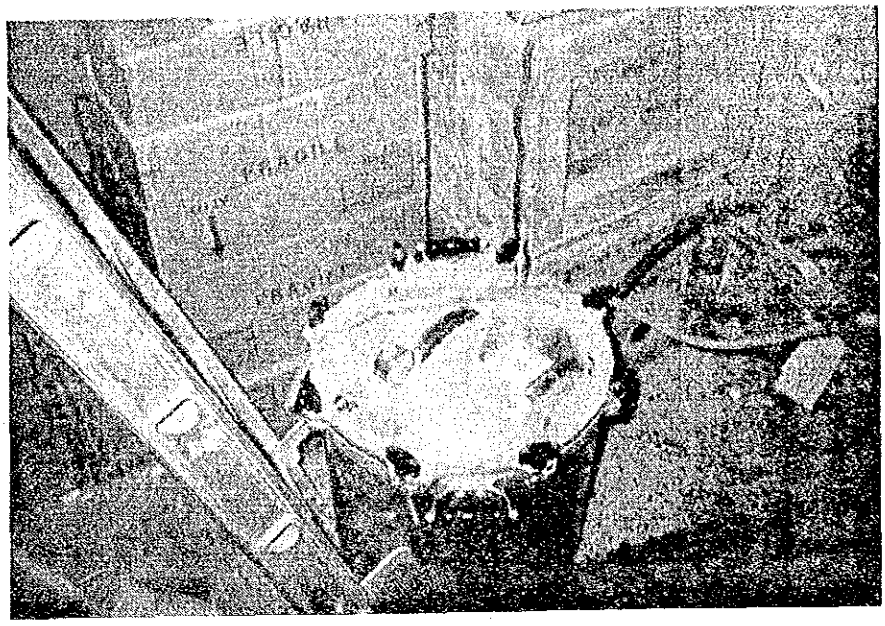
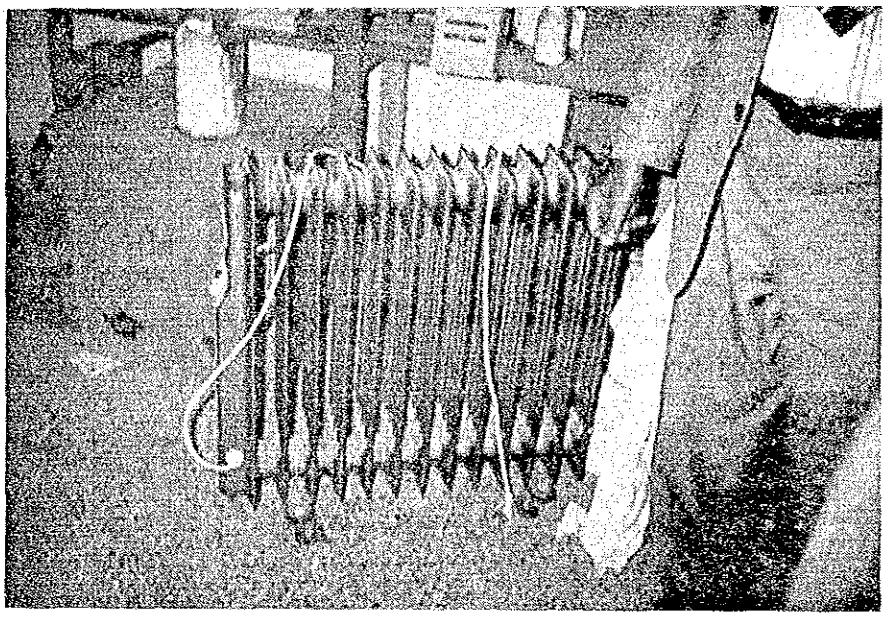
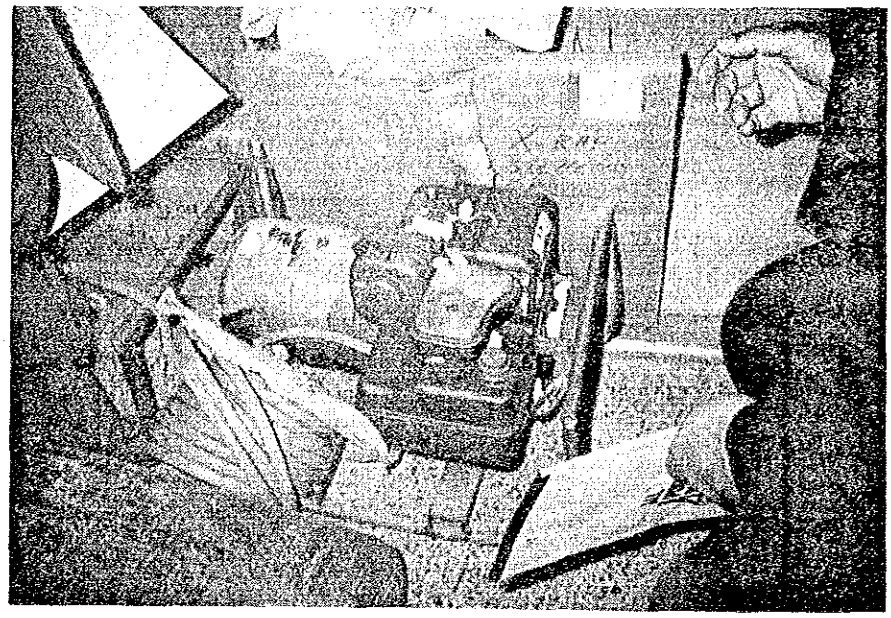
Autoclave



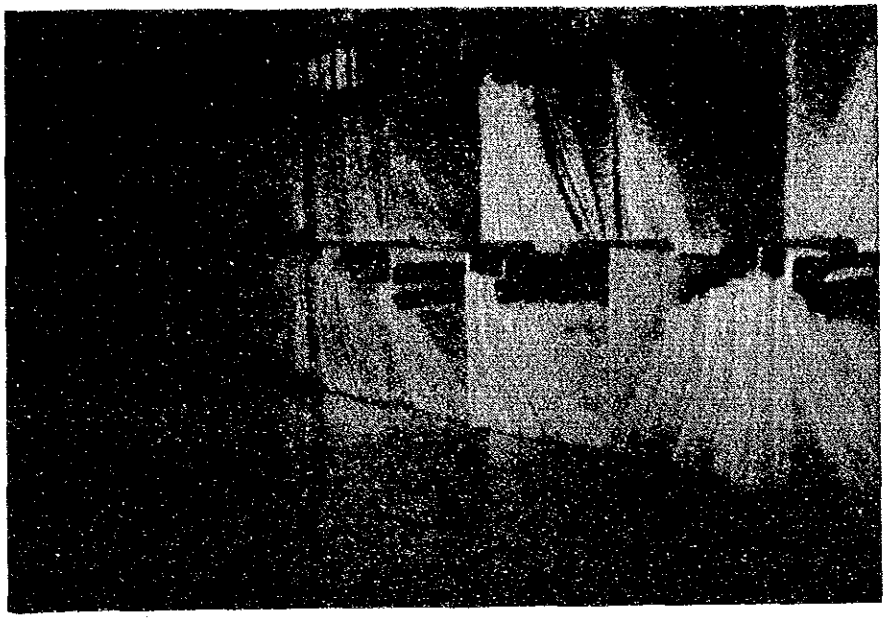
Oil Heater



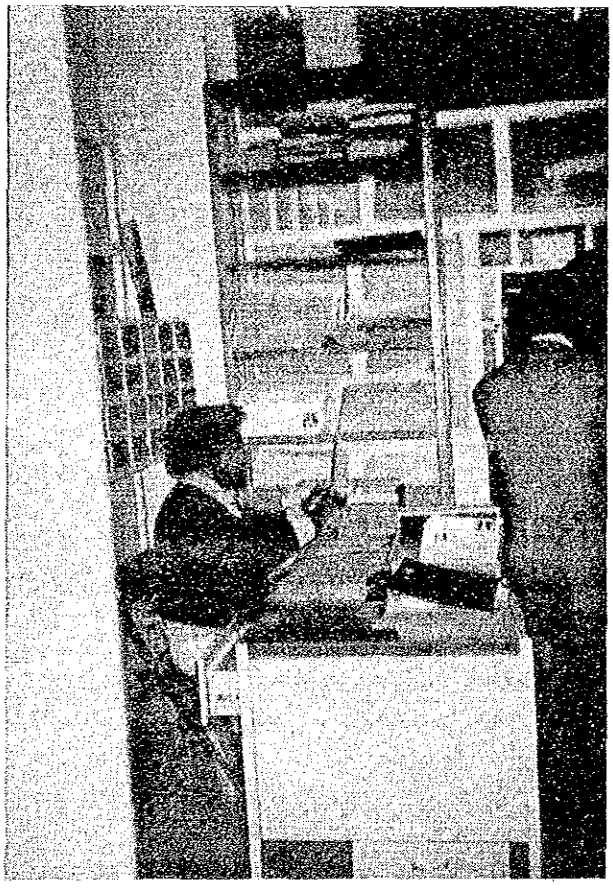
Generator



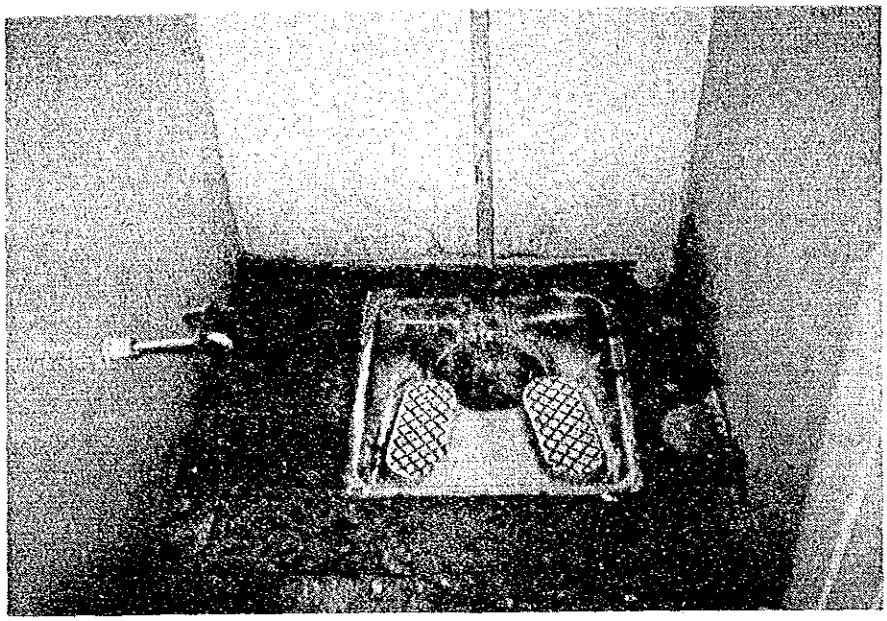
Card Files



Receiption and Card File Room



Water Closet



Maintenance Pit

② Tuberculosis Control Centres at Al-Hodeidah and Ta'iz

Within the institutional control system, a jurisdictional difference exists between the Sana'a Tuberculosis Control Centre and the centres at Al-Hodeidah and Ta'iz; i.e. the Sana'a Centre is controled by the Central Government while the others belong to the Department of Health in each Governorate, and their operating budgets are borne by the respective Governorates as well.

Although, the Central Government's supervisory actions to the activities of the centres at Al-Hodeidah and Ta'iz are performed through the administrative guidance by the Minister of Health and the Under-Secretary, the actual management of these centres seem to be carried out by the direction of each Department in the Governorate.

As shown in the Fig. 3 and 4, the Tuberculosis Control Centres at both Al-Hodeidah and Ta'iz are both single storied buildings with total floor areas of 180 m^2 and 140 m^2 respectively; and the building of the Ta'iz Tuberculosis Control Centre is a residential building of which the Centre is using under a lease.

The internal relationship of activities, the physical space and the traffic flow are not suitable in both centres as the appropriate medical facilities. In addition, both the buildings and the mechanical equipments are becoming obsolete.

The personnel distribution at these two centres are given in the Table 12, but in both cases, the numbers of staff lack the quorum.

The Tuberculosis Control Centre at Al-Hodeidah is run with rather irregular personnel affairs by a Sudanese doctor and a Yemeni male nurse holding a concurrent post of the director. In the case of Ta'iz, as one of the two doctors holds the post of the director, he is in the circumstances to handle with both clinical and managemental works.

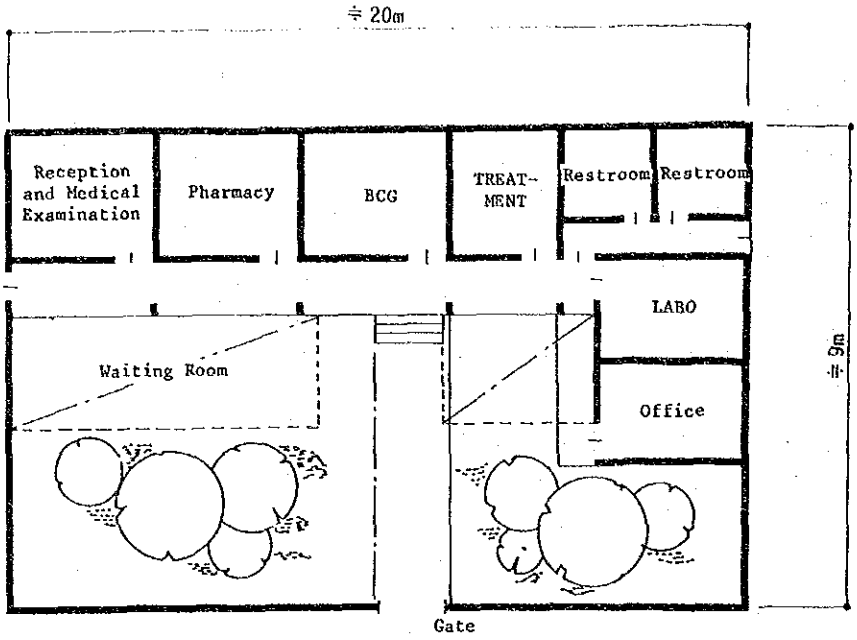
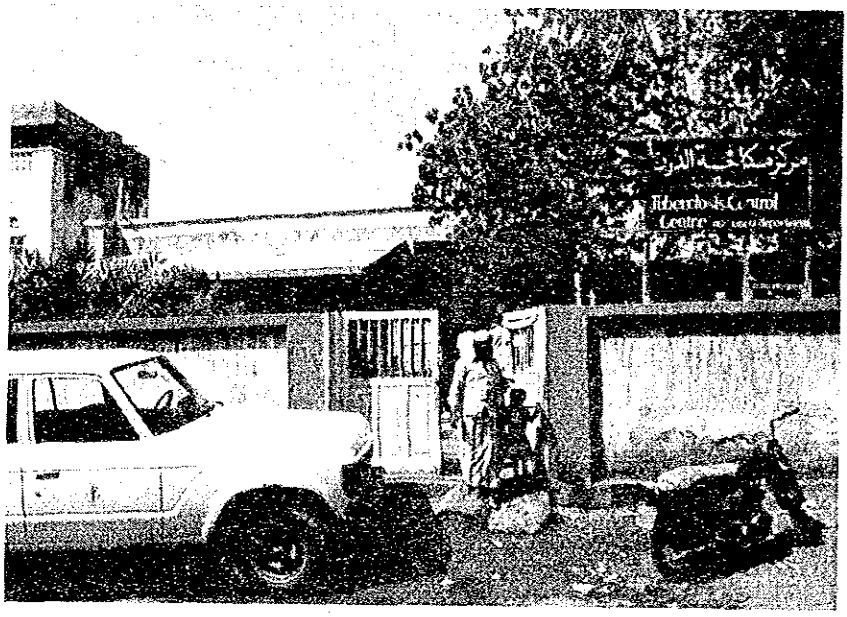


Fig. 3 Existing plan of Al-Hodeidah Tuberculosis Control Centre



Al-Hodeidah Tuberculosis Control Centre (Existing)

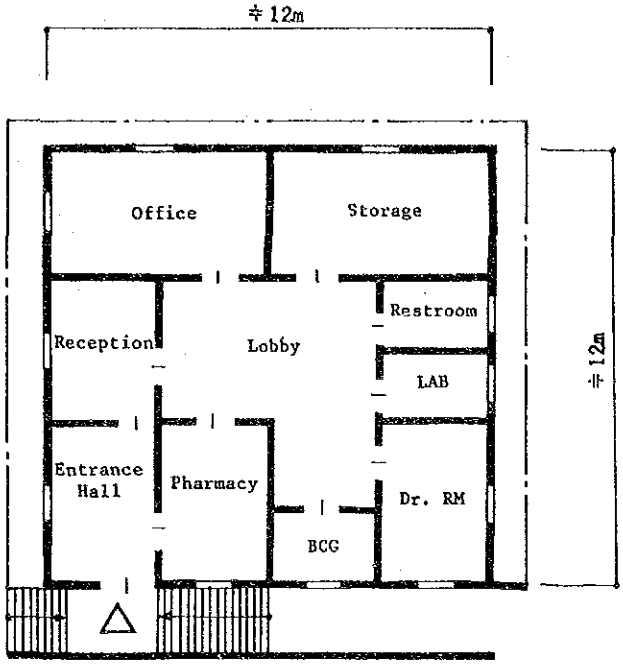
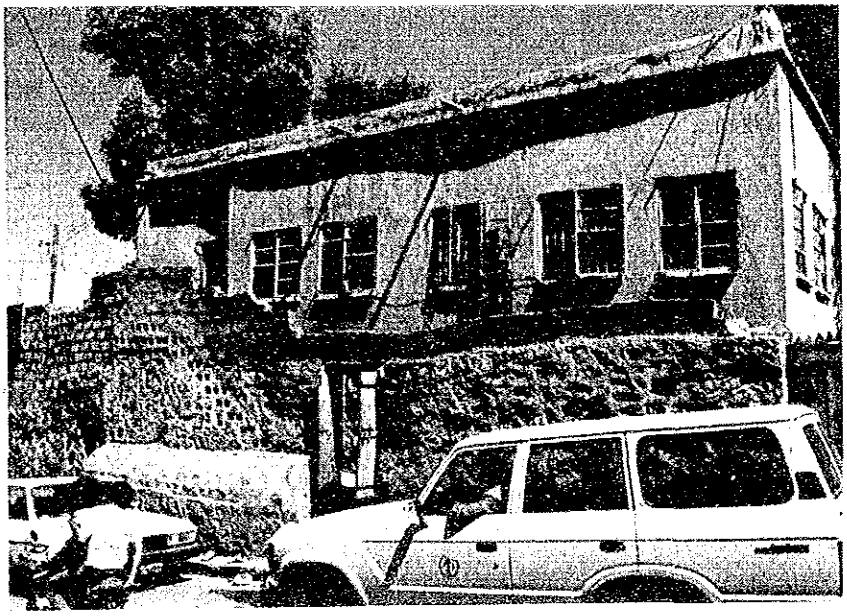


Fig. 4 Exisitng plan of Ta'iz Tuberculosis Control Centre



Ta'iz Tuberculosis Control Centre (Existing)

Table 12 The existing personnel allocation of Tuberculosis Control Centres at Al-Hodeidah and Ta'iz

Classification	Al-Hodeidah	Ta'iz	Specified Number
	Present No.	Present No.	
1. Doctor	1	2	2
2. Public Health Advisor	-	-	-
3. X-Ray Technician	-	-	1
4. Assistant X-Ray Technician	1	-	1
5. Laboratory Technician	1	1	1
6. Assistant Laboratory Technician	-	-	1
7. Medical Assistant	0	-	1
8. Nurse	2	2	1
9. Pharmacist	-	-	-
10. Assistant Pharmacist	-	-	1
11. BCG Vaccinator	0	0	1
12. Assistant Statistician	-	1	1
13. Office Clerk	-	1	2
14. Driver	-	1	1
15. Assistant	1	2	2
16. Guard	1	2	1
17. Janitor	3	4	-
Total	9	16	17

Under these conditions, with limited personnel and inadequate scale of facilities, these Centres are examining and treating on an average of about 50 outpatients daily, so that full measures cannot be undertaken.

The outpatients coming to these branches are not only residents of Al-Hodeidah and Ta'iz but also include those from the neighboring Governorates, and at Al-Hodeidah, the existing conditions are such that the patients from remote districts are forced to spend the night in the inner yard of which is by no means provided with lodging facilities.

Consequently, at both branches, not only is the training of medical personnel and primary health workers for tuberculosis control impossible but, the compiling of reports on diagnoses and treatment, and the collection of epidemiological data, which they are obligated to submit to the Sana'a Tuberculosis Control Centre, not carried out due to a lack of personnel.

As for medical equipment, there is no comparison with those at Sana'a, and at Ta'iz, there are no X-Ray equipment, operating under a system in which the patients themselves bring in photographs taken by private X-Ray photographing services.

Both branches depend entirely on the Sana'a Tuberculosis Control Centre for their medical and office supplies, etc.

The present medical situation in the YAR for fighting the tuberculosis disease (expressing it mildly) is grim. The realization of the following items is strongly recommended in order to implement a tuberculosis control system covering the entire country.

a. The early establishment of a powerful tuberculosis control headquarters capable of carrying out, on a countrywide level, developing an actual tuberculosis control plan, training of personnel, supervision of activities and coordination with related mediums.

b. A working system for a National Tuberculosis Control Programme through the establishment of several branches which can coordinate their activities with those of the control headquarters to expand the programme systematically.

c. These branches will engage in the training of personnel for tuberculosis treatment and at the same time, exercise a tuberculosis control system which will function by working in conjunction with the Centre, by guiding and supervising the peripheral medical mediums such as BHS/PHC which have already been established by NHP (National Health Programme) as previously mentioned.

The basic policy of the project proposed is naturally aimed at the materialization of these factors, and in the following chapters, detailed studies will help to clearly define the considerations being made.

2-7 Relations with Japanese Technical Cooperation

In order to implement the Tuberculosis Control Programme under conditions as explained in the preceeding chapters, the Government of the YAR has repeatedly asked Japan for guidance and suggestions on the control of tuberculosis in which Japan has made remarkable success. In response, the Japanese Government made preliminary investigations on tuberculosis control measures in February 1979, advanced preliminary investigations in July 1982, and investigations for prior consultation on implementation in April 1983. Also, since 1980, through the support of the Japan International Cooperation Agency, four Yemeni doctors and two technicians were accepted as trainees at the International Training Course for Tuberculosis (held jointly by JICA and WHO)and at the Course for Laboratory Technician (held by JICA), both at The Research Institute of Tuberculosis, Japan Anti-Tuberculosis Association. Furthermore, Japan's technical cooperation with the YAR has started in September 1983 when Dr. Kuniyoshi Azuma was dispatched to Sana'a T.B Control Centre as a tuberculosis specialist. The objectives of the technical cooperation are as follows:

a. To improve of the system for the tuberculosis control in the YAR.

b. To develop techniques connected with the control, diagnosis and medical care of tuberculosis at the National Tuberculosis Control

and Training Centre at Sana'a and at the Tuberculosis Centre(s) in the other districts.

c. To conduct surveys and experiments for improving the National Tuberculosis Control Programme.

d. To proffer advice and guidance to their counterparts in the YAR.

2-8 Contents of the Request for this Project

In November 1983, in addition to the technical cooperation, which is in operation, the Government of the YAR sent the request for the Japanese Government's grant aid to expand the Sana'a Tuberculosis Centre and its Branches for improving the tuberculosis control programmes of the country. Concrete details of the request are as follows:

① Buildings

a.	Main Centre:	Sana'a City
b.	Branches:	Al-Hodeidah City, Ta'iz City

② Medical Equipments

Medical equipments required for related activities in diagnosis, treatment and prevention of tuberculosis.

In response to this request, the Government of Japan conducted preliminary design studies on the expansion plan for the YAR's Tuberculosis Centre. The result of the site investigation held in conjunction with meetings with the Government authorities of the YAR, the following items represent the most critical needs of the project.

Confirmed Items:

a. The construction of three tuberculosis centres; Sana'a Centre, Al-Hodeidah Branch and Ta'iz Branch.

b. The provision of medical equipments to the above three facilities.

The objectives are to expand and to strengthen the activities of the National Tuberculosis Centre of the YAR through the construction of these facilities and the supply of medical supplies and equipments.

Chapter 3: THE CONSTRUCTION OF THE CENTRES

CHAPTER 3: THE CONSTRUCTION OF THE CENTRES

3-1 Objectives · Details

The primary goal of this project is to construct new tuberculosis centres in Sana'a, Al-Hodeidah and Ta'iz in order to expand the YAR's tuberculosis control activities.

The centres' aim is not only to concentrate their clinical services for the out-patients but also to establish a nation-wide network system for eliminating the problems created from the tuberculosis, and they are expected to maintain the proper indentity as Centres for tuberculosis control by establishing and implementing programmes with separate and independent administrative and organizational structures in regards to the existing public medical/clinical organizations.

The common activities of each centre are:

a) to concentrate primarily on patient diagnosis and treatment in the respective districts they will serve;

b) to provide "in-house" training of medical staff from the hospitals, health centres etc.; and

c) to supervise the peripheral medical facilities for their administrative and service activities through mobile units.

In addition to the provision of training for staff at the centres and supervision/consultation to the Branches in Al-Hodeidah and Ta'iz, the Sana'a Headquarters will carry out the planning of programmes for tuberculosis control and conduct the specialized research work in bacteriology.

The Branches will provide training for staff from tuberculosis-related medical organizations in their subjected governorates, and supervise their various medical and treatment services. Also, the Branches will

be obliged to submit to the Headquarters data concerned with patients and their activities collected through the peripheral health/clinical facilities.

By establishing a network system for tuberculosis control, followings can be expected:

a) wider scope in the areas in tuberculosis for both the medical peronnel and patients in the districts;

b) increase in the outreach and detection of potential patients and decrease their drop-out rate;

c) up-grade the level of medical treatment and care; and

d) generate progress in the systematic studies on epidemiology.

From these points of view, the construction of the new Tuberculosis Centres based on this project will become an indispensable enterprise for the YAR to consolidate the institutional framework for the tuberculosis control and to improve the operational aspects of the control activities.

There were discussions concerning hospitalization between the JICA project team and the YAR's concerned authorities, and the results of these are as follows:

a). the construction of a hospital as an annex to the headquarters,

b). the construction of an independent hospital,

c). the construction of a ward for tuberculosis patients in existing general hospitals (eg., similiar to the ward for tuberculosis patients within the Republican Hospital in Ta'iz).

To further explain the above points, a). runs counter-against to the purpose of establishing a tuberculosis centre, and poses the risk of detracting the energy required for the important functions of the Centre in educating and supervising, b). difficulties will be encountered in securing the required personnel and coupled with the fact that the main method of treatment of tuberculosis partients today lies more in the treatment of out-patients than in hospitalization, and was determined that no hospitalization facilities for tuberculosis patients will be constructed in any form, to which the YAR representative also agreed. On c)., it is a fact that the number of wards for tuberculosis patients throughout the country are insufficient (beds for emergency cases of tuberculosis patients in particular) and although this deficiency was recognized, the conclusion was made that, as at the present time, the establishment of a nation-wide network to strengthen the peripheral health services, and the expansion of out-patient treatment facilities of the Tuberculosis Centres should be given priority. Agreement was also received on this matter from the YAR representative.

Therefore, in this Project, the planning will be towards the establishment of centres without beds of their own, i,e., they will devote their activities exclusively towards their original function for tuberculosis control.

3-2 Objectives of the Plan

(1) Conception of the Plan

According to the Second Five-Year Plan, the new Tuberculosis Centres were to include (Sadah, Hajjah, Ibb, and Dhamar), in addition to the proposed centres (Sana'a, Al-Hodeidah, and Ta'iz) by 1986, the idea of beginning with seven new tuberculosis centres. However, for the present time, other governorates without a centre (Sadah, Hajjah, Ibb, Dhamar, Ma'arib, Al-Jawf, Mahweet, Beidah) are controlled by the three proposed tuberculosis facilities. In developing this plan the nation's T.B. Control System will be a more organized structured entity.

1) Sana'a Tuberculosis Centre (Headquarters)

The Sana'a Headquarters will serve the four governorates, Sana'a, Sa'adah, Ma-Arib, and Al-Jawf, and research on tuberculosis control, consultation and treatment activities of the medical facilities whithin these four governorates, and also to guide and supervise the Branches at Al-Hodeidah and Ta'iz.

The Headquarters is to be structured to be structured from the following five Departments.

a. Administration Department
b. Clinical Department
c. Research Department
d. Supervising Department
e. Training Department

The medical personnel subjected for training at the Sana'a Headquarters is to be recruited from relatively remoted areas of the country, therefore plans for dormitory would be required for long term training.

2) Al-Hodeidah Tuberculosis Centre (Branch)

In addition to the clinical works the Al-Hodeidah Branch exercises its jurisdiction over three Governorates of Al-Hodeidah, Hajjah and Al-Mahweet; and provides training and supervising to the tuberculosis control activities carried out by medical and health facilities in those governorates. In addition, this Branch submits data from these three Governorates and also periodically sends trainees to study medical technology at the Headquarters in Sana'a.

The Branch is structured according to the following four Departments.

a. Administration Department

b. Clinical Department
c. Supervising Department
d. Training Department

3) Ta'iz Tuberculosis Centre (Branch)

The Ta'iz Branch exercises its jurisdiction over the four Governorates of Ta'iz, Ibb, Al-Beida and Dhamar. Its activities and functions are identical to those of the Al-Hodeidah Branch, and it is structured from the following four Departments.

a. Administration Department
b. Clinical Department
c. Supervising Department
d. Training Department

For the Branches, it is not provided with a research section since all specialized research work is to be handled by the Headquarters. Moreover, boarding facilities will not be provided, and the Branch training activities will be limited to one-day and will serve only its adjacent Governorates.

(2) Details on the Various Departments

1) Administration Department

In addition to the activities for general adminitrative affairs and accounts, this Department is responsible for the clerical work in other departments. Being related to the registration procedures and other miscellaneous matters, a considerable increase in the staff is expected in future.

A list of the principal rooms and their activities are given in the Table 13 and 14.

Table 13 Sana'a Headquarters

Department	Room	Activities
Administration	Director's Room	Overall supervision of the administration of Headquarters and instructions to the 2 Branches
	Secretary's Room	Common use of the Director's Room, Advisor's Room and Research Room
	Deputy Director's Office	Office of the deputy Director
	Advisor's Office	Office of the Research advisor
	Office	General affairs and accounting
	Visiting Staff Office	For research workers (2 - 3 persons) dispatched from foreign countries
	Medical Staff Office	For 5 doctors
	Reception Room	Reception and Information Service to visitors
	Telephone Exchange Room	Telephone exchange services
	Storage	Storage for the arrangement and storing of material
	Conference Room	To accommodate meetings up to about up to 30 persons
	Janitor's Room	Room for janitor and messengers, and others
	Laundry Room	Room for laundering staff's uniform and linens

Table 14 Al-Hodeidah and Ta'iz Branches

Department	Room	Activities
Administration	Branch Director's Office	Overall supervision of the administration of the branch and submission of reports to Headquarters
	Office	General affairs and accounting
	Medical Staff Office	For 3 doctors
	Reception	Reception and Information Service to visitors
	Office Supply Storage	Warehouse for the arrangement and storing of material
	Conference Room	To accommodate about 20 persons
	Janitor's Room	Room for janitors and messengers, and others
	Laundry Room	Room for laundering staff's uniform linens

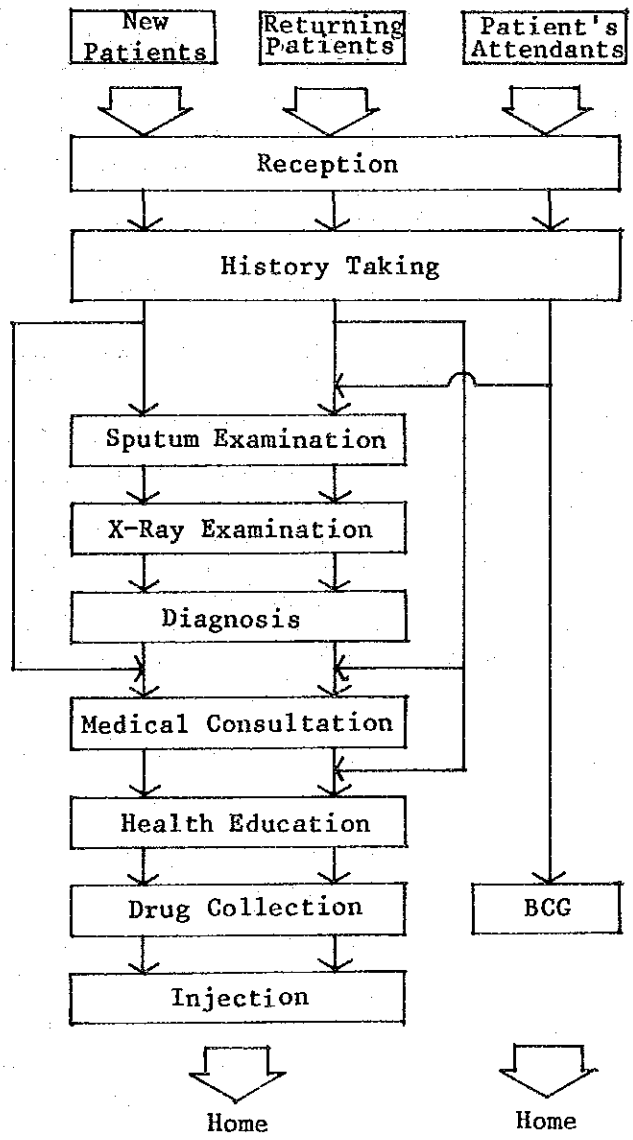
2) Clinical Department

The diagnosis and treatment of the patients and guidance on health care are carried out at this department. At present, the number of patients visiting the existing centres is about 100/day at Sana'a, about 50/day each at Al-Hodeidah and at Ta'iz, but the capacity of these facilities and number of staff are not sufficient enough to deal with these numbers. From impressions obtained during the survey, these numbers of visiting patients do not represent a relative proportion of the actual number of tuberculosis patients, but are the numbers limited through the capacities of the various facilities, and it is estimated that these numbers will undoubtedly increase after the completion of the facilities and increase in the number of personnel are expected.

As viewed from the standpoint of the internal functions of this department, its duties can be classified into two categories, the detection of the patients and guidance on treatment. For the detection of the tuberculosis patients the sputum collection laboratory and bacteriological laboratory, X-ray laboratory, history taking room, diagnosis room, are all related, operating under the doctor(s) in charge and the assisting personnel (nurses, health workers and technicians) carry out the role of diagnosing tuberculosis. On the other hand, prescription and motivation for treatment are carried out by doctors, nurses and health workers, who prescribe medicines, guide and instruct the patients, observe the progress of the disease, instructs the family of the patient and provide preventive vaccinations.

Out-patients are classified into two groups, first-visit and returning patients. The "first visit patients" are those who are referred from the various medical and health facilities and those newly diagnosed as tuberculosis at the centre, while the latter group are those who make periodical visits to receive treatment and guidance. The flow of the out-patients are illustrated in the Fig. 5

Fig. 5 Flow of Out-Patients



The major rooms for the medical treatment department are displayed in the Table 15 and 16.

Table 15 Sana'a Headquarters

Department	Room	Activities
Treatment	Reception	Reception of out-patients
	Waiting lobby	Waiting room for out-patients
	Filing room	Registration of patients
	History taking room	Detection of tuberculosis patients
	Consultation room (1)	Treatment guidance of the patient
	Consultation room (2)	Treatment guidance of the patient
	Consultation room (3)	Treatment guidance of the patient
	X-Ray Room	Diagnosis through fluorography
	Cloak room	For X-ray photography
	Film storage room	Arranging and storing of films
	Dark room	For developing films
	Film drying room	Drying developed films
	Operator switch room	For operating x-ray photographic equipment
	X-Ray reading room	Diagnosing and analysing developed films
	Sputum collection laboratory	Room for patients in ejecting sputum
	Laboratory	For clinical examinations
	Laboratory technicians' room	For 3 laboratory technician's
	Pharmacy	Room for preparing and distributing prescriptions

Department	Room	Activities
(Cont'd)	Injection room	Injection of patients
	Health education room	Guidance for patients and family
	BCG vaccination room	No direct connection with out-patients. Flow to be isolated from that for out-patients.
	Medical drug storeroom	Storage of medicines

Table 16 Al-Hodeidah and Ta'iz Branches

Department	Room	Activities
Treatment	Reception	Reception of out-patients
	Waiting lobby	Waiting room for out-patients
	Filing room	Registration of patients
	History taking room	Detection of tuberculosis patients
	Consultation room (1)	Treatment guidance of the patient
	Consultation room (2)	Treatment guidance of the patient
	Consultation room (3)	Treatment guidance of the patient
	X-Ray room	Diagnosis through fluorography
	Cloak room	For X-ray photography
	Film storage	Arrangement and storing of films
	Dark room	For developing films
	Film drying room	Drying the developed films

Department	Room	Activities
(Cont'd)	Operator switch room	For operating x-ray photographing equipment
	X-Ray reading room	Diagnosing and analysing the developed films
	Sputum collection laboratory	Room for patients in ejecting sputum
	Laboratory	For clinical Examinations
	Laboratory technicians' office	For 3 laboratory technicians' room
	Pharmacy	Room for preparing prescriptions and distribution
	Injection room	Injection of patients
	Motivation room	Guidance for patients and family
	BCG vaccination room	No direct connection with out-patients. Flow will be separated from that for out-patients.

3) Research Department

This department will be allocated at Sana'a Headquarters alone. As implied by the name, research (primarily in bacteriology and epidemiology) and investigation which are not performed at ordinary hospitals or health facilities will be carried out. Specialized tests such as susceptibility of the tuberculosis bacilli and identification tests will be included in those works. Data of all types on tuberculosis control activities in the entire country will be further analized at this department. In addition, this department will keep close relation with the Sana'a University, the Health Manpower Institute and the Central Laboratory in research activities. The major rooms and activities of the Research Department are displayed in the Table 17.

Table 17 Sana'a Headquarters

Department	Room	Activities
Research	Library	Collection of books and references for research activities
	Research laboratory	(5) doctors to carry out professional experiment
	Preparatory laboratory	Preparatory room for clinical tests and for the bacteriological research room
	Chemical storage	Storage of medicines for the research

4) Supervising Department

Each Centre has a department with a medical staff responsible for supervising its responsible governorates medical facilities, such as, Health Centres and Primary Health Care Units.

The total recorded number of Health Centres and Primary Health Care Units in the nation are 409, however, an accurate number of these medical facilities in operation has not yet been confirmed, as for example, in Al-Hodeidah, the Primary Health Care Units recorded to date are 61, however, only 18 are in operation. In quantitative analytical terms, proportion of units currently in operation is 18 ÷ 61 = 0.3. Using this constant figure (0.3), a more realistic total number of Health Centres and Primary Health Care Units in the nation can be derived, as follows: 409 (total number) x 0.3 (constant) ÷ 3 (Centres) = 40.9 (assumed figure). Therefore, assuming this fugure to be a fair one, each centre would be responsible to approximately 50 facilities (Health Centres and Primary Health Care Units). The extent of the supervisory activity will differ according to the contents, volume and the location of the health medical facility, but it is assumed that an average of 2 times a year will be sufficient. Therefore, 2 (times) x 50 (facilities) ÷ 12 = 9/month, that is, nine rounds of the various facilities are to be made per month.

Thus, the supervising department may look relatively small in its oraganization, but functionally, its contribution to the activities of the network for the tuberculosis control will be very important. Automobiles (land rovers) will be indispensable for its field activities while the case management room allocated at each centre will be something like a base camp for it. The epidemiological research room (attached only to Sana'a Centre) may be engaged in planning of the national as well as local tuberculosis control programme, arranging the statistical data on epidemiology, coordinating with other centres (Branches). Each supervising department will have the rooms indicated in the Table 18 and 19.

Table 18 Sana'a Headquarters

Department	Room	Activities
Supervising	Epidemiological research room	Summarization of the reports sent from the Branches
	Statistics room	Reporting data to the epidemiological research room
	Case management room	Office room for supervisory team

Table 19 Al-Hodeidah, Ta'iz Branches

Department	Room	Activities
Supervising	Statistics room	Reporting to the Centre
	Case management room	Office room for supervisory team

5) Training Department

This department provides training and guidance to the medical personnel (doctors, laboratory technicians, x-ray technicians, nurses) of

the Health Centres, Primary Health Care Units and public hospitals in the eleven Governorates of the country; and the students of Sana'a University and the National Health Manpower Institute located each at Sana'a, Al-Hodeidah and Ta'iz. In addition, the department is to actively collaborate with health volunteer leaders in the communities, through providing the basic knowledge in tuberculosis control. Thus, the headquarters will be in a position to control these training programmes and activities at branches in Al-Hodeidah and Ta'iz. A dormitory (for around 20 persons) will be required at the headquarters for long term training sessions provided to the trainees sent from fairly remoted areas in the country.

The rooms and their functions for the Training Department at Sana'a, Al-Hodeidah and Ta'iz Centres are indicated in the Tables 20 and 21.

Table 20 Sana'a Headquarters

Department	Room	Activities
Training	Classrooms (1), (2)	20 trainees per room (Total 40)
	Locker room	Dressing room for the trainees
	Bacteriological training laboratory	Practical training (20 trainees)
Dormitory	Residents manager's room	Supervision of the boarders
	Twin room	10 rooms (Total 20 persons)
	Lounge	For the trainees
	Pantry	For the trainees
	Laundry room	For the trainees
	Bedding storage	Storage of bedding for the boarders

Table 21 Al-Hodeidah and Ta'iz Branches

Department	Room	Activities
Training	Classroom	For 10 trainees
	Bacteriology training laboratory	For 10 trainees
	Library	For the trainees and the staff
	Chemicals storage	Storage of medicines/reagents for the practical training
	Preparation laboratory	Preparation for the clinical and practical training activities

(3) Plans for Personnel Training

The followings are the eligibles for the training :

1. Personnel of the medical facilities in the various districts (Hospital, Health Centre, Primary Health Care Unit)

2. Students of the National Health Manpower Institute in Sana'a, Al-Hodeidah, and Ta'iz.

3. Students of the Medical school of Sana'a University

4. Health volunteers interested in public health are to be leaders in the remoted districts.

At the Centre, the eligibles for the training are the staff and the students of the medical and health facilities in the eleven governorates, and the staff of the Al-Hodeidah and Ta'iz Branches. The branches will also provide the training for personnel of the medical and health facilities, and medical students within their jurisdiction. The proposed training plan and the number of trainees and the training period at the Headquarters and both Branches are given in the Table 22. No boarding facilities will be provided at the Branches.

Table 22 Training Plan for the Tuberculosis Control Centres

Number of trainees and period / Types of personnel	Headquarters			Branches (per Branch)		
	Present	Planned		Present	Planned	
	Student	Student	Staff	Student	Student	Staff
Doctor	-	20 persons (in 4 groups) for 2 weeks	20 person (in 2 groups) for 2 weeks	-	-	10 persons (in 2 groups) for 2 weeks
Medical Assistant	-	30 persons (in 4 groups) for 1 week	30 persons (in 4 groups) for 1 week	-	20 persons (in 3 groups) for 1 week	20 persons (in 3 groups) for 1 week
Nurse	15 - 25 persons (in 2 - 3 groups) for 2 weeks	15 - 25 persons (in 2 - 3 groups) for 2 weeks	20 persons (in 4 groups) for 1 week	-	10 - 20 persons (in 2 - 3 groups) for 2 weeks	10 persons (in 4 groups) for 1 week
Laboratory Technician	-	15 persons (in 5 groups) for 2 weeks	6 persons (in 3 groups) for 1 month	-	10 persons (in 5 groups) for 2 weeks	6 persons (in 3 groups) for 1 month
X-ray Technician	20 persons (2 - 3 groups) for 1 month	20 persons (2 - 3 groups) for 1 month	10 persons (in 4 groups) for 10 days	-	10 persons (in 4 groups) for 1 month	6 persons (in 3 groups) for 10 days
Health Volunteers (Primary health care)	-	-	20 persons (in 1 group) for 1 week	-	-	10 persons (in 1 group) for 1 week

(4) Stationing Plan of the Personnel

The serious shortage of manpower at the existing Tuberculosis Control Centres is perpetuating the obstacles not only for daily clinical services, but for carrying out the systematic tuberculosis control activities which are the major functions of the centres. Therefore, securing the required number of personnel is of great importance for the implementation of the concerned project. As for the medical manpower training there are the National Health Manpower Institute and the Sana'a University School of Medicine. It is considered that the securing of personnel will not be so difficult since training programmes on national level in the above-mentioned institutions are well in progress.

The personnel allocation plan under the concerned project is as shown in the Tabel 23. This allocation plan was configurated by examining the physical conditions, functional contents, and course of activities, to

be proposed for the new Tuberculosis Centres (Headquarters and Branches). Also, the numbers estimated in the Second Five-Year Plan are used as reference to the personnel stationing plan mentioned above; even though, for example, the number of drivers has increased, to meet the expanding needs of field trip for the supervisory activities. The number of personnel in the existing tuberculosis control centres, the number that is currently defined and the number as given in the Second Five-Year Plan are indicated in the Table 23 as for reference.

Table 23 Personnel Allocation Plan

Occupation \ Number of persons	Sana'a (Headquarters)				Al-Hodeidah (Branch)				Ta'iz (Branch)			
	Present	Full strength	5 year plan	This project	Present	Full strength	5 year plan	This project	Present	Full strength	5 year plan	This project
1 Doctor	5	5	6	5	1	2	3	3	2	2	4	3
2 Health worker	1	1	1	1	0	0	0	0	0	0	0	0
3 X-ray technician	⓵	1	2	2	⓵	1	2	2	0	1	3	2
4 Ass't X-ray technician	1	1	2	2	1	1	2	2	0	1	3	2
5 Laboratory technician	1	2	4	3	1	1	3	2	1	1	3	2
6 Ass't labo. technician	1	1	2	2	0	1	2	2	0	1	2	2
7 Health advisor	⓵	2	3	3	0	1	2	2	0	1	3	2
8 Nurse (Male)	2+2	1	1	2	2	1	1	1	2	1	3	1
9 Pharmacist	0	1	2	2	0	0	1	1	0	0	0	1
10 Assistant pharmacist	0	1	3	2	0	1	3	2	0	1	3	2
11 BCG Vaccinator	1	2	3	2	0	1	2	2	0	1	3	2
12 Assistant statistician	1	1	3	2	0	1	2	2	1	1	3	2
13 Clerk	1	3	3	4	0	2	2	3	1	2	2	3
14 Driver	2	4	4	5	0	1	1	2	1	1	1	2
15 Assistant	1	3	3	4	0	2	2	3	2	2	2	3
16 Guards-man	2	2	2	2	1	1	1	1	2	1	1	1
17 Janitor	5	0	0	3	3	0	0	2	4	0	0	2
Total Number	26 (29)	31	44	46	9	17	30	32	16	17	36	32

Notes:
1. The numbers within ( ) include the Director, Technical Cooperation Specialists and Health Advisors from abroad.
2. 'Health Workers' means assitant doctors.
3. ○ indicates a foreigner. (Exclude the number of personnel.)
4. Presently in Al-Hodeidah the Director functions as well as a 'Nurse'.
5. By 'Maintenance staff' are meant the janitors, messenger boys, night watchmen, etc.

Chapter 4: PRELIMINARY DESIGN

CHAPTER 4: PRELIMINARY DESIGN

4-1 The Outline of Planned Site

(1) The Proposed Site of Sana'a Tuberculosis Measure Center

Sana'a city is the capital of the YAR and is located in the plateau area (a height of 2,300m) of the Central Highland. It has a population of about 210,000 (1981 Census). The YAR has a remarkable influx of population to the cities as other countries, thus Sana'a population increased dramatically to 76,000 over the seven year period between 1975 - 1981. The climate is generally mild except for large temperature difference between day and night particularly in the winter season. There are two rainy seasons in a year respectively between (March - April, July - August) and the annual rainfall averages between 150 - 250 mm.

The area of Bait Balas, located at the centre of Sana'a city was the previous location for the site of the proposed Sana'a Tuberculosis Centre (area: 7000 m^2) recommended by the YAR Government. This site was agreed at the signing proceedings on February 9, 1984. Since then, the YAR Government has re-assessed the conditions of the site and has decided to relocate the proposed centre for the following reasons:

a. The Bait Balas site was originally private land and the purchase price went beyond the estimated expenditure that the Ministry of Health was prepared to spend for purchase of the land.

b. The YAR Government owned property (44,000 m^2) located in the Aljarda district, about 7 km south of Sana'a city was recently secured as an alternative to the Bait Balas site. The Ministry of Health has obtained permission from the Ministry of Municipalities and Housing to use the land for the purpose of the proposed tuberculosis centre.

Following a government sponcered survey of the Aljarda site, the site change was accepted under the condition that the YAR Government conduct preliminary site works such as; levelling of land, telephone, electric and water supply and road works prior to the commencement of the proposed construction. Negotiations for the relocating of the Sana'a Tuberculosis Centre site to the Aljarda district were finalized at the signing proceeding on May 24, 1984.

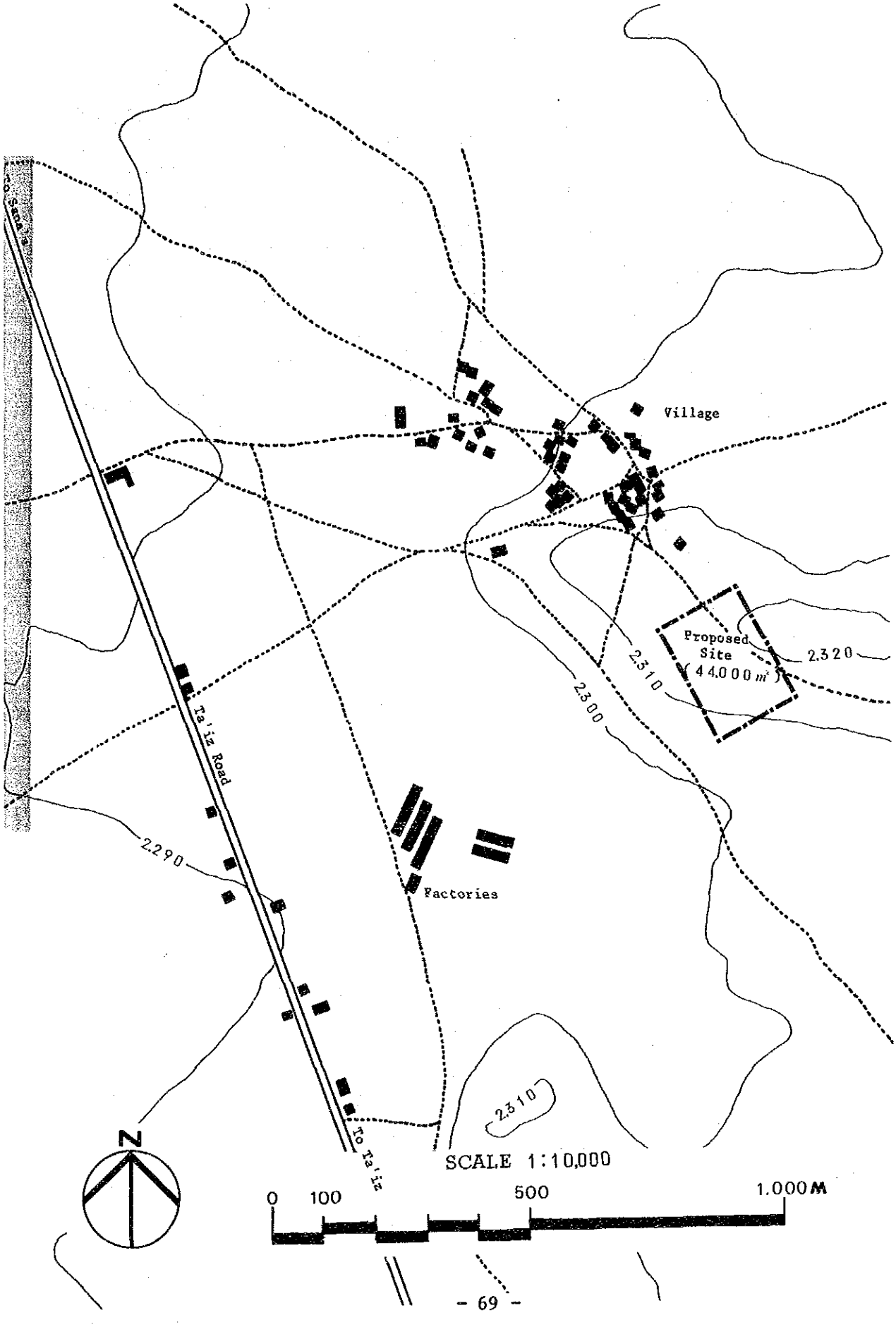
The newly decided site is located near to the Ta'iz Road track the major link connecting Sana'a with Ta'iz. This site is about 7 km south of downtown Sana'a and about 900 - 1000m east of the highway. At present there no paved access road. The site and its adjacent areas are government owned and although there are no definite plans for developing the entire area, it is anticipated that this proposal will stimulate further development of the district.

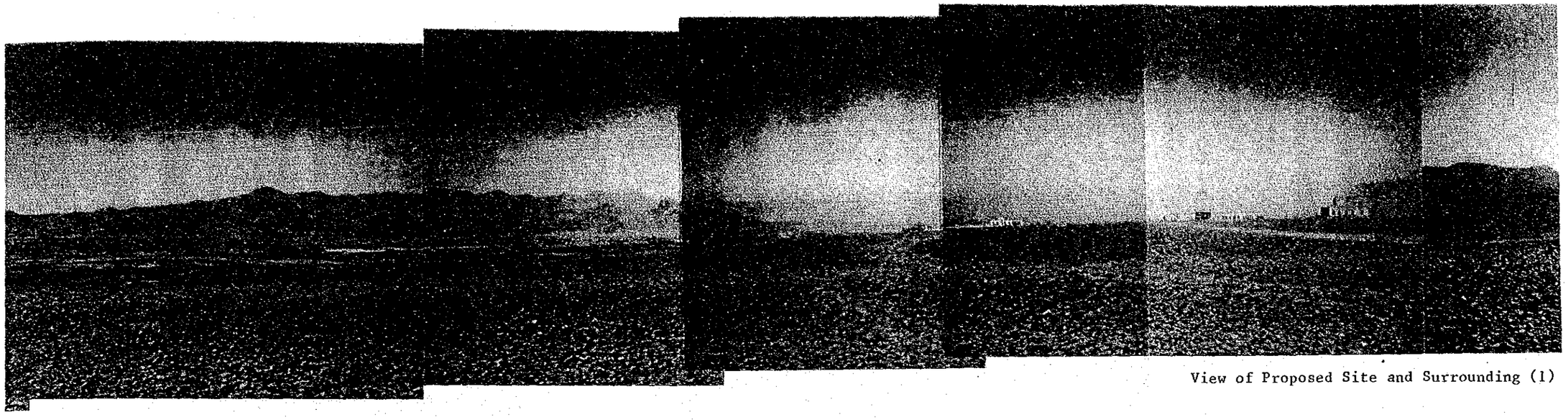
The area (44,000 m^2) secured for the site will be left to the discretion of the concerned parties as long as the revisions do not exceed the concept of the original plan. The surrounding areas of the site grades gradually towards the Ta'iz Road, and the surface grade is of hard gravel and pebble substance. The district has little vegetation and is very hot during the daytime. At present, the area is classified as open space; there is no pollution (noise or air pollution), and the site is blessed with a beautiful natural landscape.

Concerning preliminary site works, although they have not yet been provided existing electricity and telephone lines servicing a nearby village about 500m from the site are to be extended from this village to the site. As for water supply, the YAR Government promised to provide wells as soon as possible.

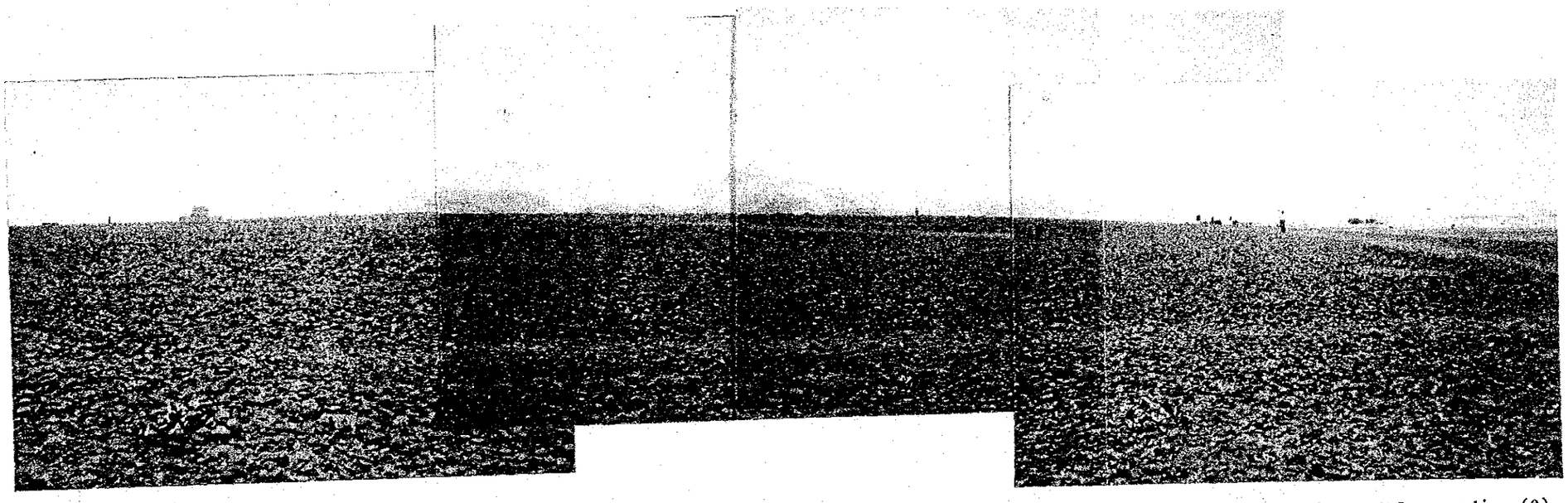
Regarding the soil consistency (according to an acquired boring data), the surface soil of Sana'a is about 4m in depth. The inorganic substance found below the surface soil (4 to 31m in depth) consist of lapilli and sands. The newly proposed site is considered to have similar conditions, as is in most parts of Sana'a.

Fig. 6 Proposed Site for Sana'a Tuberculosis Centre





View of Proposed Site and Surrounding (1)



View of Proposed Site and Surrounding (2)

(2) The Proposed Site of Al-Hodeidah Tuberculosis Centre

The city of Al-Hodeidah faces the Red Sea and is located on the ocean front plain called Tihama. The sand dune with a width of 50 km to 70 km expands to across the Red Sea. Because of the Red Sea, the city has Al-Hodeidah Port which is the country's most important port, and most of its imported and exported goods pass through there. The population of the city is about 96,000. Since the climate is affected by the Red Sea, it has a tropical climate with high temperature and high humidity. The average relative humidity is 70%, usually the average temperature is about 30°C (however daytime temperatures sometimes exceeds 40°C in the summer season), and rainfall is quite scarce. The buildings of this city are constructed to suit the climatic conditions. In order to make natural ventilation and permeability well, the ceilings are designed high, and the stomatal opening is made widely.

A vacant lot of land is located adjacent to the Revolution Hospital, south of the city. The vast area has been reserved for the hospital expansion needs which is expected to take place in the future. From the land-use point of view, the proposed site presents a desirable environment for a place of the tuberculosis centre projected, since the area, including the site, has been designated to be central district for medical activities. As previously mentioned the site will be located at the south edge of the city with an ease of accessibility, with no obstacles for the location within the site. The proprietary of the location reverts to the hospital, but it will revert to the centre on account of this project, so that there should be no problems in administrative proceedings.

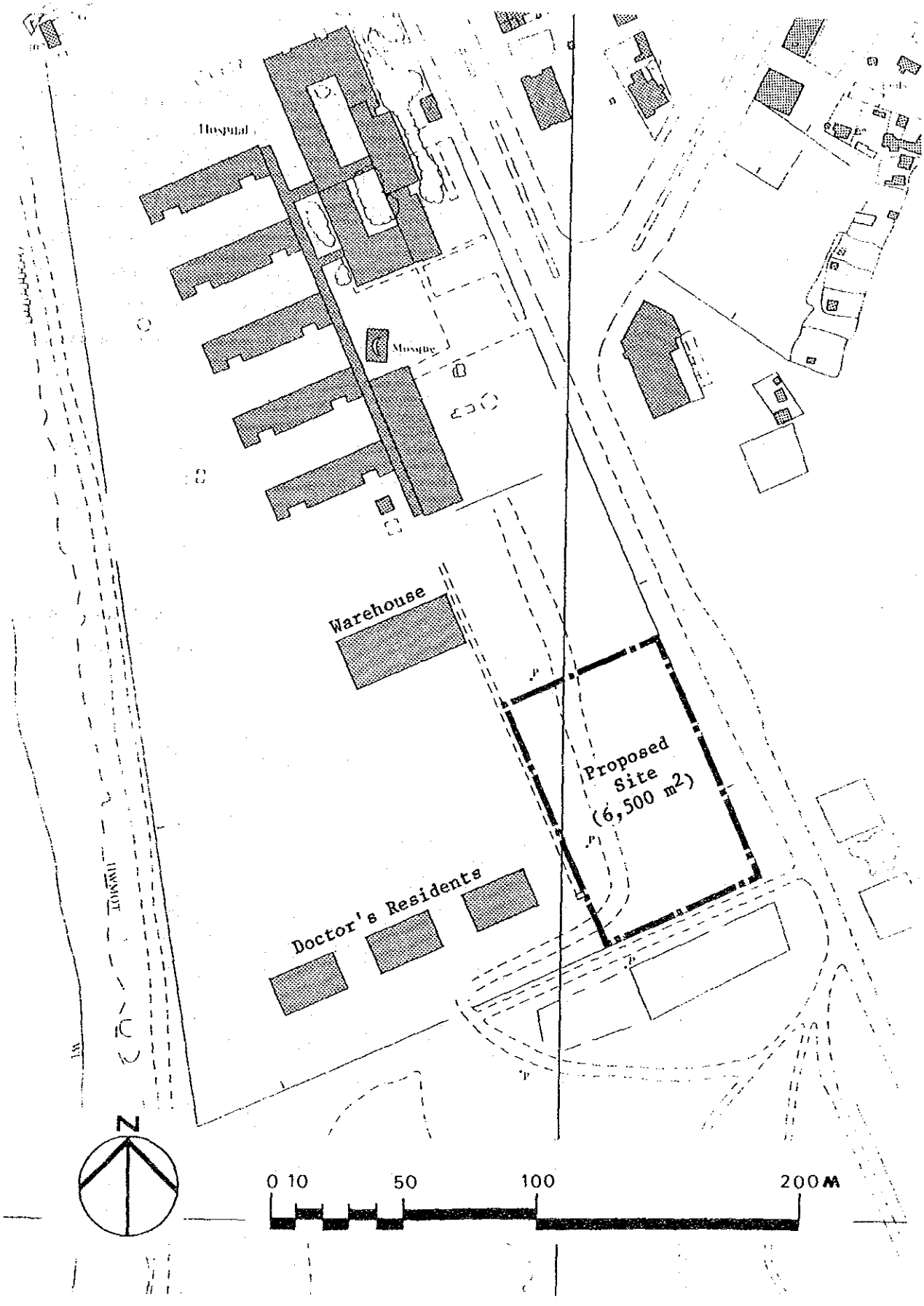
View of Proposed Site

The site, rectangular in form (100m x 65m), is about 6,500 m^2. It has no level difference, basically flat, sandy land. (The westside of the hospital site faces the Red Sea.)

Infrastructure is already found in the existing hospital. There are no problems expected in expanding those facilities of infrastructure to the proposed site. (Sewerage and city gas are not fully distributed, as compared to Sana'a city.)

According to previously obtained boring data due to well drillings, the area's geologic substance is fine sand stratum up to 3m in depth from surface grade, 18m-depth below this is the sand-stratum. The proposed site is considered to be the same.

Fig. 7 Proposed Site for Sana'a Tuberculosis Centre



(3) Proposed Site of Ta'iz Tuberculosis Centre

Ta'iz is a mountainous city located in the south of the Central Highlands district, surrounded by steep mountains of the Central Highland and Eastern Mountains. The altitude is at about 1,300m, 1,000m lower than Sana'a city's 2,300m. Being located in a gorge, it has a mild climate. The average temperature throughout the year is about 25°C, and in winter, it is about 18°C. Even though from September to February, it becomes a little lower, it seldom becomes 0°C. And there are two rainy seasons (from March to April, from August to September), because it rains comparatively heavy, its monthly rainfall is sometimes more than 100 mm.

The proposed site is located at the north district of the city and adjacent to the (east of) Revolution Hospital, in the city's northern district. This area is to be developed as the medical area focusing around the Revolution Hospital.

And this plan calls for a project of this nature and thus, this site was offered. Therefore, as far as planning is concerned the site offers an ideal location, similar to that as with Hodeidah city.

View of Proposed Site

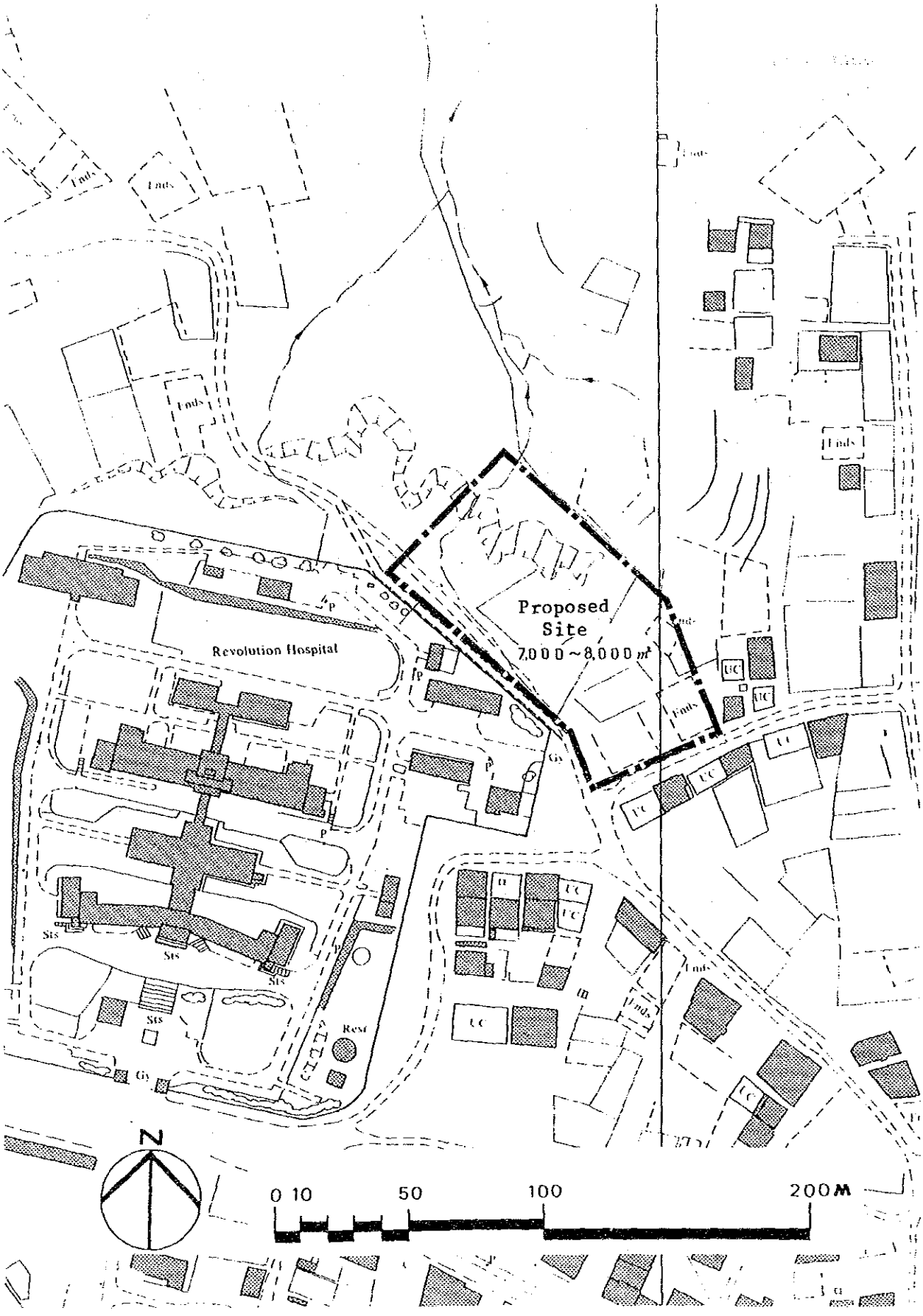
As for the image of Ta'iz city, its downtown is located at the bottom of the valley and spreads out along the steep skirts of mountains. Accordingly, the site is located on a hill, and since the road network of the city is advanced, there are no problems concerning access. Also, there are no obstacles in the site, and it's government owned, so that there is no administrative interruption for performing this plan.

The site is roughly rectangular in shape of 6,000 - 7,000 m^2, with plane land along the border line against the hospital, because the land is composited extensively.

Because Revolution Hospital is a modern hospital, there are no consolidate problems of infrastructure. (Ta'iz city has generally a better sewerage network compared with Sana'a city and Hodeida city.)

As for the geological features, the depth of the top soil is 3m, and a 15m layer of conglomerate and sand lies beneath this, according to the boring data due to well-drilling. Therefore generally the foundation can be judged as good one.

Fig. 8 Proposed Site of Al-Hodeidah Tuberculosis Centre



4-2 Design Policy

The following items are to be regarded as policy restraints:

① Materials, construction methods and equipments which are to be practically applied should be closely examined according to the grade of institution.

② The buildings should blend harmoniously with the surrounding natural environment.

③ The buildings should be easily maintained and managed.

④ The plan for equipment and materials should be designed according to the function, and contents and the cost should be moderate and evenly balanced.

This country has had many architectural inheritances since the Sheba Kingdom, and arch arbesque windows are found in nearly all public buildings and private houses; the beauty of traditional architecture and people's great concern about it should not be overlooked. However, in tuberculosis medical care, emergency measures are far more important at present than the issue of beauty of the country's architecture.

Medical facilities (X-ray camera, clinical examination instruments, etc.) are of course in shortage. Space for medical care is limited in its present state. Tuberculosis control programme is far behind the aim planned in the national level. After the consideration of the above mentioned, the designing of this plan is aimed at satisfying its major requirements of both a realistic institution and appropriate architectural aesthetics.

4-3 Basic Plan

(1) Location Plan

1) Location Plan for Sana'a Headquarters

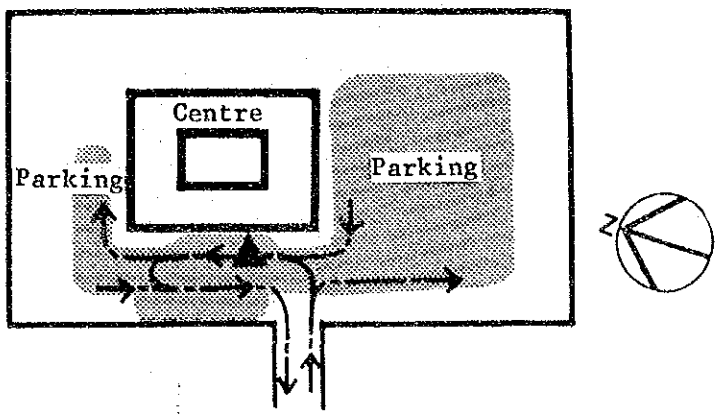
A site (some 44,000 m^2) of government owned property has been secured and offered for utilization of the proposed Sana'a Tuberculosis Centre. Although 44,000 m^2 has been offered for the centre, the first proposed development in this area, the entire area will not be used and possible future developments providing good, flexible design options will be considered.

The site is located about 900 - 1,000m off the Ta'iz Road (major interurban trunk road connecting Sana'a and Ta'iz in the south) and the slope of the land gradually rises from the road to the site some 10 - 20m high providing a good view from the road. Therefore, the entrance facade and service access road will face to the Ta'iz Road. Since the major means of access to the site will be by private car and taxis for hire, adequate parking, waiting space, and an uninterrupted traffic flow will be important design elements.

As far as climatic conditions affect the design, in Sana'a there is a great temperature range between high daytime temperatures and relatively low nighttime temperatures in winter. Besides this, it is a traditional design feature to locate the length of the structure parallel to the earth's North/South coordinates. With these constraints in mind most major daytime activity spaces will be located in a position to avoid the north side.

The site and its surrounding area have no existing vegetation, bare except for a hard gravel surface grade which is potentialy good soil and with the provision of water would prove to be good for plantation. Therefore the enclosed courtyard will be planted to create pleasant natural environment.

Fig. 9 Conceptual Diagram of Location Plan for Sana'a Headquarters

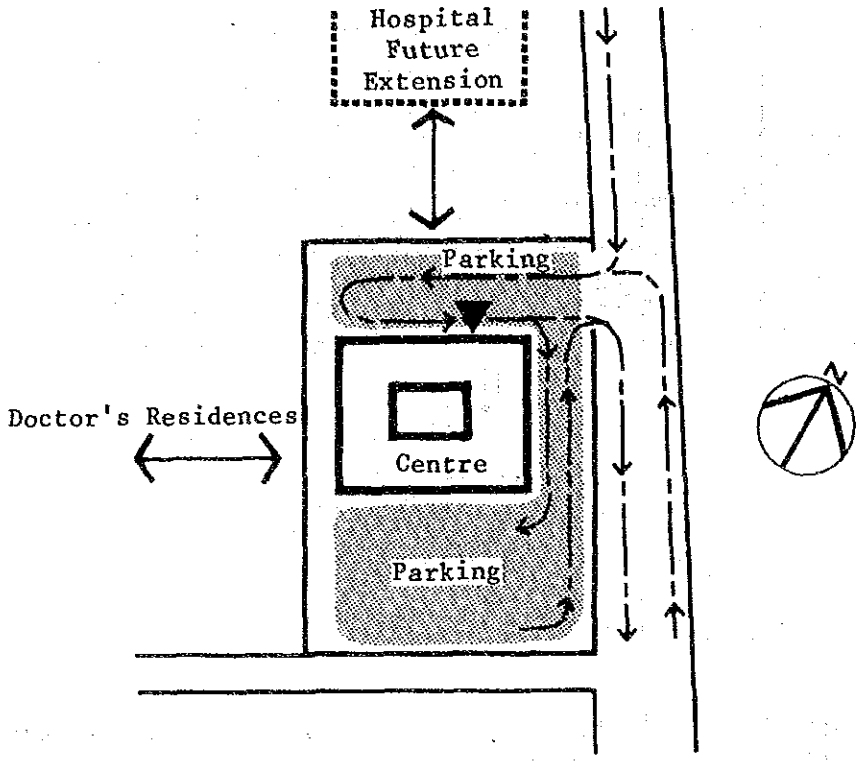


2) Location Plan for Al-Hodeidah Branch

As the site will be within the boundaries of the Revolution Hospital, future expansion plans of the hospital must be taken into consideration in the selection of the site. On the west side, there are 3 buildings serving as collective housing for the doctors and as this section is expected to become a housing block for hospital personnel, a fence will be constructed on the west side to separate the proposed center from the housing block. The north side is reserved for the expansion of the hospital, leading to the possibility that in future their clinical facilities may be positioned very near to the proposed center, and although there will be no direct connection, it can be expected that a relationship will develop. For this reason, the main entrance to the building will be placed to the north side in a position where it can approach both to the hospital and the Center.

Moreover, space for future expansions to the center will be secured on the southern side where the future expansion of the hospital will have least effect, and simultaneously, this space will be used as a parking lot.

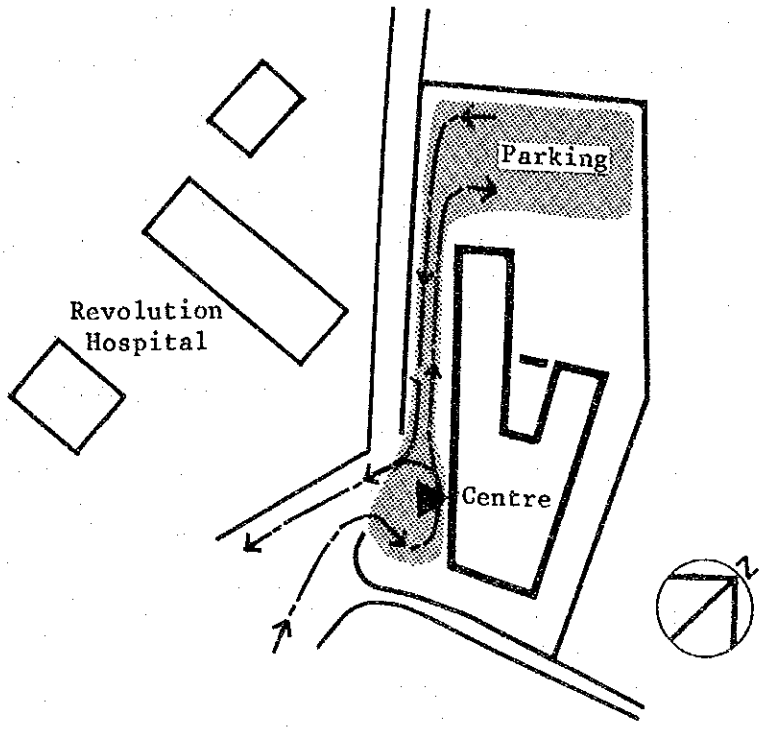
Fig. 10 Conceptual Diagram of Location Plan for Al-Hodeidah Branch



3) Location Plan for Ta'iz Branch

The site will be to the north-east of the Revolution Hospital located behind the hospital as seen from the main trunk road of the city providing a minimum of visibility. For this reason, an attractive magnetic element of entrance face to the building will be required. The front entrance will therefore not be positioned at the center of the building but will be placed at the southern end, in order to identify the building by enhancing its frontage. On the other hand, as previously mentioned, as a large portion of the site was levelled through fill-up earth, the building will be formed along the natural ground foundation, this is, on the hospital side, surrounded by the parking lot, service area, etc.

Fig. 11 Conceptual Diagram of Location Plan for Ta'iz Branch



(2) Architectural Plan

1) Configuration

The Sana'a Headquarters will be a two-storied structure, while the Al-Hodeidah and Ta'iz Branches will be single storied structures. This is because the research department and the dormitory belonging to the training department will only be required at the Headquarters. These research and training departments and the dormitory in will function as independent entities within the centre, to be located at the 2nd floor, with a separate traffic flow. Each of the Branches will be classified into clinical department and training department, with a configuration in which these departments will enclose a courtyard.

The basic design configuration of the buildings will be planned with the following items as the basic policy for the architectural planning.

① Functional Relationships between Activities

Administration, Training, Research, (Headquarters alone) Supervising and Medical Department should maintain a clearly defined but closely connected functional relationship between the activities. However, concerning traffic flow, each section must maintain its independence. In the proposed plan, a configuration will be designed to satisfy these two conflicting factors with a minimum of conflict. The following diagram describes these functional relationship.

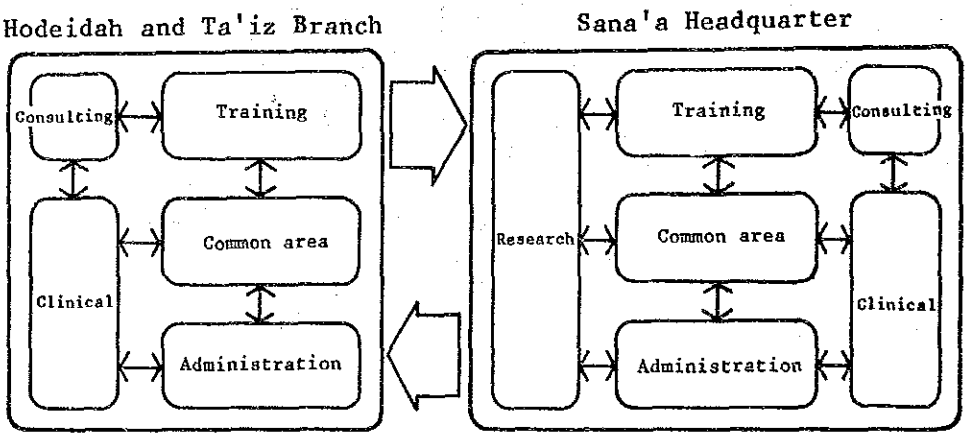
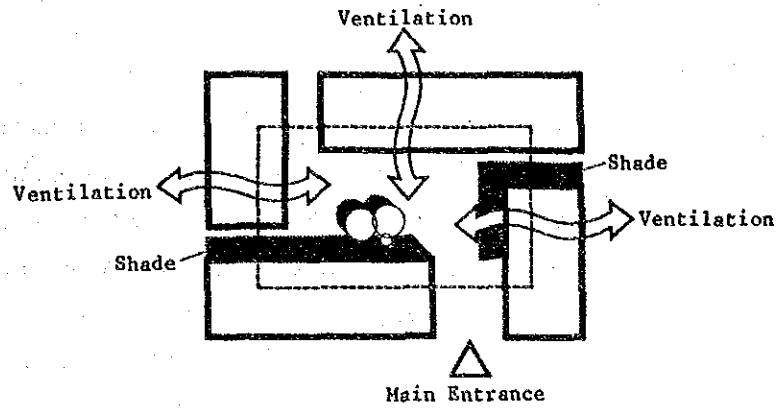


Fig. 12 Functional Relationships

② Interpretation of Internal Environment by Courtyard

Both the Headquarters and Branches will incorporate courtyards within the design. This spatial configuration will enable the facilities to form the inherent internal environments without interference from external influences. Moreover, the long eaves on the arcade corridors and trees will provide effective shading against the sunlight, and will also be used for generating the ventilation effects through the building. The spatial configuration incorporating the courtyard not only creates an open space for air ventilation, or a place for people to gather, or to relax in the shade of the trees, but represents a heritable element in the YAR's architectural design stimulating a comfortable sensation for the people. The following diagram describes those spatial arrangement.

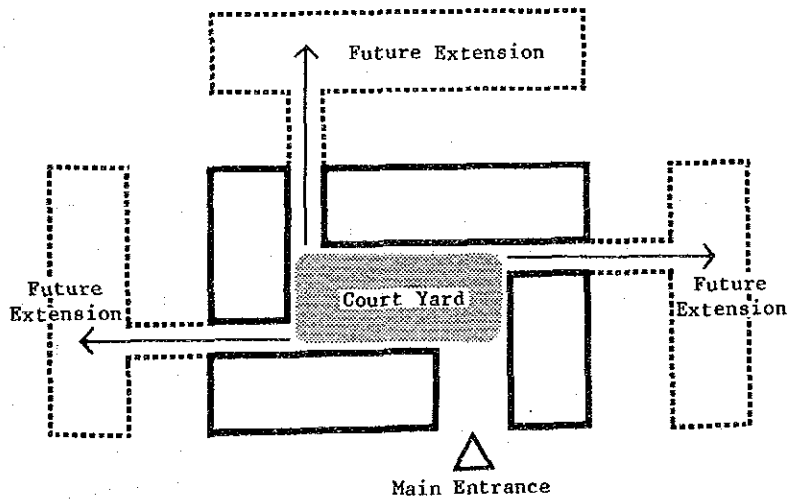
Fig. 13 Conceptual Diagram of Interpretation of Internal Environment by Courtyard



③ Plans to Allow for Future Changes

The future possibility of economic development and changes and progresses in medical techniques can be expected. For this reason, the planar form will be capable of conforming with ease to expansions and remodelling work without affecting the functions of the facilities to any appreciable extent. Actually, the ends of the corridors will not be spatially closed and will be of the so-called 'open end' type (to permit passage to the exterior), so that connections to expansions and remodelling constructions can be made by extending these corridors. The following diagram describes these design concepts.

Fig. 14 Conceptual Diagram of Consideration for Future Extension



④ Buildings Designed in response to Natural Environmental Conditions

The climatic conditions found in Sana'a and Ta'iz is comparatively temperate, but the air is extremely dry with severe variations during the day. There is also considerable damage from dust particularly in the dry season. On the other hand Al-Hodeidah has a typical tropical climate of high temperature and high humidity. However, in this country, with the exception of large hotels and offices, almost all buildings depend on natural ventilation for cooling, so that buildings constructed under this project will be naturally ventilated, eliminating the use of heating and cooling equipment, but constructional innovations will be considered as measures response to the natural environment by devising openings, incorporating high ceilings and utilizing the flow of air from the inner yard. These ideas are shown in the following sectional scheme.

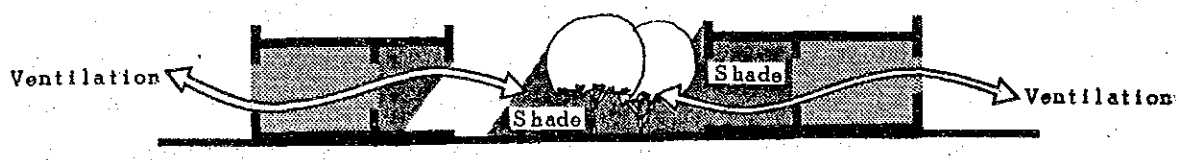


Fig. 15 Sectional Diagram

⑤ Easy to Maintain Buildings

The conditions necessary to facilitate the maintenance and management of the buildings after their completion, are that the construction materials can be easily procured, that the method of construction is familiar to one which is prevailing in the country, and that the equipment plan be easy to maintain and manage with easy access to spare parts which must also be capable of being assembled. The basic design will be drawn for the present plan after considering these factors, and after fully understanding the level of constructional techniques at site and the necessity of cost saving.

2) Materials

A deep impression was left after investigating the construction conditions at site and the traditional masonry techniques of the country. In fact, the stone buildings that can be seen in all parts of the country are very beautiful and transcend a decorative preference, and are cultural legacies backed by the YAR's own historical climate, natural features and religious background. The features of these building materials can also be seen in the baked brick outer walls and in plaster made arches for stained glass windows, and is a factor that cannot be ignored in the design/development plans for the building material for this project.

If these materials are to be used for the proposed project (e.g. masonry) even for ordinary houses, it will take several years to complete, and under the strict time limitations placed on modern constructions, this method would not be compatible. The reason for the long period requirement is due to plans which must consider the high cost of the material and the lack of workmen.

The materials that will be used for finishing the interior will have no particularly noticeable features as compared with the forementioned masonry, but the terazzo tiles, baked bricks and concrete blocks (not accurately made) available, will be used. As for furniture, except for items made of wood, nearly all are to be imported products, however, the assembly of aluminum sashes will be carried out by local factories. Consequently, for the materials plan, efforts will be made to use locally procurable materials wherever possible, in order to reflect the constructional tradition of this country.

3) Construction Method

The buildings that have recently been completed or those presently in the building process are the works of Chinese or Korean contractors and although there are differences in the method of construction among the various sites, modern building methods are being adopted.

Particularly in Sana'a where their constructions and civil engineering works constitute the greater part of all constructional operations, the knowledge of modern construction methods is considerably high. However, the Chinese and Korean contractors depend on their own countries for the direct labour force in the majority of cases, so that the diffusion of modern construction methods have not necessarily reached the common local labourer's level. Consequently, for this project, after recognizing these facts, the construction method which is popular in the country will be adopted wherever possible, and a basic policy will be taken to introduce such techniques as will contribute to the education of these labourers. The basic policy for the work methods to be adopted for this project will be as given below.

a. Temporary Constructions

This will be simplified after considering constructional conditions at site, procurement capability and the scale of this project (1st and 2nd floor buildings) to the extent as not to endanger the safety of the labourers or affect the efficiency and accuracy of the work.

b. Foundation Constructions

As the buildings for this project will be built above ground, the foundations need not be deep. Therefore, it is expected that direct manual digging will be possible, in combination with heavy machinery. It will also be necessary to plan a schedule to avoid the work for foundation construction during the rainy season in this country (twice a year).

c. Earth Work

The foundation of this country is generally good, the bearing power of the soil being 8 - 9 t/m^2 for even the sandy soil at Al-Hodeidah, so that the direct foundation method will be used.

d. Concrete Work

Ordinary Portland cement produced at the Amran Cement Plant would be available. This cement plant was constructed previous through Japanese technical assistance, and possesses a good performance record and is highly reliable. For the aggregates, although river pebbles and sand cannot be obtained locally, crushed rock, although its use is not expected to have any significant effect on strength is being used as conglomerate. There are two ready-mixed concrete factories in Sana'a and one each in Al-Hodeidah and Ta'iz from which this material can be procured. The ready-mixed concrete factory in Sana'a uses equipment made in West Germany, and is equipped with instruments for conducting strength and other tests on the concrete.

e. Reinforcement Work

Reinforcement bars are not manufactured locally but are all imported. In this country, round bars are mostly used, but as deformed bars have since recent been used, there will be no technical problems in using deformed bars for the proposed project. However, the standard level of skills are not high enough regarding the accuracy of the reinforcement work and the knowledge of the method of operation, therefore careful guidance and supervision will be required.

f. Masonry Work

Although masonry is the type of work in which local labour is most familiar with, and high reliance can be placed on their technical skills, as the price of the materials and cost of labour is fairly high, they will only be adopted for parts of the project. For the brick work, a modern plant in Sana'a manufactures compressed burned brick, which turns out good quality products and has a high production capacity, so that this material would be used at the advantage of the project. Concrete blocks are also being manufactured locally in large quantities, but as they are not of sufficiently good quality for decorative purposes, they will be used in forming the partitions (mortar finished).

g. Comparison with Local Contruction Methods

Construction methods that differ from those used locally are shown in the Table 24.

Table 24 Comparison of Construction Methods

Item	Local Method (in general)	Proposed Method	Reasons for Adoption
Foundation	Reinforced concrete + Masonry	Reinforced concrete Continuous footing	Sound resistance against earthquake
Ground floor slab	Earth floor slab	Structural slab incorporated with beams	
Exterior walls	Masonry with tooled finished joint	Burned brick with tooled finish joint	Sound resistance against earthquake; Stable supply of bricks favourable for limited constuction period
	Mortar with sprayed lysin		
Interior walls	Non-reinforced concrete blocks	Reinforced concrete blocks	Sound resistance against earthquake
Floor finish	Terazzo blocks;	Terazzo blocks;	Sound durability; Locally purchasable
	PVC tiles	PVC floor sheet with chemical resistance	Required for laboratories where chemicals will be used.
Wall finish	Mortar with paint finish	Mortar with paint finish	Commonly used; economical
Ceiling	Underside slab with paint finish	Underside slab with paint finish	Commonly used; easy to maintain
	Suspended ceiling with plaster boards	Suspended ceiling with plaster boards	Partial use for required rooms
Roof	Flat roof slab with mortar water proofing	Flat roof slab (RC) with asphalt water proofing	Commonly used; Sound water proofing

4) Structural Planning

In 1982, for the first time in 100 years, an earthquake occured in the Dhamar district of the YAR, and due to the insufficient recognition of this sort of catastrophe that most dwelling where of masonry type of suffered considerable damage. On the other hand, constructions built according to modern methods suffered almost no damage, as, for instance, the Dhamar Hospital, which had been completed immediately preceding the earthquake, was undamaged, and was said to have taken part in the relief operations of the refugees. Consequently, if the constructional standards of the Japan Architectural Institute is to be used, as reference for the proposed project, appropriate measures can be taken against earthquakes.

Due to the scale of the constructions and procurement capability in the country for the constructional materials, and to the unfavorable conditions regarding aggregates, the buildings will be of reinforced concrete construction with a design criterion strength of Fc = 180 kg/cm^2. For the framework, the rigid frame reinforced concrete structure will be adopted for the columns, beams and floor slabs. The reasons are the following.

a. As the building is to be used as medical facilities, it is expected that free changes in the partitioning between rooms will be demanded in the future, so that the rigid frame construction will provide more flexibility in this respect than the bearing wall structure.

b. The probability of using local materials for the partitions will be increased, which will facilitate future maintenance and supervision by the local side

c. The structural system with reinforced concrete bearing wall is not widely used in the YAR; and may hardly expect the accuracy of construction.

With regard to the construction of the foundations, the ground bed at the Sana'a and Ta'iz districts are formed of lapilli called 'Yemen volcanic' and is exceedingly good, while that at Al-Hodeidah, although sandy, posesses a soil bearing power of 8 - 9t/m^2. For these reasons, the direct foundation method will be adopted without using pilings.

(3) Mechanical Equipment Planning

The mechanical equipment planned for this project will directly correspond to the running and maintenance costs of the proposed buildings. For this reason, in proceeding with this project, a practical equipment plan will be drawn up after an accurate grasp is obtained of the grading of the equipment for the present public and medical facilities being constructed.

1) Air Conditioning and Ventilation Equipment

In Sana'a, with the exception of modern and large-scaled buildings such as the exclusive hotels and the Central Bank of Yemen, air conditioning equipments are not in use. In Ta'iz, air conditioning equipment is not even used in hotels, however, in Al-Hodeidah, due to the high temperatures and humidities in the summer, the installation of split type coolers are popular.

In regard to the proposed project, in response to factors as economy, ease of maintenance and repairs (in case of trouble), the central cooling and heating system will be avoided in favour of the individual types used in major rooms, while for ventilation, dependence will be placed on natural ventilation, as a general rule. The installation plans for those air conditioning and ventilation equipments applicable for the centres are as given in the Table 25.

Table 25 Installation Plan of Air Conditioning and Ventilation Equipment

	Air Conditioning System	Heating	Remarks
Sana'a (Head-quarters)	*Split Type Coolers Ceiling Fan + Natural Ventilation	Electric heaters	Early winter mornings are some-what cold.
Al-Hodeidah (Branch)	Split Type Coolers Ceiling Fan + Natural Ventilation	Not provided	Will be provided only for main liv-ing rooms
Tai'iz (Branch)	Split Type Coolers Ceiling Fan + Natural Ventilation	Not provided	

* Split type coolers are required for the research laboratory and the preparatory laboratory. (Sana'a Headquarters)

2) Water Supply Equipment

Tap water system is almost throughly furnished in all the cities of Sana'a, Al-Hodeidah and Ta'iz. All water is obtained from wells and is supplied to the homes from reservoirs but, the the water pressure is low (average 0.5Kg/cm^2) so that the majority of the facilities have their own receiving tanks. Water quality is raised to potable level by filtering and chemical treatment, but in general the people are drinking mineral water sold on the market.

For the present project, a system will be required for the water supply in which city water will be drawn into a receiving tank from which it will be lifted by pump with sterilizing equipment to an elevated tank and be distributed to the necessary places by a gravity system.

3) Hotwater Supply Equipment

The supply of hotwater will be managed by a "local hot water supply system"; i.e. for kitchinette a wall hanging electric hotwater

heater (storage water type), and for shower room an electric water boiler will be installed.

4) Water Drainage and Ventilation Equipment

The expansion of the sewage system has been delayed, the construction of such systems being at a stage where only work is being carried on with the major cities. Consequently, for public and large scale buildings, independent septic tanks are provided, and treatment being left to natural seepage into the ground. (The disposal of the sediment in these septic tanks being effected through vacuum trucks.)

For these reasons, in this project, the sewage and miscellaneous drainage will be formed into a combined flow and treated separately from rainwater drainage. The sewage and liquid waste drainage will be combined system; and rain water will be drained separately. The sewage and liquid waste, after treatment in outdoor septic tanks (decomposition tank system), will be led into seepage wells where they will be disposed of through natural seepage into the ground. The tuberculosis bacteria may be contained in the sewage will undergo disinfecting treatment within the septic tanks. Cast iron pipe and galvanized iron pipe are required to use for the piping. Rainwater will be drained through natural seepage. Galvanized iron pipes will be required for the downspouts.

5) Kitchen Equipment

The Sana'a Headquarters must be provided with kitchen equipment for the boarders. The electricity will be used as the heat source and the minimum of utensils used for local cooking customs will be provided.

The main equipment will be electric stove, kitchen sink, kitchen table, refrigerator.

Fig. 16 Water Supply System (Sana'a Headquarters, Al-Hodeidah and Ta'iz Branch)

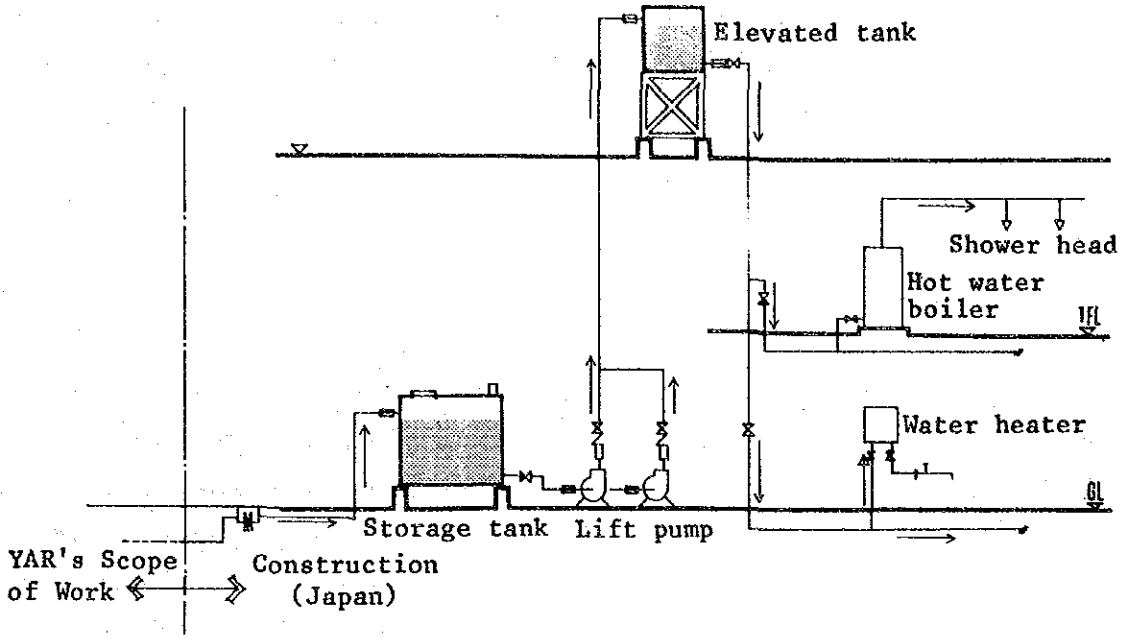
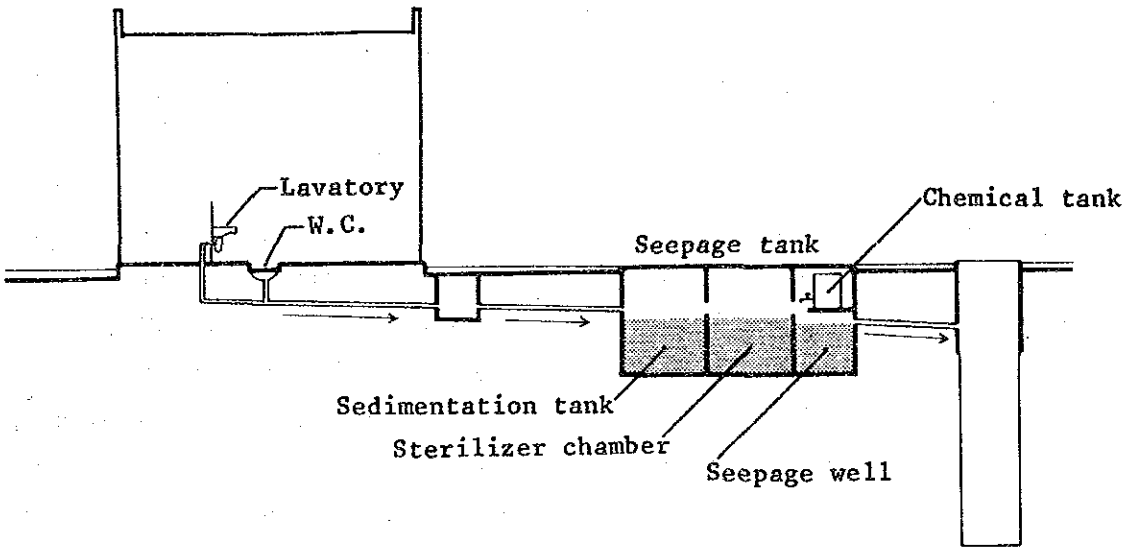


Fig. 17 Sewerage System (Sana'a Headquarters, Al-Hodeidah and Ta'iz Branch)



6) Sanitation Fixtures and Equipment

Western style, flush valve type water closet will be provided for use by the staff, while the oriental type will be installed for use by visitors, staff, and trainees. Lavatories will be provided with liquid soap dispensers, shelves and mirrors.

7) Heating Fuel

The heat sources available in the YAR are heavy oil, gas oil, kerosene oil, gasoline, and L.P.G., but city gas is not yet available. Homes in general use firewood, charcoal, kerosene and L.P.G. but for large users such as public buildings and hotels, fuel oil is used. L.P.G. is generally used with a little concern for safety and exhausting its supply while heavy oil is in storage at Al-Hodeidah from which supplies are sent to Sana'a and Ta'iz cities. In the proposed project, for the reasons above, heavy oil will be used for the generators, and electricity will be the heat source for the kitchenette room, shower room and kitchen.

8) Electrical Equipment

In the YAR, high voltage power (3 phase 3-wire 10 KV 50 Hz) is transformed into a 3 phase 4-wire 380V - 220V 50 Hz current in the electric room for use within the various facilities. Electric power is mostly supplied from the Al-Hodeidah and Reskateneb power Plants (total 165,000 KW). Although all major cities are provided with small scale power plants in addition to these sources, they are basically for emergency use or military facilities, and blackouts sometimes occur in all cities even to the present day. For this reason large facilities such as the principal hotels, hospitals, etc. have their own generators.

Therefore, for this project, at both Headquarters and Branches, transformers in the electrical rooms will similarly receive the high voltage power and will supply 3 phase 4-wire 380V, 220V, 50 Hz power, the

single phase 220V will be used for the electrical outlets for lighting system, and 3 phase 380V will be used for driving the motors. Generators (operating on heavy oil) will be installed at Headquarters and Branches to ensure their research works, such as the cultivation of bacteria will proceed without hindrance.

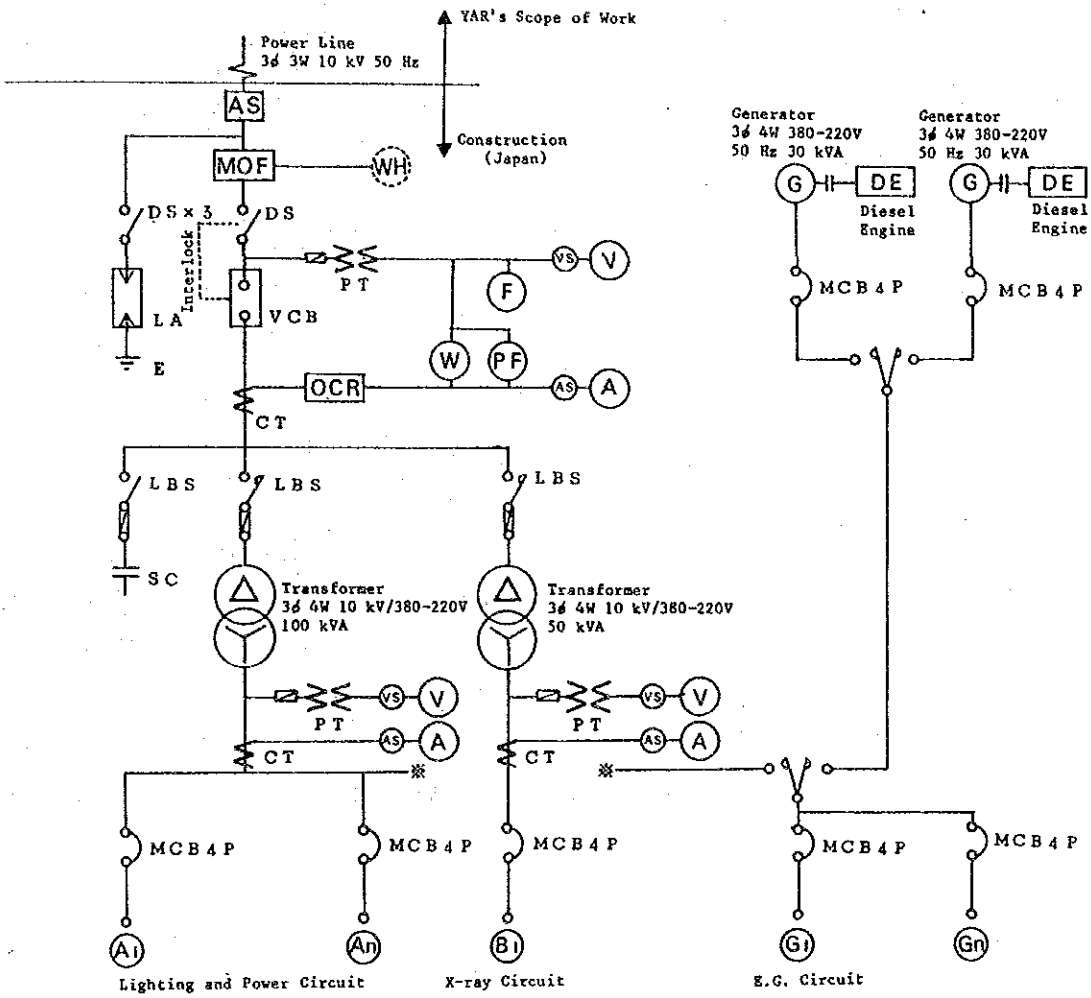


Fig. 18 Diagram of the Electrical System Sana'a Headquarters

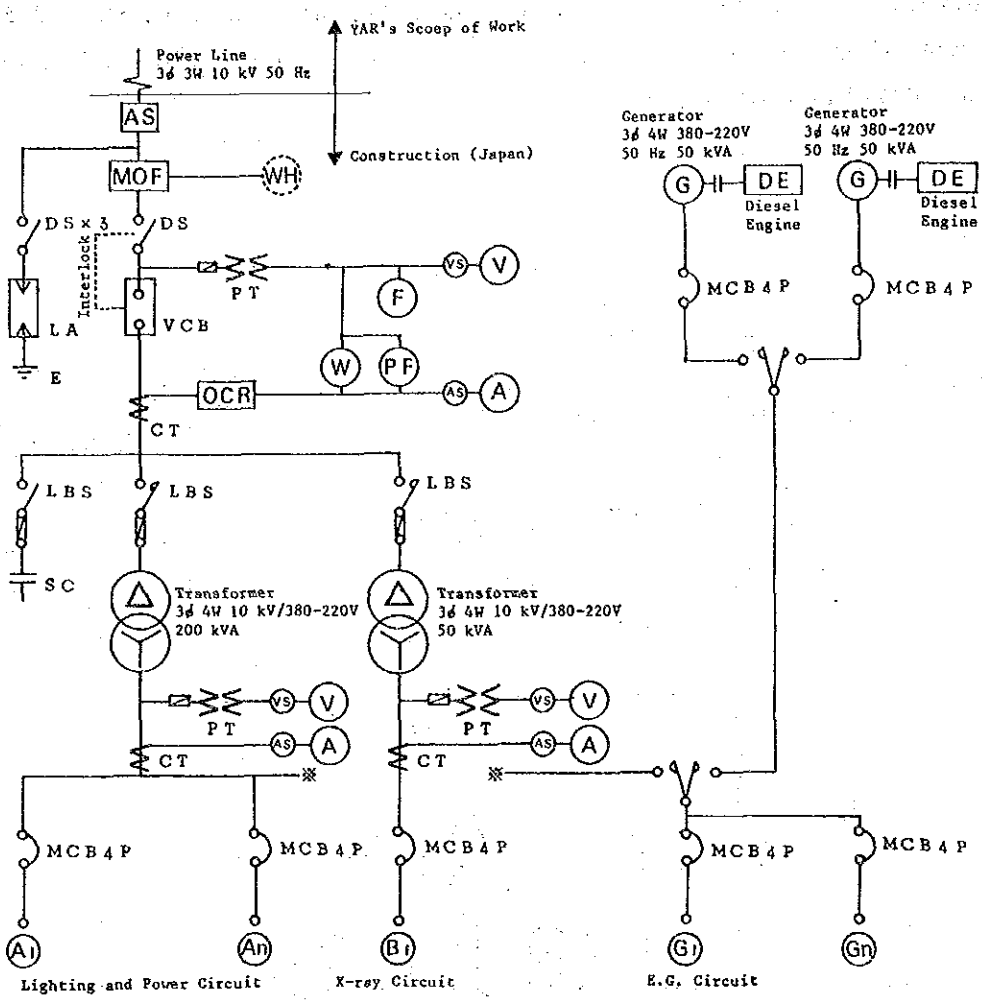


Fig. 19 Diagram of the Electrical System - Al-Hodeidah and Ta'iz Branches

9) Electrical Outlets for Illuminating Equipment

3 Phase 380V will be used for power and the 220V will be used for illumination and for the electrical outlets. The lighting system for the facilities will be through fluorescent lamps, but incandescent lamps and other illuminating devices, such as sterilizing lamps, will be used wherever necessary. The illuminance standards for the principal rooms are given in the following Table 26. [Conforms to JIS (Japanese Industrial Standards)]

Table 26 Illuminance Standards Required

Illuminance (Lux)	Room
400	Laboratory, Consultation Room
300	Reception, Office, Pharmacy, Medical Office, Conference Room, Classroom
200	Entrance Hall, Lounge
100	Waiting Lobby, X-Ray Room, Dormitory, Toilet, Corridors

10) Telephone Equipment

The propagation rate of the telephone in the YAR is about 13.5% but telephone charges are comparatively low (e.g. 12YR for 3 minutes between Ta'iz and Sana'a), and further expansion is expected. Automatic Exchanges of the electronic type and electronic pushbutton type telephone sets are being used so that there will be no difficulty to their implication for the project. A telephone exchange room will be allocated for the Sana'a Headquarters in which an electronic type automatic telephone exchange will be installed, while for the Branches, in view of the small demand, electronic pushbutton type telephones which do not require exchanges or operators, will be installed.

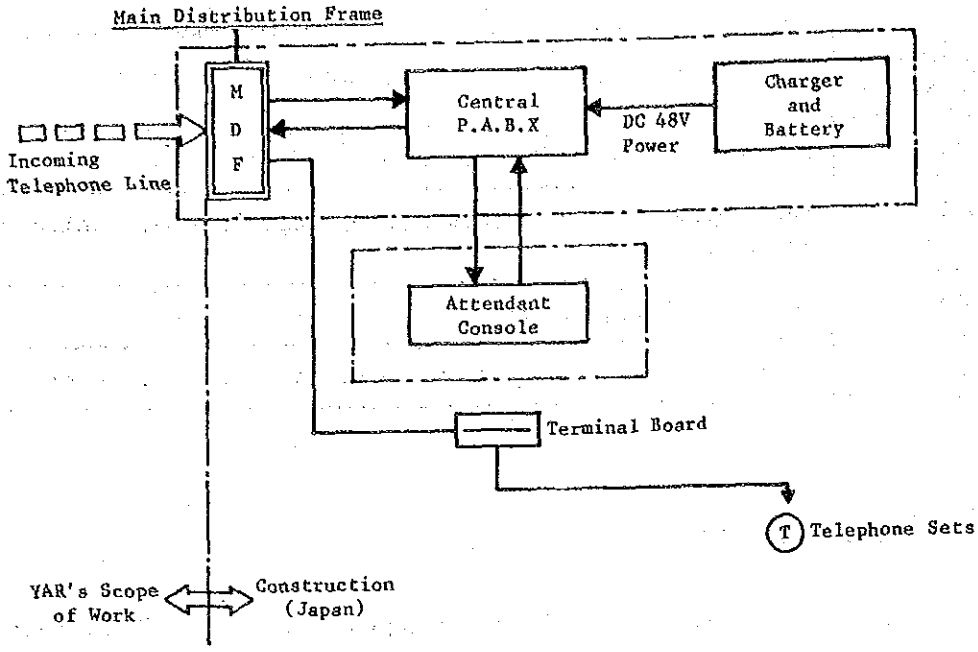


Fig. 20 Telephone (PABX) System, (Sana'a Headquarters)

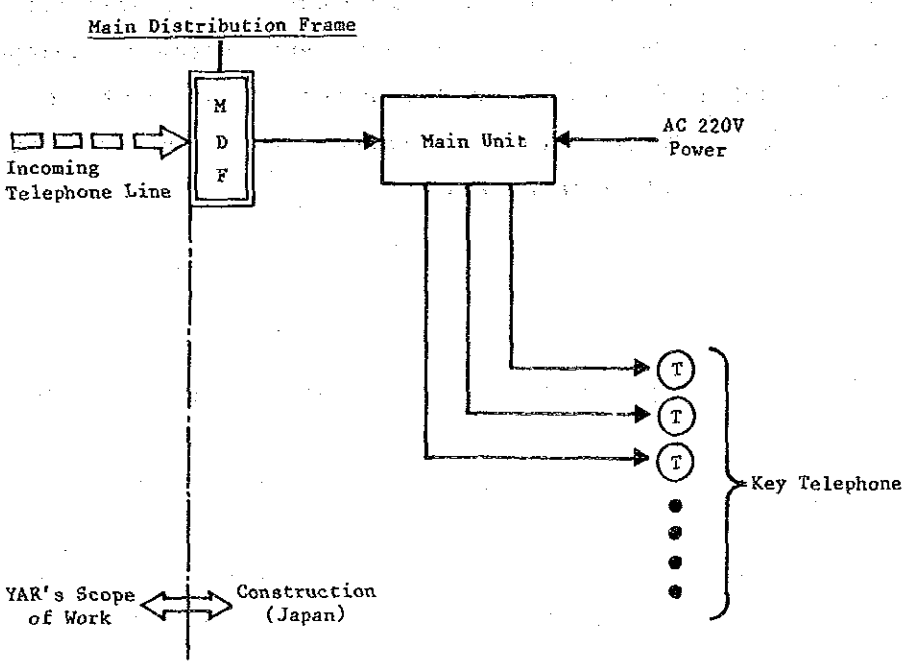


Fig. 21 Telephone (KEY) System, Al-Hodeidah and Ta'iz Branch

11) Interphone Equipment

It is installed between the X-ray room and the operation room.

12) Fire Alarm Equipment

Equipment that will automatically sense a fire and send out an alarm to vacate the building will be installed within the Centers. Alarm indicating panels will be installed in the offices for Headquarters and for the Branches. For Headquarters, another panel will be installed in the supervisory room for the dormitories.

13) Fire Extinguishers

In order to limit the damage in case of fire, extinguishers are to be installed in the kitchen where fires tend to occur.

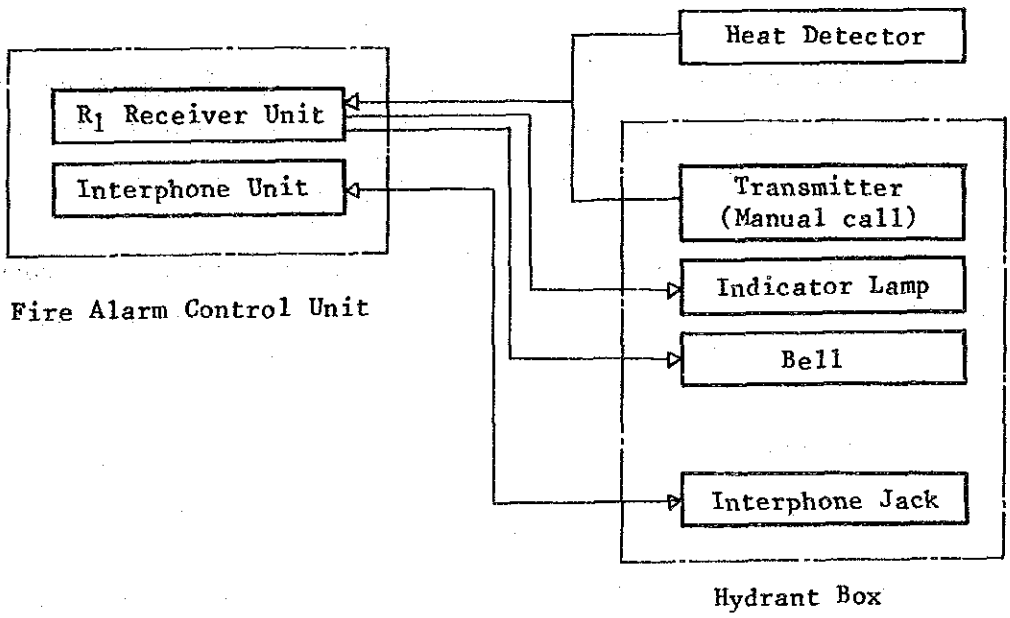


Fig. 22 Fire Alarm System

14) Outdoor Lighting Equipment

Lights will be distributed around the facilities and within the inner court yard for illumination and also as protection against thieves and vandals. The lighting will be through fluorescent lamps.

15) Lightning Protection

As protection against lightning, arrestors will be erected on top of the buildings with copper earth wires leading down to the ground.

(4) Materials Planning

1) Construction Materials

The selection of construction materials for this project will conform to the following policy:

① That the material can relate to the natural features and tradition of North Yemen and at the same time be adapt to modern construction methods.

② Materials that can be made available/match and to be procurable at the time when future expansion/renovations are to take place in the Tuberculosis Centres.

③ That the materials are clean, soil resistant durable, and applicable for medical facilities.

④ Application of local materials where they are stable in cost, procurability and of high quality.

⑤ That the materials are easy to maintain.

The main materials for the finishing operation, selected to conform to the above policy are shown in the Table 27.

Table 27 Finishing Profile

Main Section	Material
Exterior wall	Burned brick decorative masonry
Fixtures	Aluminum window, Steel door Wooden door
Flooring	Terazzo and Hard vinyl tiles, Vinyl lengthy flooring (chemical resistance)
Interior wall	Trowelled mortar + Paint
Ceiling (partial)	Sound absorbing rock wool panels and Direct ceiling
Interior doors	Wood
Decorative window	Plastered, Arabesque window

2) Facilities Equipment

The selection of facilities equipment for this project will be made under the following policy.

① Facilities equipment and materials which are difficult to obtain locally will be obtained from Japan.

② Conditions for the selection of the manufacturer are those experienced in export and possession of a system for after-care service.

③ Products will be used that are easy to maintain and are long lasting.

④ The system of the facilities will be simplified to reduce the initial and running costs.

⑤ Construction standards will conform to the regulations of YAR. If they are not available, Japanese standards will be used for reference.

⑥ Equipment is to conform to future plans of the Centres.

⑦ A plan will be provided for the supply of tools for the maintenance of the equipment and for consummable spare parts.

⑧ Provision will be made for prevention of disasters in the equipment planning.

Lists of the Facilities Equipment for the respective Centres are given in the Table 28.

Table 28 Mechanical Equipments Required (Sana'a Headquarters)

Classification	Item	Number of units
Water Supply and Sanitary Euipment	Water tank	1
	Elevated tank	1
	Lift pump	2
	Septic tank	1
	Seepage well	1
	Water heater (wall hanging type)	5
	Hot water boiler	1
Kitchen Equipment	Double sink	1
	Sink	4
	Cooking table	1
	Electric cooking stove (large)	2
	Electric cooking stove (small)	4
	Cooling stove table	4
	Freezer - Refrigerator	1
Air Conditioning Equipment	Room air conditioner 4,000 Kcal/H	5
	Ceiling fan 1,400 ϕ	3
	Electric heater	33
	Ventilating fan	14
Electrical Equipment	Transformer 3ϕ 4W 10 KV/380V/220V 200 KVA	1
	Transformer 3ϕ 4W 10 KV/380V/220V 50 KVA	1
	Generator 3ϕ 4W 380V-220V 50 KVA	2
	Telephone exchange outside line/inside line = 24/60	1

Table 29 Mechanical Equipments Required (Al-Hodeidah Branch)

Classification	Item	Number of units
Water Supply and Sanitary Equipment	Water tank	1
	Elevated tank	1
	Lift pump	2
	Septic tank	1
	Seepage well	1
	Water heater (wall hanging type)	1
Kitchen Equipment	Sink	1
	Electric cooking stove (small)	1
	Cooking stove table	1
Air Conditioning Equipment	Room air conditioner 4,000 Kcal/H	26
	Room air conditioner 2,000 Kcal/H	6
	Ceiling fan 1,400 ϕ	3
	Ventilating fan	8
Electrical Equipment	Transformer 3ϕ 4W 10 KV/380V/220V 100 KVA	1
	Transformer 3ϕ 4W 10 KV/380V/220V 50 KVA	1
	Generator 3ϕ 4W 380V-220V 30 KVA	2

Table 30 Mechanical Equipments Required (Ta'iz Branch)

Classification	Item	Number of units
Water Supply and Sanitary Equipment	Water tank	1
	Elevated tank	1
	Lift pump	2
	Septic tank	1
	Seepage well	1
	Water heater (wall hanging type)	1
Kitchen Equipment	Sink	1
	Electric cooking stove (small)	1
	Cooking stove table	1
Air Conditioning Equipment	Room air conditioner 4,000 Kcal/H	25
	Room air conditioner 2,000 Kcal/H	6
	Ceiling fan 1,400 ϕ	5
	Ventilating fan	8
Electrical Equipment	Transformer 3ϕ 4W 10 KV/380V/220V 100 KVA	1
	Transformer 3ϕ 4W 10 KV/380V/220V 50 KVA	1
	Generator 3ϕ 4W 380V-220V 30 KVA	2

3) Medical Instruments

Medical equipments required for this project will be selected under the following policy:

① Selection will be made of a product which can be operated manually, is efficient and sturdy, and is not a fully automatic product necessitating a high degree of technique for repairs in case of trouble.

② Inspecting instruments will be classified according to objective such as, microscopes for training and for research.

③ Product should be easy to maintain and supervise. The parts can be supplied to it extending for a long term

④ Product should be attached to stabilizer, etc. for unstable power source voltages, whenever necessary.

⑤ Product should be in accordance with the YAR specification (applicable to the natural conditions, climate, water quality and etc.)

⑥ Product should be in accordance with specifications and the reliability of the export.

⑦ The selection of the required product(s) should not duplicate with the one(s) which might be granted through Japan's Technical Cooperation.

Miscellaneous Factors

① Packaging to be carried out carefully to withstand temperatures of about 70°C in ship holds during transportation.

② Precision instruments should be vacuum packed or equivalent.

③ Proper care measures to be taken for precision instruments, such as coating the lenses of the microscopes.

④ Consideration to be paid to provide measures against dust, dirt (such as covering the openings with wire netting).

⑤ Instruction manuals will be prepared and provided and, a minimum training period to operate the equipment will be allocated.

The Table 31 is a list of medical equipments required in this Project.

Table 31 List of Medical Equipment Required
(Headquarters and Branches)

Department	Instrument Room	Item	Quantity			Total
			Sana'a	Hodeidah	Ta'iz	
Administration	Medical Staff Office	Film illuminator	1	1	1	3
		RP film illuminator	1	1	1	3
		Film illuminator with magnifier	1	1	1	3
	Advisor's Room	RP film illuminator	1	-	-	1
Clinical	Consultation Room (1),(2),(3)	Film illuminator	3	2	2	7
		RP film illuminator	3	3	3	7
		Examination bed	3	3	2	7
		Diagnostic instrument set	3	3	2	7
		Sphygmomanometer	6	4	4	14
		Instrument cabinet	3	2	2	7
		Screen	3	2	2	7
		Treatment instrument set	3	2	2	7
		Hand washing stand	3	2	2	7
		Waste receptacle	3	2	2	7
	X-ray Room	X-ray diagnostic system for mass chest	1	0	0	1

Table 31 (Cont'd)

Department	Instrument Room	Item	Quantity			Total
			Sana'a	Hodeidah	Ta'iz	
Clinical (Cont'd)	Dark Room	Work bench	1	1	1	3
		Safe lamp	1	1	1	3
		Film exchanger box	1	1	1	3
		RP Film illuminator	1	1	1	3
		Processing water bath	1	1	1	3
		Film hanger (2 types)	20	10	10	40
		Casette (3 types)	12	12	12	36
		Sink unit	1	1	1	3
	X-ray Reading Room	Film illuminator	1	1	1	3
		RP film illuminator	1	1	1	3
	Laboratory	Incubator (Small)	0	1	1	2
		Side table (Large)	3	3	3	9
		Side table (Small)	1	1	1	3
		Sink unit (Large)	1	1	1	3
		Sink unit (Small)	1	1	1	3
		Gas burner	4	4	4	12
		Clean bench	1	1	1	3
		Pipette washer with sulfur acid tank	1	1	1	3
		Chemical cabinet	1	1	1	3
		Instruments cabinet	1	1	1	3
		Microscope (x 1,000)	3	3	3	9

Table 31 (Cont'd)

Department	Instrument Room	Item	Quantity			Total
			Sana'a	Hodeidah	Ta'iz	
Clinical (Cont'd)	Laboratory	Centrifuge	1	1	1	3
		Refrigerator	1	1	1	3
		Stool	5	5	5	15
		Hand tally counter	1	1	1	3
		Centre table	1	1	1	3
	Pharmacy	Tablet filing cabinet	1	1	1	3
		Chemical balance	1	1	1	3
		Work bench	1	1	1	3
		Pharmacy set	1	1	1	3
		Instrument cabinet	1	1	1	3
	Injection Room	Injection unit	1	1	1	3
		Arm rest	2	2	2	6
		Hand washing stand	1	1	1	3
		Dressing drum stand	1	1	1	3
	BCG Vaccination	Autoclave, table top	1	1	1	3
		Hand washing stand	1	1	1	3
		Dressing drum stand	1	1	1	3
	Medical Drug Storage	Medicine refrigerator	1	1	1	3
		Shelf	4	4	4	12

Table 31 (Cont'd)

Department	Instrument Room	Item	Quantity			Total
			Sana'a	Hodeidah	Ta'iz	
Research	Research Laboratory	Centre table	2	-	-	2
		Side table	3	-	-	3
		Sink unit (Large)	1	-	-	1
		Sink unit (Small)	1	-	-	1
		Incubator (Large)	1	-	-	1
		Refrigerator	1	-	-	1
		Clean bench	1	-	-	1
		Pippet washer with sulfur acid tank	1	-	-	1
		Reagnet cabinet	1	-	-	1
		Instrument cabinet	1	-	-	1
		Cabinet for microscope	1	-	-	1
		Microscope (x 1,000)	1	-	-	1
		Microscope, with teaching head (x 1,000)	1	-	-	1
		Stool	5	-	-	5
		Centrifuge	1	-	-	1
		Balance, direct reading	1	-	-	1
		Balance table	1	-	-	1
		Hand tally counter	3	-	-	3
		Water bath	1	-	-	1
		Gas burner	4	-	-	4
	Chemical Storage	Medicine refrigerator	1	-	-	1
		Shelf	3	-	-	3

Table 31 (Cont'd)

Department	Instrument Room	Item	Quantity			Total
			Sana'a	Hodeidah	Ta'iz	
Training	Bacteriological Training Laboratory	Centre table	4	1	1	6
		Side table (A)	4	1	1	6
		Side table (B)	1	-	-	1
		Side table (C)	-	3	3	6
		Sink unit (Large)	1	1	1	3
		Sink unit (Small)	1	-	-	1
		Refrigerator	1	1	1	3
		Pipette washer with sulfur acid tank	1	1	1	3
		Reagent cabinet	1	1	1	3
		Instrument cabinet	2	2	2	6
		Cabinet for microscopes	1	1	1	3
		Microscope, with teaching head (x 1,000)	1	1	1	3
		Staining set	1	1	1	3
		Hand tally counter	6	6	6	18
		Balance, top-pan	1	1	1	3
		Stool	20	10	10	40
		Gas burner	4	4	4	12
		Microscope (x 1,000)	5	5	5	15
		Chalk board (wall type)	1	1	1	3

Table 31 (Cont'd)

Department	Instrument Room	Item	Quantity			Total
			Sana'a	Hodeidah	Ta'iz	
Training	Class Room (1)	Over-head projector	1	1	1	3
		Screen	1	1	1	3
		Slide projector	1	1	1	3
		Projector stand	1	1	1	3
	Class Room (2)	Over-head projector	1	-	-	1
		Screen	1	-	-	1
		Side projector	1	-	-	1
		Projector stand	1	-	-	1
	Preparatory Laboratory	Auto still	1	1	1	3
		Hot-air sterilizer	1	1	1	3
		Autoclave	1	1	1	3
		Blood coagulator	1	1	1	3
		Double sink	1	1	1	3
Others		Incinerator	1	1	1	3