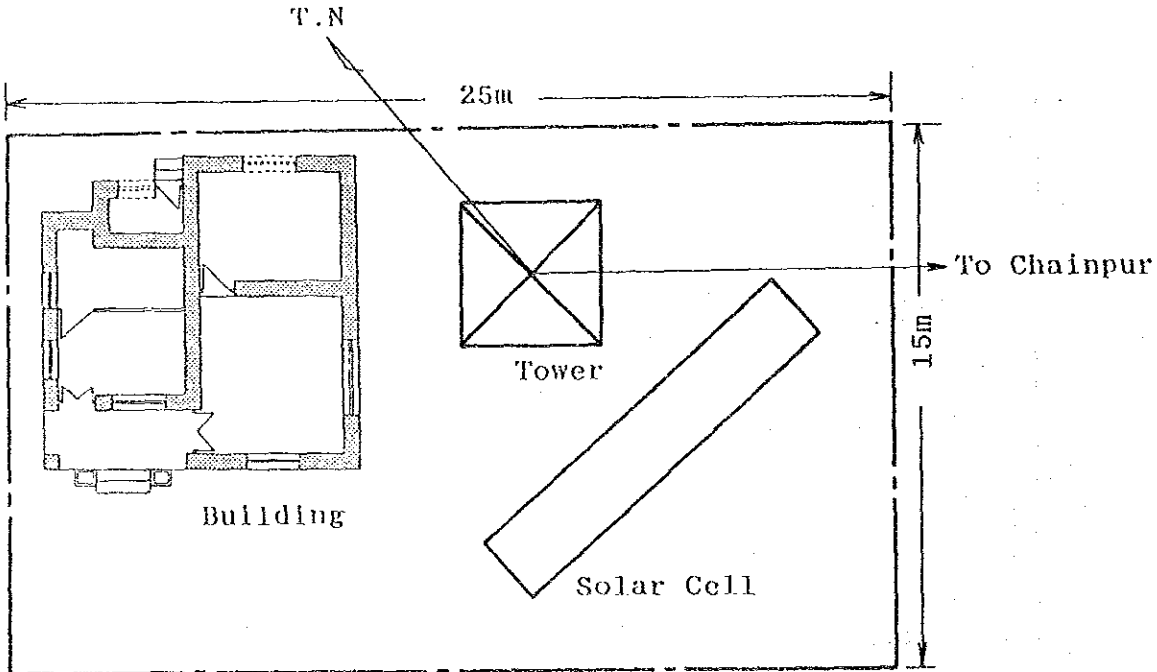
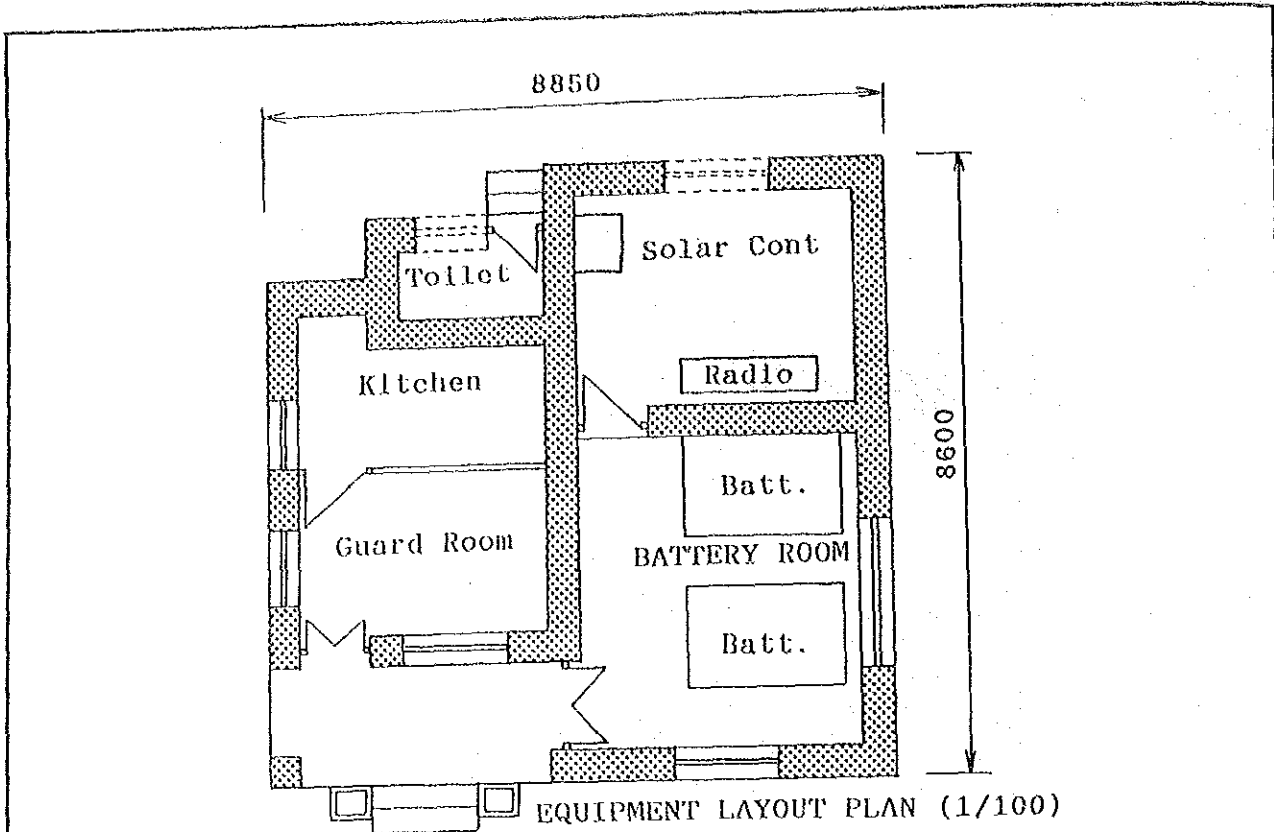


SITE LAYOUT PLAN (1/200)

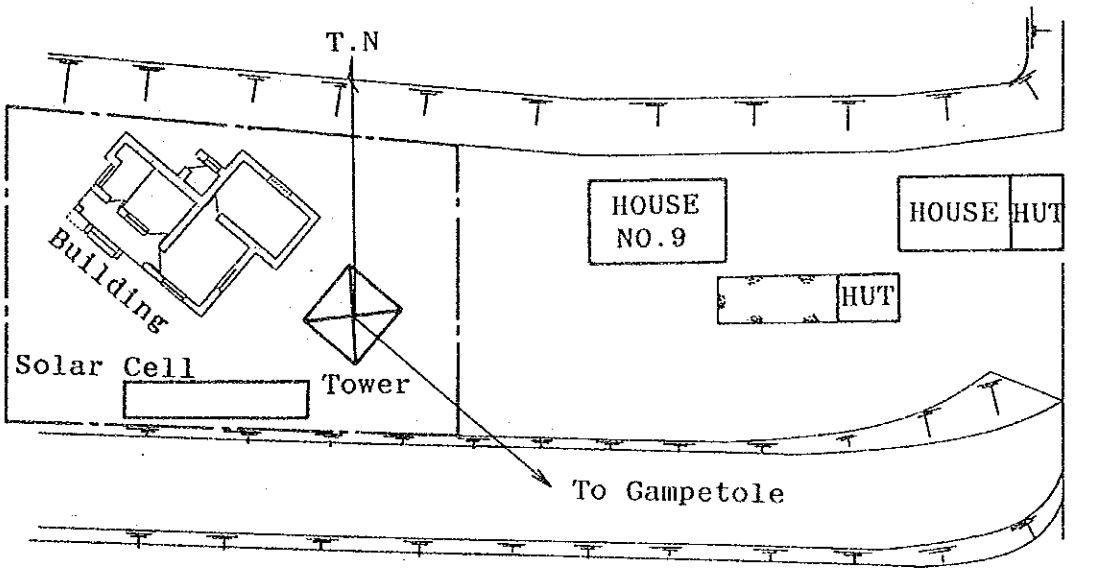
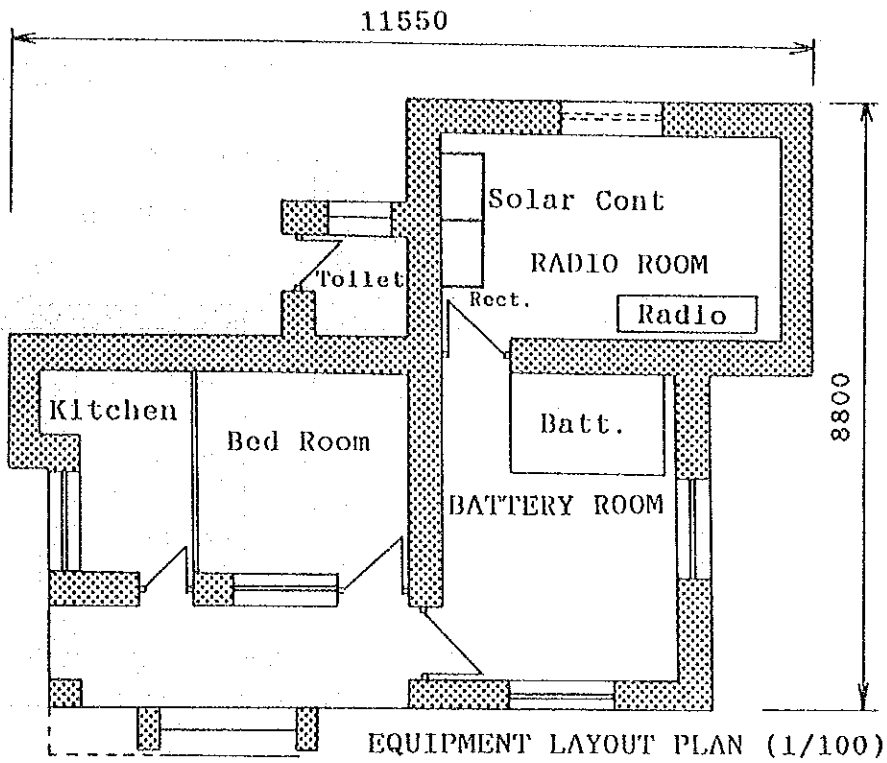
SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	RAMCHE
SCALE :	FIGURE-2-4 (4/23)
UNIT :	



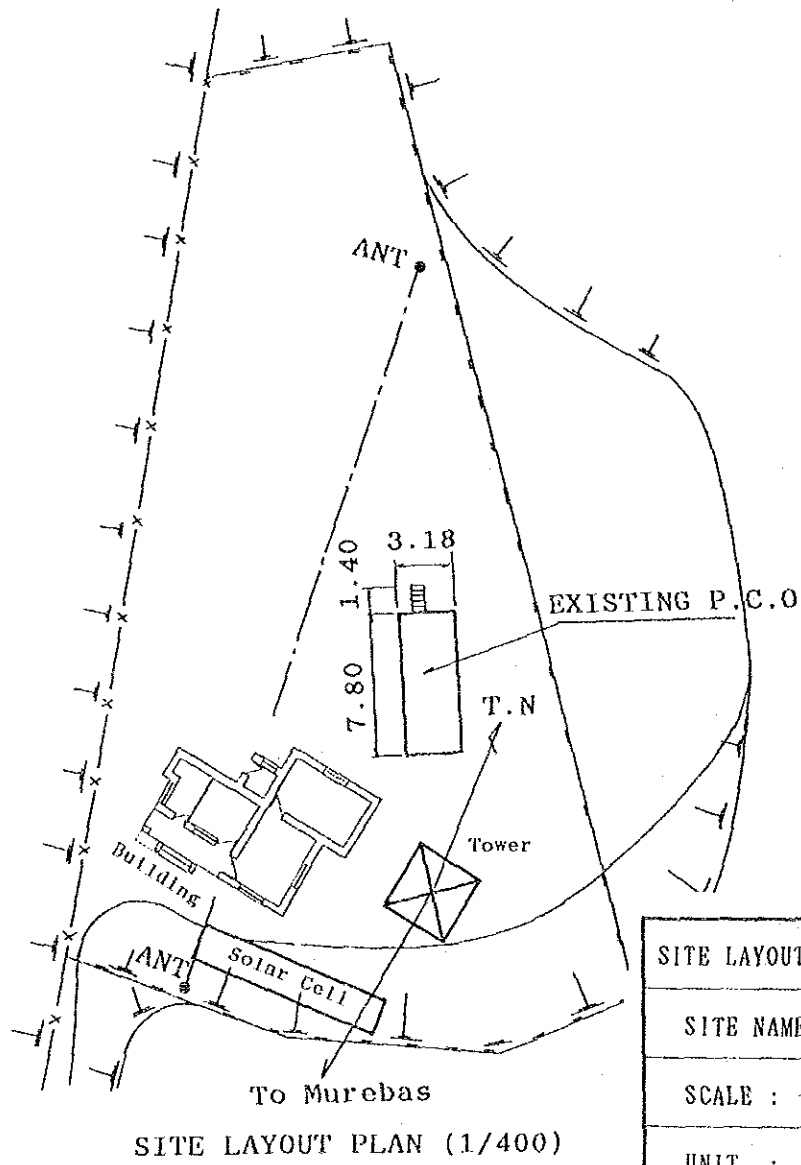
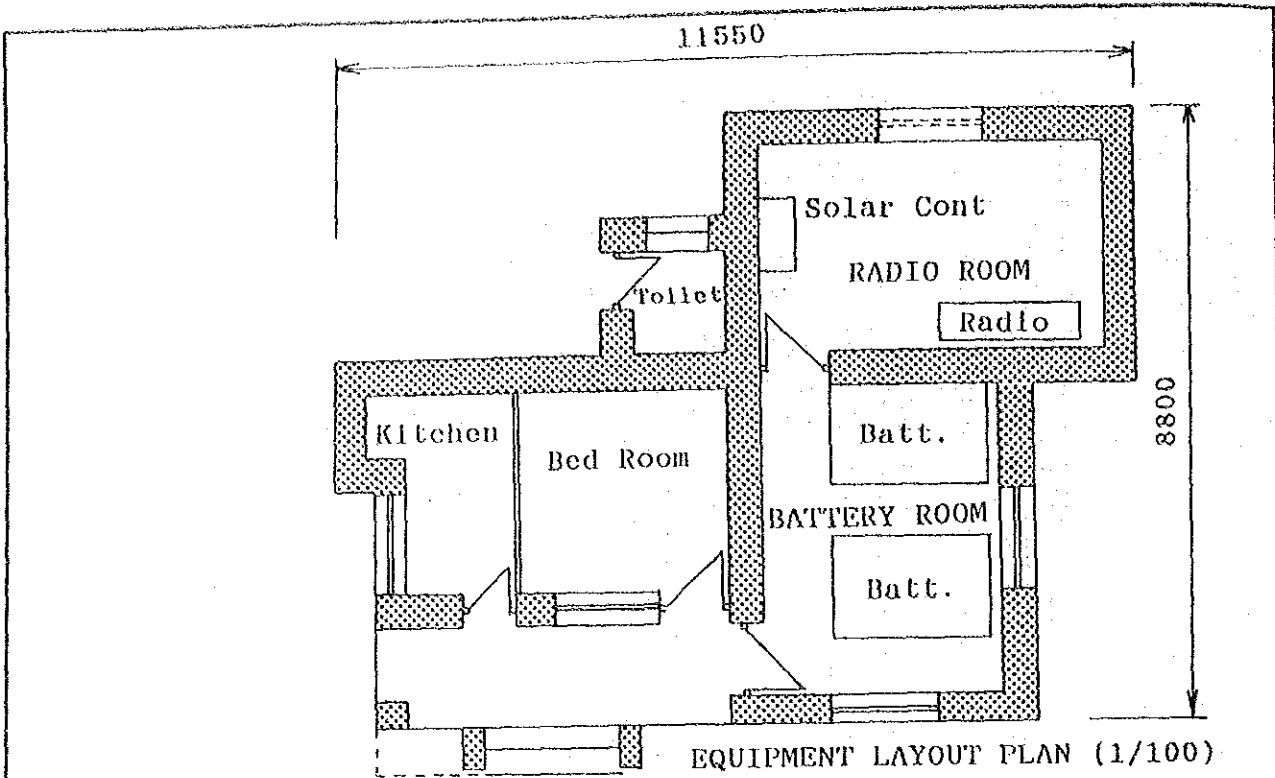
SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	CHAINPUR
SCALE : -	FIGURE-2-5 (5/23)
UNIT :	



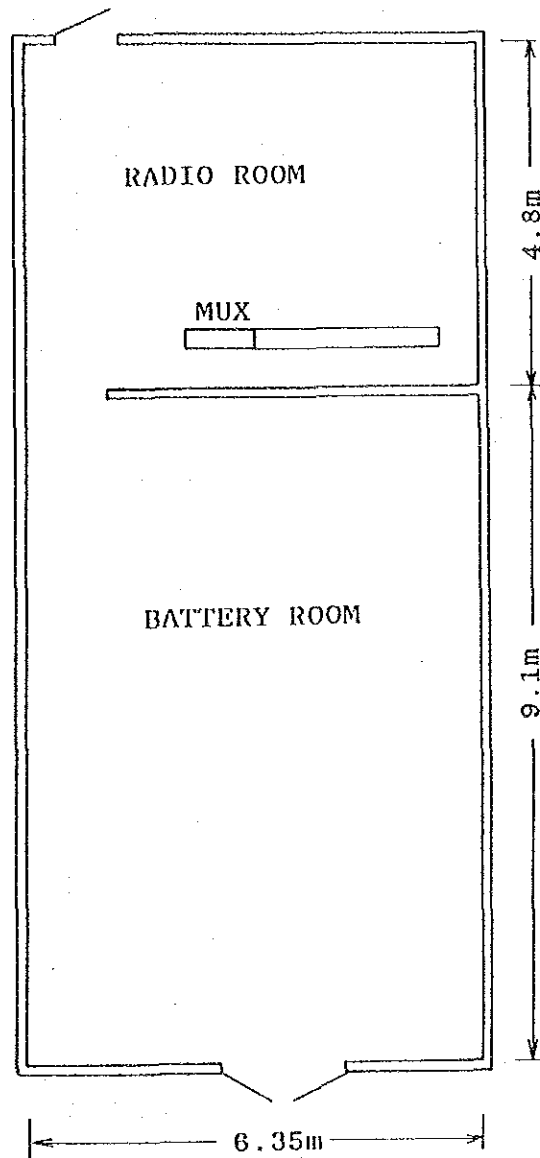
SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	KHANDBARI
SCALE : -	FIGURE-2-6 (6/23)
UNIT :	



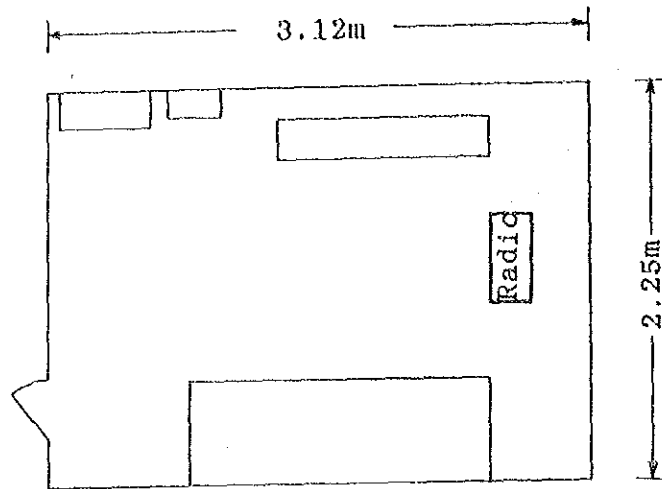
SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	BHOJPUR
SCALE : -	FIGURE-2-7 (7/23)
UNIT :	



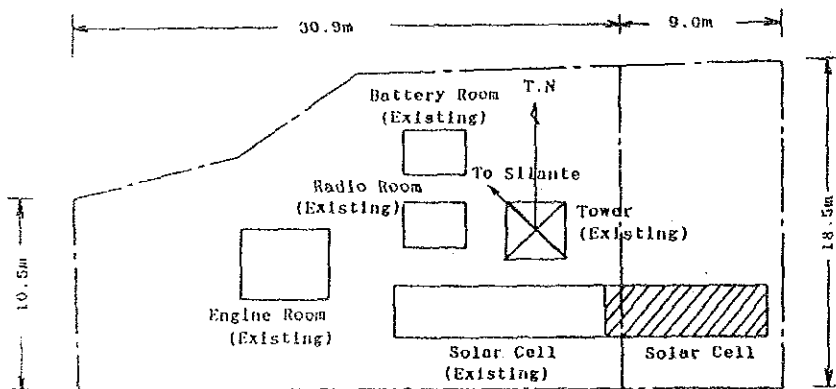
SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	TERHATHUM
SCALE : -	FIGURE-2-8 (8/23)
UNIT :	



EQUIPMENT LAYOUT PLAN	
SITE NAME	BHADRAPUR
SCALE : 1/100	FIGURE-2-9 (9/23)
UNIT : m	

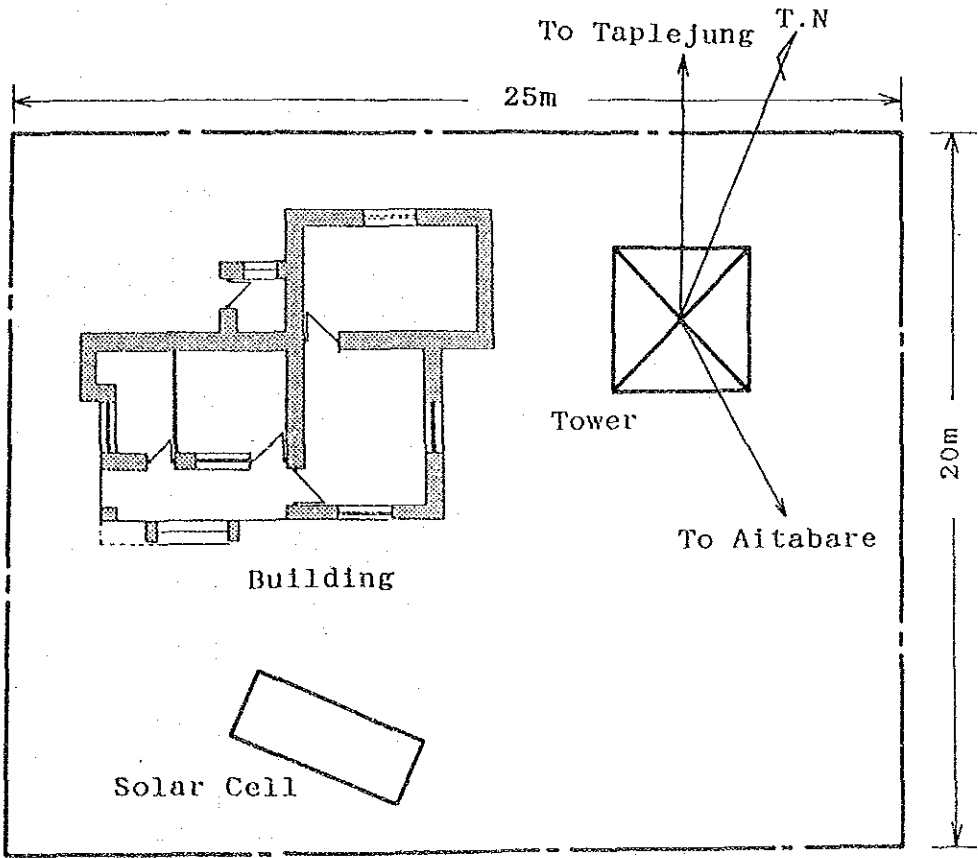
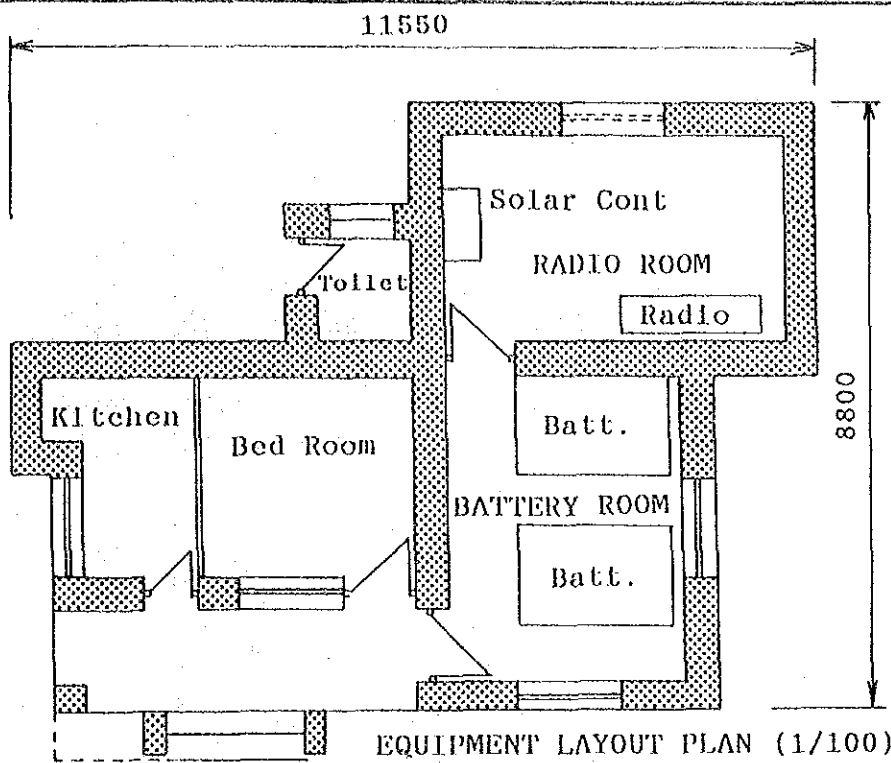


EQUIPMENT LAYOUT PLAN (1/40)



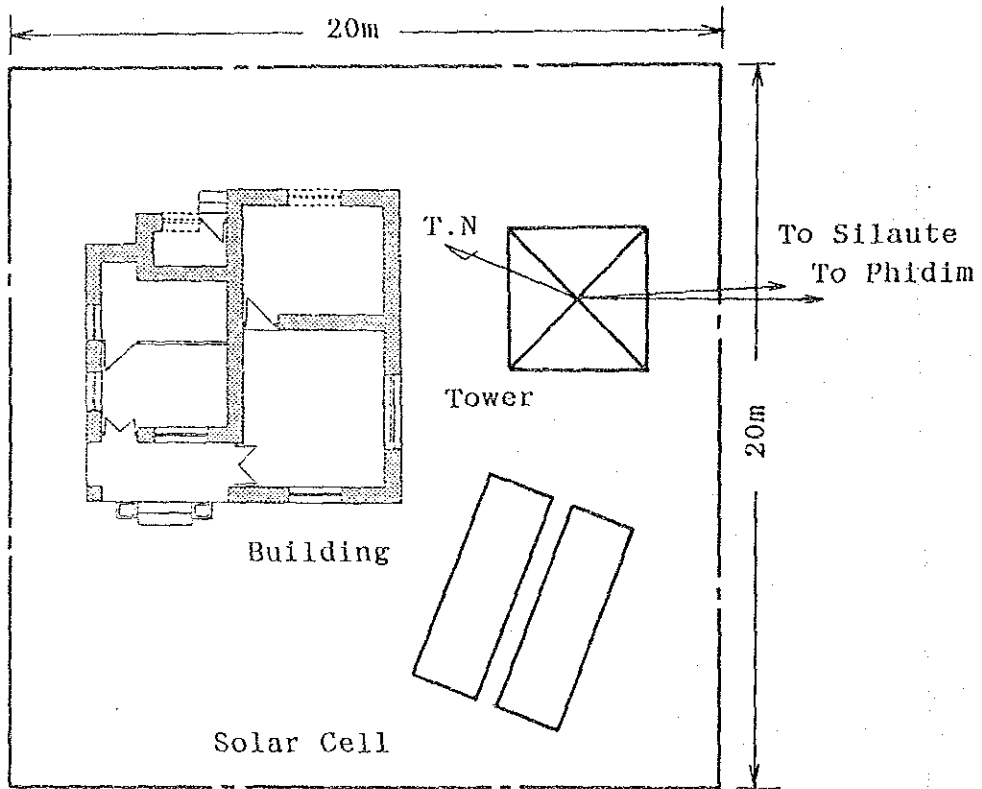
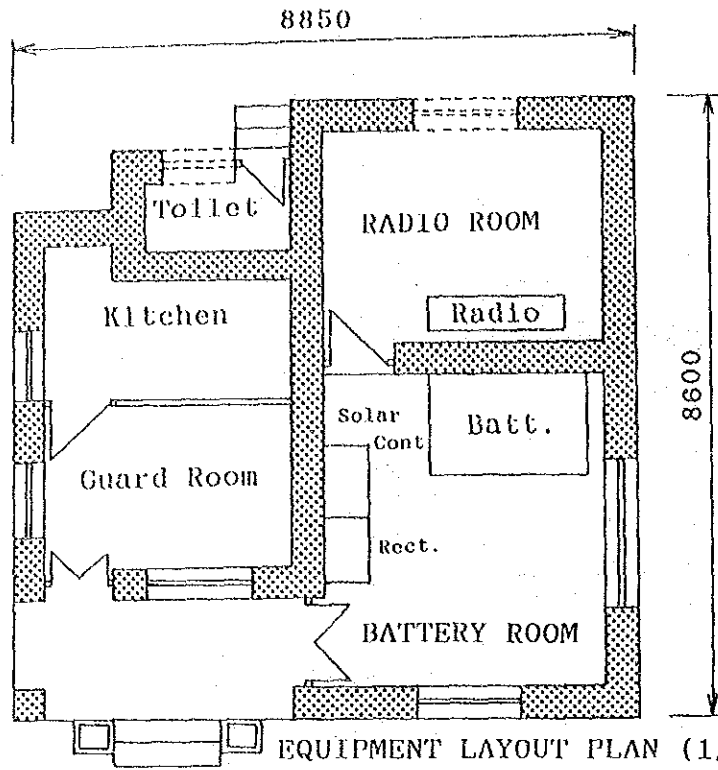
SITE LAYOUT PLAN (1/400)

SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	AITABARE
SCALE : --	FIGURE-2-10 (10/23)
UNIT :	



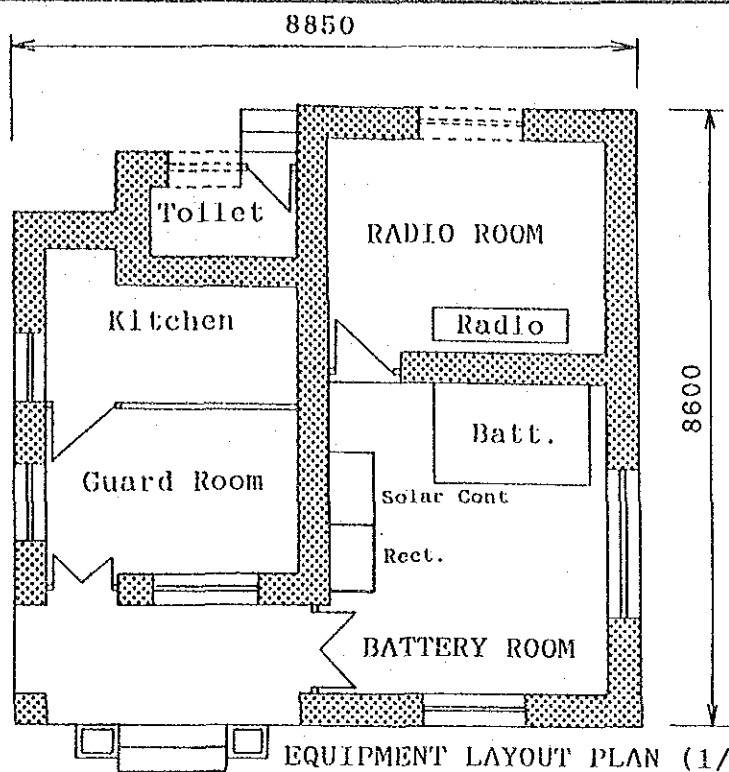
SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN

SITE NAME	SILAUTE
SCALE : -	FIGURE-2-11 (11/23)
UNIT :	

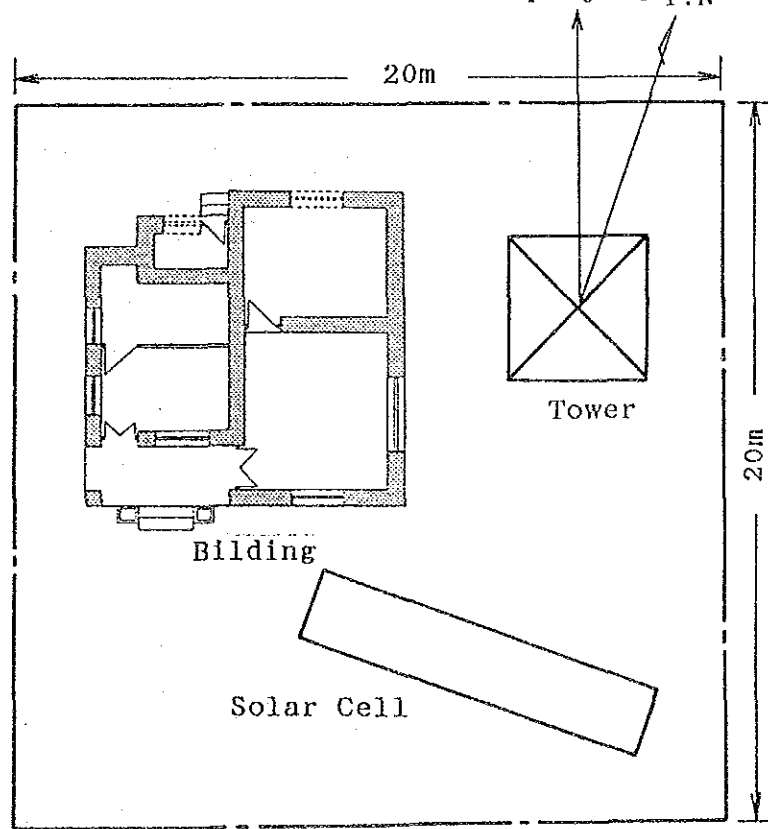


SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN

SITE NAME	TAPLEJUNG
SCALE :	FIGURE-2-12 (12/23)
UNIT :	

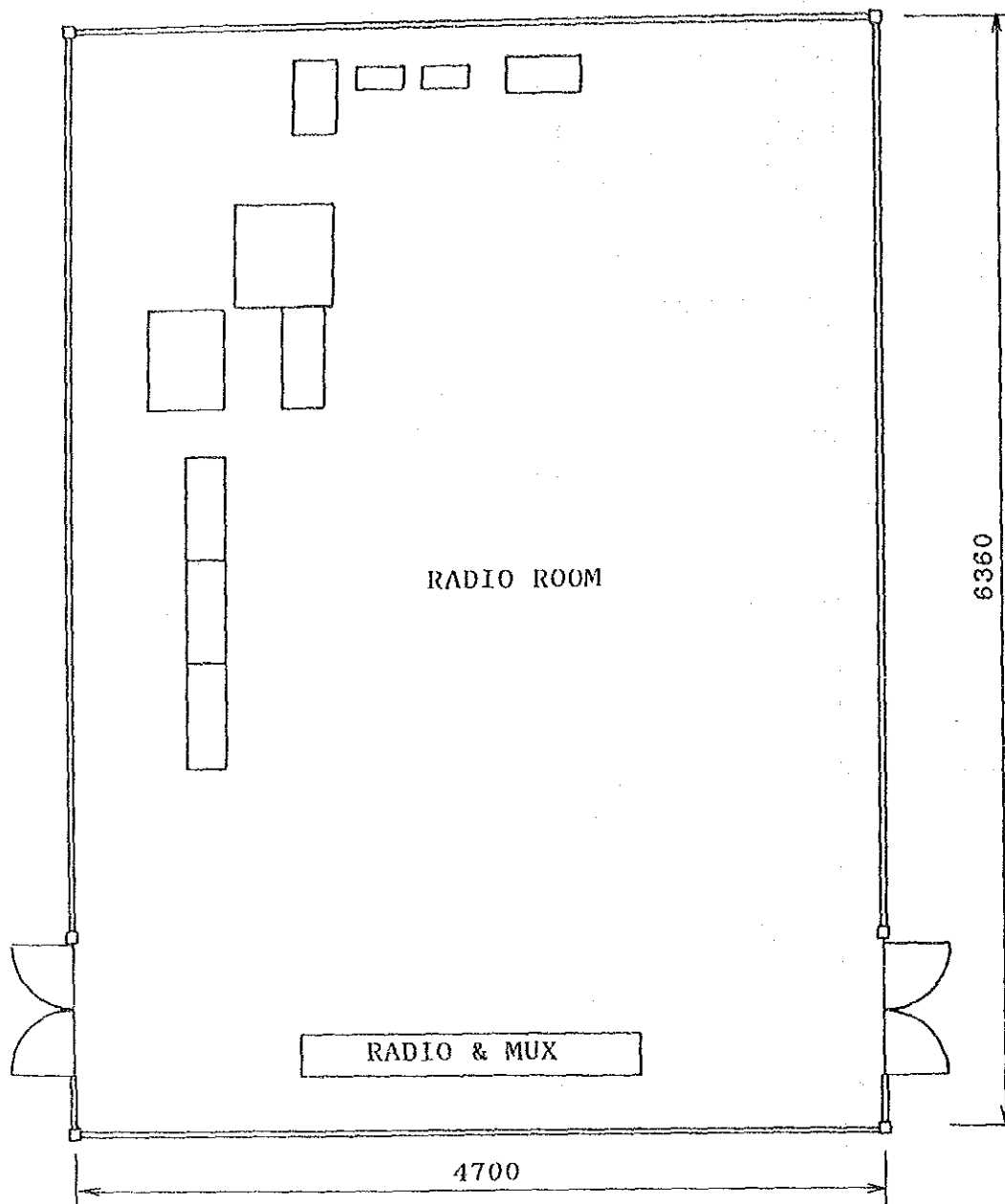


EQUIPMENT LAYOUT PLAN (1/100)
To Taplajung T.N

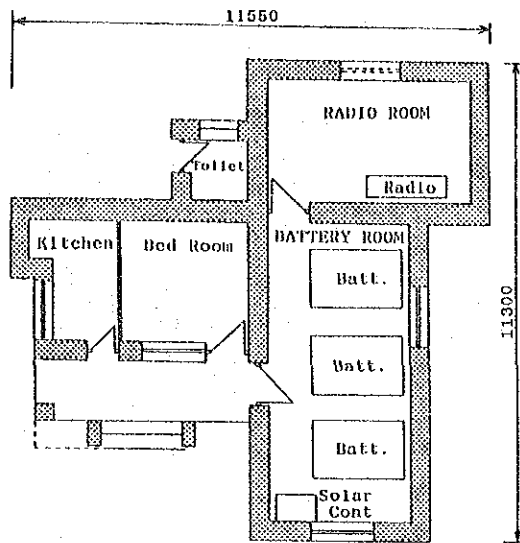


SITE GOUND PLAN (1/200)

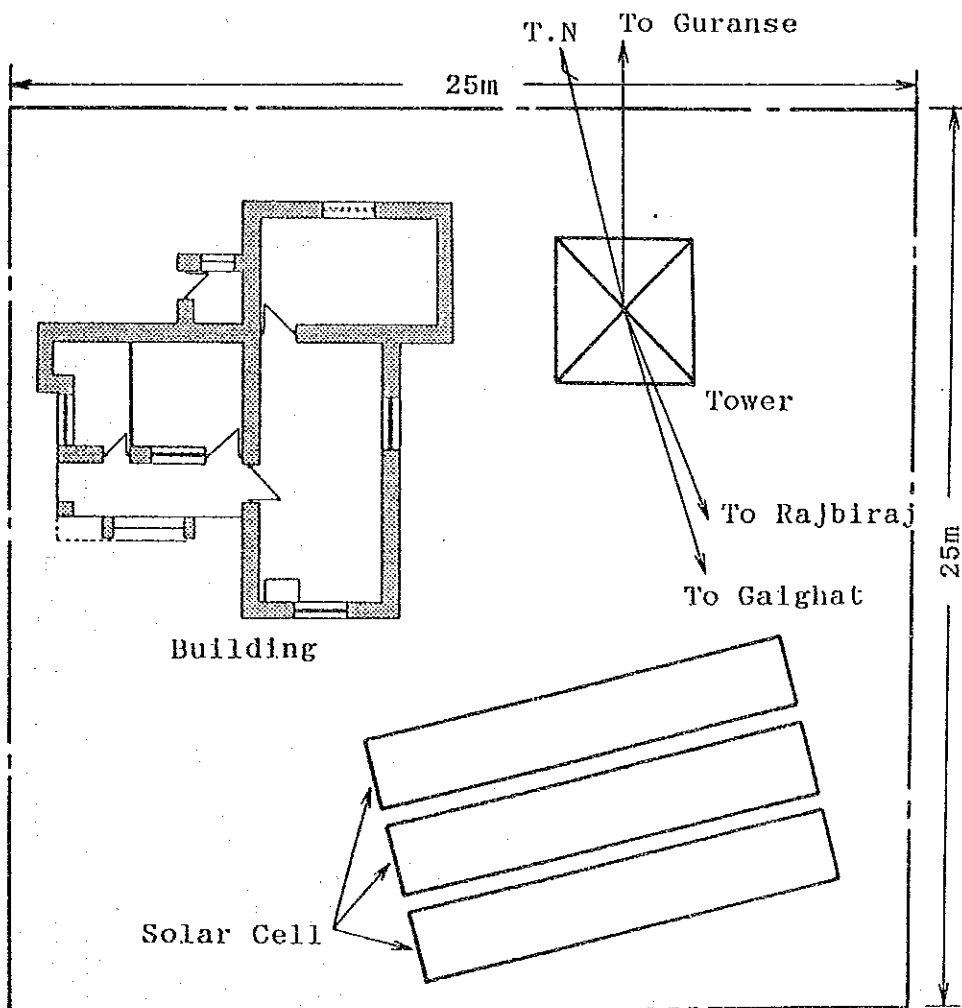
SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	PHIDIM
SCALE : -	FIGURE-2-13 (13/23)
UNIT :	



EQUIPMENT LAYOUT PLAN	
SITE NAME	RAJBIRAJ
SCALE :	FIGURE-2-14 (14/23)
UNIT :	



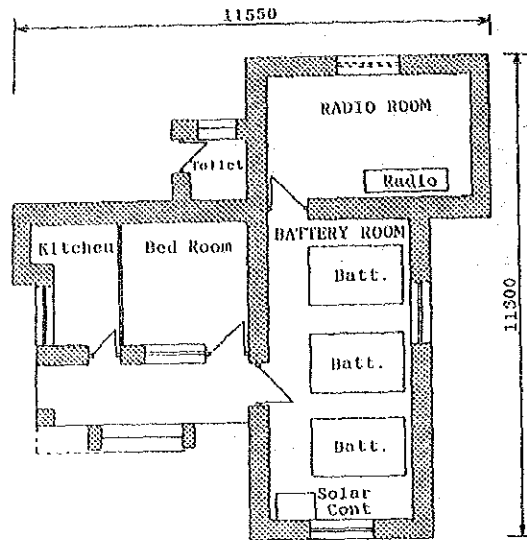
EQUIPMENT LAYOUT PLAN



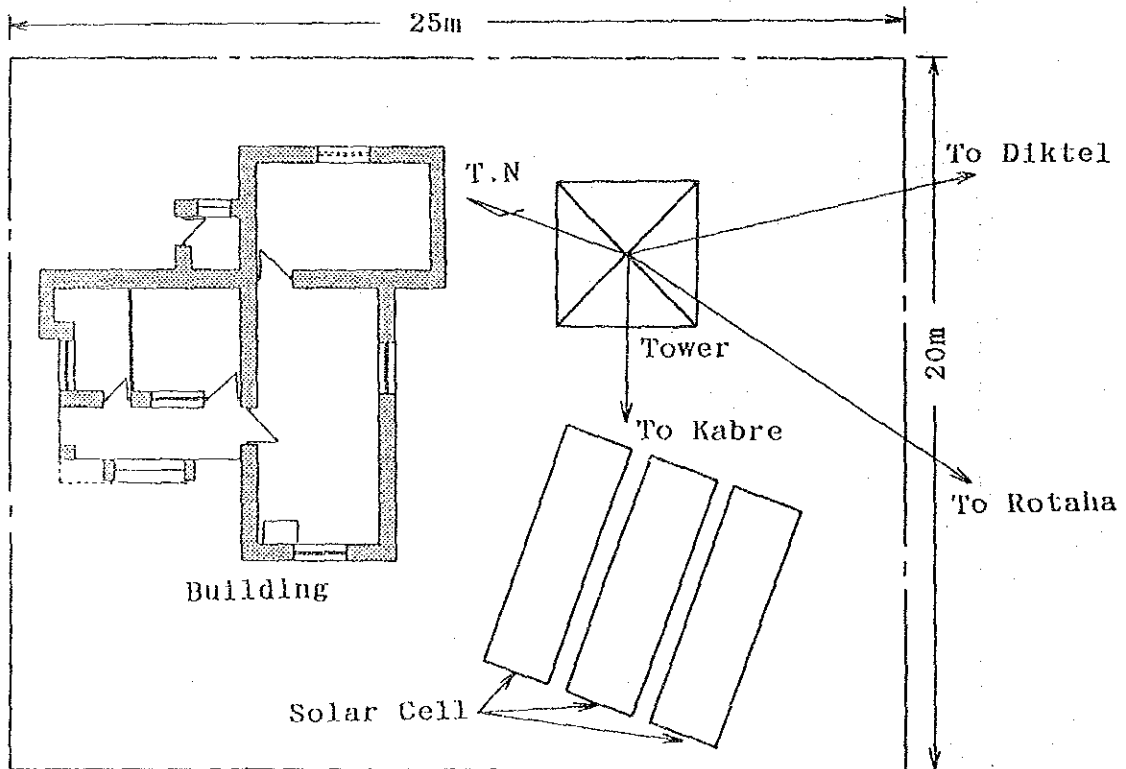
SITE LAYOUT PLAN (1/200)

SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN

SITE NAME	ROTAHA
SCALE : -	FIGURE-2-15 (15/23)
UNIT :	



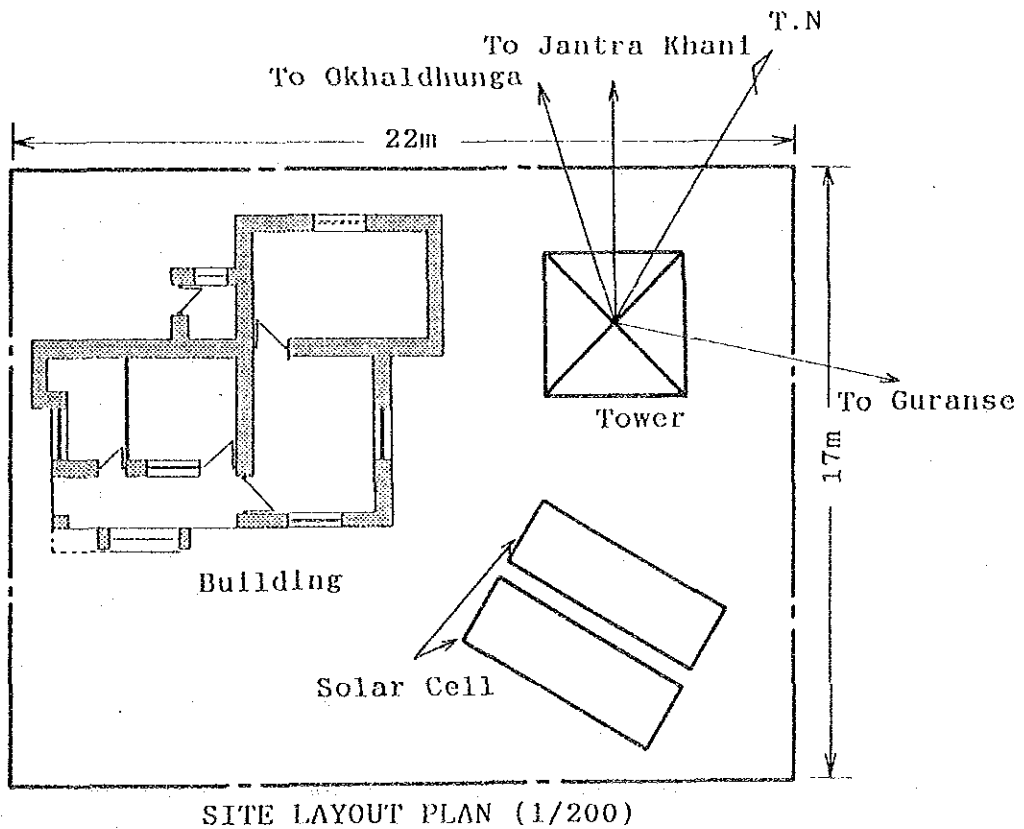
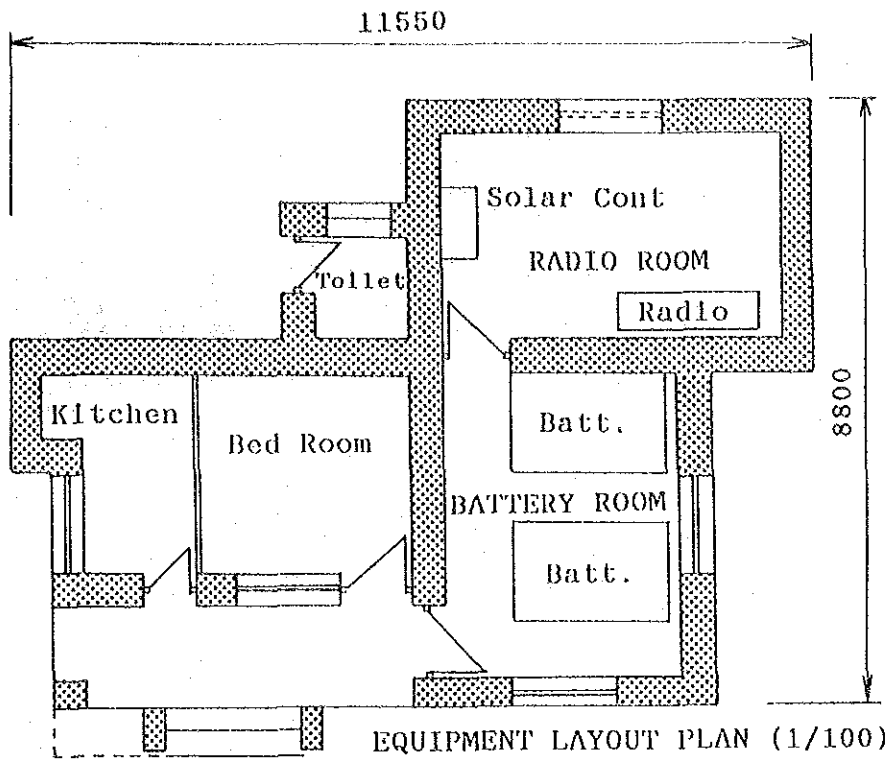
EQUIPMENT LAYOUT PLAN



SITE LAYOUT PLAN (1/200)

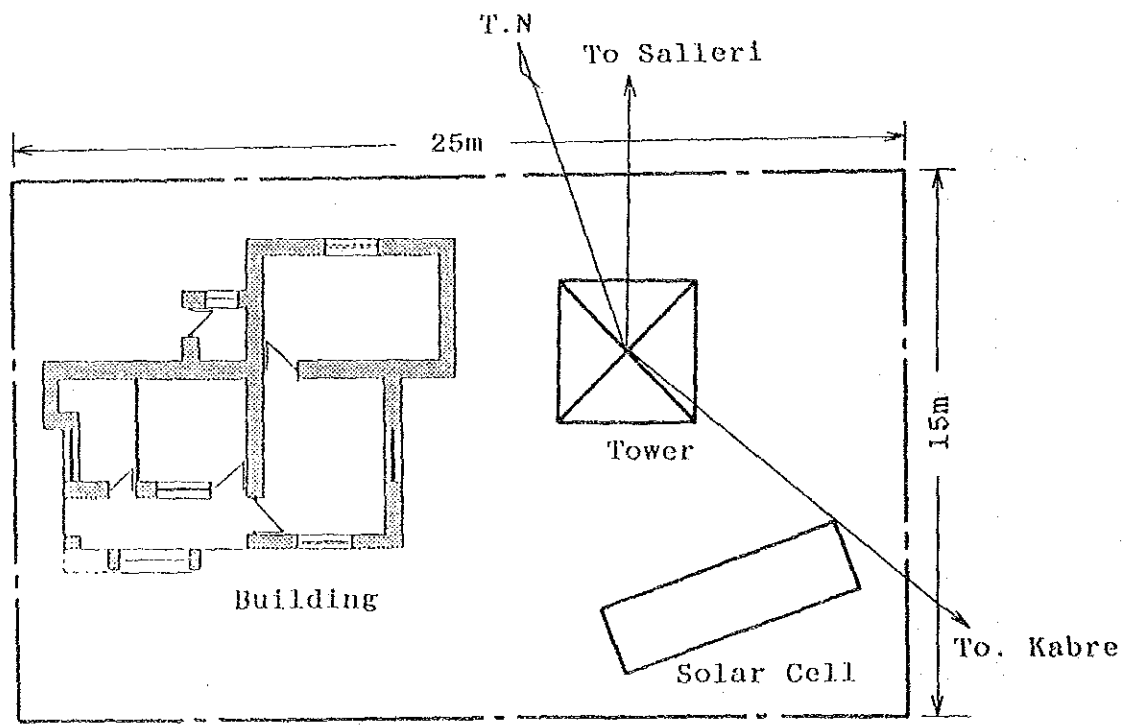
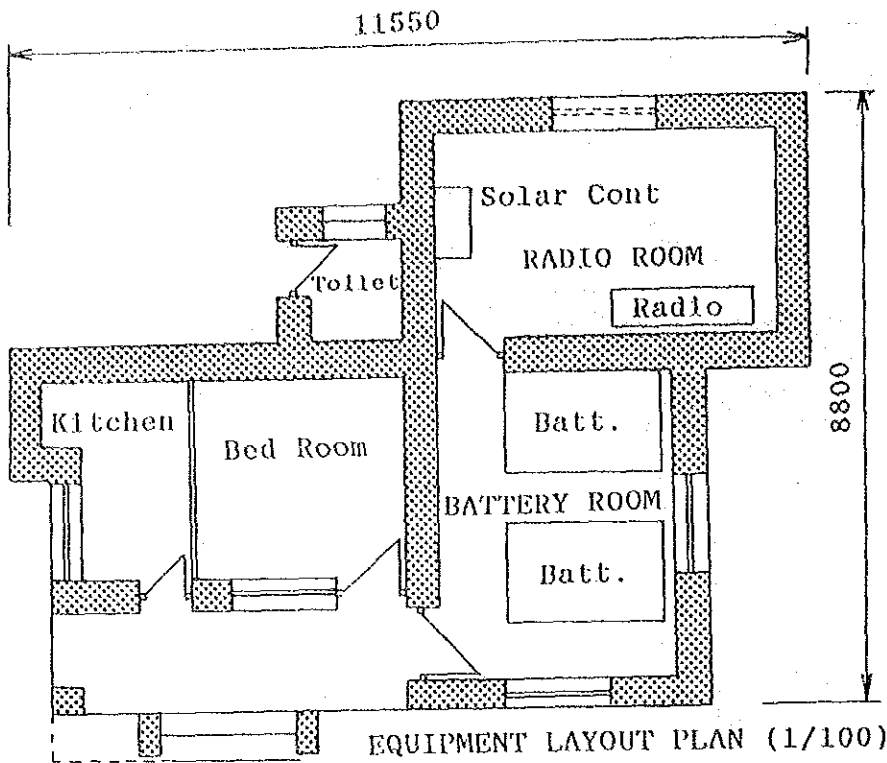
SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN

SITE NAME	GURANSE
SCALE :	-
UNIT :	FIGURE-2-16 (16/23)



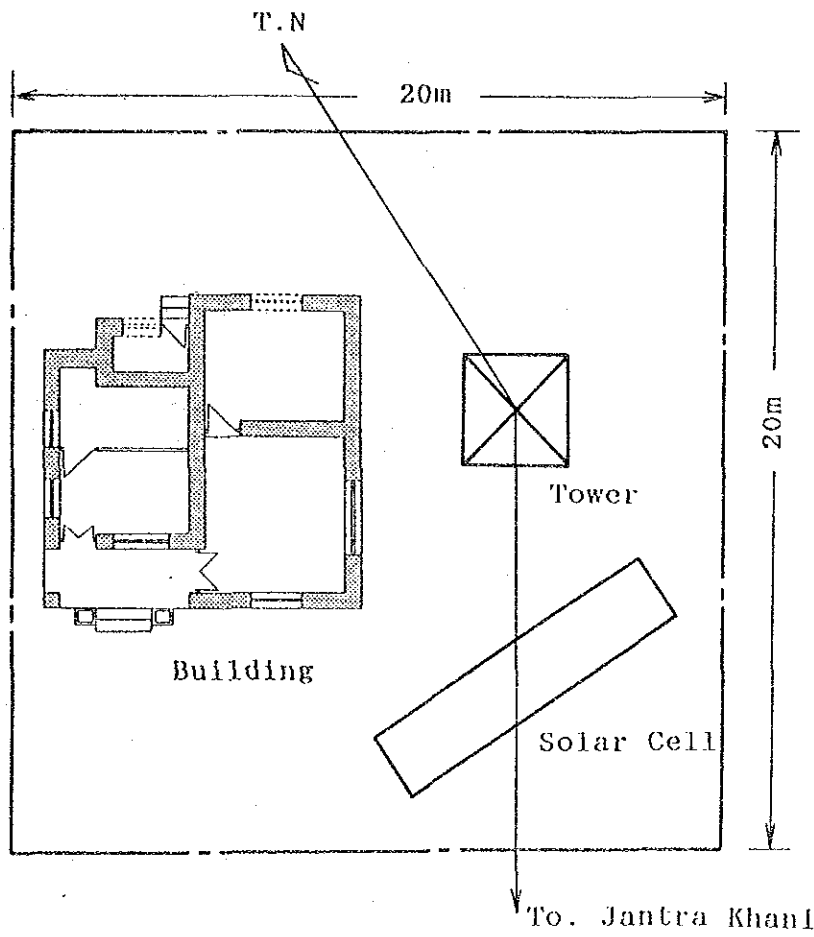
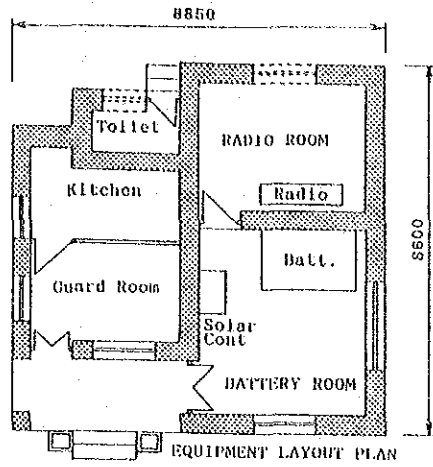
SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN

SITE NAME	KABRE
SCALE :	FIGURE-2-17 (17/23)
UNIT :	



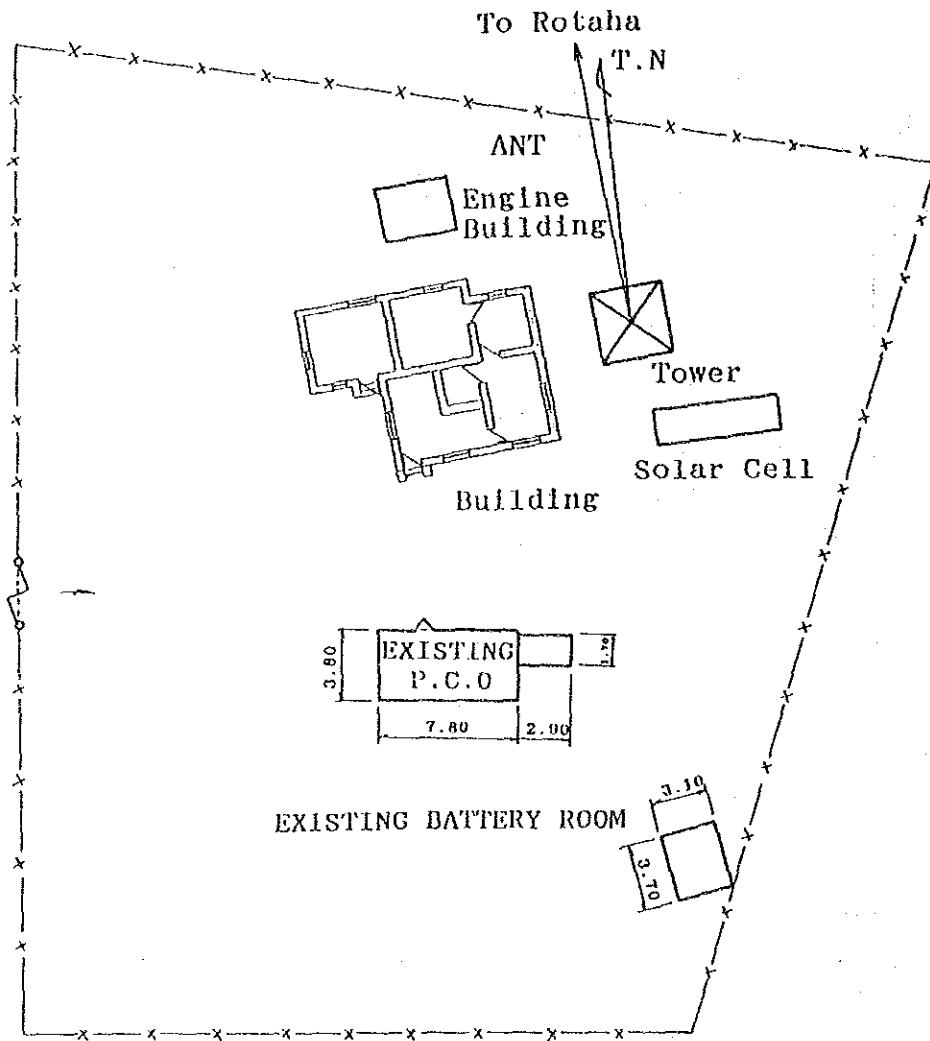
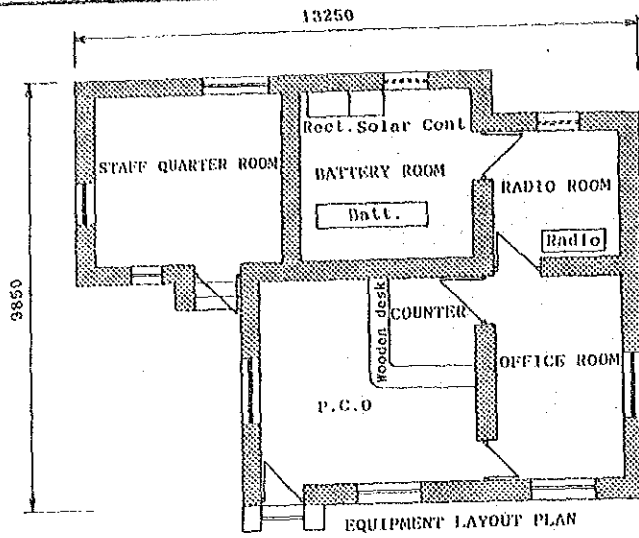
SITE LAYOUT PLAN (1/200)

SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	JANTRA KHANI
SCALE : -	FIGURE-2-18 (18/23)
UNIT : m	



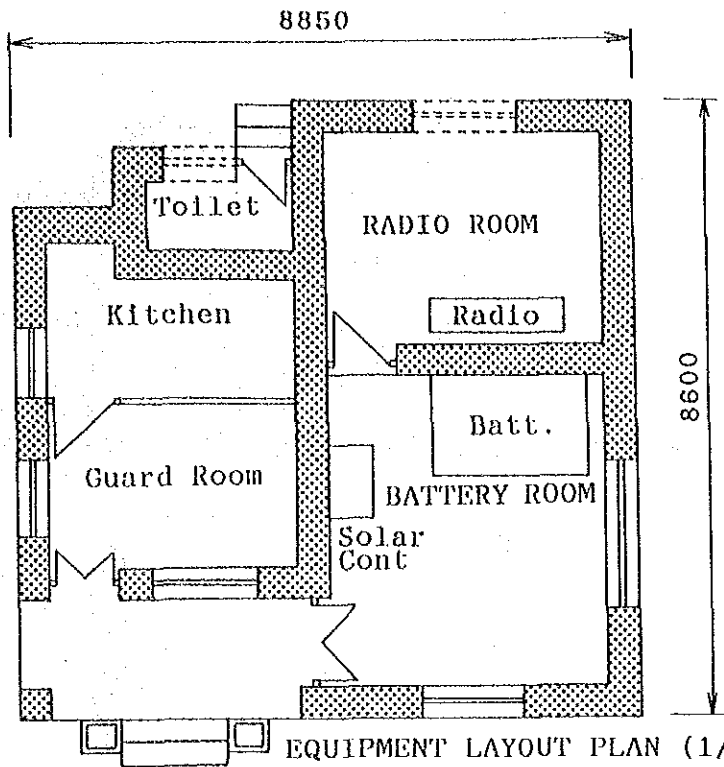
SITE LAYOUT PLAN (1/200)

SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	SALLERI
SCALE :	FIGURE-2-19 (19/23)
UNIT :	

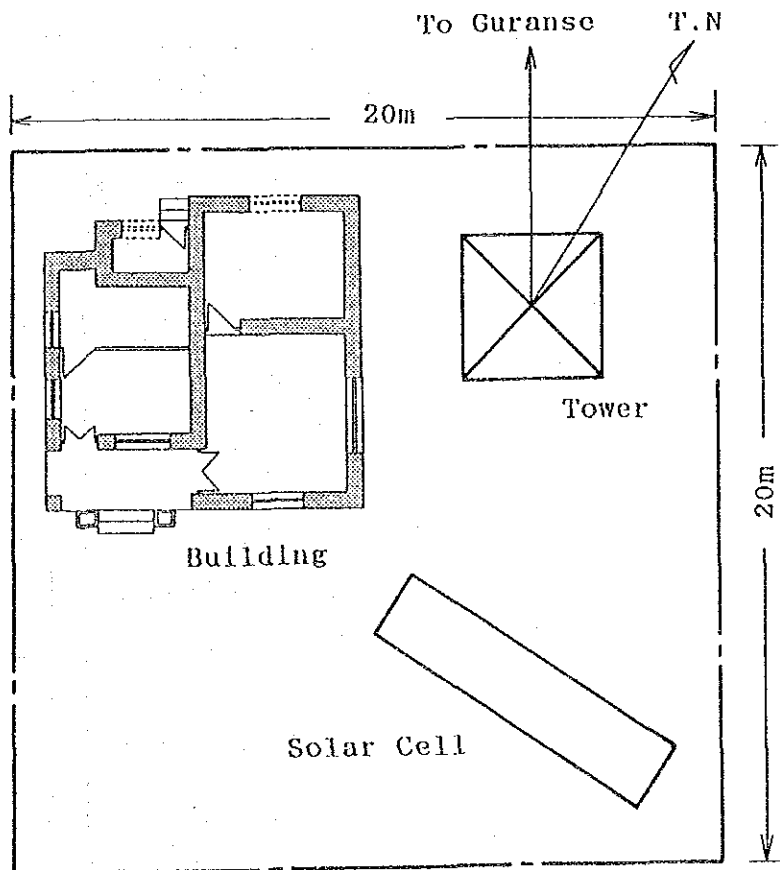


SITE LAYOUT PLAN (1/400)

SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	GAIGHAT
SCALE :	FIGURE-2-20 (20/23)
UNIT :	



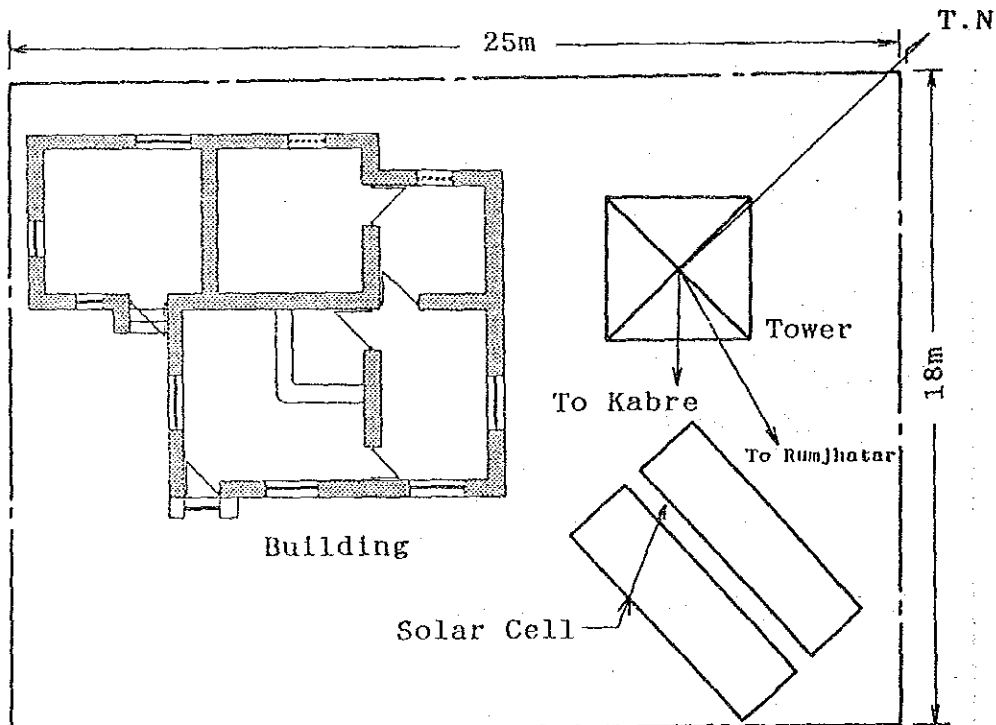
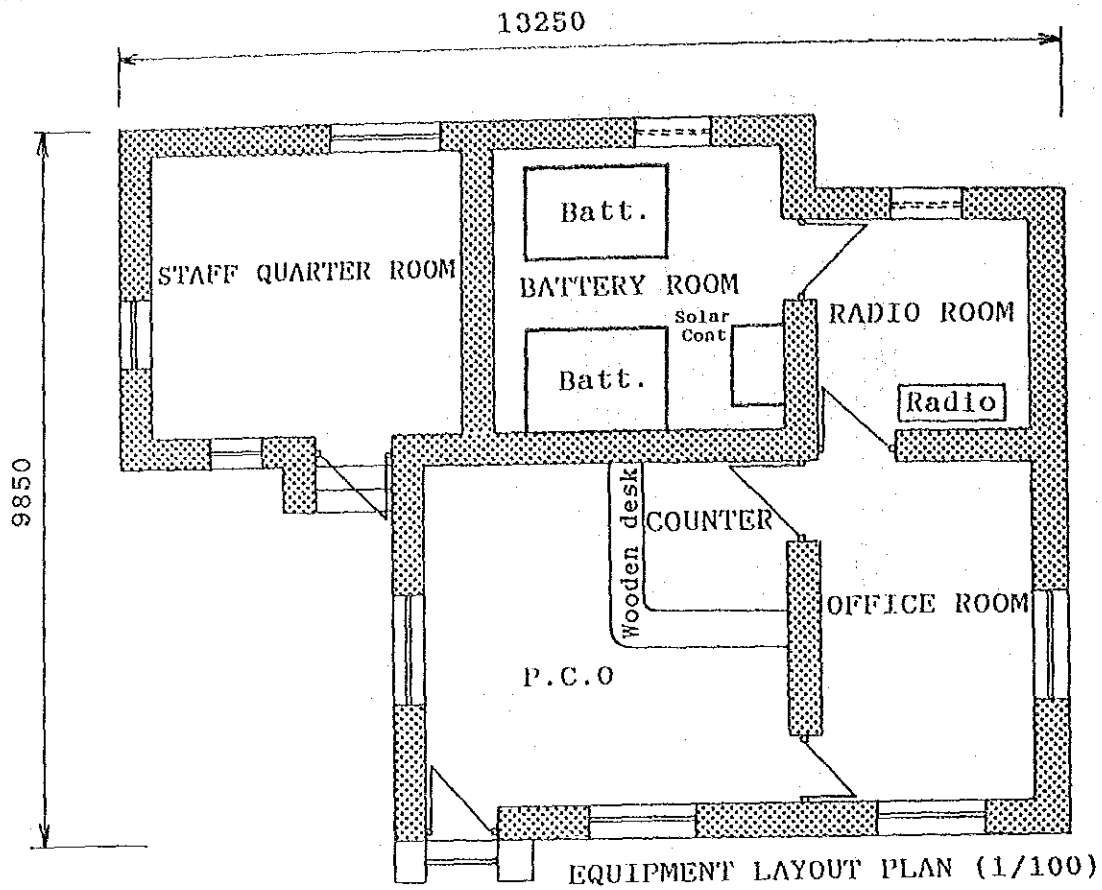
EQUIPMENT LAYOUT PLAN (1/100)



SITE LAYOUT PLAN (1/200)

SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN

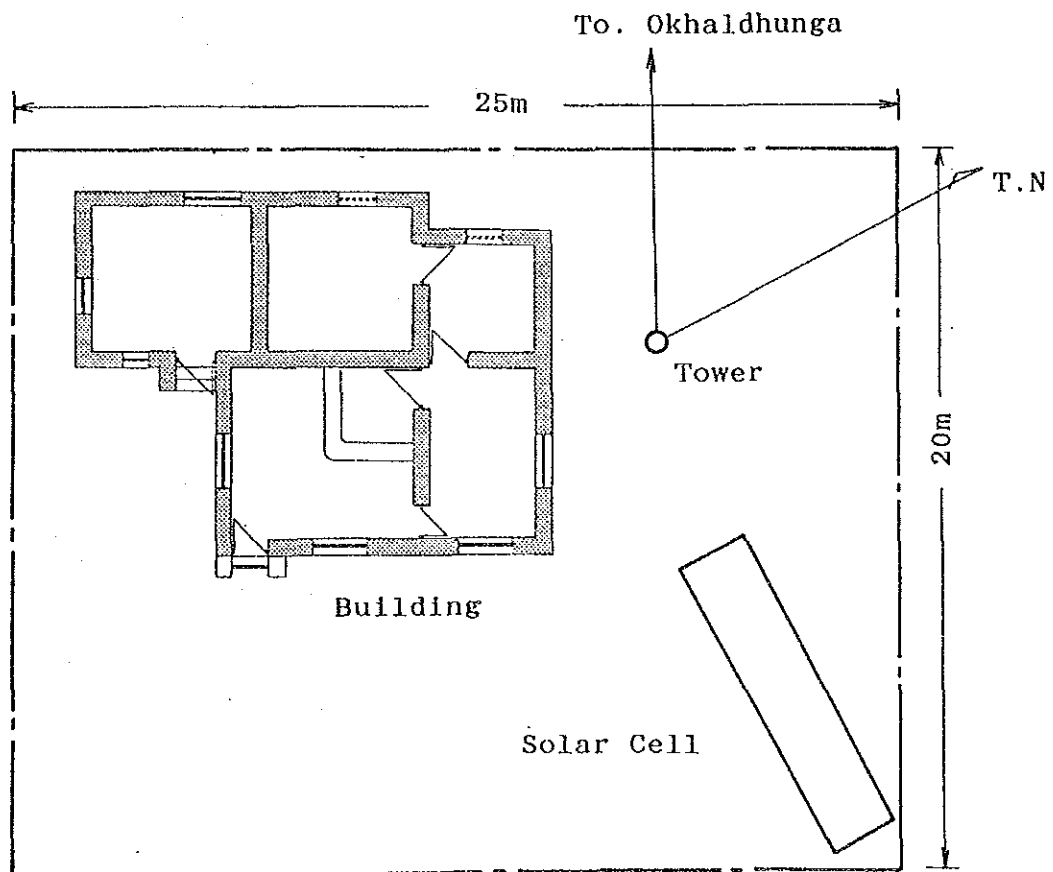
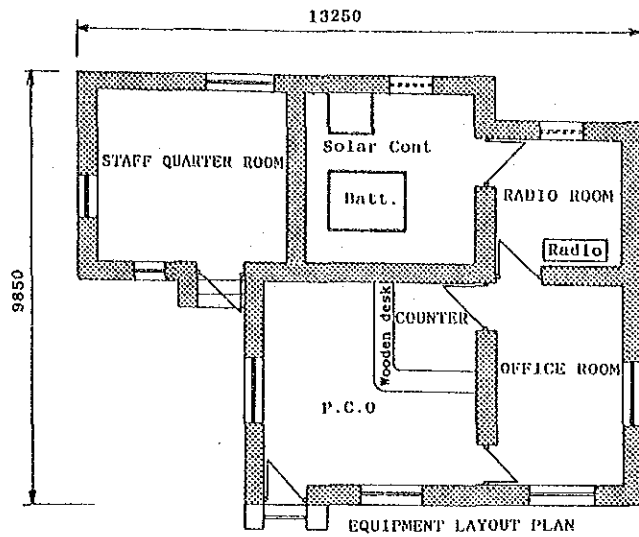
SITE NAME	DIKTEL
SCALE : -	FIGURE-2-21 (21/23)
UNIT :	



SITE LAYOUT PLAN (1/200)

SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN

SITE NAME	OKHALDHUNGA
SCALE : -	FIGURE-2-22 (22/23)
UNIT :	

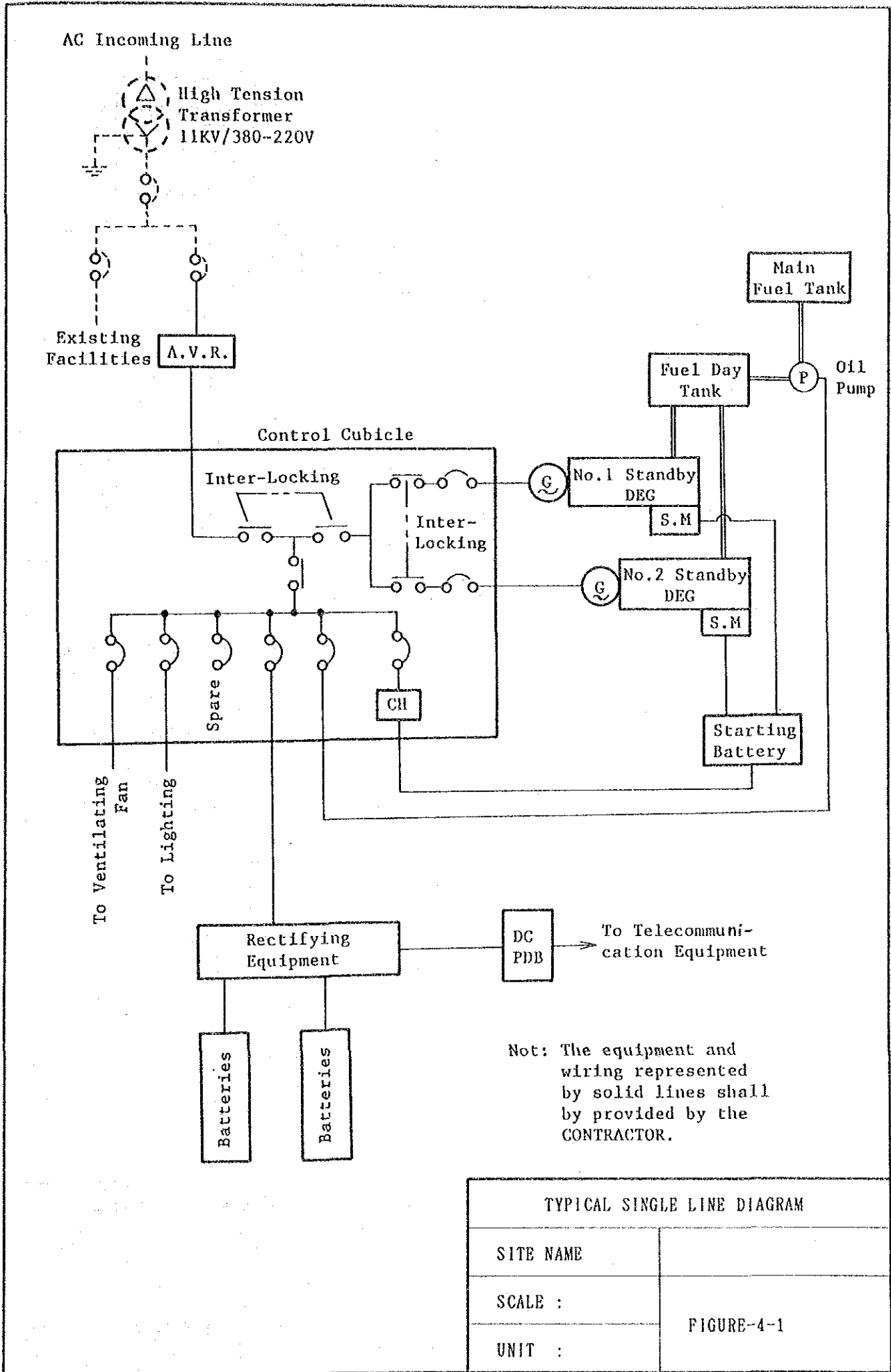


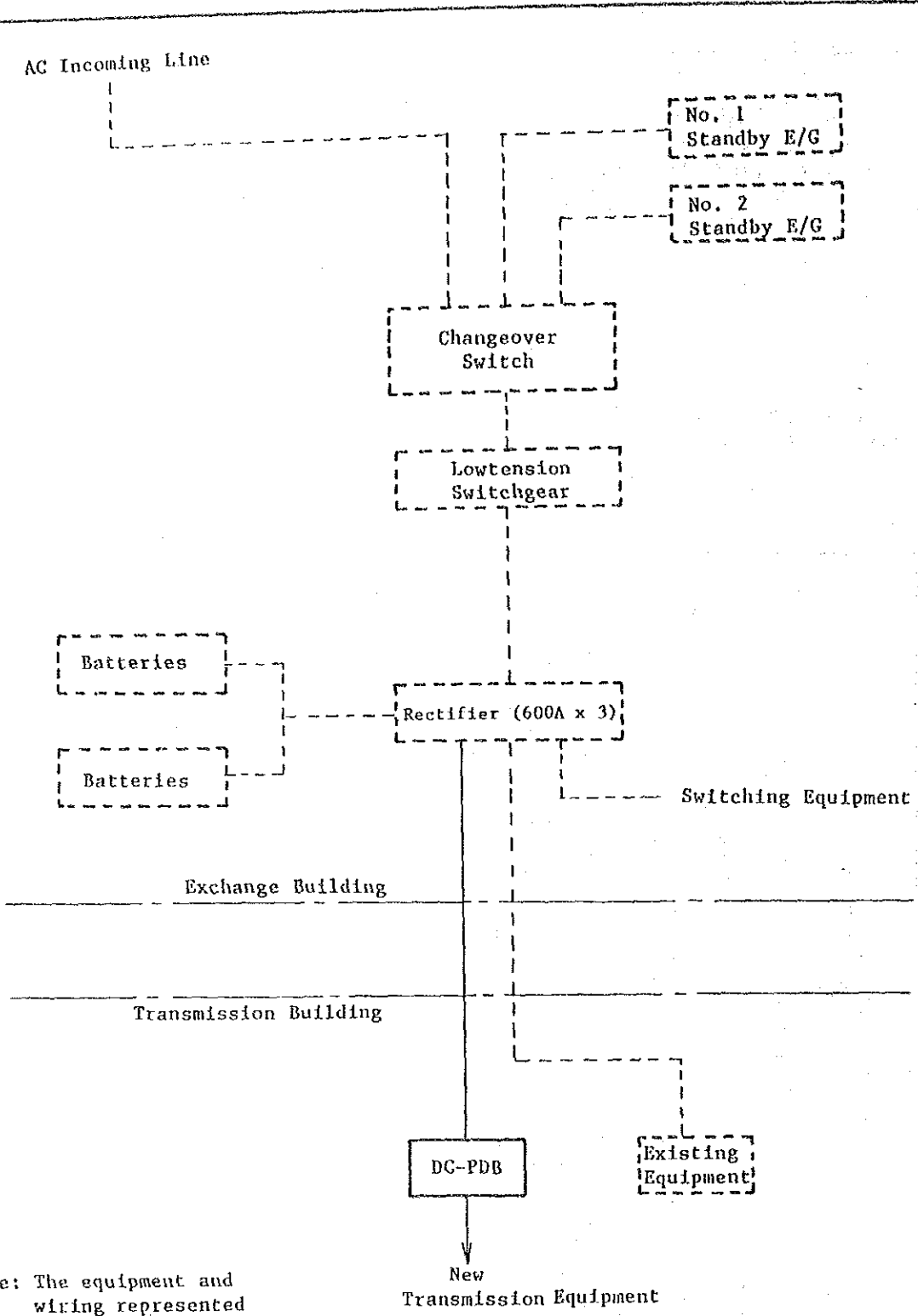
SITE LAYOUT PLAN (1/200)

SITE LAYOUT PLAN AND EQUIPMENT LAYOUT PLAN	
SITE NAME	RUMJHATAR
SCALE : -	FIGURE-2-23 (23/23)
UNIT :	

BASIC DESIGN - 3

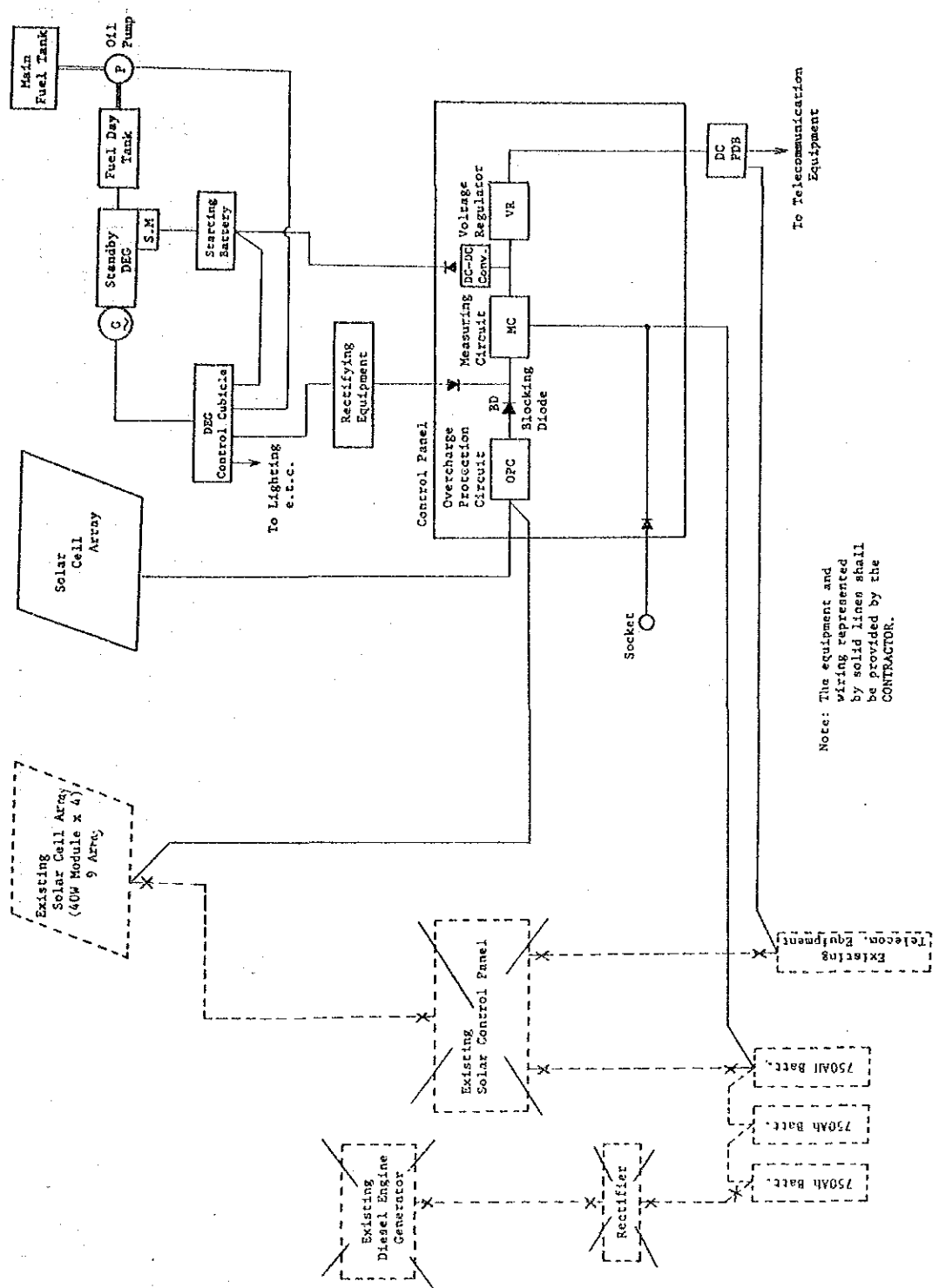
SINGLE LINE DIAGRAM FOR POWER SUPPLY SYSTEM





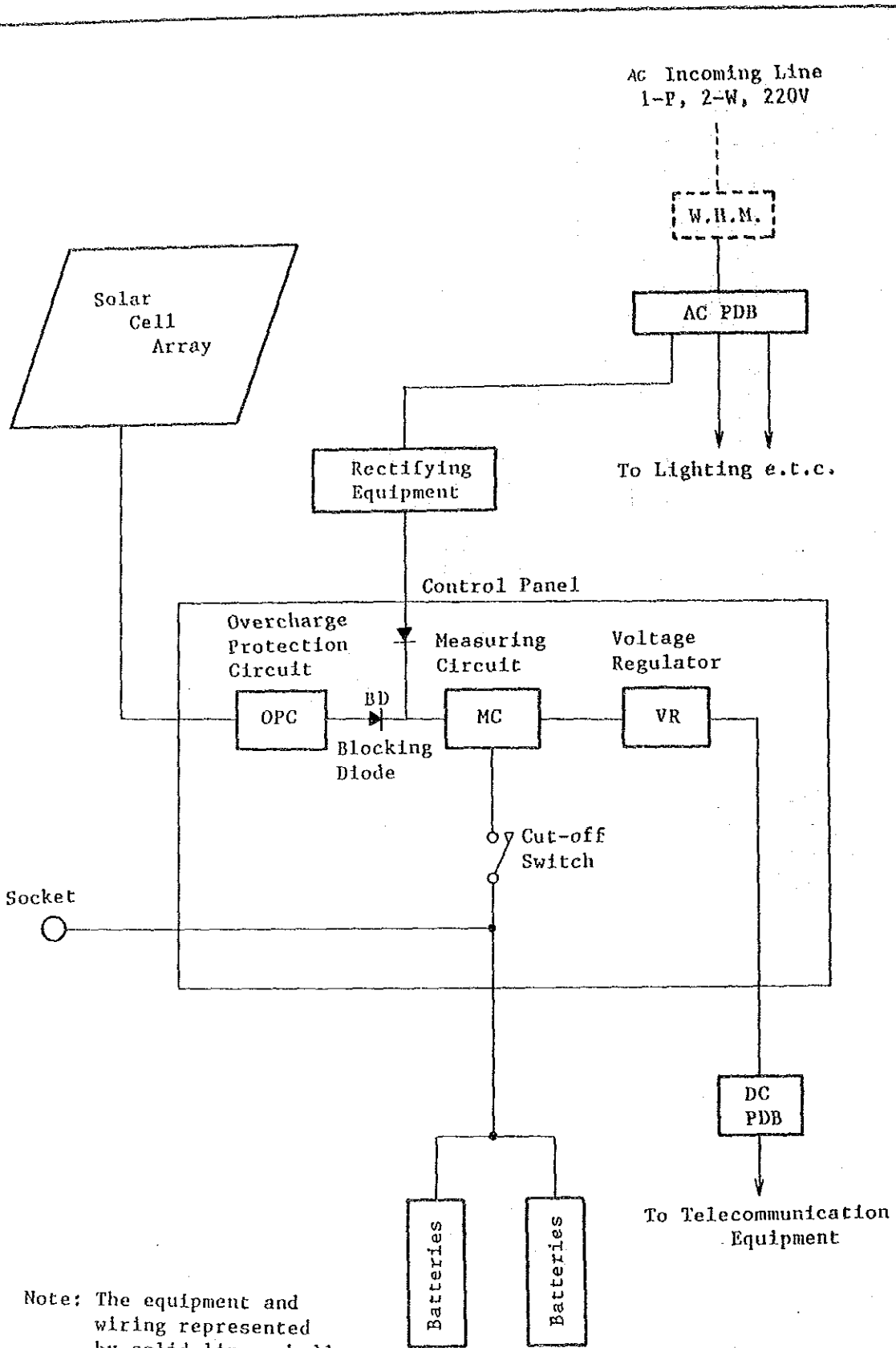
Note: The equipment and wiring represented by solid lines shall be provided by the CONTRACTOR.

TYPICAL SINGLE LINE DIAGRAM	
SITE NAME	
SCALE :	FIGURE-4-2
UNIT :	



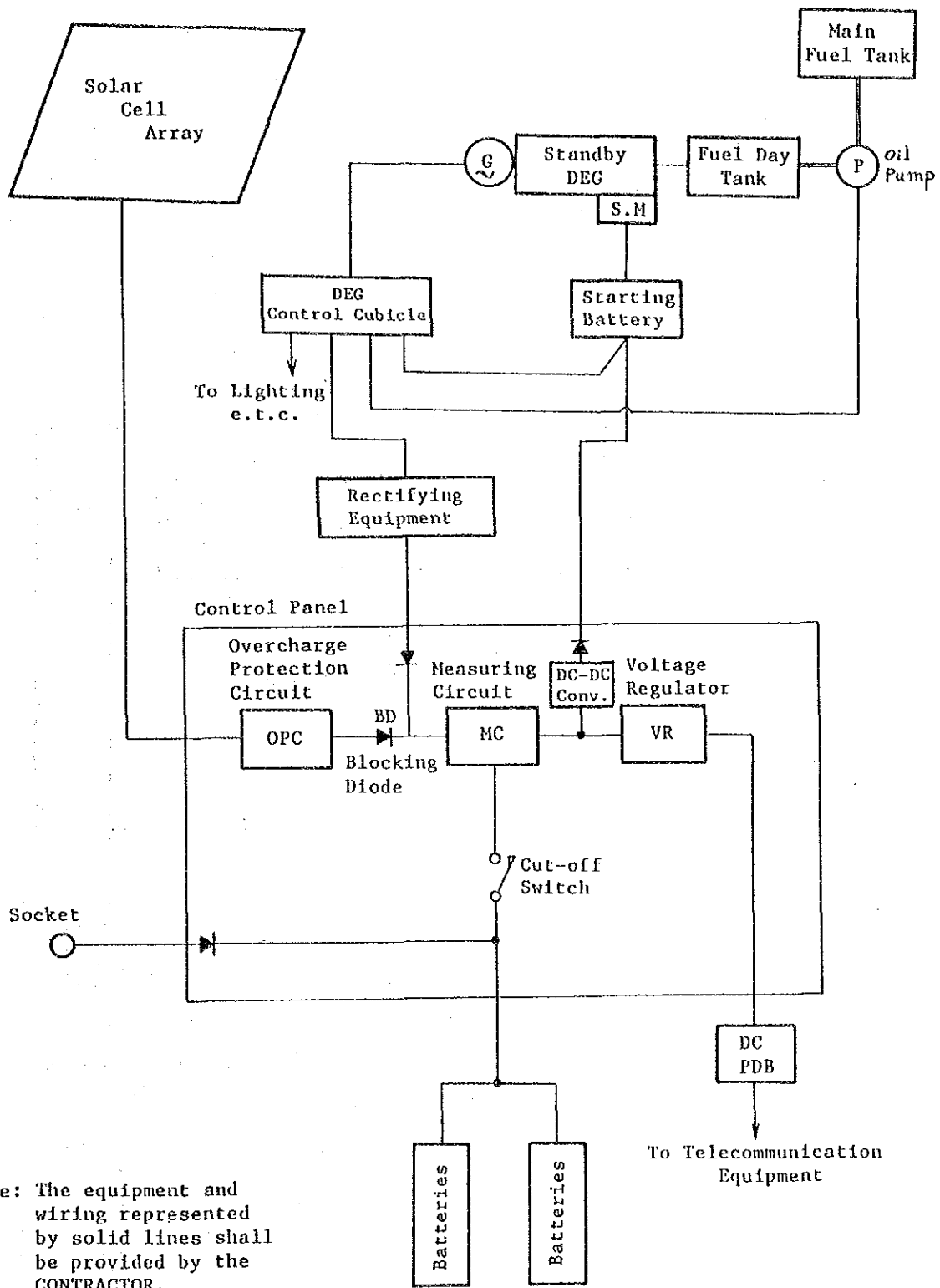
Note: The equipment and wiring represented by solid lines shall be provided by the CONTRACTOR.

TYPICAL SINGLE LINE DIAGRAM	
SITE NAME	
SCALE :	FIGURE-4-3
UNIT :	



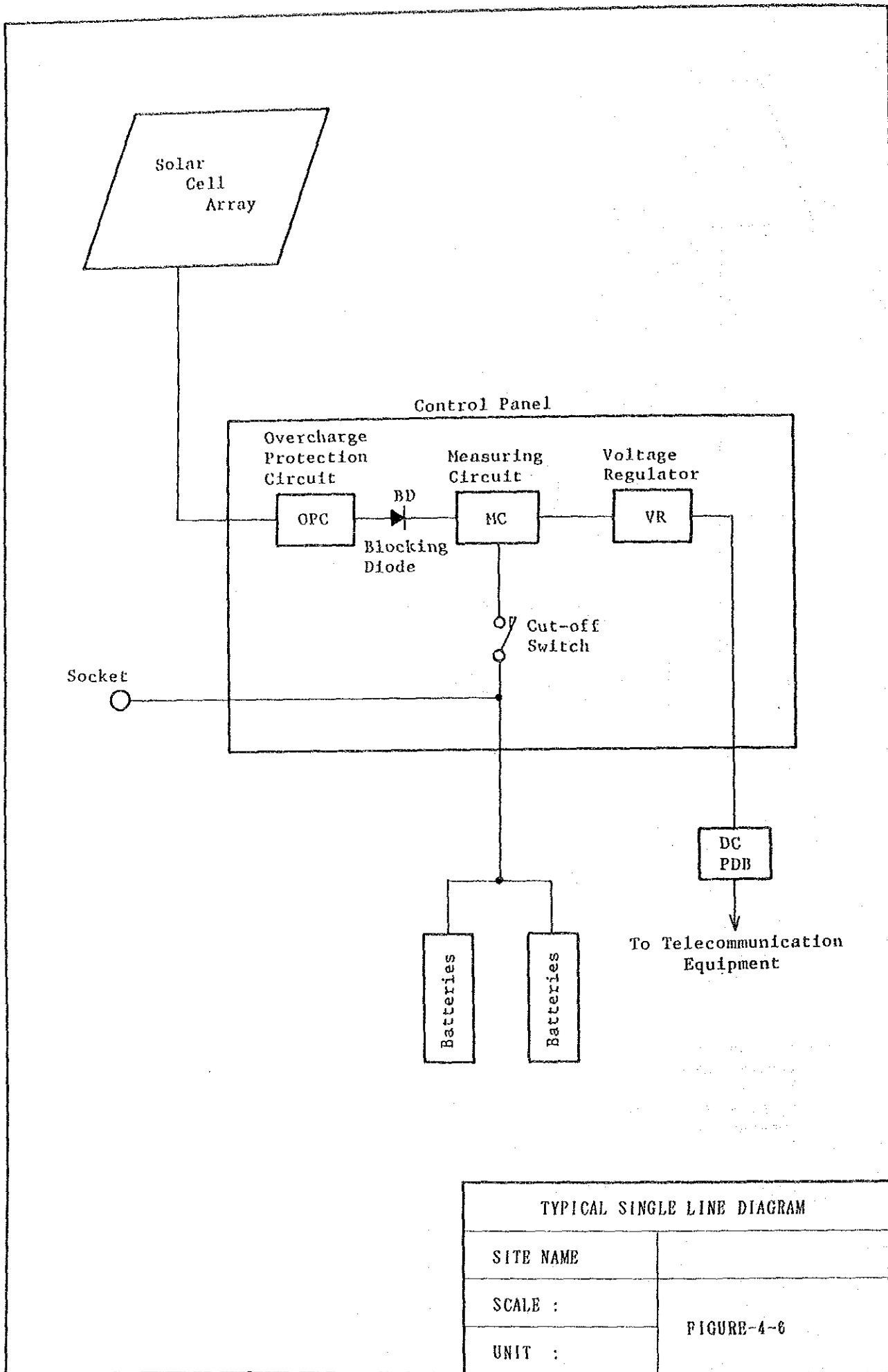
Note: The equipment and wiring represented by solid lines shall be provided by the CONTRACTOR.

TYPICAL SINGLE LINE DIAGRAM	
SITE NAME	
SCALE :	FIGURE-4-4
UNIT :	



Note: The equipment and wiring represented by solid lines shall be provided by the CONTRACTOR.

TYPICAL SINGLE LINE DIAGRAM	
SITE NAME	
SCALE :	FIGURE-4-5
UNIT :	



TYPICAL SINGLE LINE DIAGRAM	
SITE NAME	
SCALE :	FIGURE-4-6
UNIT :	

BASIC DESIGN - 4

COORDINATES AND GROUND ELEVATION

Coordinates and Ground Elevation (02 Area)

Site Name	Ab.	Coordinates		Ground Elevation(m)
		Longitude	Latitude	
AITABARE	ATB	88° 01' 58"E	26° 53' 04"N	1737.4
SILAUTE	SLT	87° 47' 24"E	27° 04' 07"N	2712.0
TAPLEJUNG	TPJ	87° 40' 18"E	27° 21' 10"N	1921.0
PHIDIM	PDM	87° 45' 45"E	27° 08' 01"N	1372.0
BHADRAPUR	BDR	88° 05' 25"E	26° 32' 19"N	118.0
BIRATNAGAR	BRT	87° 17' 19"E	26° 27' 45"N	70.0
MUREBAS	MRB	87° 30' 07"E	26° 52' 20"N	1891.0
GHAMPETOLE	GPL	87° 17' 05"E	26° 59' 42"N	1768.0
RAMCHE	RMC	87° 16' 00"E	27° 03' 42"N	1829.0
CHAINPUR	CPR	87° 18' 57"E	27° 17' 26"N	1266.0
KHANDBARI	KDB	87° 12' 36"E	27° 22' 16"N	1067.0
BHOJPUR	BJP	87° 03' 12"E	27° 10' 15"N	1585.0
TERHATHUM	THM	87° 32' 20"E	27° 07' 28"N	1645.0

Coordinates and Ground Elevation (03 Area)

Site Name	Ab.	Coordinates		Ground Elevation(m)
		Longitude	Latitude	
RAJBIRAJ	RJB	86° 45' 09"E	26° 32' 44"N	82.0
ROTAHA	RTH	86° 41' 28"E	26° 55' 48"N	1947.0
GURANSE	GRS	86° 46' 35"E	27° 14' 27"N	2196.0
KABRE	KBR	86° 39' 42"E	27° 12' 18"N	1798.0
JANTRA KHANI	JTK	86° 32' 29"E	27° 23' 17"N	3063.0
SALLERI	SLR	86° 35' 36"E	27° 30' 13"N	2469.0
GAIGHAT	GHT	86° 42' 04"E	26° 48' 15"N	192.0
DIKTEL	DIK	86° 47' 59"E	27° 12' 59"N	1539.0
OKHALDHUNGA	ODG	86° 30' 34"E	27° 19' 18"N	1798.0
RUMJHATAR	RJH	86° 32' 45"E	27° 18' 12"N	1387.0