MINISTRY OF HEALTH AND CHILD WELFARE
REPUBLIC OF ZIMBABWE

No. 01

BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
IMPROVEMENT OF MPILO CENTRAL HOSPITAL PEDIATRIC UNIT
IN
ZIMBABWE

FEBRUARY, 1998

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

SOZOSHA CO., LTD.

PREFACE

In response to a request from the Government of the Republic of Zimbabwe, the Government of Japan decided to conduct a Basic Design Study on the Project for Improvement of Mpilo Central Hospital Pediatric Unit and entrusted the study to the Japan International Cooperation Agency (JICA).

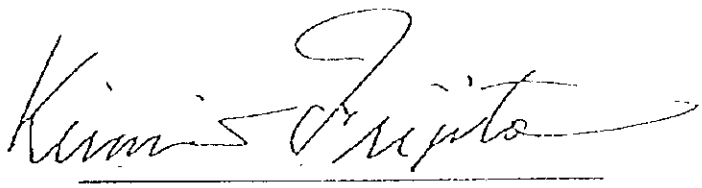
JICA sent to Zimbabwe a study team from August 11th to September 9th, 1997.

The team held discussions with the officials concerned of the Government of Zimbabwe and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Zimbabwe in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciations to the officials concentrated of the Government of the Republic of Zimbabwe for their close cooperation extended to the teams.

February, 1998



Kimio Fujita
President
Japan International Cooperation Agency

February, 1998

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Improvement of Mpilo Central Hospital Pediatric Unit in the Republic of Zimbabwe.

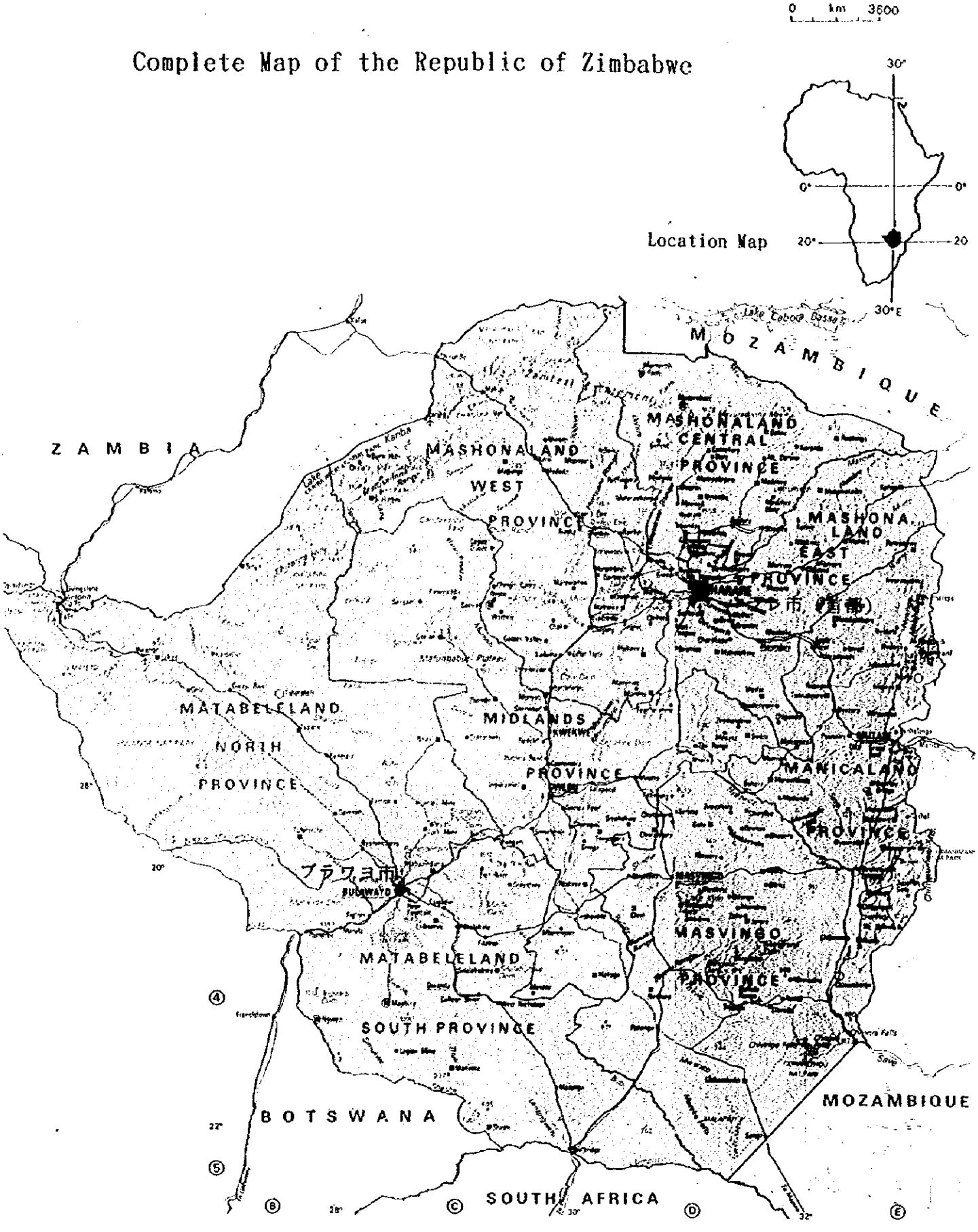
This study was conducted by Sozosha Co., Ltd. under a contract to JICA, during the period from July 31st, 1997 to February 26th, 1998. In conducting the study, we have examined the feasibility and rationale of the project with the consideration to the present situation of Zimbabwe and formulated the most appropriate basic design for the project under Japans grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

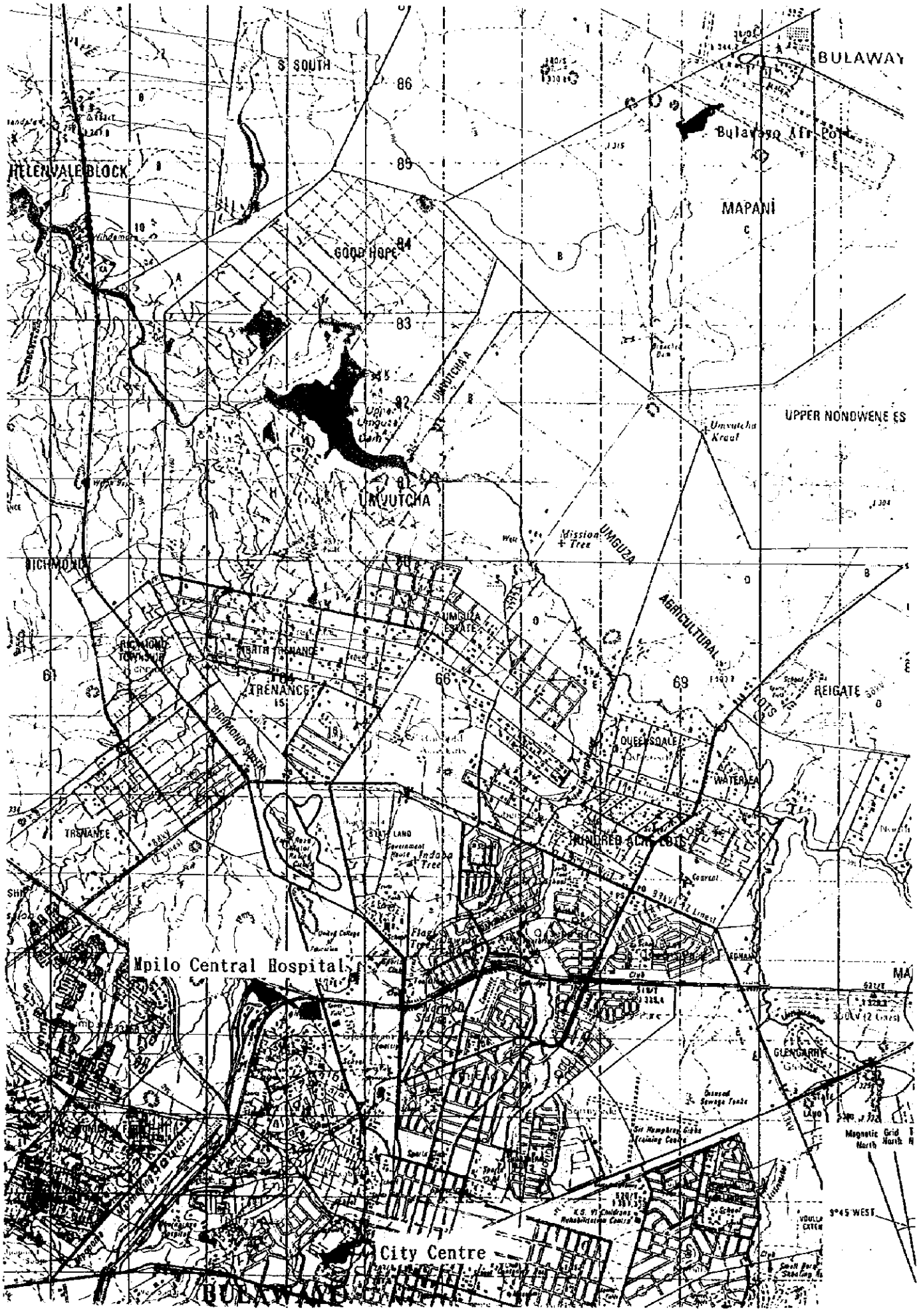
Very truly yours,

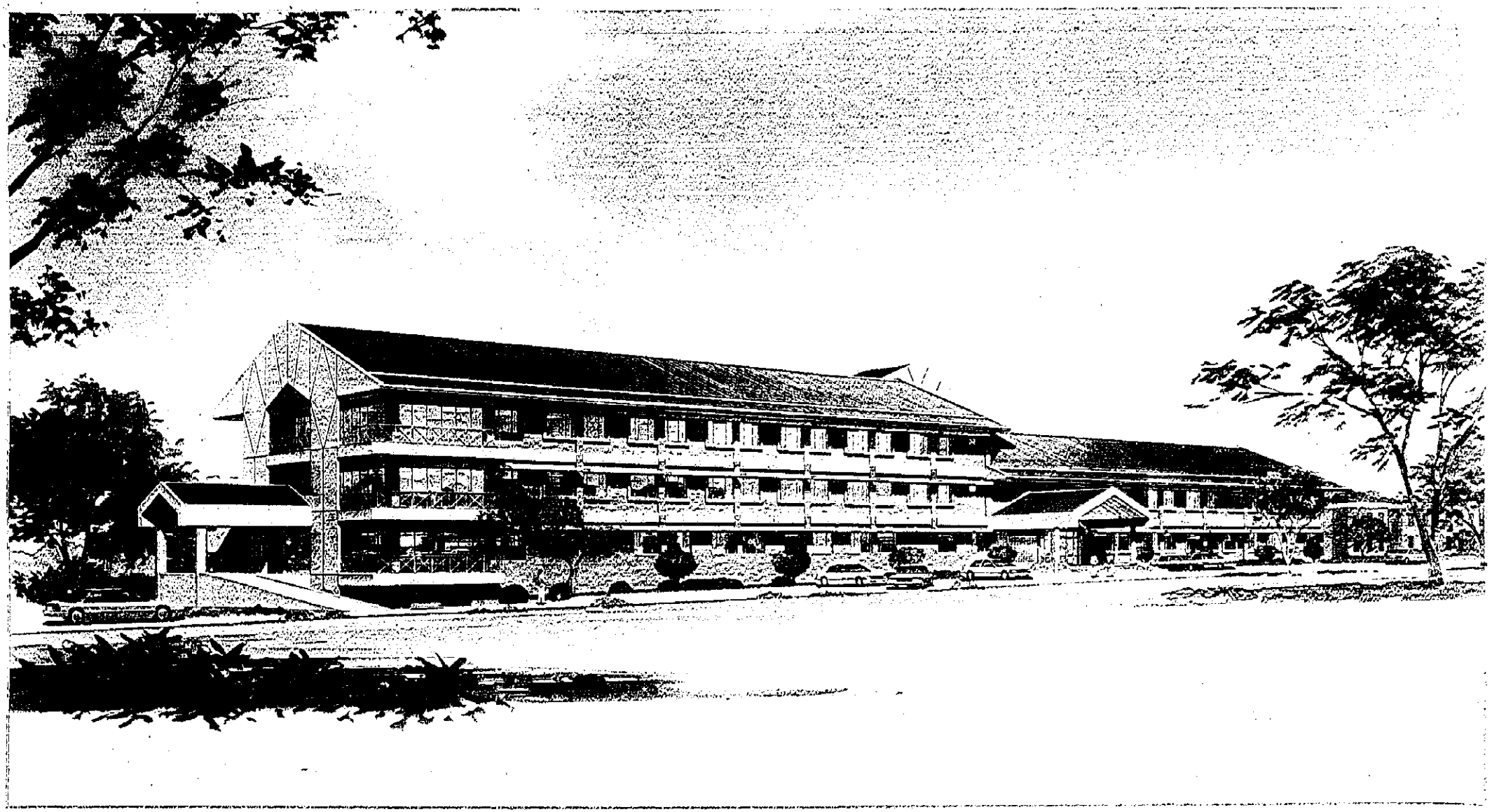
Eiji Kakizawa
Project manager,
Basic design study team on the project for Improvement of Mpilo Central Hospital Pediatric Unit in Zimbabwe
Sozosha Co., Ltd.

Complete Map of the Republic of Zimbabwe



Location Map





THE PROJECT FOR IMPROVEMENT OF MPILO CENTRAL HOSPITAL PEDIATRIC UNIT
IN
THE REPUBLIC OF ZIMBABWE

ABBREVIATIONS

AIDS:	Acquired Immunodeficiency Syndrome
BS:	British Structure Design Standard
CAS:	Central African Standard
ESAP:	Economic Structure Adjustment Programme
HIV:	Human Immunodeficiency Virus
ICU:	Intensive Care Unit
ISC:	International Seismic Center
MDF:	Main Distribution Board
NICU:	Neonate Intensive Care Unit
WHO:	World Health Organization

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CONTENTS

Chapter 1 Background of the Request

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1-1 Circumstances of the Request

Despite the goal of the Government of the Republic of Zimbabwe to "reduction of the infant mortality rate by 50%," which was established in its Second National Development Plan (1991-1995), the situation has not improved significantly still recording a high mortality rate of 37/1000 for children under five and 63/1000 for infants (1996).

Since independence, Zimbabwe has been emphasizing the development of rural and local regions under the "Development with Equity" policy. This was also applied to the health and medical sector, and the government was able to greatly improve the health and medical standards by establishing health and medical systems mainly focusing on primary health care under the "Equity in Health" slogan. Medical services in local regions, in particular, were enhanced and became functional as rural health centers and other facilities were upgraded. However, such development work quickly lost the momentum in the late 1980s and is causing various problems. Failure of economic policies under the socialistic government, spread of HIV infection and AIDS, and the worst draught of the century that struck the country in 1991 and 1992 pushed the Zimbabwean economy on the verge of bankruptcy, which resulted in a large budget cut for the health and medical sector. To reverse the economic situation, the Zimbabwean government adopted a structural adjustment plan under the guidance of World Bank, which led to a further reduction of medical budget and deterioration of medical service qualities. In the two year period following 1992, the real health budget per capita decreased by 30%.

As for the proportion of diseases, on the whole, infectious diseases, such as tuberculosis, malaria, schistosomiasis, acute respiratory infection, and diarrhea, are still prevalent. It is also changing in urban areas with circulatory disorders and diabetes on the increase. In addition, the recent outbreak of HIV/AIDS is prompting the government to take countermeasures.

On the medical institution level, there are such problems as overcrowding of urban central hospitals and other upper level institutions, inefficiency of medical care systems, and worsening working conditions for medical staff. Many pediatric departments particularly suffer from these problems as they are forced to share most of the facilities and equipment with other departments for adult patients.

Under such circumstances, Zimbabwean Ministry of Health, recognizing the importance of improving pediatric care, established an objective of "50% reduction of infant mortality rate" as its top priority.

Mpilo Central Hospital is located in Bulayawo City, the second largest city in Zimbabwe, and is positioned as a general hospital containing a pediatric department to serve the population in the southern and western provinces. However, the facilities, which were constructed in the 1950s, are mostly superannuated,

and medical equipment is insufficient. Increasing number of patients is exceeding the hospitalís accommodation capacity. This is particularly serious with the pediatric department, the facilities of which are inefficiently scattered in seven locations and lacking beds.

To correct the situation, the Zimbabwean government has developed the Project to improve and upgrade the Mpilo Hospital's Pediatric Department, by integrating the facilities and upgrading and supplementing medical equipment and requested the Japanese government for grant aid for the Project.

1-2 Outline of the Project

(1) Date of request: January 26, 1996

(2) Contents of Request: With regard to Mpilo Central Hospital:

1) Facilities

① Total of 220 beds for Medical, Surgical, and Special Wards

② 2 Operation Theaters and CSSD

③ ICU and NICU with a total of 62 beds

④ 8 examination rooms and waiting space for 100 people

⑤ Exclusive Administration Block for the Pediatric Department

⑥ Rehabilitation Block with bathing facilities for training

⑦ Laboratory Block for biological and physical examinations

⑧ School for inpatients

⑨ Mortuary with freezers to store 30 bodies

⑩ Exclusive Kitchen Block for the Pediatric Department

2) Equipment

① For Inpatient ward, beds, etc.

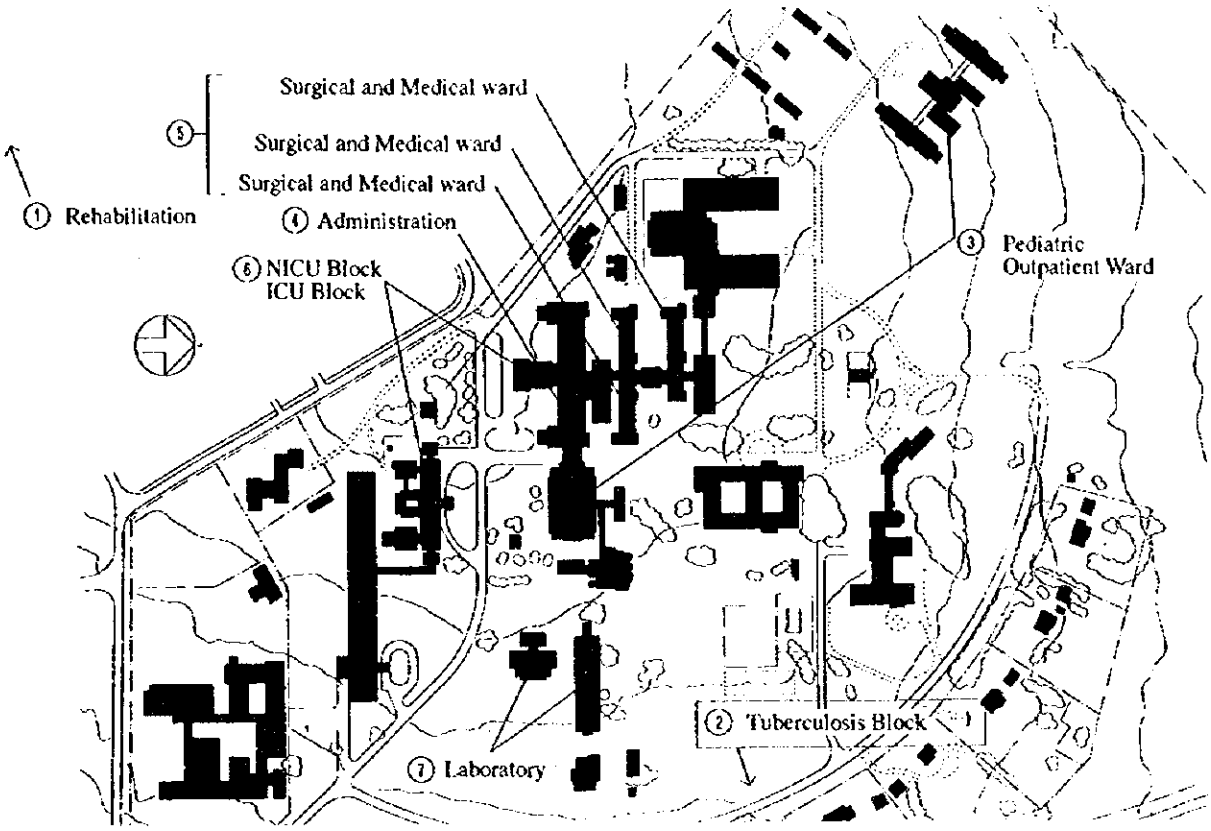
② For Theater department, operation table, suction apparatus, etc.

③ For ICU/NICU, incubator, light therapy apparatus, infusion pump, etc.

④ For Outpatient Department, wheel chair, stretcher, ECG, X ray device etc.

⑤ For Administration Department, computer, videocamera, etc. for studies and lectures

The map below shows the pediatric facilities now scattered in seven locations.



Chapter 2 Contents of the Project

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2-1 Purpose of the Project

The Mpilo Central Hospital Pediatric Department Improvement Project supports aims of achieving the primary goal promoted by the Ministry of Health to reduce the infant and juvenile mortality rate by 50% and intends to provide more proper medical services for pediatric patients from neonates to juveniles at each developmental stage by reconstructing the Inpatient Ward (145 beds), Pediatric Outpatient Ward, Theater Block, Emergency Block, ICU/NICU (37 beds) Block, and Administrative Block. Thus, the objectives of the Project are: ① to reduce the congestion of the Pediatric Ward, ② to improve the efficiency of medical operations, ③ to upgrade medical service level by the provision of superannuated and quantitatively insufficient equipment, and ④ to enhance the overall medical service quality and facilitate diagnosis and treatment at the Pediatric Department by realizing ①, ② and ③.

2-2 Basic Concept of the Project

2-2-1 Basic Policies for Cooperation

The appropriateness of the cooperation project request by the Zimbabwean government is justified by the fact that the Project intends to provide necessary facilities and medical equipment for upgrading the pediatric medical services of Mpilo Central Hospital, which is positioned to provide upper-level medical services for the population of four provinces in southwestern Zimbabwe under the government policy to reduce the infant mortality rate by 50%.

In addition, the following facts were verified through the Basic Design Survey.

① The existing beds are not sufficient to accommodate an increasing number of inpatients,

② Medical service facilities are inefficiently scattered in various locations in and outside the hospital premises,

③ Superannuated and quantitatively insufficient medical equipment is resulting in poor performances, and

By improving the above conditions, it is possible to upgrade the medical services of Mpilo Hospital of Zimbabwe and contributed to the achievement of the Health Ministry's prime objective.

However, as some of the facilities and equipment items requested by the Zimbabwean government were deemed redundant, excessive, or not absolutely necessary for the Pediatric Department, it was decided to provide the minimum amount to satisfy the essential requirements.

In view of the above considerations, we envisage the basic concept of this project as the improvement of the medical service qualities of the Pediatric Department of Mpilo Central Hospital, the top-referral hospital of the southwestern region of Zimbabwe, which will be realized by increasing the number of beds for the Medical Ward (currently with 145 beds) and ICU/NICU (37 beds), integrating and centralizing the facilities presently scattered in seven locations, and providing superannuated and insufficient medical equipment.

2-2-2 Review of the Contents of the Request

(1) Facilities

1) Medical/Surgical Ward Department

The Zimbabwean government requested the construction of a pediatric compound containing the Medial and Surgical Wards that accommodates a total of 220 beds, of which 100 beds are for neonates and infants (commonly used by male and female patients), and 120 for juveniles (separate beds for male and female patients). The number of existing beds (not separated for neonates and juveniles) in these wards are:

① No. of beds initially installed after construction:

Medical: approx. 80 beds

Surgical: approx. 40 beds

Total: 120 beds (legitimate number according to the original plan)

② No. of beds currently in place:

Medical: approx. 150 beds

Surgical: approx. 70 beds

Total: 220 beds (exceeding the legitimate capacity)

As the 220 beds currently in place are not enough to accommodate a large number of patients, each of about 20% of such beds (44 beds) is shared by two patients. This means that, if one bed per patient is to be achieved, a total of 264 beds are actually needed to meet the current requirement. Thus, 145 beds, which is the difference between the originally planed legitimate number of beds (120) and the actual requirement (264), will be included in the project design.

2) Theater Department

There are four operating theaters in the existing main building (central operation theaters) where approximately 80 operations were performed each week. There are two operating theaters in the Obstetric (antenatal) Ward (cesarean section and serious operations are performed at around 10 cases per week), and there is an operating theater in the postnatal ward (for family planning only). There is

no exclusive operating theater for pediatric patients. In view of the above, we decided to include only one operation theater, as opposed to the request requiring two theaters, because we figured that one would be sufficient to perform an average of 2.6 operations per day.

3) NICU and ICU

1. NICU

a. Legitimate number of beds (in the existing Obstetric Ward): 33 as broken down below:

- 5 beds × 4 rooms
- 7 beds × 1 incubator room
- 3 beds × 2 incubator room

→ Total of 33 beds

b. No. of beds currently required: 62 (exceeding the original plan) as broken down below:

- 5 beds shared by 10 patients × 4 rooms (40 beds are actually needed.)
- 7 beds shared by 12 × 1 room (12 beds are needed.)
- 3 beds shared by 5 × 2 rooms (10 beds are needed.)

→ Total of 62 beds

As indicated by the above figure, under these conditions , . For this reason, some of the beds and incubators are shared by two patients. Thus, 29 or so additional beds (62 minus 33) will be needed.

2. ICU

According to the hospitalis statistics, the monthly average bed requirement is eight (88/12 = 7.3). As the beds in the existing ICU are shared with adult patients, it is appropriate to establish a pediatric ICU with eight beds.

4) Outpatient Department (including Emergency Block)

The original Outpatient Block was built beside the main building to accommodate both pediatric and general outpatients. However, because accommodating both type of outpatients in one location has not been appropriate for its function, the Pediatric Outpatient Block was constructed away from the main building. The temporary Outpatient Block being remotely located from the Medical Wards and other facilities, they are poorly coordinated. In addition it is extremely crowded because of a large number of outpatients. Thus, it is essential to the centralization of the Pediatric Unit to include the construction of the outpatient department in the project.

5) Administration Department

The existing Administration Department is located by the main building like 4) above. We also decided to include the Administration Block in the project as it was necessary for the centralization of the Pediatric Unit.

The above five components are what the survey team found essential to satisfying the minimum requirements of the hospital in view of the purpose of the project, which is to centralize the Pediatric Unit currently scattered in seven locations, and to expand its accommodation capacity to reduce the congestion.

[Components to be excluded from the project]

Of the requested items, the following components were excluded from the project as we determined, based on the discussions with the Zimbabwean government officials, that their priorities were relatively low:

1) CRU/Physiotherapy Department

The hydro swimming pool and other facilities requested for speech therapy and other child development programs were excluded from the project, as we determined that the existing facilities shared by adult and pediatric patients were, although inadequate, still in an operable condition.

2) Laboratory Department

Of the biological and physical examination laboratories, the biological laboratory was excluded from the project because, although the existing facility was shared by adult and pediatric patients, it was still working and not causing particular problems.

3) School

Because the school in the existing main building is old but usable, it was excluded from the project.

4) Mortuary

Although the freezer to store bodies are not sufficient, it was excluded from the project as the current facility is still usable.

5) Kitchen Block

Although the existing building is inconveniently located in the back of the main building, it was excluded from the project as it has a sufficient capacity to prepare and provide meals.

(2) Equipment

Most of the existing equipment articles are 10 or more years old, and many have exceeded their useful lives. Such superannuated equipment is hindering the medical service activities of Mpilo Hospital.

Due to a shortage of incubators, many neonates weighing 1200 gram or less at birth are placed together in small heated rooms, to which mothers come to nurse their babies every two hours. These rooms are not equipped with respiratory monitors or artificial respiration units, and instead using the mothers to monitor the conditions of their babies. In some cases, two to three neonates (premature babies) are accommodated in one incubator. In view of these circumstances, the request for the incubators is deemed appropriate.

Oxygen cylinders are used mainly to treat and resuscitate infants and children with acute respiratory conditions (hyponea), and the resuscitation devices are not adequate to perform the job. The request for phototherapy equipment and bilirubin meters for dealing with jaundice, which newborn babies often develop, also seems appropriate.

Currently the Pediatric Department does not have its own ICU and it is using the monitoring units of adult ICU to check the vital signs of critically-ill pediatric patients when performing resuscitation or blood replacement operations. Therefore, the request for monitoring units for pediatric patients who have undergone surgeries is also appropriate.

The requests for emergency stretchers, wheel chairs, and transport incubators are appropriate as they are necessary to accommodate emergency pediatric patients sent from other areas.

As for the basic instruments requested while the survey team was on site (operating table, anesthesia unit, electric scalpel, suction unit, diffused lamps for operating theater, bed for exchanging blood of neonates, operating instrument kit, fiberscope, etc.), it is important to provide what is necessary to cover the minimum requirement.

In light of the above considerations, the appropriateness, quantity, and application of each of the requested items are as follows:

Equipment item	Q'ty requested	Location and Q'ty							
		Medical ward	NICU	ICU	Outpatient ward	Meeting room	X-ray room	Operation theater	Recovery room
Bed	66	60 (for juve-niles)							6
	70	60 (for patients)		10 (for ICU)					
Incubator	72	10	60	2					
Infant warmer	12	8	4						
Laryngoscope	1	1							
Ambulance bag	6	6							
Oxygen moni-tor	3	3							
Infusion pump	10	10							
Syringe pump	10		5	5					
Suction appa-ratus	12	2						10	
Fully-auto-mated sphyg-momanometer	4	4							
Pulse/oxy meter	20		17	2				1	
Patient moni-tor	62	1	42	3				16	
ECG	2				2				
Weighing scale	2	2							
Phototherapy apparatus	16	2	12		2				
Wheel chair	20	7			12				
Stretcher	20	7			13				
Peack flow meter	6	6							
Breast pump	8	8							
Ultrasonic nebulizer	6	6							
Blood glucose meter	2		1	1					
Ventilator	8		1	1				6	
Video camera	1					1			
Slide projector	2					2			

Equipment item	Q'ty requested	Location and Q'ty							
		Medical ward	NICU	ICU	Outpatient ward	Meeting room	X-ray room	Operation theater	Recovery room
Overhead projector	2					2			
Computer	1					1			
Electric typewriter	2					2			
Copy machine	1					1			
CPR equipment	20		20						
Film viewer	3		3						
X ray device (movable)	1						1		
Bilirubin meter	1		1						
Operating table	4							4 (for inveniles)	
	4							4 (for neonates)	
Electric scaipel	6							6	
Diffused lamp (ceiling type)	2							2	
Diffused lamp (movable)	4							4	
Portable incubator	6							6	
Anesthesia equipment	16							8	8
Defibrillator	2								2
General surgery kit	6							6	
Plastic surgery kit	1							1	
Gastroscopy surgery instrument	4	2	2						
Bronchoscope for neonates	2		2						
Rigid type bronchoscope	2				2				

2-3 Basic Design

2-3-1 Design Policy

In designing the project, it is important to consider an efficient coordination with the Obstetric (antinatal/postnatal) Department while satisfying the following conditions:

① In deciding the scale of each proposed facility, the present number of patients, personnel allocation plan of doctors and nurses, and operation costs shall be considered so that the scale shall be manageable and yet allow effective enhancement of the service quality.

② As the pediatric department will be sharing the CSSD and some of the responsibilities, such as admitting neonate ICU patients, with the adjacent antenatal ward and the existing postnatal ward, an efficient functional coordination among and easy access to and from these departments are needed. Thus, the basic design needs to be drafted based on comprehensive studies on the contents and existing equipment of these facilities as well as considerations for a good balance between the function, quantity, grade, construction cost, and other elements of the proposed pediatric unit and those of the rest of the facilities in the hospital.

③ The facilities and equipment shall be so designed that, after completion, they will require minimum maintenance and management costs and can be maintained by the Government of Zimbabwe on its own account.

④ The construction plan shall be developed to use local construction methods based on the assumption that local contractors will be constructing the buildings under the supervision of a Japanese construction company.

⑤ As a rule, only the kind of construction materials produced or obtainable in Zimbabwe at reasonable prices without any possibility of supply shortage shall be selected and used.

⑥ As a general principle, equipment types that are equivalent to those of the existing items shall be selected, fully considering the technical, maintenance, and management capabilities of the Zimbabwean medical technicians.

Based on the above design policies, the following values are adopted.

(1) Policies Concerning Natural Conditions

Altitude of Bulawayo City:	1,295 m (Mpilo Central Hospital: 1,340 m)	
Climate:	Continental tropical	
	Rainy season:	November to March
	Post lrainy season:	April to May
	Cool/dry season:	June to August
	Hot/dry season:	September to October

1) Temperature, Humidity

The average annual temperature of Bulawayo City is between 20 and 25°C. The lowest temperature in June and July (cool and dry season) is between 6.5 and 8°C. From October to March (hot and dry or rainy season), the lowest temperature is between 14 and 18°C, and the highest temperature is between 25 and 31°C.

The average humidity for the one-year period from August 1996 to July 1997 was 60%.

* Policy: To reduce maintenance costs, the buildings will utilize as much natural ventilation as possible, and air conditioners shall be installed only in the rooms in terms of the function.

2) Rainfall

The average annual precipitation of Bulawayo City (from August 1996 to July 1997) is 840 mm. It rains heavily from November through May.

* Policy: The roof pitch shall be so determined as to provide good drainage.

3) Wind

Rainy season: The Zaire Wind from northwest and the Southeast Trade Wind from southeast bring rainfall to the region.

No typhoons or storms strike the region, and no strong winds blow all year round.

* Policy: The design shall not take wind factors into consideration.

4) Earthquake

Zimbabwe, which is geologically situated in the Kalahari bedrock zone, is hardly affected by seismic activities of the surrounding areas.

According to International Seismic Center (ISC), no earthquake has occurred in Zimbabwe and its environs since 1964. Zimbabwe's Ministry of Local Government and National Housing is not taking earthquake resistance into consideration for the design of public buildings.

* Policy: The main structure shall use the reinforced-concrete rigid structure, and the structural design standard shall be in accordance with British Standard adopted by the Zimbabwean government. (According to this method, structural materials are selected and calculated based on vertical load but not on horizontal load.)

5) Thunder and Lightening

Thunder and lightning are observed about 80 days in the rainy season each year.

* Policy: Lightening conductors shall be installed.

(2) Policies Concerning Construction Conditions

1) The public facilities shall be designed in accordance with the Ministry of Local Government and National Housing standard.

2) Various application, filing, and inspection procedures shall be followed upon consultation with the representatives from the Ministry of Local Government and National Housing.

(3) Policy for Using Local Constructors, Materials and Equipment

1) Local contractor in Zimbabwe possess generally high construction capabilities.

As good cooperation with local constructors is the key to successful construction, Japanese construction company shall hire and supervise appropriate local contractors

2) Construction materials and equipment shall be selected only from those manufactured or obtainable locally so that they can be easily maintained after completion.

3) Normal construction methods likes as not beyond the capability or technical levels of local contractor and engineers shall be taken.

4) Securing and allocation of personnel and construction schedule shall be planned by taking into account the work efficiency of local laborers and the deadline for the completion of the construction.

(4) Policy for Maintenance and Management Capability of Executing Agency

1) The facility shall be so designed as to allow easy operation and management.

2) To minimize the operational cost, energy-saving measures shall be adopted as much as possible.

3) Construction materials and method that are suitable for the climatic conditions and easy to manage and control shall be selected.

(5) Policies Concerning Scope and Grade of Facility and Equipment

1) The quality levels of the proposed facilities and equipment shall be equivalent to those of the existing Obs
tetric (antenatal) Ward of Mpilo Hospital to achieve a good balance.

2) As a need for expansion due to an increase of patients and changes in medical service methods is predicted, the facility layout should be able to accommodate such expansion.

3) The main structure shall use the reinforced-concrete rigid structure and brick walls, which should be erected by means of a construction method commonly used in Zimbabwe.

(6) Policies Concerning Functional Connection with Existing Obstetric Ward

In designing the facility plan for the Pediatric Ward, its medical service connection with the operating theater and the CSSD in the existing Obstetric (antinatal) Ward and, the NICU (whose space, however, is insufficient) in the existing Obstetric (postnatal) Ward shall be taken into consideration, and the ways to effectively utilize these existing facilities shall be pursued. To enable the Pediatric and Obstetric Wards to operate efficiently, functionality and economy shall be given priority in the design.

(7) Policies Concerning Construction Period

The construction period of the proposed facilities shall be determined based on the procurement and supply conditions of construction materials, technical capabilities of local laborers, conditions of the construction site and its environs, etc.. The construction work shall be completed by the due date set forth in the E/N.

2-3-2 Basic Plan

(1) Basic Facility Plan

1) In specifying the construction site for the project, we selected the four candidate sites I to IV below, considering the coordination with the existing Obstetric Wards.

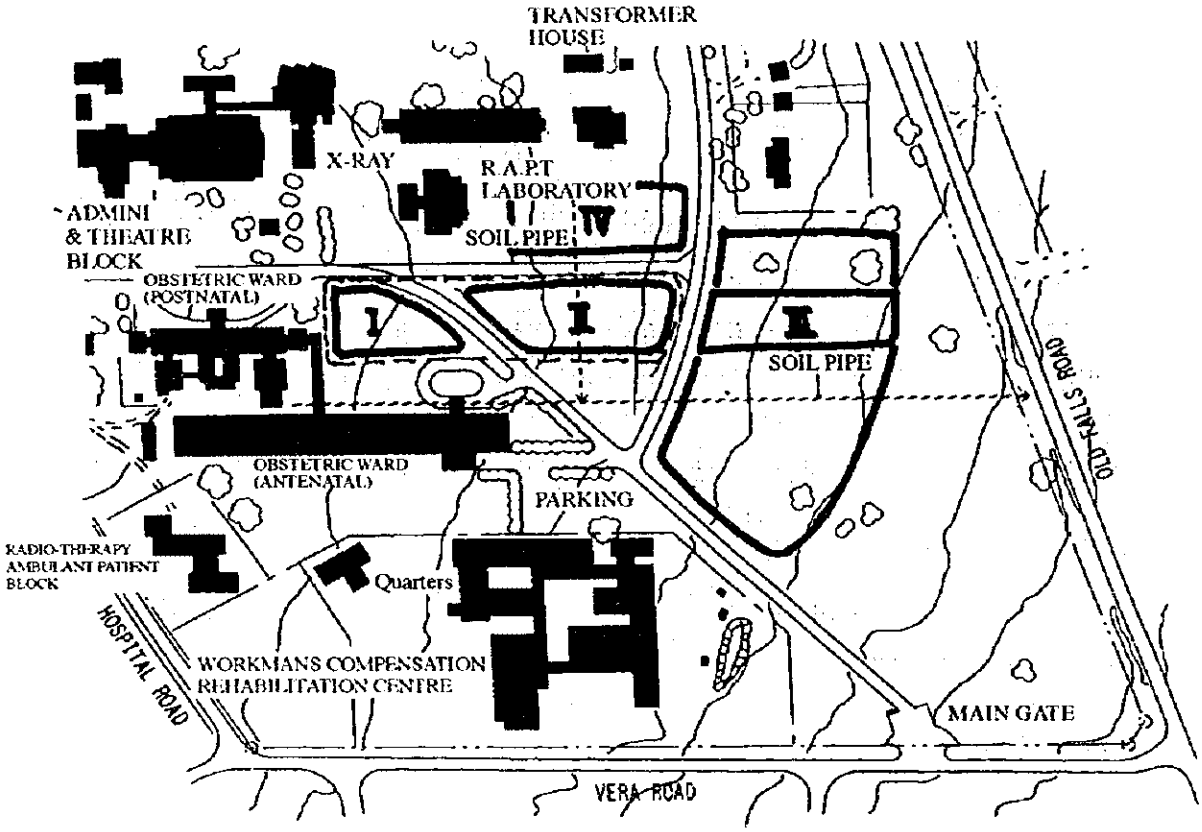


Figure 2-1 Comparison of Site Utilization

Table 2-1 Comparison of Site Utilization

	Space	Connection with existing facility	Expandability	Overall
I	Insufficient △	◎	△	×
II	Insufficient △	○	△	△
III	Sufficient ◎	△	△	○
IV	Ample △	△	○	△
I + II	Sufficient ◎	◎	◎	◎

Based on the above comparison, the site joining I and II was selected, as it would provide sufficient space and expandability and would be closer to the existing obstetric ward.

However, in designing the facility plan on the I + II site, the following factors need to be considered:

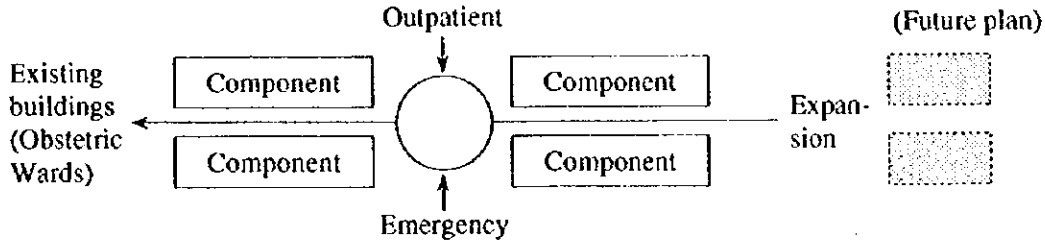
① The approach road to the main building needs to be rerouted at the expense of the Zimbabwe side. As the existing main entrance will not be usable during the construction work, a temporary one needs to be constructed on the west side of the premise.

② The access road will be shared by the emergency pediatric patients and patients of the existing obstetric (antenatal) ward. Also, as the existing approach road to main building has to be rerouted, the approach road for emergency patients needs to be partly repaired at the expense of the Zimbabwean side.

③ Some parts of the existing sewage pipelines need to be rerouted at the expense of the Zimbabwean side.

2) Facility Layout Plan

Type A (middle-corridor compact type)



Plan B (finger type)

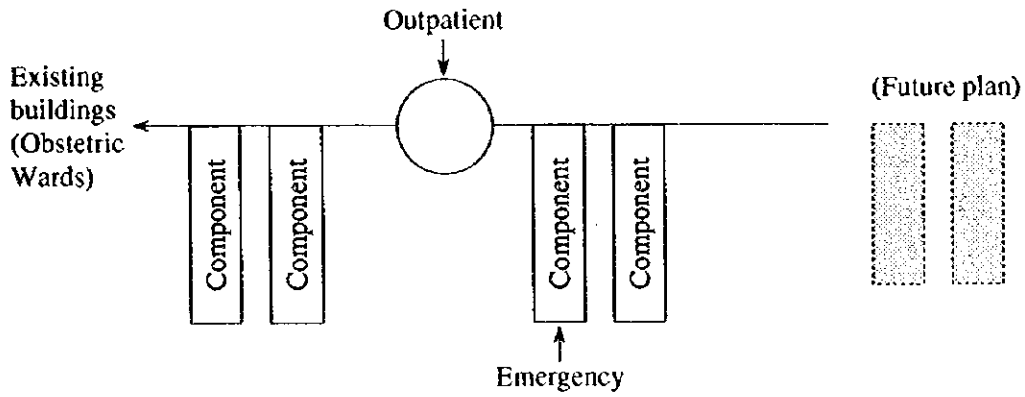


Table 2-2 Comparison of Facility Layout

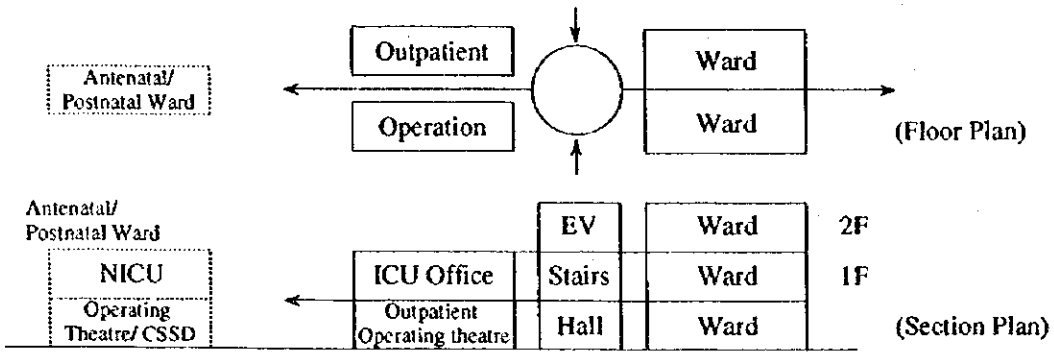
	Connection to existing wards	Expandability	Space efficiency	Cost performance	Lighting & ventilation	Overall
A	○	○	○	○	△	◎
B	○	△	△	△	○	○

Based on the above comparison, Plan A with middle corridor was selected as it could better accommodate future expansion and would require less space and construction cost to provide enough space for the installation of necessary facility contents.

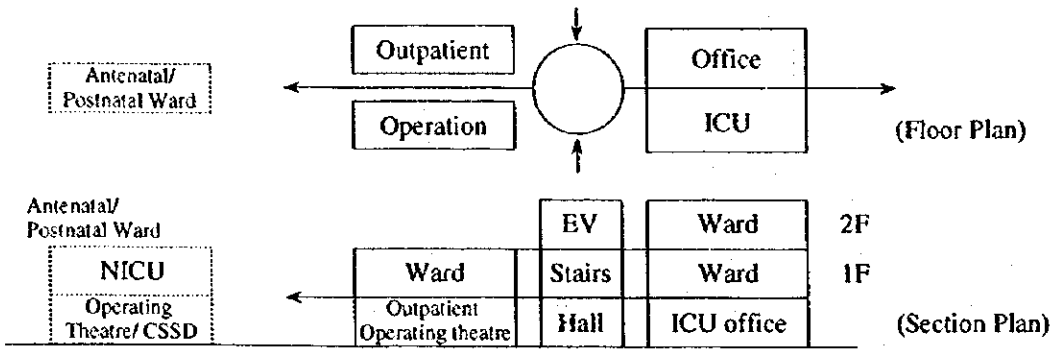
3) Floor Plan

In drafting the floor plan for each floor level of the Type-A plan, Plans A-1 and A-2 were examined and compared as below:

A-1



A-2



We selected Plan A-1 as it provides better coordination among the operating theater, CSSD, and NICU. CSSD is on the ground floor of the existing Obstetric (antenatal) Ward, and the NICU was on the first floor of the postnatal ward).

(2) Architectural Plan

1) Floor Plan

① Concept of calculation for total floor area

The total floor area for facility and floor area for each rooms were calculated based on the following principles:

a. Calculation is made for the facilities consisting of Medical Block, Theater Block, Outpatient Block, ICU Block (including NICU), and Administrative Block as described in 2-2-2 above.

b. Floor area of each room and annex building is calculated based on the accommodation requirement and floor area standards of Zimbabwe or where reference data is not available, Japanese architectural design standards.

c. For rooms or facilities for which scale calculation based on the accommodation requirement is difficult to make, floor area is calculated based on the space requirement for the equipment to be installed.

d. For rooms, for which calculation is possible based on the accommodation requirement, floor area is calculated based on the per-capita area while taking into consideration the working practice of the local staff, equipment layout, and other factors. Floor space of such rooms as toilet, change room, and shower room, which require proportional distribution of space for male and female, is calculated based on the male/female ratio of the staff and patients.

② Scale Calculation of Each Room

• Staff Room/Office space:	4.5 - 7m^2/ person
• Sickroom:	We will adopt the area required by the Zimbabwean Medical Law, which is 6 m^2/bed + 1.5 - 3.0 m^2/attendant or more.
• Operating Room:	Although the space requirement varies depending on the number of surgeons, assistants, and anesthesiologists, as well as the layout of various instruments, we will adopt a common floor space in Zimbabwe, which should be sufficient not to obstruct the movement of doctors and nurses.
• Other space:	The scale of other special rooms will be set in accordance with the layout of various equipment and other articles.

* The scale of other rooms are determined based on the layout of various equipment and instrument.

a. Surgical Department Matron

Basis of calculation: Included the space for installing a desk, bookshelves, cabinets, and other types of furniture. (25 m2 or more space is allocated in Zimbabwe.)

Floor area: 25.74 m^2

b. Change Room (male/female)

Basis of calculation: Equipped with lockers, lavatories, and showers.

Floor area: 16.50 m^2

c. Operating Theater

Basis of calculation: Surgeons, assistants, and anesthesiologists will be working, and instrument tables, scrub unit, and many other instruments will be installed in this room. We used the standard floor space for operating theater in Zimbabwe of 40 m^2.

Floor area: 41.58 m^2

d. Anesthetic Room/Patient's Waiting Room

Basis of calculation: Patient enters the operating theater through the anesthetic room, and doctors and nurses enter the operating theater through the scrub-up room. The floor space is so determined as to secure enough area for passage and instruments.

Floor area: 10.40 m^2

e. Recovery Room

Basis of calculation: The room accommodates patients, who have undergone surgery, until their breathing, pulse rate, blood pressure and other conditions become stable, and they regains consciousness. We decided to install three beds based on the average number of operations performed per day (2.6 cased/day).

Floor area: 33.00 m^2 (11 m^2 per bed)

f. Emergency Room

Basis of calculation: Pre-surgical treatment, treatment that needs protection of privacy, blood taking, bandage exchange, etc. are carried out.

Floor area: 18.15 m^2

g. Resuscitation Room

Basis of calculation: Infants and children are prone to accidents, such as choking and drowning, as well as sudden condition changes.

Work space for performing artificial respiration, cardiac compression massage, clearing of airway, injection of drugs, administration of oxygen, and other treatments shall be secured.

Floor area: 20.79 m^2

h. Sick rooms (8 beds/ room)

Basis of calculation: As stated above, 7.8 m^2 per bed is adopted.

Floor area: 62.37 m^2/room

i. Side Ward (3 beds/ room)

Basis of calculation: In addition to beds for isolated patients, lavatory and bathroom will be installed.

Floor area: 27.74 m^2

(9.24 m^2/bed)

j. Staff Room/Nurse Station

Basis of calculation: In the office space, a common table, instead of individual desks, as well as bookshelves will be installed. Work space for eight day-shift nurses (four night-shift nurses) shall be secured.

Floor area: Staff Room: 20.79 m^2 , Nurse Station: 19.53 m^2

- The number of beds per nursing unit in this project is 48.
- It is assumed that 16 nurses are required for each nursing unit (A day team is formed by a group of eight nurses alternating with one other group).

Table 2-3 Floor Area of Each Room (1/2)

(Unit: m^2)

DEPT. & FLOOR	Facility	Area m^2	Remarks
Outpatient, ER, Operating Theater, Sickroom (Ground Floor)	• Waiting hall	137.70	For 100 people (1.37m^2/person)
	• Office	25.83	For 5 people (5.16m^2/person)
	• Nurse Station	12.92	For 6 people (2.15m^2/person)
	• Examination room	64.57	12.91m^2 × 5 rooms
	• Doctor's waiting room	12.92	
	• Consultation room	12.92	
	• Matron	25.83	6. Space for 1 head nurse and reception corner and work space for 6 people (3.05 m^2/person)
	• Nurse's room	18.27	
	• Ultrasound Laboratory	14.10	
	• X-ray examination room	14.1	
	• Emergency treatment room	18.48	
	• On call Room	10.23	1 bed
	• Resuscitation room	20.79	
	• Change room	33.0	16,5 × 2 rooms
	• CSSD	20.47	
	• Dirty Corridor	62.37	
	• Anesthetic Room	10.39	
	• Sluice Room	20.79	
	• Theatre	41.58	
	• Scrub Up Room	11.88	
	• Setting room	11.88	
	• Recovery Room	33.00	3 beds (11m^2/bed)
	• Matron	23.76	
	• Doctor's room, Nurse's room	20.79	10.39m^2 × 2 rooms
	• Sickroom	311.85	62.37m^2 (8 beds × 5 rooms = 40 beds 7.8m^2/bed)
	• Nurse Station	62.37	For lavatory and dirty room
	• Tretment Room	20.7	
	• Resuscitation Room	20.7	

Table 2-3 Floor Area of Each Room (2/2)

(Unit: m^2)

DEPT. & FLOOR	Facility	Area m^2	Remarks
ICU, NICU, administration, sick-room (First Floor)	• ICU, NICU, administration sick-room		
	• ICU	208.53	8 beds, Lavatory, 12.26m^2/bed
	• NICU	85.0	29 beds, 4.25 m^2/bed
	• Nurse Station	42.5	Including work space
	• Manager's office	28.35	
	• Matron	28.35	(Internal/Surgical)
	• Waiting Room	28.35	(Doctors/Staff)
	• Meeting Room	28.35	15 peoples, 1.89m^2/person
	• Medical Records Room	28.35	
	• Sickroom	374.22	62.37 (8 beds × 6 rooms = 48 beds 7.8m^2/bed)
	• Nurse Station	62.37	For lavatory and dirty room
	• Treatment room	20.7	
	• Resuscitation room	20.7	
Sickroom (2nd Floor)	• Sickroom	374.22	62.37 (8 beds × 6 rooms = 48 beds, 7.8m^2/bed) [1 High-care sickroom 8 beds 1 High-care sickroom 8 beds 4 Sickroom 32 beds]
	• Nurse Station	62.37	For lavatory and dirty room
	• Treatment room	20.7	
	• Resuscitation room	20.7	

Table 2-4 Overall Scale of Pediatric Ward

	Pediatric Ward (m^2)					Utility Building (m^2)	
	Sick ward	Stairs B	Subtotal	Corridor Passageway	Slope way	Electric/ pump room	Medical gas storage
Ground Floor (No. of Bed)	2,132.46 (43)	43.75	2,176.21	100.5	184.25	200.0	20.0
1st Floor (No. of Bed)	1,835.46 (51+37=88)	33.25	1,868.71	84.0			
2 FL (No. of Bed)	1,087.02 (51)	33.25	1,120.27				
	5,054.92	110.25	5,165.19	184.5	184.25	200.0	20.0
	182 beds	1 location		1 location	1 location	1 location	1 location
	[No. of ward bed: 145 No. of ICU bed: 8 No. of NICU bed: 29]			5,533.94 m^2			
	Total		5,753.94m^2				

The above figure include the floor area of the Outpatient, Emergency, Surgical, Administration, ICU, and NICU Departments.

The inpatient ward occupies an area of 2,910.60 m^2, which, when divided by 182 beds, translates to 20.07 m^2 per bed.

There is no standard for per-bed space in Zimbabwe. Thus, we adopted 20.07 m^2 based on the range of 20 - 25 m^2 recommended in Japan.

2) Elevation and section planning

① The ground floor will be connected to the existing obstetric buildings by a corridor, and the floor level will be parallel to the ground level.

② The floor-to-floor heights will be 3.8 m and will be the same as that of the existing Postnatal Ward.

③ The ceiling height will be 3.0 m. The standard door height of main rooms shall be 2.0 meters.

④ In order to reduce the construction and maintenance costs, natural lighting and ventilation shall be generally used. Large windows will be installed to secure sufficient lighting and ventilation.

⑤ For security reasons, window bars and security systems shall will be installed.

⑥ To cope with torrential downpours in the rainy season, sloped saddle roofs will be used. The roof pitch will be 35% or more, and roof tiles will be used. The pitch of the eaves will be around one meter.

⑦ Glass partitions between central corridor and sickrooms can have easy management of patients by nurses and good ventilation.

3) Structure plan

① Structure design policy

The building shall be free from vibration and flexion in long-term load. The basic design policy will assure adequate safety against an earthquake load and wind pressure. The building shall be designed based on the "Model Building by-Law" of Zimbabwe and will use the structural standards of Japan and other criteria.

② Structure design standard

The structure design standard in Zimbabwe is made based on the British Structure Design Standard and specifies the following items:

Load	CAS 160	Specification of Load and Stress
Design of reinforced concrete structure	BS 164	Specification of Reinforced Concrete Structures
Design of steel frame structures	CAS 157	Specification of Architectural Steel Frame Structures

* CAS: (Central African Standard)

③ Frame structural type

The type of frame will be Rahmen structures will reinforced concrete, which will easily allow free planning in floor planning, relatively easily accommodate changes in partitions and will not require earthquake resistant walls. The roofs will have steel truss structures.

④ Seismic load.

As most of the land of Zimbabwe is situated on bedrock and there is not record of earthquake occurance, local construction methods shall be refered to the construction of the facilities.

Thus, the structure will be designed based on zero seismic force, however it will take account 0.5% horizontal load in accordance with the British Standard.

⑤ Combination of loads

Type of Design Load	Estimated State	Stress Combination
Long term	Normal time	G + P
Short term	In strong wind	G + P + W

G: Stress of fixed load (Total weight of building including finish, joinery, partitions and others)

P: Stress by live load

W: Stress by wind pressure

Other factors, such as 0.5% horizontal load will be considered separately.

⑥ Live load

The buildings will be single- and two- storey buildings. The floors on the first floor will be supported slab in consideration of load. The floor on the ground floor will be slab-on-earth floors and the load will not be considered.

The line load of roof will be considered as a load roughly equal to a working load.

⑦ Foundation construction method

The ground is very hard geology and a soil bearing capacity of approximately 50 ton/m2 can be expected. Therefore, the spread foundation type will be used.

4) Electrical and Mechanical Plan

① Power Supply

a. Power Supply

Zimbabwe Electricity Supply Authority (ZESA) supplies 11,000 V of electricity to four substations situated in the premise of the hospital through two underground loop lines (A high-voltage ring main line connecting the four substations is installed).

Low-voltage loop lines are also installed to distribute power, which is transformed to 380 V by one of the substations, to eight low-voltage distribution boards in the site.

See the following page.

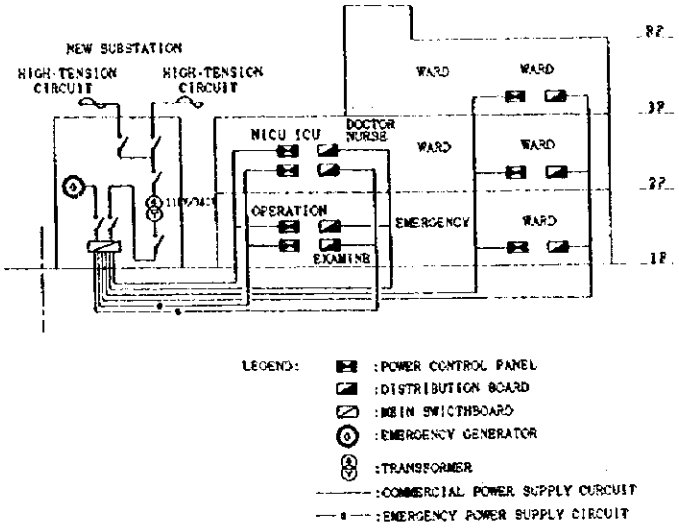


Figure 2-2 Schematic Diagram for Electrical Power Supply

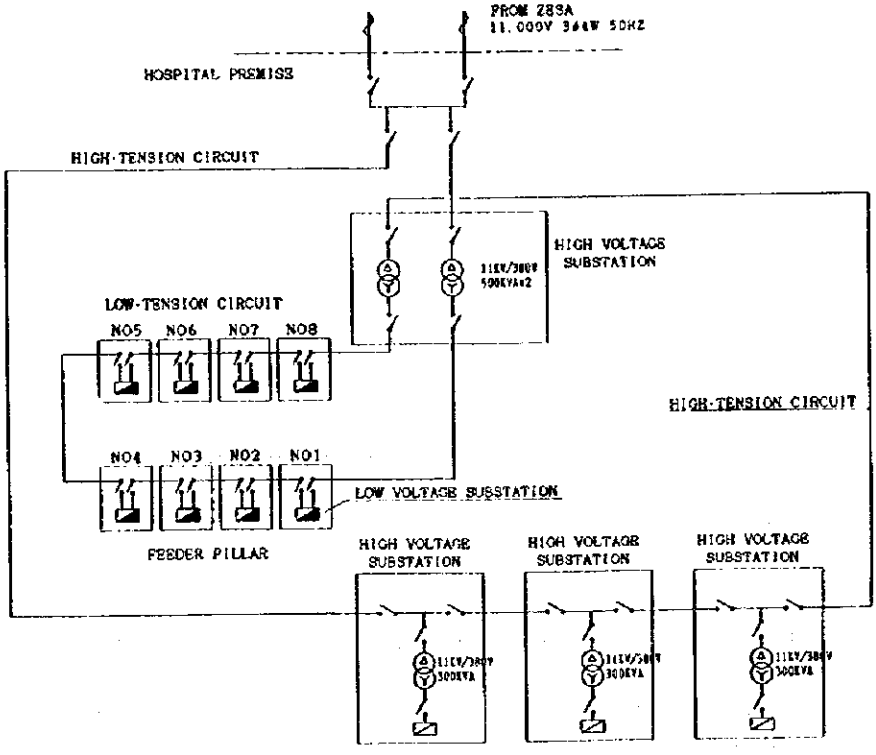


Figure 2-3 Schematic Diagram for Power Main Line System

b. Power Receiving Method

Power supply capacity from the existing low-voltage distribution boards is consumed by the existing buildings, and we determined that the capacity of the low-voltage distribution boards was too small to make a branch from. Thus, we plan to construct a high-voltage substation in a separate building to install a branch directly from the 11,000-V high-voltage line and install a high-voltage distribution board and a transformer to supply low-voltage power to the project facility.

See the following page.

c. Power Generation Facility

Although the power supply to the hospital is relatively stable, a power cut occurs a few times each month. To secure uninterrupted supply of electricity to the operating theaters and other critical rooms and equipment of the hospital, power generating equipment shall be installed.

To the lighting circuits of such critical rooms as the operating theater, ICU, and nurse station, power is supplied from batteries until the generator is started up.

d. Lighting/Outlet Plan

Lighting system will be similar to that of the existing Obstetric Ward adjacent to the project site and, as a rule, use linear light from general fluorescent lamps, which are suitable for many different applications, for easy maintenance after the completion of the buildings. Basic points for designing lighting plan are as follows:

- Secure sufficient illumination required for each room.
- Avoid sharp contrast of light and shade.
- Take measures to prevent glaring.
- Select lamps that cast soft shadows instead of strong ones.
- Select a good tone of light and color to provide comfort.
- Select items that do not generate a lot of heat.
- Give priority to efficiency and energy conservation.
- In daytime, utilize natural lighting as much as possible by installing large glass windows.

Lighting of each room shall be decided based on the standard illumination (horizontal illumination at 85 cm above floor) as listed below.

Table 2-5 Illumination Plan

Name of room	Target illumination in design (ℓ x)			General standard in Japan (ℓ x)
Operating theater	General lighting	1,000 ℓ x		1,000 ℓ x
	Operating table	20,000 ℓ x	Diffused light	10,000 ℓ x - 40,000 ℓ x
ICU		300 ℓ x		300 ℓ x
NICU		300 ℓ x		300 ℓ x
Emergency treatment room		500 ℓ x		1,000 ℓ x
Medical examination room		300 ℓ x		500 ℓ x
Doctors' room		300 ℓ x		700 ℓ x - 1,000 ℓ x
Office		300 ℓ x		700 ℓ x - 1,000 ℓ x
Matron		300 ℓ x		700 ℓ x - 1,000 ℓ x
Nurses' room		300 ℓ x		700 ℓ x - 1,000 ℓ x
Treatment room		300 ℓ x		500 ℓ x
Recovery room		300 ℓ x		300 ℓ x
Disinfection room		300 ℓ x		
Anesthesia room		300 ℓ x		
Autoclave		300 ℓ x		500 ℓ x
Meeting room		300 ℓ x		500 ℓ x - 1,000 ℓ x
Waiting room		400 ℓ x		200 ℓ x
Entrance hall		200 ℓ x		
Play room		200 ℓ x		
Sickroom		100 ℓ x		100 ℓ x - 200 ℓ x
(for inpatient ward and side ward)	All-night light	100 ℓ x		5 ℓ x
Lavatory		5 ℓ x		100 ℓ x
Corridor		100 ℓ x		100 ℓ x
Laundry room		100 ℓ x		100 ℓ x
Linen room		100 ℓ x		100 ℓ x
Hot water service room		100 ℓ x		
Parent room		100 ℓ x		150 ℓ x
Corridor	All-night light	100 ℓ x		5 ℓ x
		5 ℓ x		

e. Lightning conductor

As rainfall during the rainy season are often accompanied by thunder and lightning, conductors are needed.

Thunderbolt strikes have been recorded at an average of 80 days per year.

Desecrate-type lightening conductors that are commonly used in Zimbabwe will be used.

② Plumbing Systems

a. Water Supply System

Water is supplied to the hospital from the 200-mm (8") main pipe managed by the Bulawayo City Waterworks Bureau through a 150-mm (6") branch. Although a water pressure of 3 - 4 kg/cm^3 is provided, water supply may become insufficient at the time of water shortage during the dry season.

Water is directly supplied to each facility of the hospital.

As shown in the water analysis data (Fig. 2-10) obtained from the Bulawayo City Waterworks Bureau, the water is drinkable and used in the hospital without special treatment. A branch pipe for supplying water exclusively for the pediatric compound will be connected at the meter of the main city water supply line. When the water pressure is low, especially in the dry season, water is directed to the reception tank for the pediatric compound and sent to each building by means of a pressure pump.

b. Sewerage System

All sewerage water, including waste and soil water, is discharged to the main drainpipe installed in the premise of the hospital, which is connected to the main drainpipe of Bulawayo City.

All sewerage water of Bulawayo City is treated at the sewage treatment facility located about 10 km from the central part of the city.

Soil water and other sewerage water from the project facility will be carried through drainpipes to the existing sewage pit installed in the hospital site. Rainwater will be discharged directly to the ground and percolated through the soil like the existing facilities. (Fig. 2-5)

c. Hot Water Supply System

LPG gas as a heat source is expensive and not commonly used. Steam from a steam boiler within the site is not suitable as it is situated too far from the facility. Thus, electric water boilers, which are inexpensive and commonly used in existing Obstetric and other Wards, will be used for this project.

See the following page. (Fig. 2-6)

d. Medical Gas Equipment

The basic design for medical gas equipment will include the equipment to supply oxygen, nitrous oxide, compressed air, and vacuum suction.

Due to maintenance/inspection and safety reasons, all piping will be exposed, and the pipe sections from their respective supply sources to outlets will be painted in different colors in

order to prevent erroneous connection. (Fig. 2-7)

e. Fire Extinguisher

Fire extinguishers will be installed on the walls of indoor corridors (one in every 15 meters of walking distance as required by Zimbabwean law).

Water supply system, sewer system, hot-water supply system, and water quality data are outlined respectively in the Figures 3-4, 3-5, and 3-6 and Table 3-6 below.

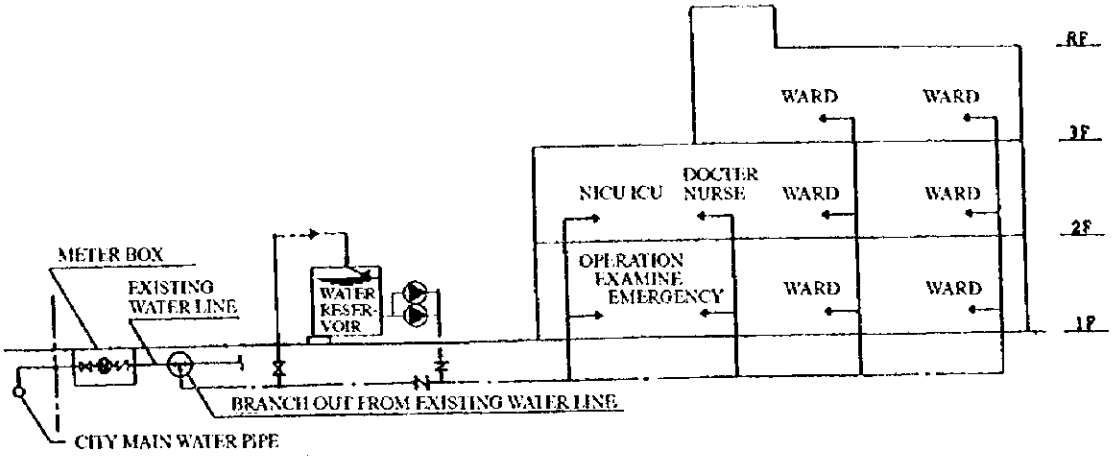


Figure 2-4 Schematic Diagram for Water Supply System

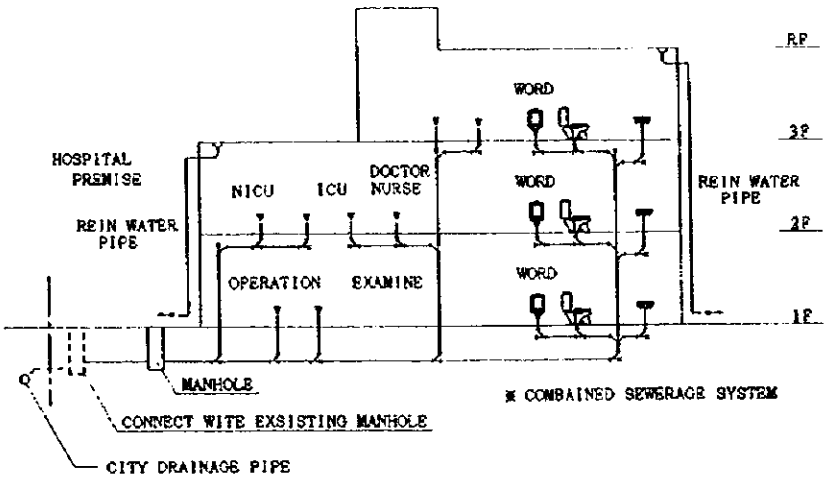


Figure 2-5 Schematic Diagram for Drein Water & Dreinage System

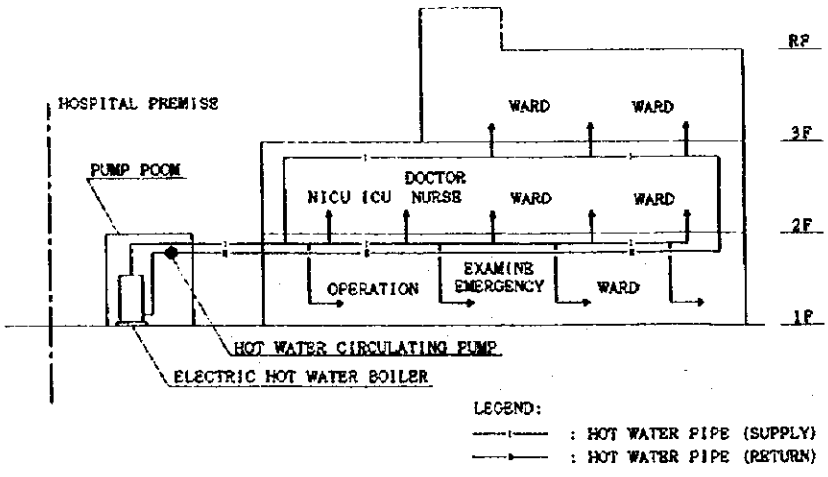


Figure 2-6 Schematic Diagram for Domestic Hot Water Supply System

Table 2-6 Water Analysis Date by Bulawayo City Waterworks Bureau

Item		Mpilo Central Hospital	Standard value	WHO	Unit
Physical analysis					
General		C			
Electric conductivity (μS/cm)		30	.....	100 or less	μS/cm
pH	O	7.0	5.8 - 8.0	0.5 - 8.5	–
NTU	O	0.8	2 or less	5 or less	%
Chemical analysis					
Hardness (as CaCo3)	O	110	300 or less	500 or less	mg/ℓ
Calcium (as CaCo3)	O	54	300 or less	.....	mg/ℓ
Magnesium (as CaCo3)	O	56	300 or less	.....	mg/ℓ
Sodium (Na)	O	3.9	200 or less	200 or less	mg/ℓ
Potassium (K)	O	1.2	10 or less	.....	mg/ℓ
Iron (Fe)	O	0.2	0.3 or less	0.3 or less	mg/ℓ
Mangan (Mn)	O	0.01	0.05	0.1 or less	mg/ℓ
Alkalinity (as CaCo3)	O	69	30-40	.....	mg/ℓ
Chlorine (Cl)	O	11	200 or less	250 or less	mg/ℓ
Sulfuric acid (SO4)	O	28	.....	400 or less	mg/ℓ
Phosphoric acid (PO4)	O	0.01	.....	.....	mg/ℓ
Anmonium (N)	O	0.01	.....	.....	mg/ℓ
Nitrogen (N)	O	0.4	10 or less	.....	mg/ℓ
Fluoride (F)	O	0.1	0.8 or less	1.0 or less	mg/ℓ
Dissolved magnesium approximation, oxygen was dissolved in every four hours.	O	168 0.4	150-200		mg/ℓ
Aluminum ion (Al)		0.01		0.2	mg/ℓ
Biological analysis					
Monthly average sample test		29.2			
% Sumplus vitb<100 bacteria/ml	O	94.5 %	100/ m ℓ or less		
%Sumplus vitbout colon bacteria/100d	O	88.2 %	Not detected		
%Sumplus vitbout feces colon bacteria/100d	O	97.4 %	Not detected		

Results

1. The sample is suitable for drinking water as far as the items analyzed.
2. Although the water quality is good, cautions need to be taken when using the water in an open-type water cooling system, as water evaporation and foreign bodies from external sources might cause deterioration of water quality.
3. As the alkalinity of spilt water of a steam boiler is high and corrosive, it is recommended that spilt water is not recycled. As the hardness is too high for a steam boiler, a water softening device will be needed.
4. As the water is in good quality but corrosive, we recommend the piping materials as follows:
   - Water supply: galvanized copper (outdoor), copper (indoor)
   - Hot water supply: copper
   - Cooling water: galvanized copper
   - Cool/hot water: galvanized copper
   - Steam: copper
   - Fire hydrant: galvanized copper

Evaluation: (means suitable for drinking

Standard: Water quality standard according to Article 4 of Waterworks Act (Health Ministry Ordinance No. 56)

WHO: Standard for drinking water by World Health Organization

f. Fire Hydrant

Fire hydrants installed at various locations in the hospital facilities from the main supply pipe through 3" pipes installed exclusively for the fire hydrant system at a pressure provided by the main pipe of the city water.

In order to secure stable water pressure and uninterrupted supply in case of suspension of city water, an exclusive water tank and pump system will be installed to supply water to fire hydrants placed inside the 3-story project building (one in every 25 meters of walking distance as required by Zimbabwean law).

See the following page. (Fig. 2-8)

g. Emergency Alarm System

A heat sensor with a covering area of 50 m^2 (as required by Zimbabwean law) will be installed in various rooms and corridors where necessary.

A smoke sensor with a covering area of 100 m^2 (as by domestic law) will be installed in various rooms and corridors where necessary.

Emergency warnings will be given by alarm bell and announcement through the PA system.

h. Guiding Light

Lamps will be installed to indicate emergency exits and corridors.

i. Telephone System

The telephone system of the hospital consists of 17 telephone lines and four public phone lines provided by the local telephone company (ZPTC). Each line is connected to a corresponding facility without going through a switching board, and there is no spare lines from the ZPTC service line.

In view of the above, we will install cables from the ZPTC line to the MDF (main distribution board), from which cables run to individual telephones through terminal boards placed in various locations in the premise.

Installation work will include, pluming and installation of MDF, terminal boards, and outlets. The switching board, wiring work, and telephones will not be included.

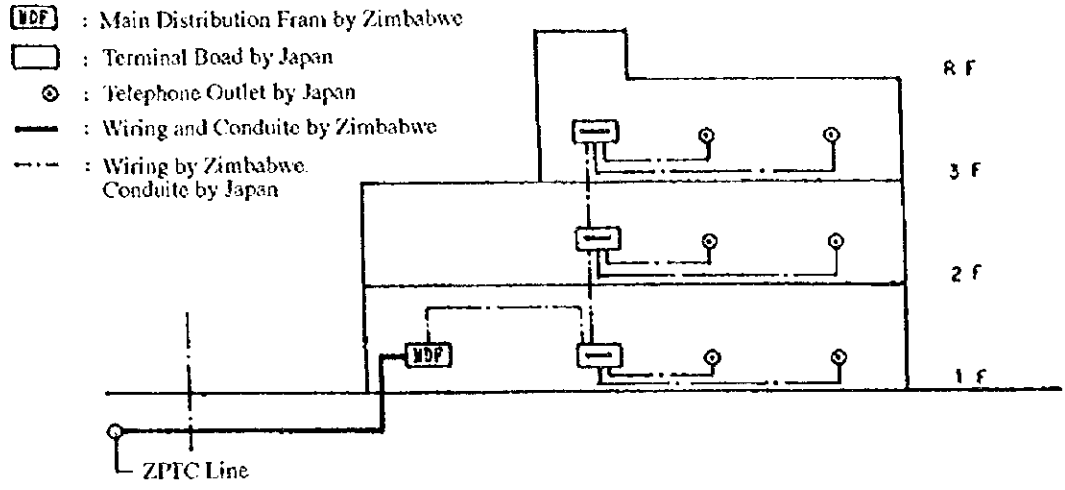


Figure 2-7 Telephone Facility Diagram

③ Air Conditioning and Ventilation System

An individual heat-pump air conditioner will be installed only in each of such important rooms as the operating room, ICU, and NICU. For rooms not equipped with an air conditioner, exclusive electric outlets will be installed for providing power for heaters in winter.

The air purity level of the operating theater, ICU, NICU, clean lobby, recovery room will be set around class 100,000, and the air pressure of these rooms will be higher than other rooms. A mechanical ventilation system, in addition, will be installed to let out chemical odors and steam from autoclaves. (Fig. 2-9)

④ Elevator System

One bed-type, winch-system elevator with a loading capacity of 1000 kg and an operating speed of 45/min. will be included in the plan.

The systems of medical gas supply, water extinguisher, and air conditioning will be provided as illustrated respectively in Figures 3-8, 3-9, and 3-10.

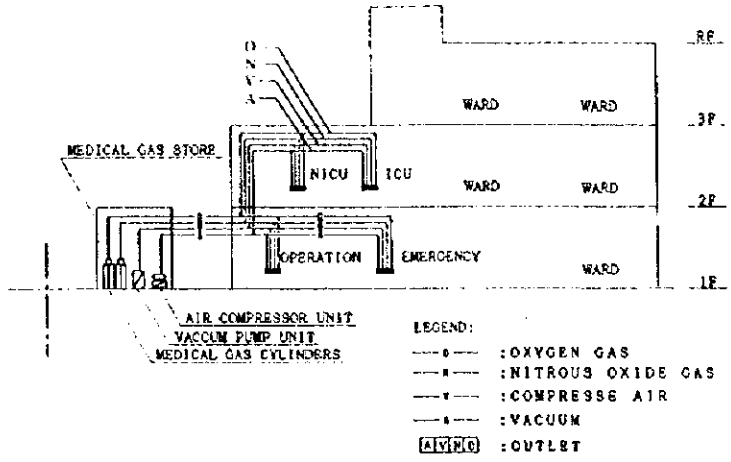


Figure 2-8 Medical Gas Supply System Diagram

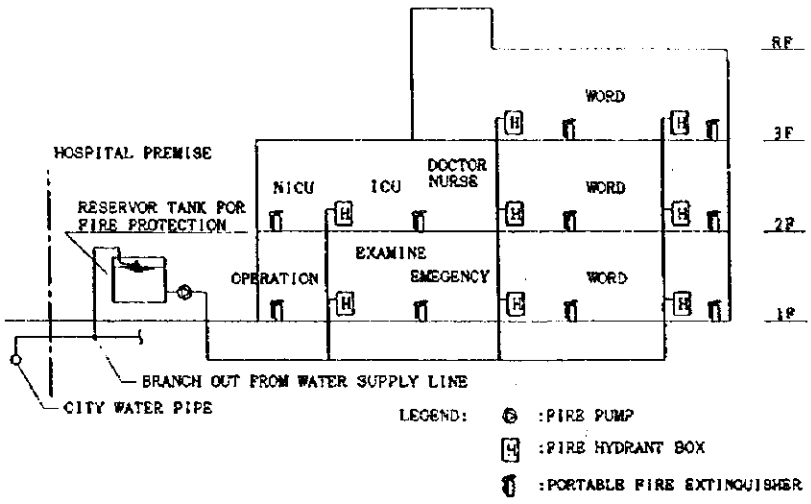


Figure 2-9 Fire Extinguisher System Diagram

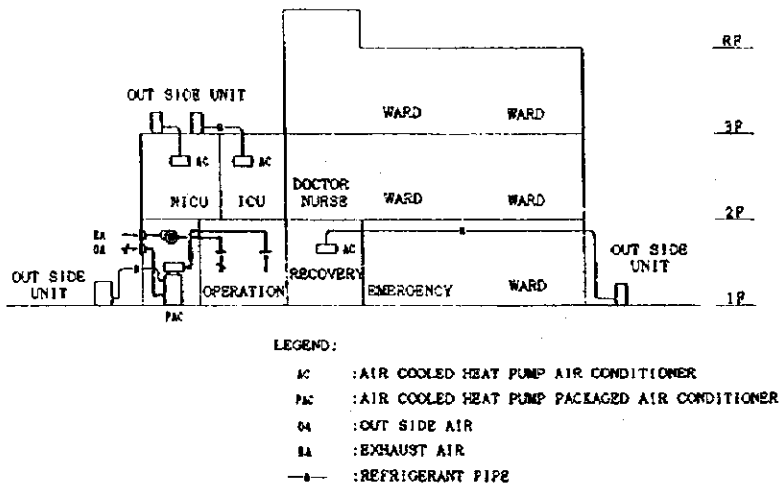


Figure 2-10 Air Conditioning System Diagram

5) Construction Equipment Plan

① Finishing Method of Each Section

Finishing method of each section and the reason therefor are outlined below.

Table 2-7 Main Finishing Materials Selected and Reasons for Selection

Room	Element	Local method	Method in this project	Reason for selection
Office	floor	Polished artificial stone with joint plates	Polished artificial stone with joint plates	The methods were selected to be consistent with those used in the construction of the Pediatric Ward of Harare Central Hospital and to ensure that local staff can handle the maintenance work after the completion of the facility on their own.
Head Nurse's Office Staff room	Skirting board	Polished skirting board	Polished skirting board	
Change room	wall	Paint finish on mortar	Paint finish on mortar	
	ceiling	Acoustic tile (system) h = 3,000 m	Acoustic tile (system) h = 3,000 m	
Sickroom	floor	Polished artificial stone with joint plates	Polished artificial stone with joint plates	
	base board	Polished skirting board	Polished skirting board	
	wall	Paint finish on mortar	Paint finish on mortar	
	ceiling	Acoustic tile (system) h = 3,000 m	Acoustic tile (system) h = 3,000 m	
Corridor Passageway	floor	Polished artificial stone with joint plates	Polished artificial stone with joint plates	
	base board	Terrazzo h = 160	Terrazzo h = 160	
	wall	Paint finish on mortar	Paint finish on mortar	
	ceiling	Acoustic tile (system) h = 2,400 m	Acoustic tile (system) h = 2,400 m	
Laboratory	floor	Polished artificial stone with joint plates	Polished artificial stone with joint plates	
	wall	Tiled wall h = 2,200 m Paint finish on mortar	Tiled wall h = 2,200 m Paint finish on mortar	
	ceiling	Paint finish on plaster board	Acoustic tile (system)	

Table 2-8 Construction Methods & Finishing Materials Selected and Reasons for Selection

Section		Local method	Method used in this project	Reason for selection
Foundation		Spread foundation	Spread foundation	As result of the boring test given by the hospital side. The methods were selected to be consistent with those used in the construction of the Pediatric Ward of Harare Central Hospital and to ensure that local staff can handle the maintenance work after the completion of the facility on their own.
Column & beam		Reinforced concrete	Reinforced concrete	
Column	frame	Reinforced concrete	Reinforced concrete	
	finish	Polished artificial stones	Polished artificial stones	
Wall	frame	Brick masonry	Brick masonry	
	finish	Paint finish on mortar	Paint finish on mortar	
Ceiling		Acoustic tile (system) Fiber tone (system) Direct plastering (operation theater only)	Acoustic tile (system) Fiber tone (system) Direct plastering (operation theater only)	
Exterior wall	frame	Brick masonry	Brick masonry	
	finish	Brick masonry, paint finish on mortar spray tile on mortar	Brick masonry, paint finish on mortar spray tile on mortar	
Roof	frame	Steel truss	Steel truss	
	finish	Tile roofing	Tile roofing	
Door, window, etc.		Paint finish on steel sash Paint finish on steel door Glass louver (aluminum/steel frame) Paint finish on wooded window Paint finish on wooden door Paint finish on burglar-proof lattice window	Paint finish on steel sash Paint finish on steel door Glass louver (aluminum/steel frame) Paint finish on wooded window Paint finish on wooden door Paint finish on burglar-proof lattice window	

(3) Medical Equipment Plan

1) Basic Policy for Equipment Design

The main purpose of this project is to expand and integrate the existing pediatric buildings. The basic policy is to work out a plan that does not impose unreasonable financial burden on the Zimbabwean government.

The selection of equipment (incubators, respirators and other instruments) essential for the more effective treatment of high mortality diseases (pneumonia and other acute respiratory infections) will be based on the following principles.

[Priority Principles]

a) Equipment that will benefit a large number of patients.

b) Equipment that is essential for treating high-mortality diseases (pneumonia and other acute respiratory.

c) Equipment that is maintainable and manageable within the technical and budgetary constraint of the hospital.

d) Equipment that is superannuated and needs to be renewed.

[Exclusion Principles]

a) Equipment that uses or generates environmentally harmful substances such as CFC.

b) Equipment that may violate laws or regulations of Japan of Zimbabwe concerning waste water, industrial waste, and radio active substances.

c) Equipment with low cost performance that will bring benefit only to a limited number of people.

d) Equipment that is difficult to maintain or manage.

e) Equipment which the hospital can purchase without external assistance.

f) Equipment that is included in other aid organizations' projects.

g) Expendable items, chemical reagents, etc.

2) Basic Equipment Plan

The Equipment Plan was drafted based on the Basic Design, which was explained to and agreed by the Zimbabwean officials, as well as the basic policies for selection as described above. The equipment items thus selected are listed in Table 2-9 below:

Table 2-9 Equipment List (1/4)

No.	Name of Equipment	Qty.	Location and quantity								Remarks
			Med. ward	NICU	ICU	Out-patient	Meet-ing room	X-ray Room	Op. Theater	Recov-ery Room	
1-4-(a)	Incubator	26		26							For care and temperature control of neonates (premature babies), a total of 29 beds in NICU, consisting of 26 incubators and 3 infant warmers, will be included in the Project design.
1-4-(b)	Infant warmer	3		3							
1-5	Bed (for ICU)	8			8						As per basic design calculation of 8 beds in ICU.
2-4	Laryngoscope	9	9								9 laryngoscopes (3 for each of 2 medical wards and surgical ward) for larynx examination.
2-5	Resuscitation pack	9	9								9 ambulance bags (3 in each of 2 medical wards and surgical ward) for manually sending oxygen to patients whose respiratory functions are failing.
2-6	Oxygen monitor	10	3	3	3	1					For measuring and monitoring oxygen concentration. 1 in each of 2 medical wards; 1 in surgical ward, 3 in NICU, and 1 in emergency department
2-7	Infusion pump	13	3	5	5						For administering whole blood, plasma, red blood cells, glucose or salt water, or other fluid according to patient's condition; 1 in each of 2 medical wards, 1 in surgical ward, 5 in each of ICU and NICU.
2-8	Syringe pump	10		5	5						For administering a small amount of fluid; 5 in each of ICU and NICU.
2-9	Suction unit (for med. ward)	3	3								For suctioning sputum and other bodily fluid from patients; 1 in each of 2 medical wards and surgical ward.
3-1	Auto sphygmomanometer	4	4								For measuring patients' blood pressure; 4 sphygmomanometers (2 in each of 2 medical wards).

Table 2-9 Equipment List (2/4)

No.	Name of Equipment	Qty.	Location and quantity								Remarks
			Med. ward	NICU	ICU	Out-patient	Meeting room	X-ray Room	Op. Theater	Recovery Room	
3-2-(a)	Pulse oxy meter	2		1	1						For monitoring patient's pulse and oxygen saturation; 12 meters (6 in NICU and 6 in ICU each having 1 meter with printer).
3-2-(b)	Pulse oxy meter	10		5	5						
3-3	Patient monitor (heart/respiration)	9		4	4					1	For monitoring patient's heat, respiration, and temperature; 9 monitors (4 in each of ICU and NICU and 1 each in recovery room).
4-3	Electrocardiogram	1				1					For monitoring patient's heat rhythm; 1 in emergency department.
5-2	Electrocardiogram (electronic)	3	3								For measuring patient's weight; 3 scales (1 in each of 2 medical wards and surgical ward). (Electronic scale)
7-3	Wheel chair	5	3			2					For transferring inpatients and outpatients; 5 wheel chairs (2 in emergency dept. 1 in each of 2 medical wards and surgical wards).
7-4	Stretcher	5	3			2					For transferring inpatients and outpatients; 5 stretchers (2 in emergency dept. 1 in each of 2 medical wards and surgical wards).
9-10	Ultrasonic nebulizer	6	6								For administering bronchodialator drugs in aerosol; 6 nebulizers (2 in each of 2 medical wards and surgical ward).
9-12	Blood sugar measuring instrument	6	3	1	1	1					For measuring patient's blood glucose level; 6 meters (1 in each of NICU, ICU, emergency dept., 2 medical wards, and surgical wards).
12-1	Artificial respirator (for neonates)	2		2							For sending air into and expelling it from patient's trachea; 2 ventilators in NICU.

Table 2-9 Equipment List (3/4)

No.	Name of Equipment	Qty.	Location and quantity								Remarks
			Med. ward	NICU	ICU	Out-patient	Meeting room	X-ray Room	Op. Theater	Recovery Room	
12-2	Artificial respirator (for juveniles)	4			4						Used to take over respiration in juvenile patients: 4 ventilators in ICU.
16-1	Video camera	1					1				1 camera for studies and lectures in seminar room (meeting room).
16-2	Slide projector	1					1				1 projector for studies and lectures in seminar room (meeting room).
16-3	Over head projector	1					1				1 projector for studies and lectures in seminar room (meeting room).
16-4	Computer	1					1				1 computer for studies, data processing, and analysis in seminar room (meeting room).
16-5	Electric typewriter	1					1				1 for producing data analysis documents, research paper, and other documents in seminar room (meeting room).
16-6	Copy machine	1									1 for making copies of documents in seminar room (meeting room).
17-14	phototherapy equipment	8	2	6							For treating newborn jaundice; 8 apparatuses (6 in NICU and 1 in each of 2 medical wards).
17-17	X-ray device	1									1 small X ray device (potable) for examining lung diseases, TB, bone fracture, etc.
17-21	Bilirubin meter	1		1							1 in NICU for examining newborn jaundice.
18-1	Pediatric operating table	1							1		1 table in pediatric surgical operation theater.
18-8	Suction unit	2							2		For suctioning sputum and other bodily fluid from patients; 2 in operating theater.
18-9	Electric scalpel	1							1		1 in operation theater for cutting and clotting tissue.

Table 2-9 Equipment List (4/4)

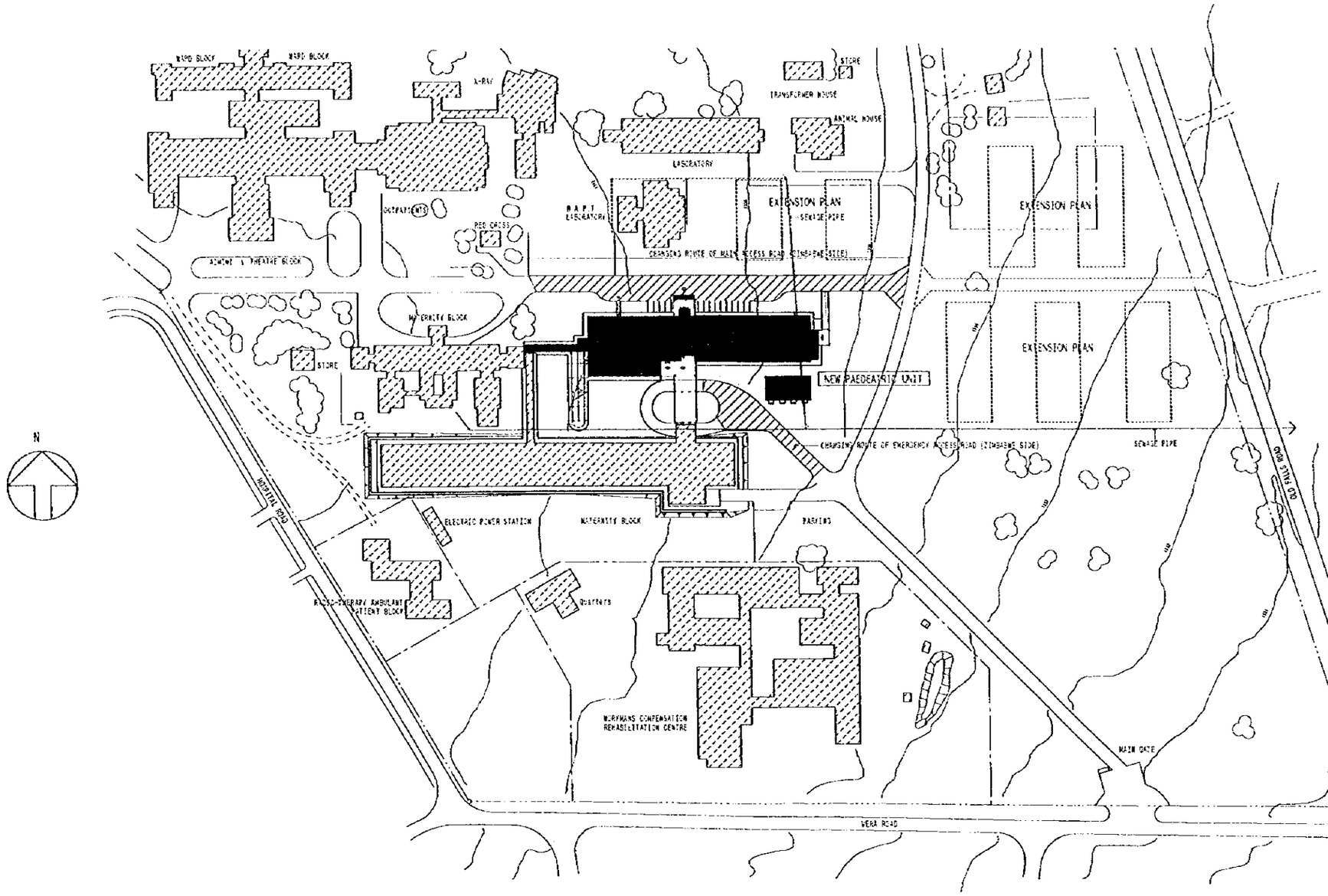
No.	Name of Equipment	Qty.	Location and quantity								Remarks
			Med. ward	NICU	ICU	Out-patient	Meeting room	X-ray Room	Op. Theater	Recovery Room	
18-10	Diffused lamp (ceiling type)	1							1		1 in operation theater for providing lighting during operation.
18-11	Diffused lamp (movable type)	1							1		1 in operation theater for providing lighting during operation.
18-13	Portable incubator	1				1					1 with oxygen cylinder in operation theater for transferring emergency patients.
18-15	Anesthesia unit	1							1		1 in operation theater for administering general anesthetic to patients.
24-1	Recovery bed	3								3	3 beds for recovering patients after surgery.
24-6	Defibrillator	1								1	1 in recovery room for converting fibrillation after surgery back into a normal, regular heat beat.
25-1	General surgery instrument kit	1							1		1 kit in operation theater for general surgery.
25-2	Plastic surgery instrument kit	1							1		1 kit in operation theater for plastic surgery.
30-8	Hard pediatric bronchoscope	1				1					1 in outpatient/emergency dept. for examining trachea and bronchi.

(4) Basic Layout Plan

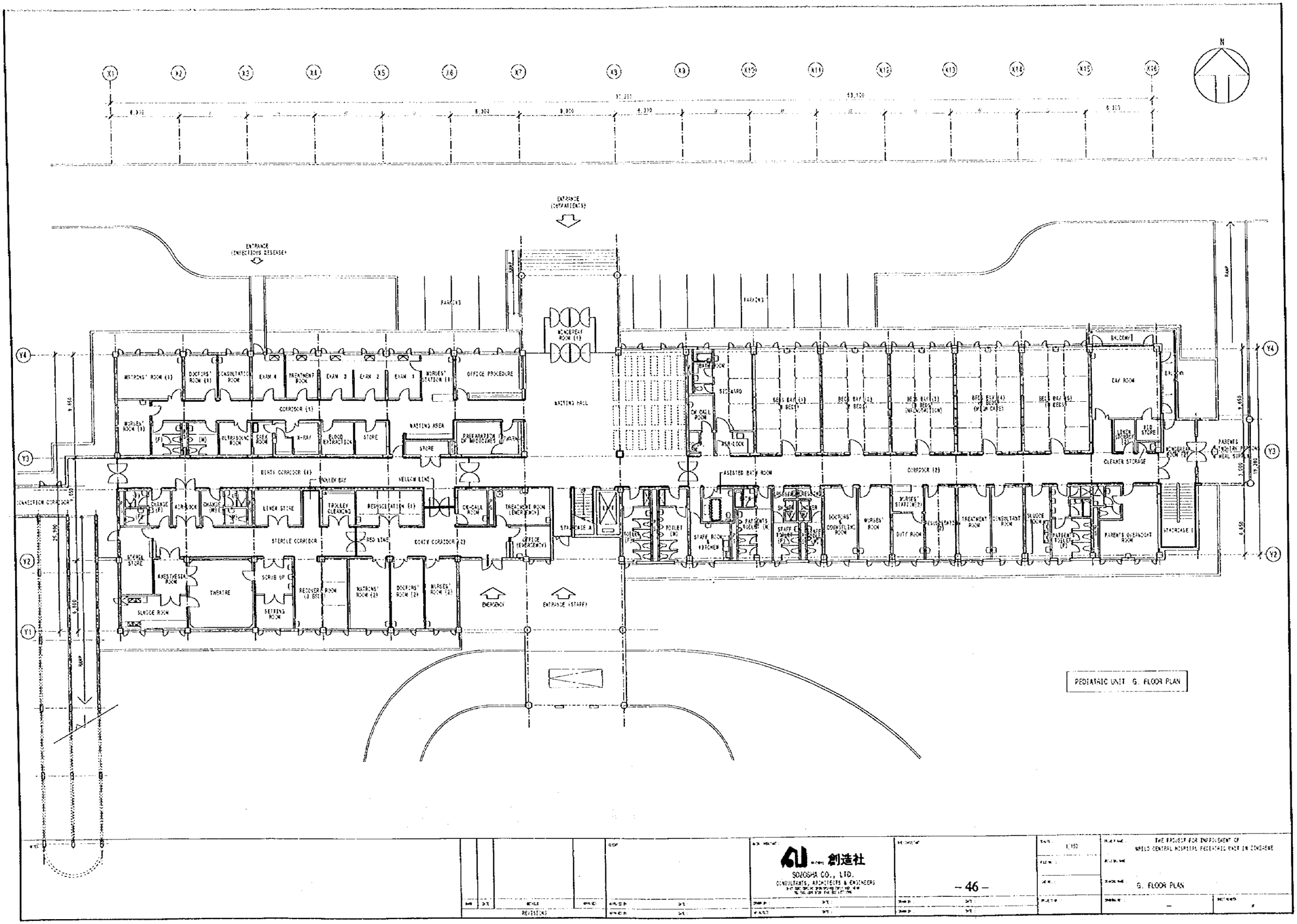
1) Layout Plan

2) Floor Plan

3) Elevation and Section Plan



				SOZOSHA CO., LTD. CONSULTANTS, ARCHITECTS & ENGINEERS	– 45 –	DATE: 1.1998	THE PROJECT FOR IMPROVEMENT OF MPILO CENTRAL HOSPITAL PEDIATRIC UNIT IN ZIMBABWE
							PLOT PLAN
		REVISIONS					



PEDIATRIC UNIT G. FLOOR PLAN

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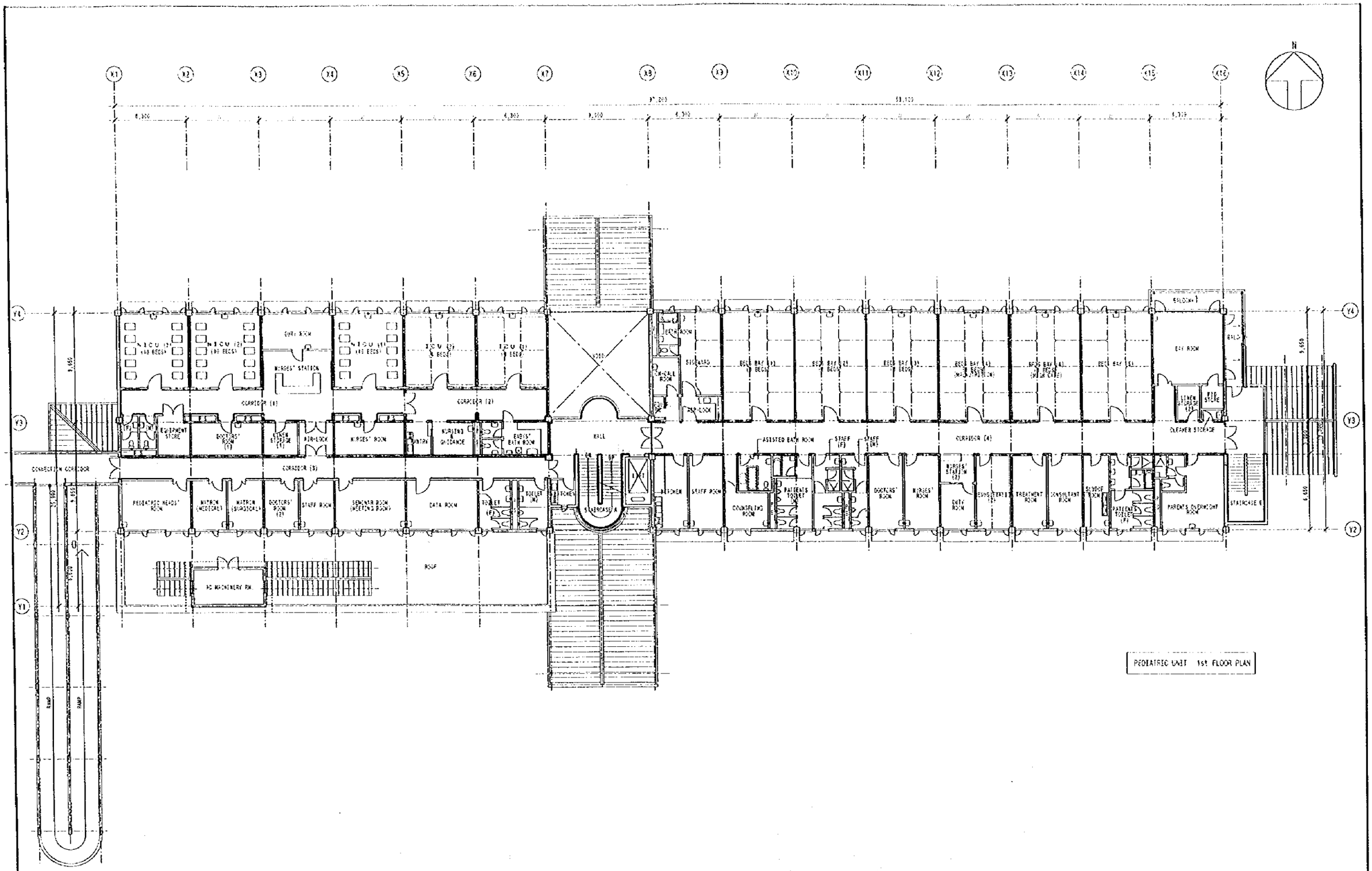
G. FLOOR PLAN



PEDIATRIC UNIT 1st FLOOR PLAN

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– 47 –

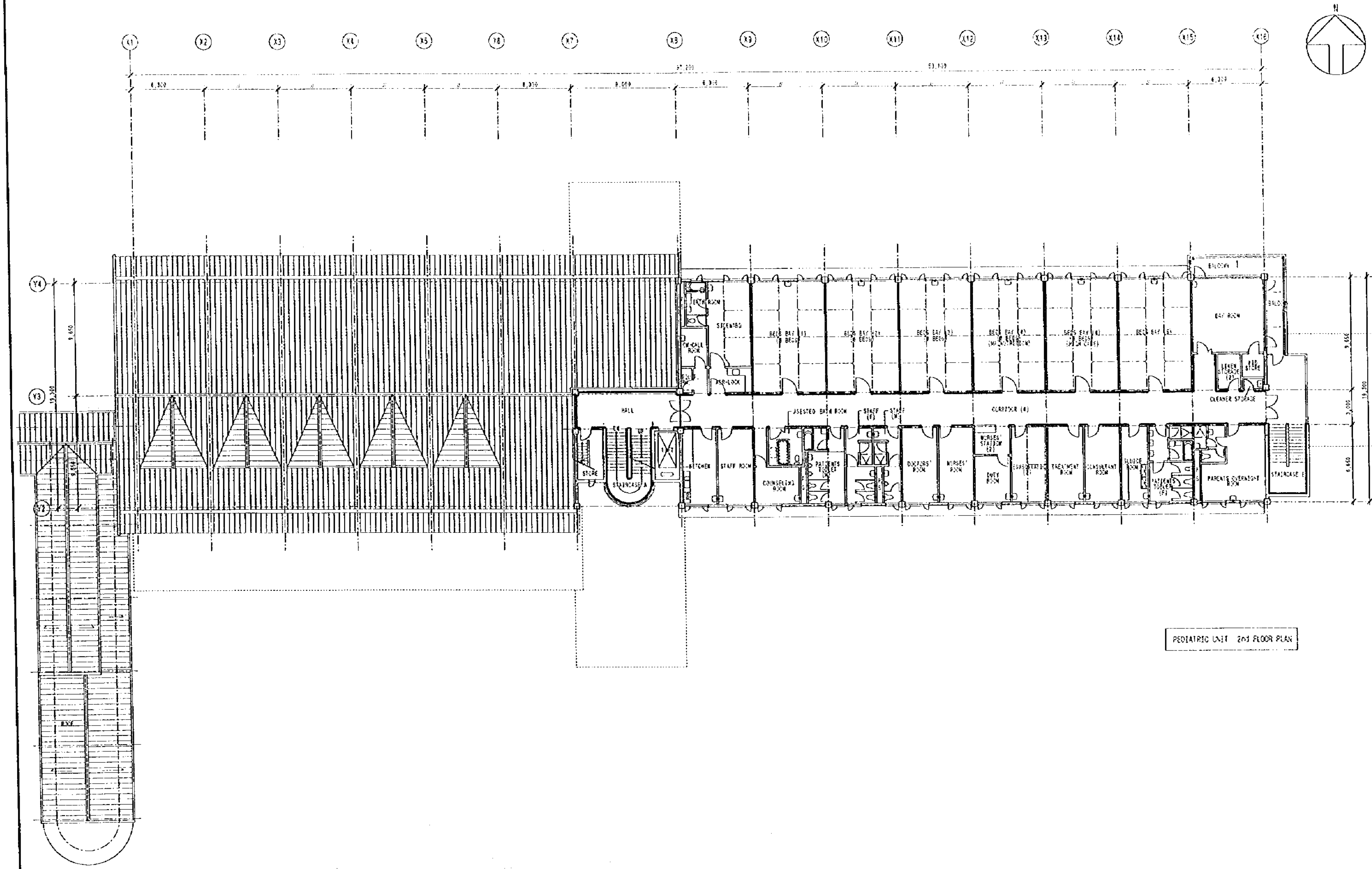
SCALE	1:150
FILE NO.	
DRAWN BY	
PROJECT NO.	

THE PROJECT FOR IMPROVEMENT OF MEDICAL CENTRE HOSPITAL PEDIATRIC UNIT IN ZIMBABWE

1st FLOOR PLAN

DRAWING NO. –

SHEET NUMBER 4



PEDIATRIC UNIT 2nd FLOOR PLAN

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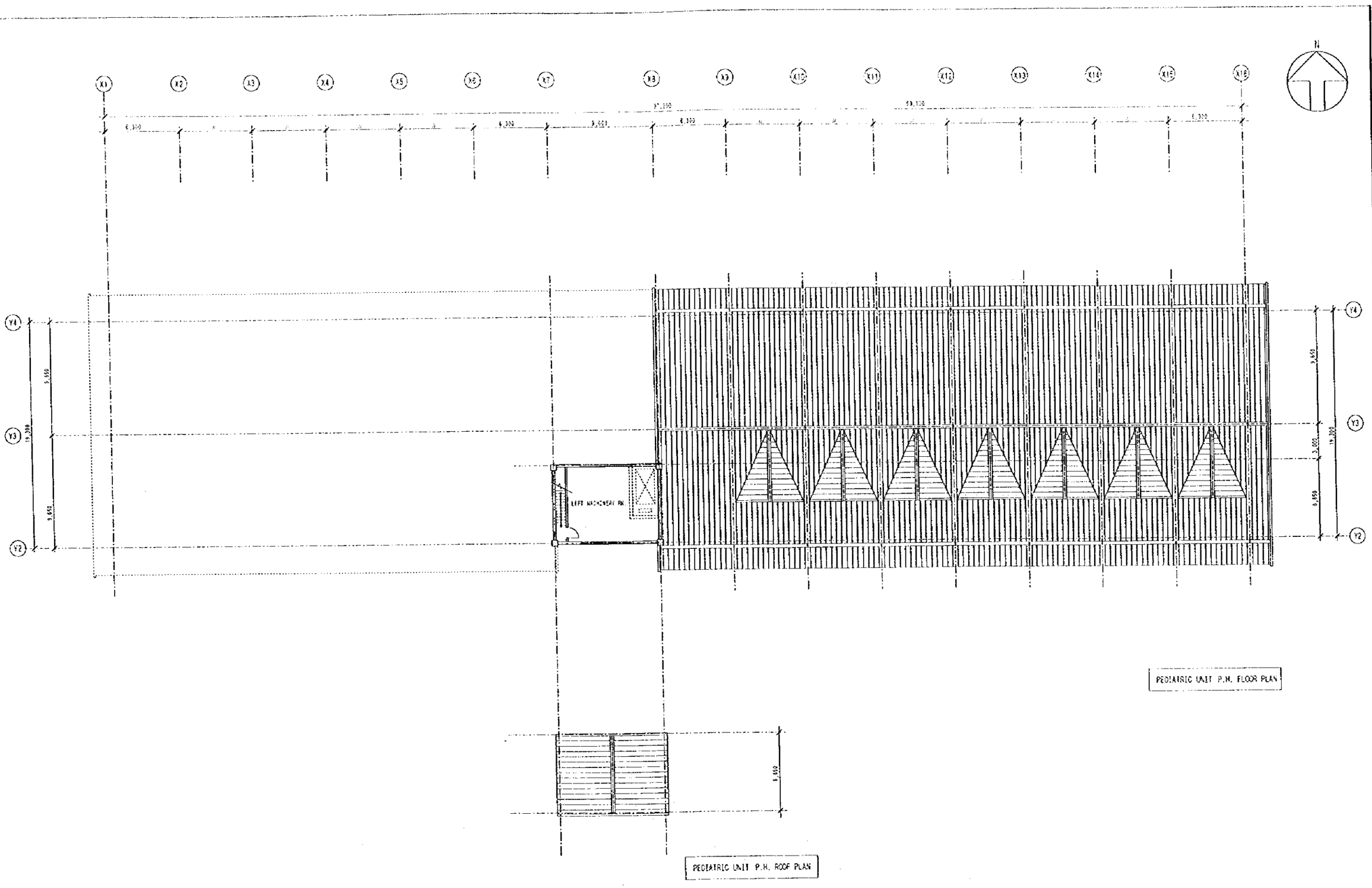
2nd FLOOR PLAN



PEDIATRIC UNIT P.H. FLOOR PLAN

PEDIATRIC UNIT P.H. ROOF PLAN

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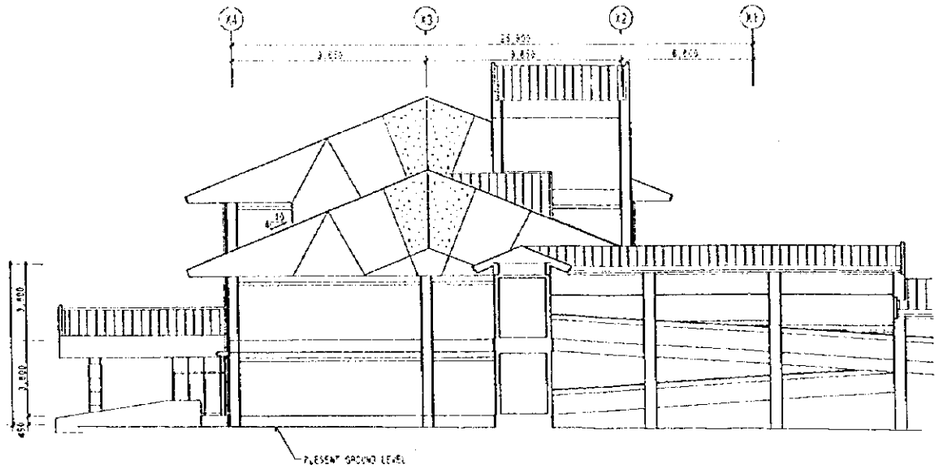
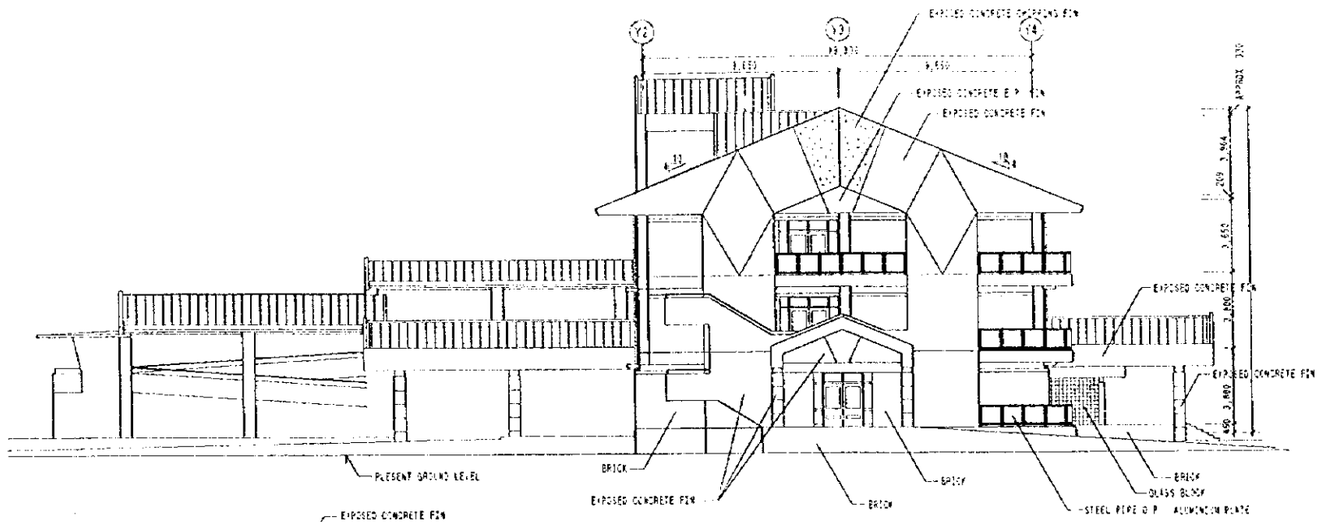
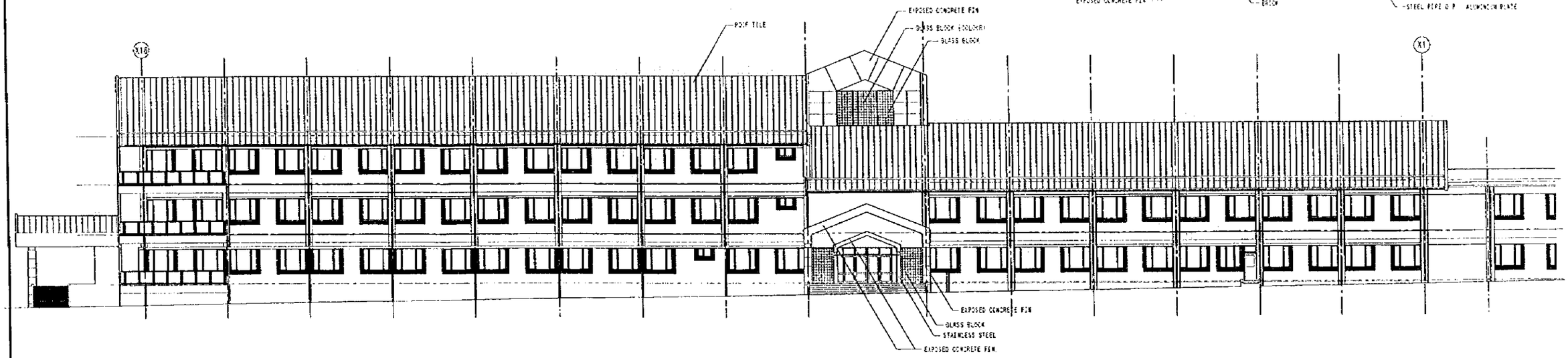
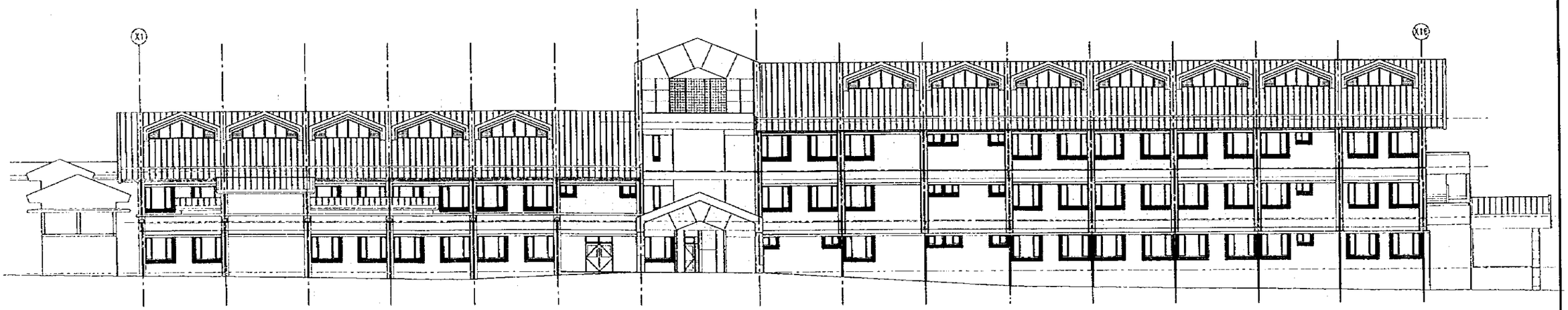
THE PROJECT FOR IMPROVEMENT OF
MPILO CENTRAL HOSPITAL PEDIATRIC UNIT IN ZIMBABWE

P.H. FLOOR PLAN









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			SECTION			ELEVATION

Chapter 3 Implementation Plan

Chapter 3 Implementation Plan

3-1 Implementation Plan

When this project be implemented under Japan's grant aid, it shall be done in consideration of the grant aid system of Japan by observing following procedures:

3-1-1 Implementation Concept

(1) Implementation Plan

1) Before implementing this project, an Exchange of Notes (E/N) of detailed design is signed by the Government of Japan and the Government of Zimbabwe. After the signing of the E/N, the Government of Japan engages commitment of assistance, and the execution of the grant aid.

2) After signing of the E/N, Japanese consultant firm and the Government of Zimbabwe conclude Detail Design Agreement and Construction Supervision Agreement. Upon execution of the Agreement, the consultant firm starts design work.

3) The consultant firm prepares a set of design document required for the construction and the equipment procurement and shall obtain approval of the Government of Zimbabwe.

4) After signing the E/N for the construction work, the consultant firm concludes Construction Supervision Agreement with the Zimbabwean government, selects construction contractors through Preliminary Qualification (P/Q), and summons the selected contractors for competitive tendering. In addition, the consultant firm selects equipment suppliers and summons them for tendering.

5) After summoning the tenderers, the consultant assists the client in proceeding the tendering by means of Lamp sum tender.

6) The breakdown of the bid price of the successful tenderer(s) is evaluated. When the appropriateness of the bid price is confirmed, the successful tenderer(s) concludes Construction Contract and Procurement Contract with the Government of Zimbabwe.

7) The construction work will commence upon approval of the construction and equipment-procurement contracts by the government of Japan.

   After the Construction Contract and Procurement Contract are verified by the Government of Japan, the contractor proceeds to the construction and procurement.

8) The Government of Zimbabwe completes all necessary preparation work for the construction, including ground preparation, setting in place water supply/discharge system, electric power, and telephone cables, and obtaining building permission, so that the construction work can be started without any hindrance.

(2) Positions of Companies Involved in the Construction and Scopes of Work

1) Consultant

The consultant for construction work will be entrusted by the Ministry of Local Government and National Housing of Zimbabwe to perform design of the project and supervision of the construction, and the consultant for the equipment will be entrusted by the Ministry of Health to perform detail design of the project and supervision of the procurement, which consists of the following work:

[Scope of work]

① Detail Design stage

- Based on the basic design, detail design shall be performed and tender documents including detail drawings, specifications, draft of contracts, calculation sheet, and speck sheet for equipment shall be prepared.

  The consultant prepares these documents through close discussions with the concerned parties of Zimbabwe (Ministry of Local Government and National Housing and Ministry of Health) in the first, middle, and end phases of the detail design stage. Final documents are approved before tender.

② Construction supervision stage

- The consultant discusses thoroughly with such relevant authorities (Ministry of Local Government and National Housing and the Ministry of Health) as well as with Japanese construction and trading firms, supervises the construction and procurement work by checking to see if it is carried out according to the working drawings and specifications, makes adjustment so that the construction and procurement will be completed without delay, and records the results. The consultant periodically reports the progress of the project to the relevant agencies in Zimbabwe and Japan.
- The consultant issues a completion certificate at the end of each stage and get approval from the Government of Zimbabwe.
- The consultant for construction work dispatches a resident engineer to the construction site and equipment engineer for equipment work to the project site for inspection.

  When handing over the facilities and equipment to the Zimbabwe side, the consultant checks the items, quantities, etc. against the record in the presence of people concerned, issues a certificate of handing over and delivery, and receives a certificate for completion of inspection from the Government of Zimbabwe.

2) Executing company (construction work, equipment procurement)

① Construction firm

A Japanese contractor carries out the construction work as a principal contractor and manages the construction schedule, quality, materials, safety, etc. while maintaining close communication with parties concerned in order to make the construction work be completed smoothly without delay.

② Equipment supplier

Japanese equipment suppliers procure equipment articles which satisfy the specifications, and deliver them before a specified date. When delivering the equipment, the supplier explains and instructs how to operate, maintain, and repair the equipment to the hospital staff.

3) Local consultant

When the Japanese consultant deems necessary to hire a local consultant, the local consultant will conclude a contract with the Japanese consultant and implement assistant service for the working drawing and specifications.

4) Local contractor

If local contractors are to be hired as deemed necessary by the Japanese consultant, the same procedures as 3) shall be used.

(3) Execution System (Project implementation system)

The system for implementing of this project under Japan's grant aid is as follows:

1) The Ministry of Finance of Zimbabwe is in charge of the signing of Exchange of Note (E/N) and Banking Arrangement (B/A) with the government of Japan.

2) The executing agency of this project on the Zimbabwe side is the Ministry of Health and Ministry of Local Government and National Housing. The Ministry of Local Government and National Housing (: facilities) and the Ministry of Health (: equipment) are respectively in charge of signing contracts with Japanese consultant, construction firm, and equipment suppliers as well as permitting, approving the design and construction work of this project.

Relations among the relevant agencies of Zimbabwe and Japanese agencies, consultant, construction firm, and equipment suppliers are outlined in the diagram below:

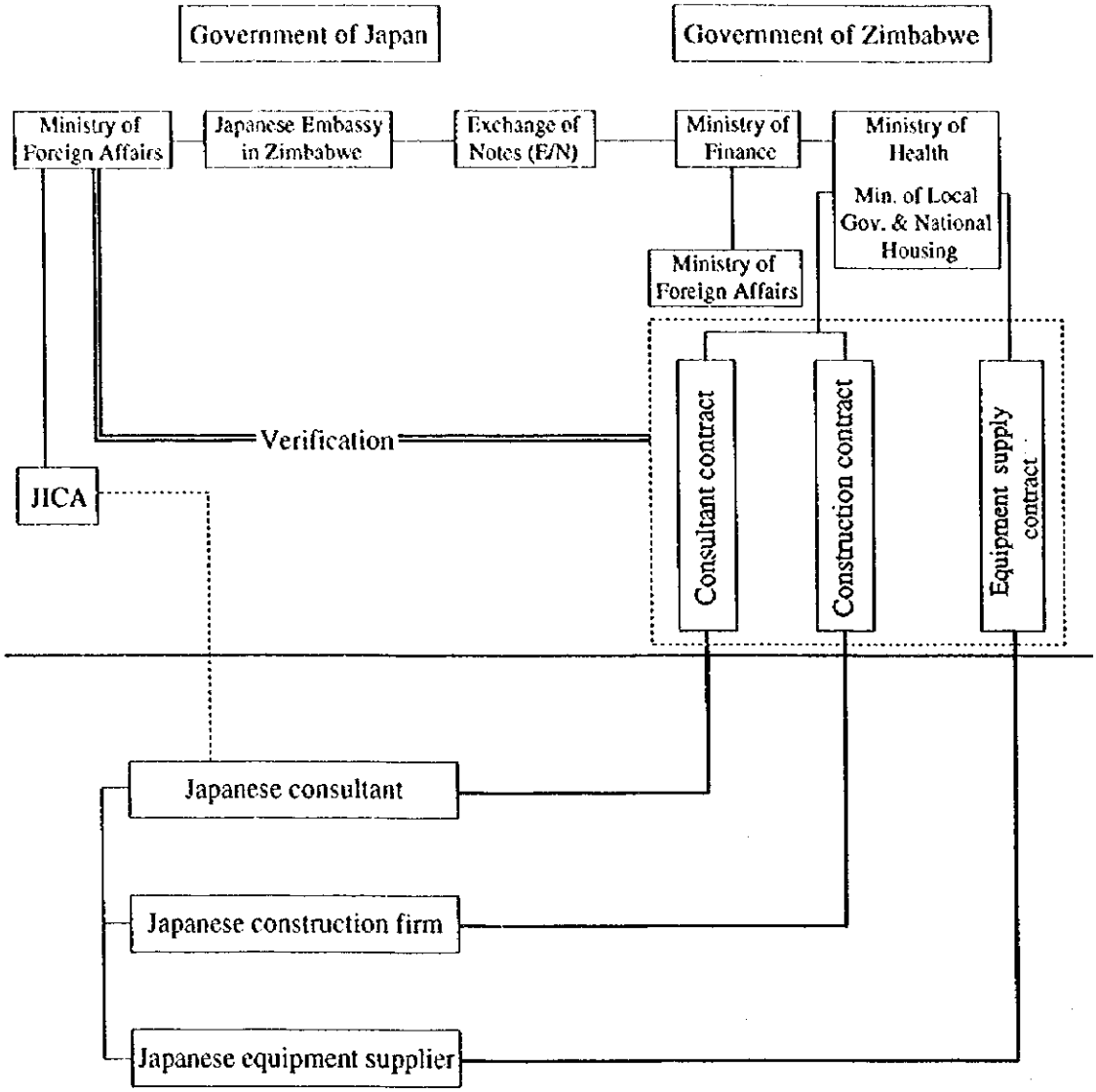


Figure 3-1 Relations Among Relevant Organizations

3-1-2 Implementation Conditions

Basic policies for the construction and procurement of the proposed project under the grant aid system are as follows:

(1) Strict observance of construction period

The entire construction process shall be designed on the premise that the construction work will be carried out under the guidance of Japanese engineers.

(2) Securing of quality and quantity

All of the qualities and quantities specified in the design drawings and specifications shall be secured at all stages of the construction.

(3) Safety during construction

Considerations must be given to safety during the construction.

Sufficient safety considerations shall be given to the temporary work.

3-1-3 Scope of Works

In the event that the proposed project is implemented under Japan's grant aid system, the respective scopes of work to be undertaken by the Japanese side and the Government of Zimbabwe are summarized below:

Table 3-1 Scope of Works

Work to be undertaken by Japan		Work to be undertaken by Zimbabwe	
1.	Construction work Structural framework, architectural finish	1.	Ground preparation Removal of existing facilities, grading, Replumbing of existing pipes, removal of trees and bushes.
2.	Electrical installation Electric service and substation, motive power, main cables, lighting outlets, telephone system, emergency alarm system, lightening protection system	2.	Exterior Work Landscaping, tree planting, fencing
3.	Plumbing and Air conditioning Water supply system, sewerage system, sanitary fixtures, air conditioning and ventilation system, fire extinguishing system, kitchen	3.	Infrastructure connection Connecting to main supply lines of electric power, telephone, and water, installing portable fire extinguishers
4.	Exterior work Street lamps	4.	General Furniture and equipment Desks, chairs, office equipment
5.	Equipment Medical equipment	5.	Fixtures Curtains, window shades
		6.	Miscellaneous Filing of various applications and application fees, application for receiving utility services and application fees, tax exemption
		7.	Maintenance, management, and operation costs
		8.	Changing the route of access roads and gate

3-1-4 Consultant Supervision

In the construction supervision, the consultant will dispatch a resident engineer to the construction site. The consultant will also, according to the progress of the construction, dispatch to the site short-term engineers, who will inspect, witness, and instruct the construction work.

The scope of work during the construction period is as follows:

(1) Construction

1) Assistance for concluding construction contract

Consultant shall assist an execution of tendering, examination of details of tender documents, and witnessing of the execution of contract.

2) Inspection and approval of shop drawings, etc.

Inspection of shop drawings, material sheet, finishing samples, and equipment presented by the contractors.

3) Construction guidance

Reviewing of construction plan and schedule, guidance for construction workers, report to the client about the progress of the construction work.

4) Assistance for payment authorization procedure

Inspection of the work at each construction stage, and examination of invoices, etc.

5) Inspection and issuance of certificate

Inspection of the work value in each consideration stage and issuance of completion certificate.

(2) Equipment

1) Cooperation Regarding Contractor Contract

Selection of procurement contractors through tender, drafting the procurement contract, examining the details of procurement contract price, and witnessing the execution of the contract.

2) Inspection and Approval of Specifications, Catalogues, etc.

Inspection of the equipment specifications, catalogues, labels, and other items to be submitted by the procurement contractors.

3) Verification of Equipment

Inspection and verification of the quality and performance of the equipment to be delivered.

4) Supervision of Transport of Equipment and Customs Clearance

5) Attending and Inspecting Equipment Installation

Inspection of equipment at the time of installation by verifying the quantity, quality, and performance thereof as well as assistance for the equipment transfer to the client by verifying the transfer documents and confirming the completion of transfer procedures.

The consultants will complete its duties by attending the hand over of the facilities and the equipment from the contractor to the client, upon verifying that the construction and installation work has been completed according to the terms and conditions of the contract. In addition, they will report the progress of construction and equipment procurement work, payment procedures, completion and hand over, and other events of the project to the relevant agencies of the Japanese government.

3-1-5 Procurement Plan

(1) Construction work

Building materials to be procured for the project need to be those that can be maintained easily and repaired quickly in case of damage or breakage. In this project, materials will be sourced locally as much as possible.

(2) Procurement of Medical Equipment

Many items of medical equipment used in Zimbabwe are imported. As it is necessary for the hospital to be able to promptly receive expendable supplies and repair work and other technical services, the equipment plan shall be designed based on the following policies.

1) Of the equipment articles to be used in the project, X-ray instruments, electronic medical devices, clinical testing instruments for analysis, etc. that satisfy the following requirements are given priority. These requirements will be specifically defined in the technical specifications of tender documents as the conditions for technical service providers that need to:

   ① be technically certified for repair services by the maker of the equipment,

   ② be equipped with workshop and technicians that have technical capabilities of maintaining the equipment in Zimbabwe,

   ③ have, in principle, sufficient stock to handle the hospital's orders for general-purpose repair and consumable parts and/or a system for importing specialized items.

2) Some of the equipment, of which we think third-countries are a more preferable source, for which third-countries suppliers are deemed to be able to provide better maintenance services from the standpoints of service capability of the agent and grade and price of the equipment, will be sourced from third countries. Some of the X-ray instruments, electronic medical devices, with which the hospital staff are already familiar, will be procured from third countries.

Equipment items that do not pose any problems in quality, delivery date, or supply will be sourced locally.

3-1-6 Implementation Schedule

Whole length ranging from detailed design to supervision of construction work will be needed 19 months.

The length of time needed to implement the portion of the project to be undertaken by the Japan side is as follows:

(1) Detail Design stage

The time needed to produce working drawings and specifications is estimated at 6.5 months after the conclusion of the E/N. When construction documents are completed, tender applicants for the construction work are examined beforehand (P/Q). Based on the preliminary examination, the executing agency will summon qualified tenders and conduct a tender in the presence of the parties concerned.

The tender that offers the lowest price will conclude a construction contract with the Zimbabwean Ministry of Local Government and National Housing and an equipment procurement contract with the Ministry of Health. The work from the preliminary examination (P/Q) to the conclusion of the construction contract is estimated to take 2.5 months.

(2) Construction work

It is estimated that construction of the facility will take 12 months after the conclusion of the construction contract with the Zimbabwean government.

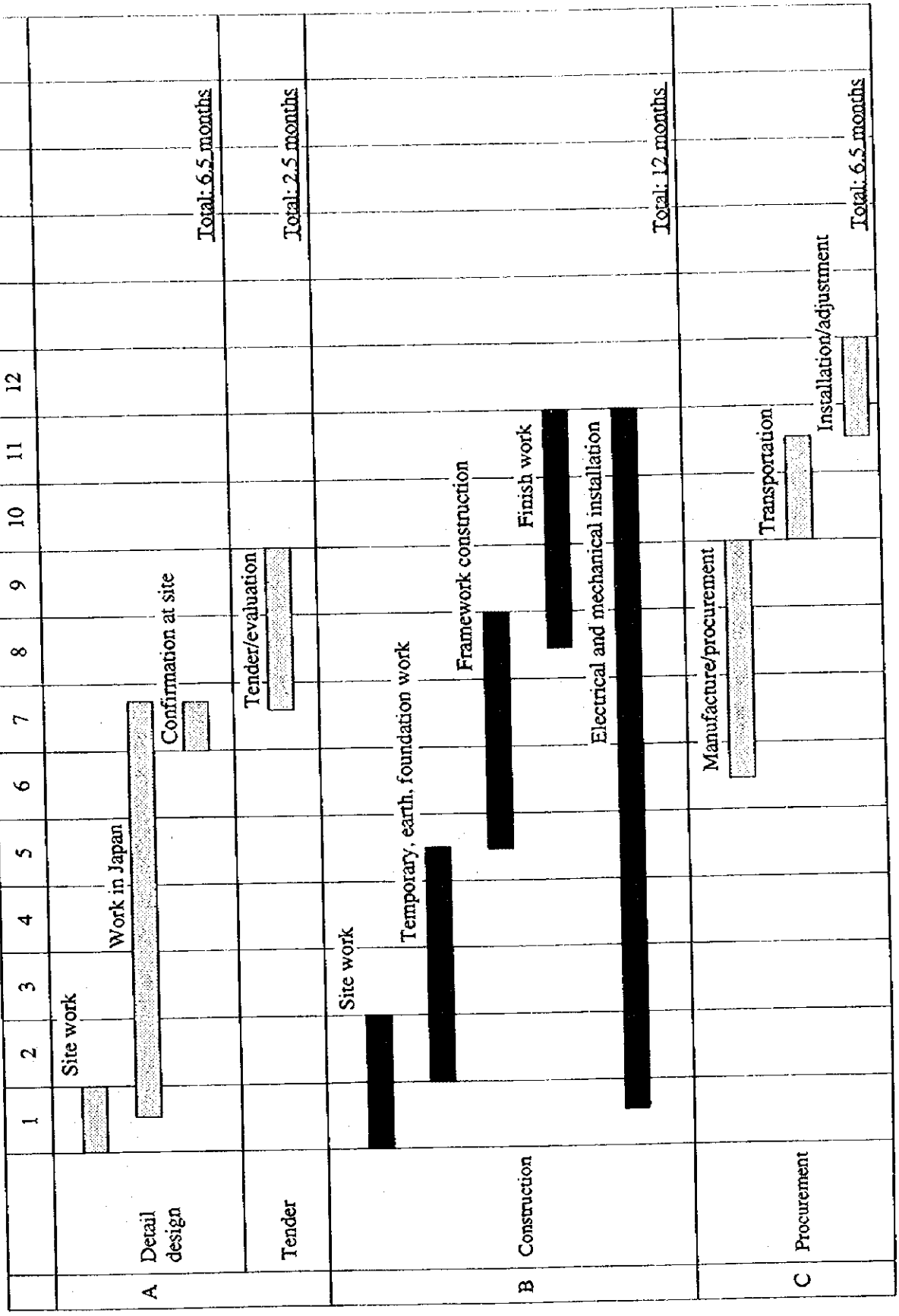
(3) Equipment procurement

The process of manufacture, procurement, installation, and adjustment of equipment is estimated to take 6.5 months after the conclusion of the equipment procurement contract with the Zimbabwean government.

Project execution schedule described above is summarized in the following chart.

(4) Project execution schedule

Table 3-2 Project Execution Schedule



3-1-7 Obligations of Recipient Country

Should this cooperation project be implemented, the obligations of the Government of Zimbabwe are as follows:

(1) Signing of E/N Between Two Governments

The Government of Japan sets forth the objective, contents, and the grant limit of the proposed project at the Cabinet meeting and negotiates with the Government of Zimbabwe for the signing of the E/N. By signing of the E/N, the execution of the project begins.

(2) Banking Arrangements (B/A)

The Government of Zimbabwe concludes a banking arrangement (B/A) and agrees on payment terms with an authorized foreign exchange bank in Japan to open a special account for the purpose of receiving the funds granted by the Government of Japan and making payments to the contracting companies. The banking arrangement serves as the basis for the Government of Zimbabwe to issue the Authorization to Pay (A/P). Any banking charges that accompany the transactions under the banking arrangement are borne by the Government of Zimbabwe.

(3) Authorization to Pay (A/P)

Japanese contracting companies carry out their contract responsibilities after receiving verified contracts and the A/P issued by the Government of Zimbabwe.

(4) Other

Other obligations of the Government of Zimbabwe are carried out according to the scope of work to be undertaken by Zimbabwe side described in section 3-1-3.