3) Jeep

When a certain area has been declared unsafe as a result of rainfall observed on the radar, the jeep will be dispatched from the VSTC to the said areas in order to ascertain the situation as well as evacuate residents. The jeep will be equipped with a radio transmitter.

(5) Equipment for Restoration of the Mt. Galunggung Mudflow Warning System

The study, which was carried out on the various requested details, is stated in the results of investigation into the requested restoration in (6)-1)-(f) of Chapter 2.

## 4-4 GENERAL PLAN

### 4-4-1 Location and Condition of the Planned Construction Site

*The planned construction site for this centre is located in* Yogyakarta City at the middle of Java, 2 km north of Solo avenue which connects Solo city and Yogyakarta city.

The existing facilities, such as the Experiment Building, the Administration Building, the Radar Tower, etc., were constructed as parts of "the Improvement Project for the Volcanic Sabo Technical Centre".

In preparation for the current request, Indonesia has already acquired a site area of 3,000 $m^2$, opposite this centre, and has completed budgeting for the acquisition of an additional site area of approximately 2,600 $m^2$. A total of approximately 7,000 $m^2$ is planned with the future addition of a further 1,400 $m^2$.

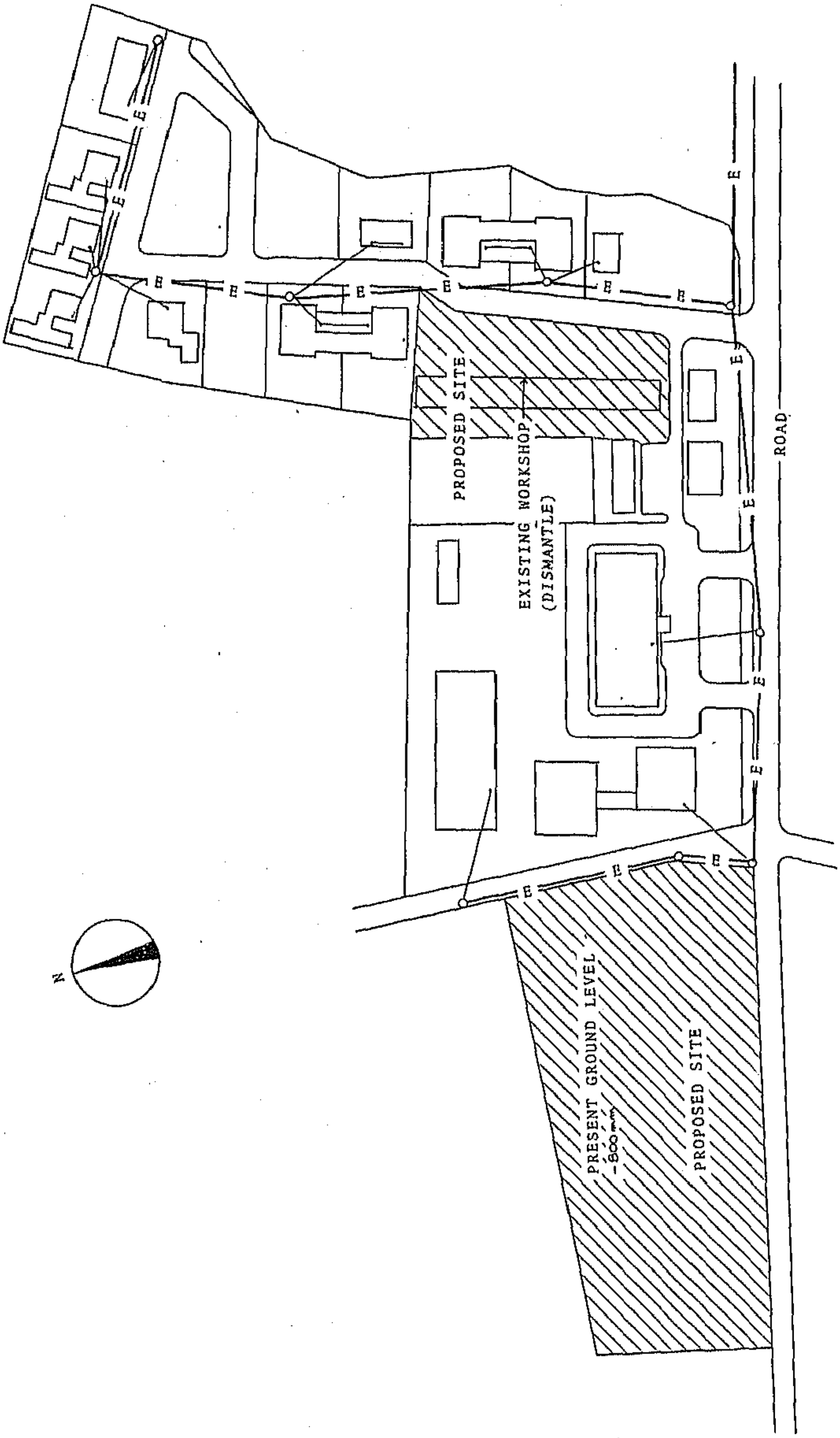
On the above mentioned site area of approximately 5,600 $m^2$, "the Sabo Information Centre" and "the Lahar Laboratory" will be constructed, and the Dormitory will be constructed within the confines of the existing site after the workshop has been demolished.

With regard to infrastructures, a single-phase 220 V electricity supply will be provided first within the existing site, followed later by three-phase 380 V. There are no problems expected with the provision of power to the new site because power has already been provided up to the corner of the site by aerial cables.

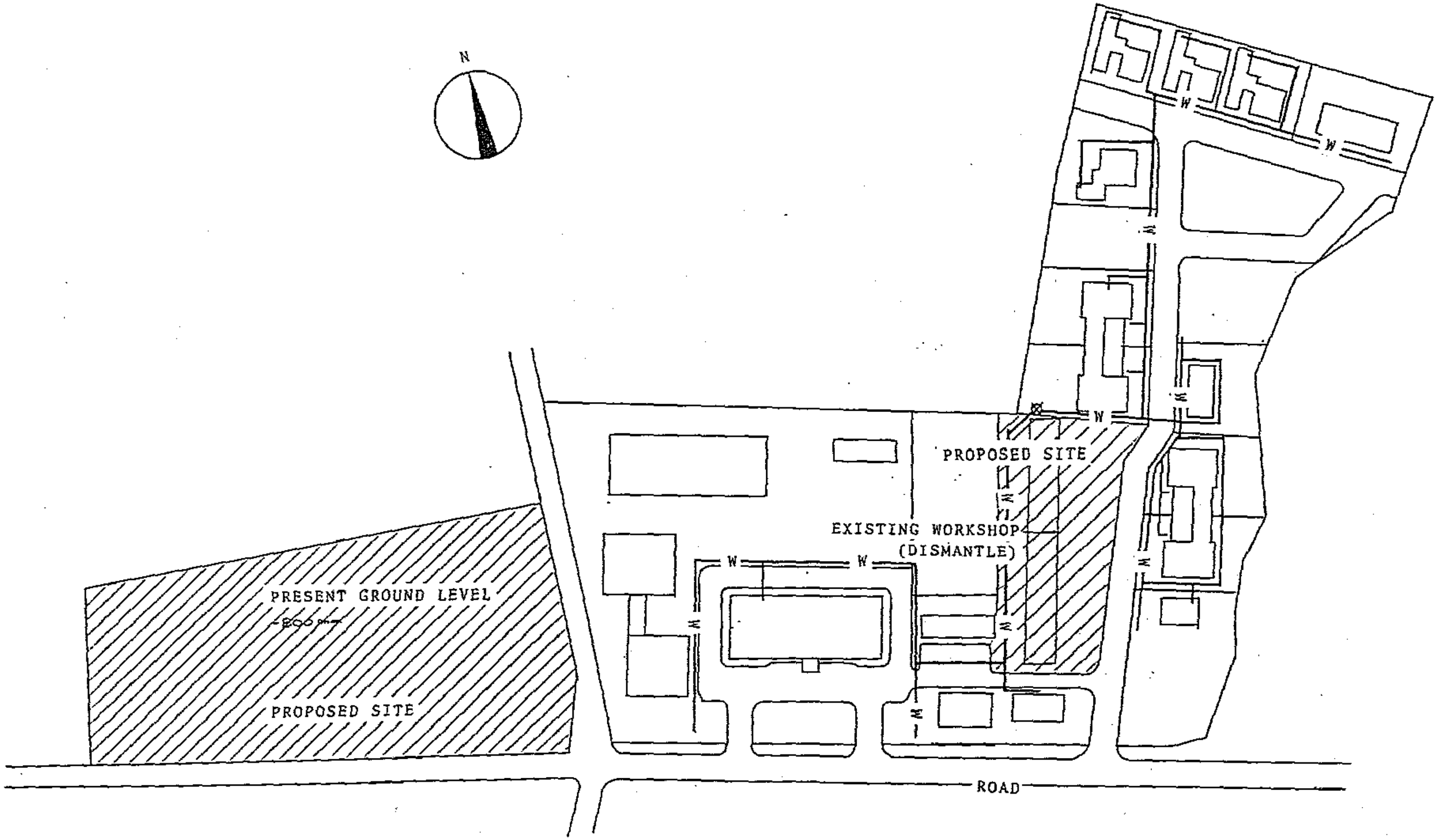
With regard to the water supply to the new site, although a well with the depth of 100 m is provided within the existing site, because of difficulties with the supply capacity and piping work, the installation of a new well must be considered.

With regard to drainage, the discharge of water into open channels located around the perimeter of the existing site is considered possible. There are also open channels around the new site, however these require some improvement.

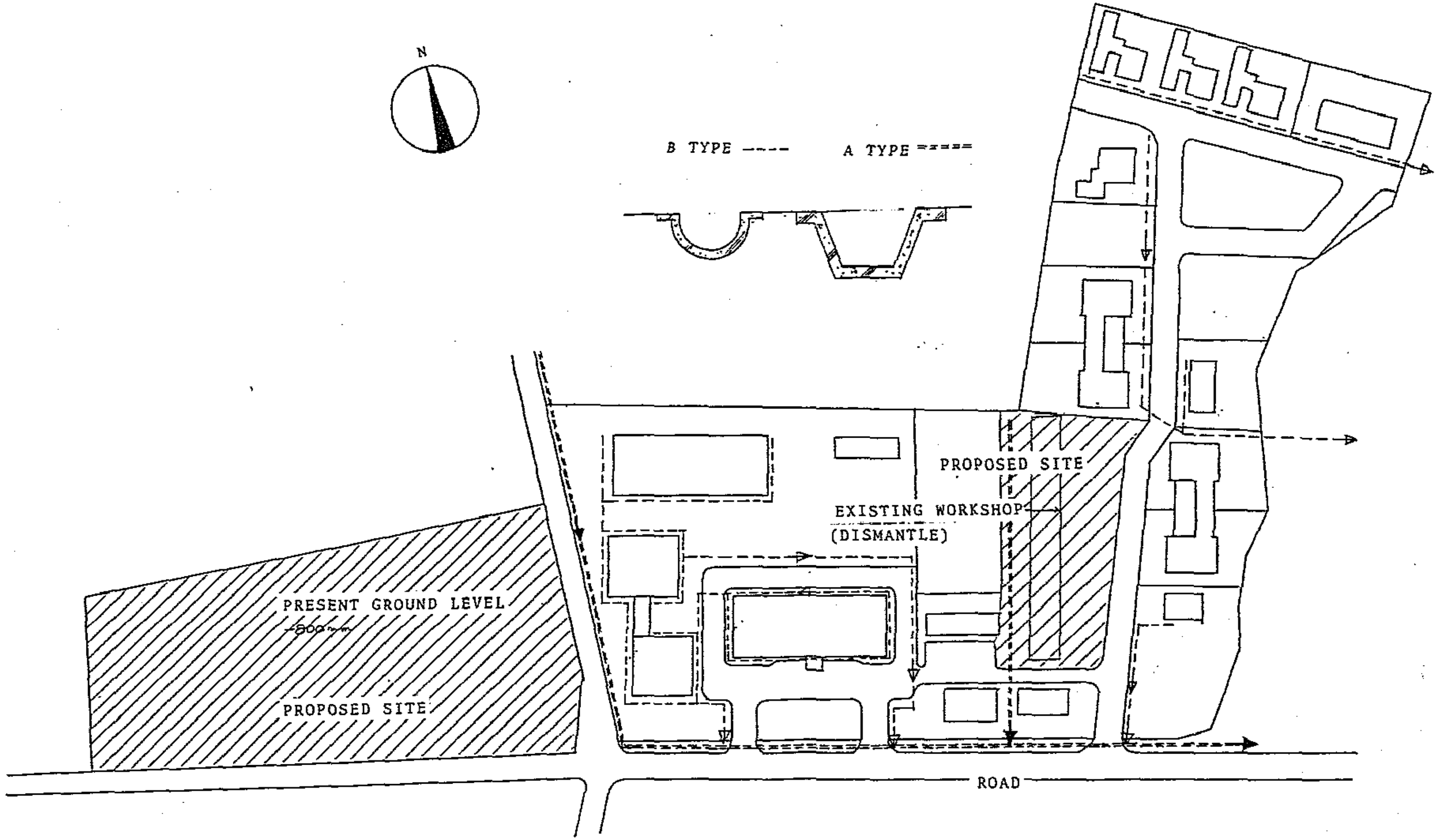
Current Conditions of Proposed Construction Site




SITE CONDITIONS — VSTC
EXISTING POWER SUPPLY




SITE CONDITIONS – VSTC
EXISTING WATER SUPPLY




SITE CONDITIONS — VSTC

EXISTING DRAINAGE

### 4-4-2 Outline of Facilities

Facilities to be constructed in this plan are as follows.

(1) Sabo Information Centre

| | |
|---|---|
| No. of Floors: | 2 stories |
| Structure: | Reinforced concrete with rigid frame |
| Building Area: | 720 $m^2$ |
| Total Floor Area: | 1,218 $m^2$ |

The building layout will be arranged to provide a Training Auditorium and a Training and Conference Room on the 1st floor, and a Book Storage, a Reading Room, a Computer Room and offices on the 2nd floor.

Locally manufactured tiles will be used for the roof, and the external walls will be urethane spray finished, while the internal wall will be finished with acryl emulsion paint after plastering of the bricks. The commonly used floor sections will be of terrazzo blocks whereas the floors of individual rooms will basically be finished with parquet tiles.

(2) Lahar Laboratory

| | |
|---|---|
| No. of Floors: | Single storey (with mezzanine floor) |
| Structure: | Reinforced concrete |
| Building Area: | 810 $m^2$ |
| Total Floor Area: | 986 $m^2$ |

The roof will be of locally manufactured tiles on a steel frame base, the external walls will be urethane spray finished while the internal walls be acryl emulsion paint finished after plastering of the bricks, and the floor will be of cement tiles.

(3) Dormitory

| | |
|---|---|
| No. of Floors: | 3 storeys |
| Structure: | Reinforced concrete with rigid frame |
| Building Area: | 540 $m^2$ |
| Total Floor Area: | 1,560 $m^2$ |

The layout will be arranged to provide rooms for short-term lecturers, a cafeteria and a janitor's room on the 1st floor, rooms for long-term lecturers on the 2nd floor, and twenty single rooms for trainees on the 3rd floor.

Locally manufactured tiles will be used for the roof, and the external walls, will be urethane spray finished while the internal walls will be finished with acryl emulsion paint after plastering of the bricks. The commonly used floor sections will be of terrazzo blocks, whereas the floor of individual rooms will be of parquet tiles.

### 4-4-3 Outline of Equipment

| Classification | Usage | Major Equipment |
|---|---|---|
| Equipment for training and sabo technology experimentation | This equipment will be used for experiments for solving problems of hydraulic behavior of debris related to the flow rate of debris, the displacement of river bed, measures against local erosion in the lower reaches of rivers and spacings for the installation of structures. By carrying out experiments under the field conditions, recreated on the models, the data obtained from the experiments can be interpreted as equivalent to the actual phenomena by using the law of similarity. Judgement as to whether or not a facility plan is appropriate can therefore be made, and development of construction plans for structures will become possible. It will also be used for analysis of fundamental data relating to concrete and soil, etc. | Artificial Rainfall Apparatus<br><br>Mudflow Model Generator<br><br>Mudflow Model Flume<br><br>Hydraulic Model Test Flume<br><br>Water supply equipment for outdoor hydraulic model tests<br><br>Concrete Abrasion Testing Machine<br><br>Concrete Impact Testing Machine<br><br>Triaxial Compression Testing Apparatus |
| Training Equipment for Mudflow Warning System | Equipment for observing the actual mudflow conditions, river water flow speeds and river levels, to detect their rapid changes and to issue mudflow warnings. It will also be used for collection and accumulation of data. | Mudflow Observation Equipment<br><br>Electronic-Wave Current Meter<br><br>Ultrasonic Water-Level Gauge |
| Equipment for data processing and educational text preparation | Preparation of educational texts to be distributed for training. (For computer operation training) | Word Processor<br><br>Blue Printing Machine<br><br>CRT Display for Computer<br><br>Copying Machine |

| Classification | Usage | Major Equipment |
|---|---|---|
| Audio-visual equipment for education | To be used for study purposes in each training course as well as for sabo related information activities, such as symposiums. | Sound Equipment<br><br>TV Monitor System |
| Vehicles for training | To be used for field experiments in each training course and for determining the actual conditions when dangerous areas are detected by the mudflow warning system, as well as for guidance of the evacuation of residents. | Bus (40 passengers)<br><br>Jeep |
| Equipment for restoration of the Mr. Galunggung Mudflow Warning System | Restoration of the Mt. Galunggung Mudflow Warning System, damaged by lightning. | Equipment for Radar Raingauge restoration<br><br>Equipment for Telemetry Rainfall Gauge restoration.<br><br>Equipment for Mudflow Sensor restoration.<br><br>Equipment for building up of lightning measures.<br><br>Equipment for Radar Raingauge power source backup measure. |

# CHAPTER 5. BASIC DESIGN

# CHAPTER 5 BASIC DESIGN

## 5-1 BASIC DESIGN OF FACILITIES

### 5-1-1 Design Principles

The facilities planned will be designed based on the following design principles.

(1) The facilities should be designed to be fully functional and rational to the extent that they exhibit their expected roles as required by the "Improvement Project for Volcanic Sabo Technical Centre" undertaken by the Indonesian government.

(2) As the facilities are planned to be constructed on the plot of the existing Volcanic Sabo Technical Centre and on the newly acquired plot adjacent to the existing site, new facilities should be designed in such a manner that they will harmonize with the existing facilities. In addition, since the construction site is located in Yogyakarta where a number of historical and traditional spots or remains are preserved, it is important to design the new facilities so that they match the surrounding environment.

(3) The natural environment in Java, such as climatic conditions, as well as the current conditions with regard to building structure should be fully understood so as to take advantage of the possibility of natural lighting and ventilation, and thereby to design energy-saving type facilities which are economical in operational and maintenance costs.

(4) In the construction of these facilities, it is planned to use local materials as much as possible and to use construction methods to which the workers who may be involved in the work are fully accustomed. While a certain level of workmanship

should be assured for the work carried out by local labor, all possible efforts should be made to reduce the construction costs and to shorten the construction period.

(5) As a considerable amount of water will be consumed by the equipment and apparatus to be installed under this plan, e.g., a hydraulic testing model and an artificial rainfall apparatus, an appropriate water recycling system should be planned to minimize wastage.

Based on the basic design principles described above, various matters related to the designing of the planned facilities are discussed in the following sections.

### 5-1-2 Review of Design Conditions

(1) Natural Environment

1) The rainy season in Java starts in November and ends in May, recording high levels of precipitation every year. It is necessary to take certain measures to cope with this wet weather. The results of the examination of the design conditions with regard to the natural environment are explained below.

(a) The roof pitches of the buildings should be large enough to ensure adequate drainage of the roof surfaces.

(b) The floor level of the 1st floor should be 600 mm above ground level to prevent water from inundating the buildings during the rainy season.

(c) Eaves gutters and drainage pipes should have sufficiently large capacities to carry the large volumes of rainwater.

(d) The projection length of the eaves should be in the vicinity of 3.0 m.

2) Java is located along an earthquake zone and has experienced a number of earthquakes to date. To cope with earthquakes, the following measures should be taken.

a) A seismic coefficient of K=0.1, which is half the value applied in Japan, will be adopted for designing the structures to be constructed under this plan, although the seismic coefficient required to be applied to the structural design by the relevant Indonesian standards is about one tenth of the value applied in Japan.

(2) Site Conditions

1) Two plots have been selected as the site of construction under this plan. One plot is currently a paddy and crop field. A wooden structure now stands on the other plot and will be dismantled before the new facility is constructed. Considering these conditions, the following steps will be taken.

(a) The existing difference in height between the ground surface of the site and the road running in front of the site will be offset by filling with soil to a height of approximately 80 cm. The cost of this work will be borne by the Indonesian government.

2) Because the construction site is located in the historic Yogyakarta area and the planned facilities will be constructed on the plot of the existing Volcanic Sabo Technical Centre and on the adjacent plot, the following considerations should be made in the architectural design of the facilities.

(a) The Sabo Information Centre, which will be a two-story structure, is expected to serve as the central facility of the Volcanic Sabo Technical Centre. The structure should, therefore, be of a symbolic design, featuring a large roof with three different pitches.

(b) The Lahar Laboratory, which will be located next to the Sabo Information Centre, will also have a large roof with a skylight allowing natural lighting.

(c) The Dormitory will be a three-storey structure, the verandas of which open at an angle to the building toward the volcanic Mt. Merapi, offering a pleasant view and comfortable atmosphere to the trainees and other personnel who will lodge there.

(3) Construction Methods and Materials

1) The design will be such that the construction methods generally used in Indonesia are easily adoptable.

(a) Since the Lahar Laboratory will be a single storey building with a large ceiling height and large ceiling span, the columns and beams will be of reinforced concrete while the roof will be steel framed.

(b) The exterior walls will be brick masonry with a mortar base, and will be paint-finished.

(c) The roof backing will be of wooden truss assemblies.

(d) Termite countermeasures will be taken in the areas below the first floor concrete floor and around the structures.

2) Materials produced in Indonesia will be used as much as possible for the construction of the planned facilities.

(a) The materials to be used will generally be those which are easily maintainable and whose spare parts can be purchased without difficulty.

(b) The durability and other properties of the materials will be examined to ensure that proper materials are used. The materials shall be selected in accordance with the relevant provisions for the restriction of import materials enforced in Indonesia.

5-1-3 Basic Plan for Facilities

(1) Construction Site

The construction site is located in Yogyakarta city of the Central Java Province and is positioned at about 2 km north of Solo Avenue which connects both Solo and Yogyakarta cities. Existing buildings at the site include a laboratory building, an administration building, a radar tower and other supporting facilities, which were constructed in 1982 and form the Volcanic Sabo Technical Centre.

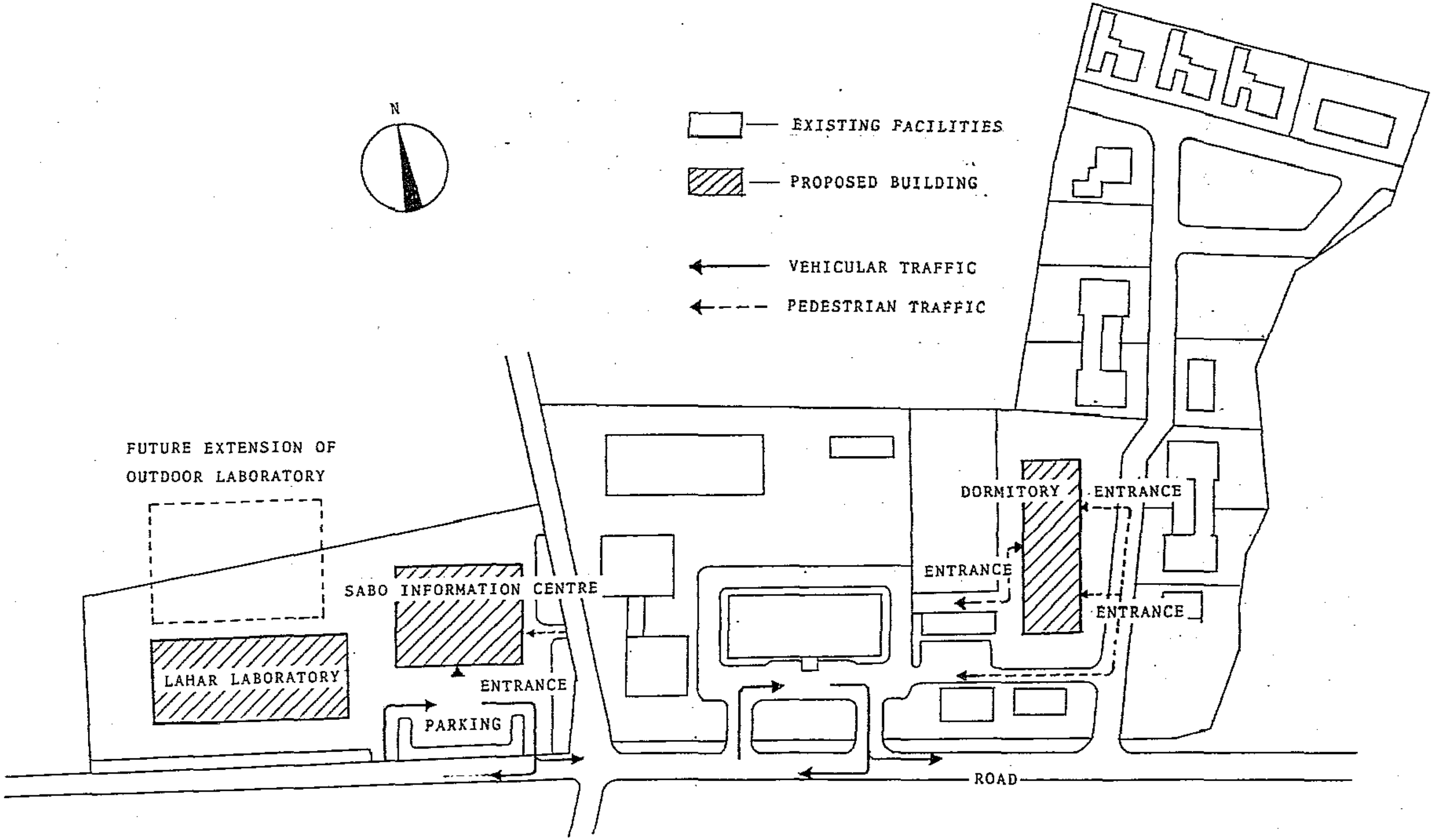
The Indonesian government, which requested Japanese cooperation for this project, has already acquired plots of land covering approximately 3,000 $m^2$, one plot of which is within the premises of the existing Volcanic Sabo Technical Centre, the other plot being separated from the existing Centre by a road running between them. The government has also already taken the necessary budgetary steps to acquire an additional 2,600 $m^2$ of land. For future expansion, it is planned to further add an area of approximately 1,400 $m^2$, totalling approximately 7,000 $m^2$.

As is indicated in the attached drawing (Basic Plan for Facilities), the Sabo Information Centre and the Lahar Laboratory will be constructed on the newly acquired 5,600 $m^2$ plot. The Dormitory will be constructed within the premises of the existing Centre where the workshop building now stands, after the workshop building has been dismantled.

(2) Layout Plan

As a result of the investigations into the scale of the two planned plots and the other probable construction sites, it is planned that both the Sabo Information Centre, which will be the central facility of the Volcanic Sabo Technical Centre and the Lahar Laboratory will be constructed in the newly acquired plot opposite the existing premises. The Lahar Laboratory will be located in front of the outdoor hydraulic experiment yard to be provided by the Indonesian government sometime in the future. Under this project, only water supply facilities will be provided for the outdoor experiment yard.

The Dormitory will be constructed in the existing premises as the newly acquired plot is limited in area. It will be located near the existing apartment for personnel use so that the residential zone will be separated from the working zone. A wooden workshop now stands on the plot planned for the Dormitory. It was agreed, however, upon mutual deliberation that it will be dismantled at the expense of the Indonesian government.




LAYOUT OF FACILITIES — VSTC
TRAFFIC FLOW DIAGRAM

### (3) Architectural Plan

#### 1) Sabo Information Centre

The Sabo Information Centre will function as a facility for promoting the propagation of sabo-related technology as well as for public relations. The two-storey building will consist of various rooms designed to facilitate training and education. It will house a training auditorium with a seating capacity of approximately 80 persons and conference rooms on the 1st floor and a data storage, reading rooms, computer rooms, and an office, etc., on the 2nd floor.

##### (a) Floor and Cross-Sectional Plan

A training auditorium, of which the ceiling penetrates into the 2nd floor, will be located at the center of the 1st floor. On the same floor, conference rooms will be located on both sides of the training auditorium. The floor level of the training auditorium will be flush with that of the other rooms except that the stage of the training auditorium will be at a higher level than the other parts.

Movable partitions will be provided in the conference rooms so that they can be divided into a group of small rooms when necessary.

The 2nd floor of the Sabo Information Centre will consist of various data-related facilities such as a data storage, reading rooms, computer rooms, and an office room which will manage the other rooms. The ceiling height of the rooms located on the 2nd floor will be 3.0 m.

The ceiling of the training auditorium will be flush with those of the other rooms on the 2nd floor, and will have a skylight for admitting natural light. The skylight can be closed with movable louvers to shield the entering light when necessary, e.g., when movies or slides are to be projected in the auditorium

Sabo Information Centre

(Building area: 720 $m^2$, Overall floor area: 1,218 $m^2$)

| Rooms | Purpose of Use and Basis for Calculation of Area | Required Area | Planned Area |
|---|---|---|---|
| Training auditorium | 55 personnel from all the provinces in Indonesia (or 54 engineers, 2 each from 27 provinces) + 25 trainees<br><br>80 persons x 2 $m^2$/person = 160 $m^2$<br><br>Stage: 50 $m^2$ | 210 $m^2$ | 224 $m^2$ |
| Training and conference room (1) | 25 trainees + 10 lecturers = 35 persons<br><br>Discussion room with a seating capacity of approximately 35 persons<br><br>35 persons x 2 $m^2$/person = 70 $m^2$<br><br>To be used for advanced course group study | 70 $m^2$ | 72 $m^2$ |
| Anteroom for lecturers | 3 trainees x 5 $m^2$/person = 15 $m^2$ | 15 $m^2$ | 18 $m^2$ |
| Training and conference room (2) | Study and work room for comprehensive course trainees<br><br>5 trainees x 7 $m^2$/person = 35 $m^2$ | 35 $m^2$ | 36 $m^2$ |

| | | | |
|---|---|---|---|
| Store room (1) | Auditorium equipment and accessories storage space | 36 $m^2$ | 36 $m^2$ |
| Drawing room | Working area for tracing, editing, or arranging stored drawings | 24 $m^2$ | 24 $m^2$ |
| Store room (2) | Drawings and data store room | 18 $m^2$ | 18 $m^2$ |
| Store room (3) | Materials and text store room | 18 $m^2$ | 18 $m^2$ |
| Manager's room | Manager's room of 20 $m^2$ + guest reception room of 15 $m^2$ | 35 $m^2$ | 36 $m^2$ |
| Office | 9 clerical workers<br><br>9 persons x 5 $m^2$/person = 45 $m^2$ | 45 $m^2$ | 36 $m^2$ |
| Data storage | Storage of books, literature, and research data and drawings related to VSTC | 54 $m^2$ | 54 $m^2$ |
| Data room | Storage of computer related data | 18 $m^2$ | 18 $m^2$ |
| Computer room | Computer processing room for research and trainees education | 36$m^2$ | 36 $m^2$ |
| Reading room | Data reading and self-studying room for trainees | 54 $m^2$ | 54 $m^2$ |

2) Lahar Laboratory

The Lahar Laboratory will be a one-storey structure with a large ceiling height, with a partial mezzanine floor, as some of the equipment and apparatus to be installed in the laboratory will have large heights. Major equipment and apparatus to be installed are:

- Artificial rainfall apparatus
- Mudflow model generator
- Mudflow model flume
- Hydraulic model test flume (with adjustable pitch)

a) Floor and Cross-sectional Plan

On the first floor, the above-mentioned equipment and apparatus, as well as water supply equipment and an artificial rainfall operation room will be provided. Each piece of equipment and apparatus will be installed with sufficient clearance to allow experiments to be performed without any interference. A certain area of space will also be reserved for temporary storage of experimental materials.

A water storage tank, return water channels, and a sand sedimentation pit will be installed under the floor so that there will be no obstacles along the working corridor.

The laboratory will have a clear height of 9.0 m, considering the heights of the experimental apparatus to be installed.

An observation corridor, from which the progress of experiments can be observed by trainees or other personnel, will be provided on the mezzanine floor.

3) Dormitory

The Dormitory will accommodate the trainees assembled from all over Indonesia to attend the lectures and training programs offered by the Centre as well as the instructors and lecturer dispatched from Jakarta, Bandung, and other cities.

(a) Floor and Cross-sectional Plan

The Dormitory will be a three-storey structure, the 1st and 2nd floors of which will be allocated for instructors and lecturers and the 3rd floor of which will be offered for trainees.

The 3rd floor will consist of 20 private rooms which will be divided by a central corridor. Trainees will approach their rooms from the working zone through the stairs provided at the center of the Dormitory. The 2nd floor will be used by long-term instructors and lecturers, and will consist of four flats, each being of the three bedroom type. Each flat will be accessible through the entrance facing the residential zone, separate from the entrance for trainees.

The 1st floor will consist of six twin rooms allocated for the short-term instructors and lecturers, a cafeteria, and a resident caretaker's apartment. The cafeteria will be open for both trainees and personnel working at the Centre.

The ceiling height of each room will be 3.0 m and the height of each floor will be 3.8 m.

Dormitory

(Building area: 540 $m^2$, Overall floor area: 1,560 $m^2$)

| Rooms | Purpose of use and basis for calculation of area | Required area | Planned area |
|---|---|---|---|
| Room for short-term instructor | To be used by the instructors who will be dispatched from Yakarta or Bandung and who will stay for a shorter period of time.<br><br>Each unit will consist of a twin room and a unit bath. | 24 $m^2$ | 21 $m^2$ |
| Room for long-term instructor | Each unit will consist of three bedrooms, a living room, a dining kitchen, and other necessary facilities. | 80 $m^2$ | 80 $m^2$ |
| Cafeteria | 40 seating capacity x 1.5 $m^2$/person = 60 $m^2$<br><br>Accommodation for general and advanced course trainees | 60 $m^2$ | 68 $m^2$ |
| Private room for trainees | Single room (can accommodate a maximum of 2 persons) | 13 $m^2$ | 14 $m^2$ |

(4) Structural Plan

1) Basic Principles

(a) The proposed structures of the facilities under this plan are as follows:

- Sabo Information Centre
  2-storey reinforced concrete structure
- Lahar Laboratory
  1-storey reinforced concrete structure with steel frame roof
- Dormitory
  3-storey reinforced concrete structure

(b) The framework of each structure will have sufficient strength to resist all possible external forces and will have such a construction that all such forces are simply transmitted to the ground without any interference.

(c) As the result of a study conducted on the foundation work methods, based on the boring records data submitted by Indonesia, the foundations for the Sabo Information Centre, the Dormitory and the Lahar Laboratory will employ a method in which the buildings are supported by the bearing layer of the ground. Although settlement within allowances may occur during construction due to the dead weight of the buildings, it will be unlikely to cause any problems.

(d) Since the Sabo Information Centre and the Lahar Laboratory will be constructed on land which is currently being used as paddy or crop fields, and the Dormitory will be constructed on a plot where a structure now stands and will have been dismantled before the construction of the Dormitory, the 1st floor structures of each building will be of structural slab, not slab-on-grade.

(e) It is expected that the structures will be constructed with sound quality by adopting construction methods which have been commonly applied in the local area and to which the workers who may be involved in the construction are accustomed, thereby taking advantage of the superiority in workability over other construction methods.

2) Structural Design Plan

(a) Applicable Design Standards

In Indonesia, there are various standards applicable to structural design. They include: Peraturan Bangunan Nasional, Peraturan Pembebanan Indonesia Untuk Gedung, Peraturan Buton Bertulang Indonesia, U.S. Standards, British Standards, Japanese Industrial Standards, and Japanese Agricultural Standards. The Japanese Industrial Standards (JIS) and the Japanese Agricultural Standard (JAS) will apply in designing of the facilities planned under this project.

(b) Frame Assembly

The frame structure of the Sabo Information Centre and the Dormitory will be of reinforced concrete rigid frame construction, which is commonly adopted in Indonesia.

The roof of the Sabo Information Centre will be of a steel truss construction while the Dormitory roof will be a steel truss structure over reinforced concrete floor slab plates.

The Lahar Laboratory, which will have a large ceiling height, and a large ceiling span, will be of steel frame construction, supported by reinforced concrete columns and beams.

(c) Foundation Work

The Sabo Information Centre, the Dormitory and the Lahar Laboratory will employ the direct foundation method, directly supported by the bearing layer of the ground.

(d) Design Loads

The design loads are as follows:

a) Fixed Loads

The unit volumetric weights of the main materials are as follows:

- Reinforced concrete: 2.4 $t/m^3$
- Red brick: 1.9 $t/m^3$

b) Movable loads

The movable loads of major rooms are expected to be as follows:

| | Loads set by Structural calculation of floor | Loads to be supported by girders and columns | Loads to be supported considering earthquake forces |
|---|---|---|---|
| . Office, conference room, training room | 300 $kg/m^2$ | 180 $kg/m^2$ | 80 $kg/m^2$ |
| . Book storage | 500 $kg/m^2$ | 350 $kg/m^2$ | 150 $kg/m^2$ |
| . Computer room | 300 $kg/m^2$ | 180 $kg/m^2$ | 80 $kg/m^2$ |
| . Dormitory room, cafeteria | 180 $kg/m^2$ | 130 $kg/m^2$ | 80 $kg/m^2$ |
| . Corridor, stairs | 350 $kg/m^2$ | 320 $kg/m^2$ | 60 $kg/m^2$ |
| . Storeroom | 500 $kg/m^2$ | 350 $kg/m^2$ | 150 $kg/m^2$ |

c) Earthquake Forces

In Indonesia, an earthquake belt runs along the islands of Sumatra, Java and Bali and a number of earthquakes have been recorded to date.

The Japanese earthquake loading standards will apply to the structural design of the facilities under this plan, with the compatible Indonesian standards fully taken into consideration.

d) Wind Pressure

Based on the data of maximum wind pressures recorded at various points in Indonesia, a wind velocity of 20 m/sec., and a wind pressure coefficient of 20 $h/kg/m^2$ will be applied to the structural design of the facilities.

(e) Main Structural Materials

In accordance with the provisions of the Japanese Industrial Standards, the following values will be employed as the allowable stresses.

a) Concrete

| | |
|---|---|
| Design 28 days strength | $Fc = 210\ kg/cm^2$ |
| Slump | 15 cm |

b) Reinforcement

| Type | Long-term | Short-term | JIS material |
|---|---|---|---|
| Ordinary round bar | 1,600 $kg/cm^2$ | 2,400 $kg/cm^2$ | SR24 |
| Deformed | 2,000 $kg/cm^2$ | 3,000 $kg/cm^2$ | SD30 |
| | 2,200 $kg/cm^2$ | 3,500 $kg/cm^2$ | SD35 |

c) Steel Frame

| Type | Long-term | Short-term | JIS material |
|---|---|---|---|
| H-shaped | 1,600 $kg/cm^2$ | 2,400 $kg/cm^2$ | SS41 |
| Steel plate | 1,600 $kg/cm^2$ | 2,400 $kg/cm^2$ | SS41 |

(5) Equipment and Utilities Plan

1) Basic Principles

The equipment and utilities design will, in principle, be based on the relevant Indonesian standards or regulations wherever they are applicable, and on the Japanese standards or regulations if there are no applicable Indonesian standards.

(a) Taking energy saving and conservation of energy sources into consideration, equipment that is easily maintained and that can be operated with reduced running costs will be employed. For example the adoption of energy-saving type lighting fixtures and the divided control of lighting switches are considered to be effective. With regard to the ventilation and air-conditioning, natural ventilation will be used as much as possible to minimize the installation of mechanical air-conditioning equipment. Where required, however, an individual air-cooling package system will be adopted.

(b) All the equipment and apparatus to be used will be safe and easily maintained. All the switchboards and distribution boards will be of the steel-box enclosed type. Wires will in principle, be cased in conduit pipes. The plumbing system will be of a gravity type. Water receiving tanks will be made of fibreglass reinforced plastics.

(c) With regard to the materials and equipment to be used for this project, materials produced in Indonesia will be employed as much as possible.

(d) In addition, equipment and apparatus will be easily repairable at the local site. Where Japanese products are to be used, however, only those manufactured by a manufacturer of which an agency is stationed in Indonesia and are maintainable by such an agency whenever required, will be selected.

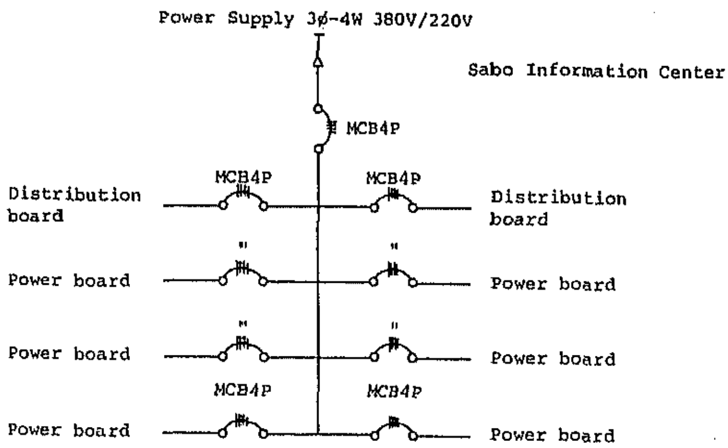
2) Electrical Equipment Design Plan

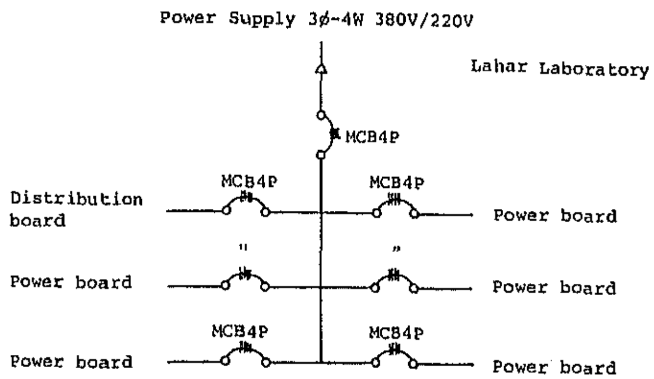
(a) Lead-in System

Sabo Information Centre and Lahar Laboratory

A 3ø-4W 380V/220V 50 Hz electricity supply, transformed from the transmission line 3ø - 3W 20 kV 50 Hz supply available at the corner of the site, will be connected to the lead-in panels installed in the buildings through aerial wires. The electricity will then be fed to each loading point via distribution boards.

The capacity for receiving power shall be 96 kVA for Sabo Information Centre and 112 kVA for Lahar Laboratory. A power receiving equpment connection diagram is shown below.

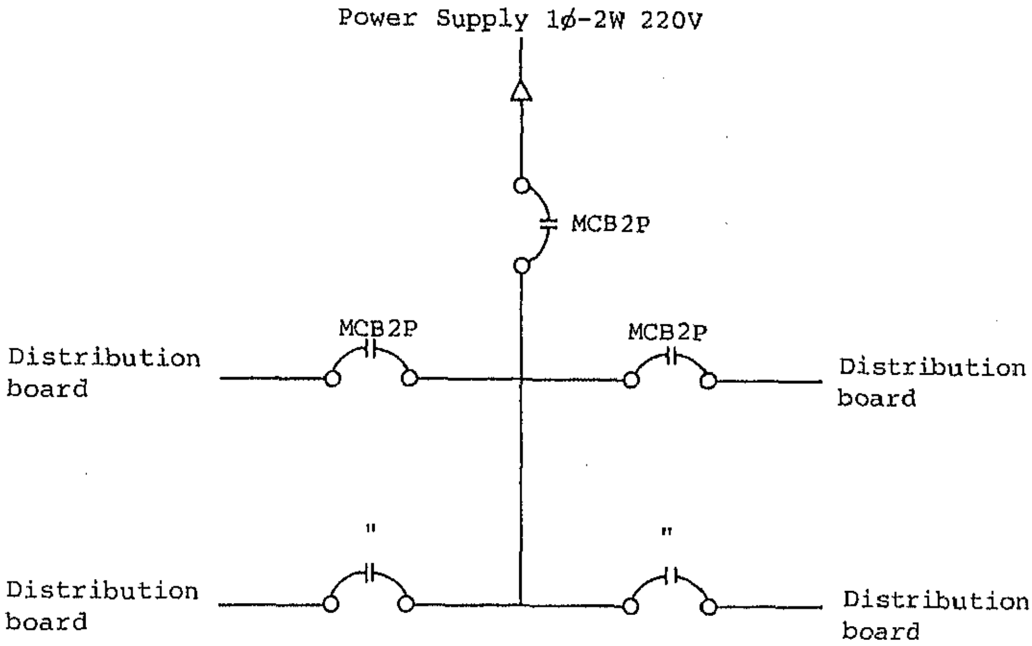


Dormitory

A single phase 2W 220 V 50 Hz electricity supply fed from the transmission line embedded in the road running in front of the site, will be connected to the lead-in panels installed in the building through aerial wires. The electricity will then be fed to each loading point via distribution boards.

The capacity for receiving power shall be 28 kVA. A power receiving equipment connection diagram is shown below.



(b) Electrical Capacity

Sabo Information Centre and Lahar Laboratory

| | | | |
|---|---|---|---|
| Main line: | 3ø-4W | 380V/220V | 50 Hz |
| Power: | 3ø-3W | 380V | 50 Hz |
| Electric lamp, receptacle: | 1ø-2W | 220V | 50 Hz |

Dormitory

| | | | |
|---|---|---|---|
| Main line: | 1ø-2W | 220V | 50 Hz |
| Power: | 1ø-2W | 220V | 50 Hz |
| Electric lamp, receptacle: | 1ø-2W | 220V | 50 Hz |

(c) Main Line and Power Equipment

For power equipment, electricity will be fed into the buildings through aerial wires from the lead-in poles provided within the site. Electricity will then be fed to each loading point via distribution boards and control boards. A distribution board will be provided at each individual loading point where loading is quite large, e.g., where experimental equipment is connected, so as to receive an adequate supply of electricity.

(d) Electric Lamps and Receptacles

With regard to the lighting fixtures, fluorescent lamps will mainly be used with incandescent lamps and mercury lamps in some locations. The switching control system of lighting fixtures will be divided into small groups so as to reduce electricity consumption.

The basic level of illuminance will be 300 lux at the office and conference rooms and 200 to 300 lux on the working surfaces of the laboratory.

Receptacles will be of the wall-mounted type and a minimum of two receptacles will be provided at the appropriate points of each room.

(e) Telephone System

A push-button type master telephone unit will be installed in the office room of the Sabo Information Centre. The master telephone will be connected with the secondary telephone units provided at other rooms requiring communication facilities.

The same communication system will be applied to the Dormitory with a master telephone unit being installed in the caretaker's room.

(f) TV Antenna

A television antenna set will be installed on the top of the Dormitory roof and wired television outlets will be provided at the cafeteria and other living spaces.

(g) Lightning Arrester

Lightning conductors will be installed at each building.

(h) Automatic Fire Alarm System

To locate a fire in its early stages and to facilitate alarming and evacuation during an emergency, fire detectors will be installed in each room and in addition manually operated transmitters and alarm bells will be provided in the corridors. The signals sent by the detectors or the transmitters will be received by the receiver units which will be installed in the Sabo Information Centre and the Dormitory. The receivers will indicate the location where a fire has broken out. Alarm bells will be installed at required places in the Lahar Laboratory.

(i) Self Power Generation System

A 75 kVA generator has been installed in the existing facility. It will be connected only to those points deemed necessary in the Dormitory.

3) Plumbing System and Sanitary Equipment Plan

In designing the plumbing system and sanitary equipment, it should be noted that the facilities will be constructed on two different sites: the Dormitory will be constructed on the plot of the existing premises and the Sabo Information Centre and the Lahar Laboratory will be constructed on the newly acquired plot.

(a) Water Supply Equipment

a) Dormitory

In the existing premises, there is a 100 m deep well, from which water is fed to the existing one-story buildings.

It is planned that water be supplied from the existing well to the three-storied Dormitory. The pump associated with the existing well, however, does not have sufficient capacity to pump water up to the elevated water tank which will be installed in conjunction with the Dormitory. It is therefore planned that the existing pump be removed and a new pump and a water receiving tank made of fiberglass reinforced plastic panels be installed.

The water pumped up to the water receiving tank associated with the Dormitory will be gravity-fed to the individual rooms.

The planned capacity of the water supply is 8 $m^3$/day, based on the accommodation plan. The water receiving tank will have a minimum storage capacity equivalent to one day's consumption (8 $m^3$), whereas the capacity of the elevated water tank will be 4

$m^3$, which is half the planned consumption of the Dormitory. With regard to the water supply for the existing facilities, they will receive water through the existing pipes, which will be connected with the newly installed pump.

b) Sabo Information Centre

As neither public water supply pipes nor wells have been provided in the planned construction site, it is planned to provide a well within the site and to pump water up by means of motorized pumps.

An elevated water tank made of fiberglass reinforced plastic panels will be installed outside the building. This tank will be used as a water receiving tank, and the water stored in it will be gravity-fed to each water supply point within the building. Water will also be fed from this tank to the water storage tanks at the Lahar Laboratory and the outdoor hydraulic model test yard.

The planned capacity of the water supply is 6 $m^3$/day, based on the experimental and personnel resource plans. The elevated water receiving tank will have a minimum storage capacity equivalent to one day's consumption (6 $m^3$).

c) Lahar Laboratory

The water fed from the elevated water tank installed next to the Sabo Information Centre will be received by the double slab water storage tank in the Lahar Laboratory. Based on the experimental plan, it is expected that a water storage tank with a capacity of 80 $m^3$ will be necessary. As water will be recycled using return water pipes, the volume of daily unrecovered water will only be about 16 $m^3$, which is equal to 20% of the tank's storage capacity of 80 $m^3$. The planned capacity of water supply at the Lahar Laboratory is, therefore, 16 $m^3$/day.

d) Outdoor Hydraulic Model Test Yard

The planned consumption for experimental use is 18 $m^3$/day. As water will be recycled through the return water pipes, the daily volume of unrecovered water will only be about 3.6 $m^3$, which is equal to 20% of the planned flowrate of 18 $m^3$. It is pannned, therefore, to supply 4 $m^3$ of water per day.

Water will first be fed to a water storage pond from the elevated water tank installed next to the Sabo Information Centre. It will then be pumped up to a water storage tank. The stored water will be gravity-fed to the point of use in the yard.

(b) Drainage System

The sewage generated by the Dormitory, and the Sabo Information Centre will first be piped to an independent sewage purification tank. After being treated in this tank, the sewage will be discharged into the drainage channel provided around the site.

The miscellaneous wastewater drainage system will be independent from the sewage drainage system but the wastewater will be collected in the rainwater drainage channel provided around the site.

With regard to rainwater drainage, a drainage system will be provided around the structure. Rainwater will be collected by this drainage system and then discharged into the drainage channel provided around the site through underground pipes.

When the water stored in the Lahar laboratory is to be drained, it will first be pumped up and then discharged into the drainage channel provided around the site through the drainage system.

(c) Sanitary Equipment and Fixtures

The sanitary fixtures to be installed will, in principle, be of type which is commonly used and produced in Indonesia.

Water closets will be of western-style except that one water closet of the type commonly used in Indonesia will be installed at each male and female lavatory.

A shower unit will be provided for each individual trainee room on the 3rd floor of the Dormitory.

(d) Purification Tank

Purification tanks to be exclusively used for sewage treatment will be installed at both the Dormitory and the Sabo Information Centre. These tanks will be made of cast-in-situ concrete and will employ such a treatment system that the BOD value of the sewage fed into the tanks is reduced to 90 ppm or less. The tanks installed at the Dormitory and the Sabo Information Centre will have treatment capacities for 40 persons and 60 persons, respectively.

(e) Fire Extinguishing Equipment

There are no definitive regulations on fire fighting equipment in Indonesia, in particular for the local area under this project.

In addition, no public fire fighting services are expected at present. For fire fighting measures under this plan, therefore, fire extinguishers and fire hydrant boxes directly connected with the elevated water tank, will be provided at the points where necessary.

4) Air-conditioning and Ventilation System

The air-conditioning and ventilation systems of the facilities are planned as explained below.

(a) In principle, cooling equipment will be installed only where heat generation is high and it is necessary for a room to be sound-proofed, such as in training rooms, conference rooms, and the training auditorium where conferences will be held or movies projected.

(b) Individual air-cooling package type air-conditioners will be employed for cooling from the standpoints of maintenance and running costs.

(c) For the rooms where cooling equipment is not to be installed, some architectural consideration will be made to allow natural ventilation by making the ceiling height large, by providing louvers or jalousie windows, or by other appropriate means.

(d) Wall penetrating sleeves and receptacles will be provided with the future installation of cooling equipment taken into consideration.

(e) Air-conditioning temperature and humidity conditions will be as follows:

| | Indoors | Outdoors |
|---|---|---|
| Temperature | 27 deg. C | 35 deg. C |
| Humidity | 60% | 70% |

(f) It is planned to install cooling equipment in the following rooms.

Sabo Information Centre

1F Training and conference rooms (1) and (2), and training auditorium

2F Reading room, manager's room and Computer room

(g) Lavatories will be mechanically ventilated with ventilation fans.

5) Gas System

An LPG gas cylinder storage yard will be provided outside the Dormitory, from which gas will be supplied to the necessary points.

(6) Finishing Plan

1) Exterior Finish

(a) Roof

The roofs of the Sabo Information Centre and the Dormitory will be steel truss frame structure. Water-resistant plywood of 12 mm thickness will be used as batten boards, and will be covered by asphalt roofing and finished with tiles.

The roof of the Lahar Laboratory will be a steel frame strucdture. Water-resistant plywood of 12 mm thickness will be used as batten boards, and will be covered by asphalt roofing and finished with asbestos cement board.

(b) Exterior Wall

The exterior walls of the Sabo Information Centre, the Dormitory, and the Lahar Laboratory will be made of concrete or brick and will be plastered by cement mortar, and urethane-spray finished.

(c) Floor

The floor of the balcony will be made of terrazzo tiles, each tile measuring 30 cm by 30 cm. Berms will be made of concrete and will be joint mortar finished.

(d) Ceiling

The eaves ceilings will be made of edge top boards and finished with oil stain paint. The ceiling of the balcony will be lysine-spray finished.

(e) Openings

Heat absorbing glass in aluminum sash frames and jalousie windows will be mounted in the openings. Movable aluminum louvers will be partially used. Doors will be flush-type, made of steel, and oil paint finished.

2) Interior Finish

(a) Floor

The floors of the office, conference rooms, and data storage of the Sabo Information Centre and the individual rooms of the Dormitory will be covered with parquet material.

The entrance hall, corridors, stairs, and cafeteria will be finished with terrazzo tiles, each tile being 30 cm by 30 cm.

The computer room will have a double wooden floor made of 15 mm thick plywood and will be carpeted.

The floor of the reading room will be covered with long-length cut vinyl sheets. The lavatories and kitchen areas will be covered with porcelain mosaic tiles.

The floor of the Lahar Laboratory will be finished with cement tiles.

(b) Wall

Most of the walls of the facilities will be made of concrete or bricks, and will be covered with mortar and finished with acrylic emulsion paint. Some portions may be made of wooden base boards, which will be covered with plywood and finished with oil stain clear lacquer.

The lavatories and kitchen areas will be covered with semi-porcelain tiles, each tile being 100 mm by 100 mm.

(c) Ceiling

The ceilings of the entrance halls and corridors will be made of edged top boards and will be finished with stain paint. The ceilings of the offices, conference rooms, individual rooms and other ordinary rooms will be made of asbestos sound absorbing boards.

The ceilings of the lavatories and kitchen areas will be made of calcium silicate boards and will be finished with vinyl paint.

### 5-1-4 <u>Basic Design Drawings</u>

(1) Sabo Information Centre

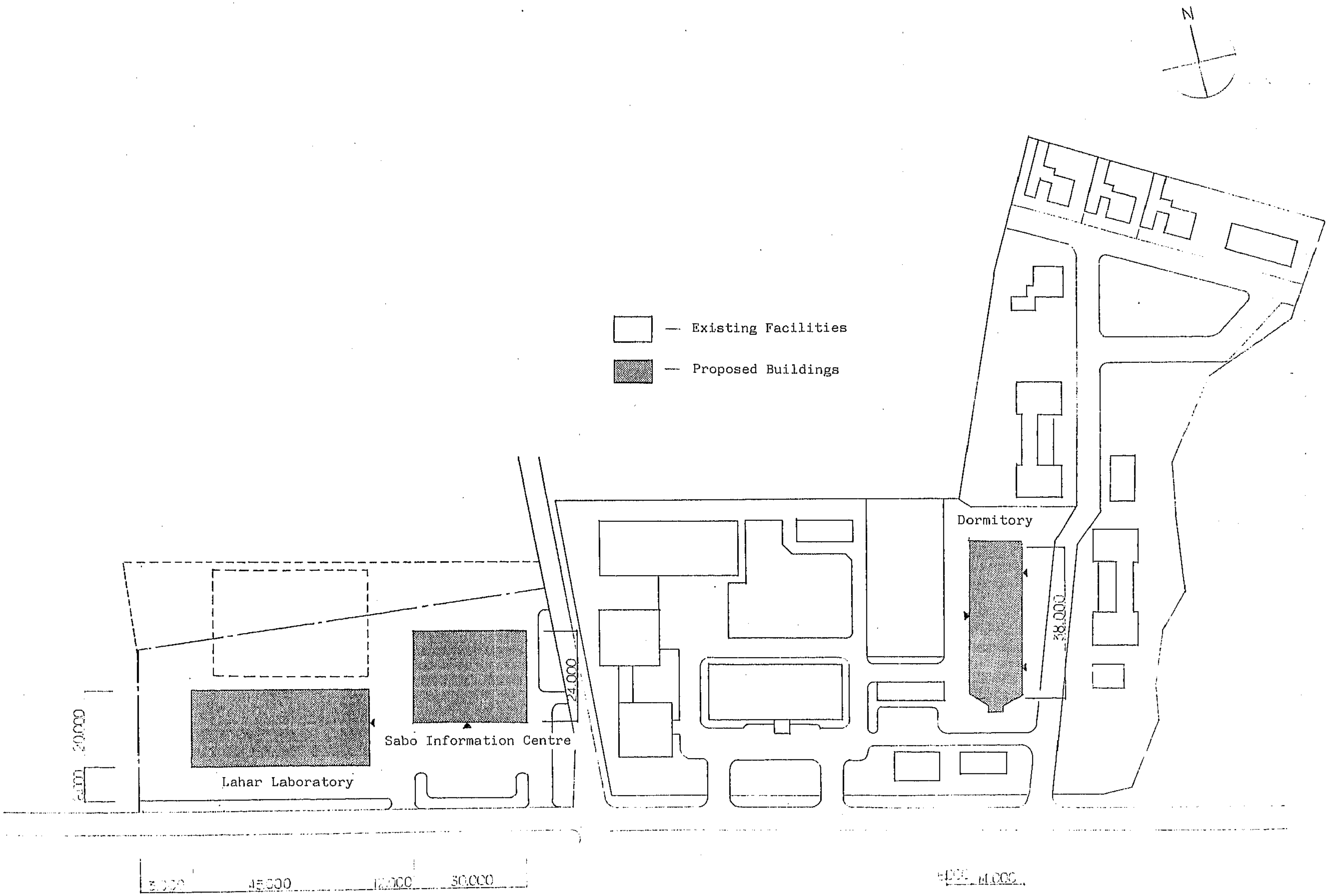
1) Layout plan
2) 1F floor plan
3) 2F floor plan
4) Roof plan
5) Cross section
6) Elevation 1
7) Elevation 2

(2) Lahar Laboratory

1) 1F floor plan
2) Mezzanine floor plan
3) Roof plan
4) Cross section
5) Elevation 1
6) Elevation 2

(3) Dormitory

1) 1F, 2F, and 3F floor plans
2) Roof plan
3) Cross section
4) Elevation 1
5) Elevation 2




1

SITE PLAN V.S.T. CENTER - YOGYAKARTA

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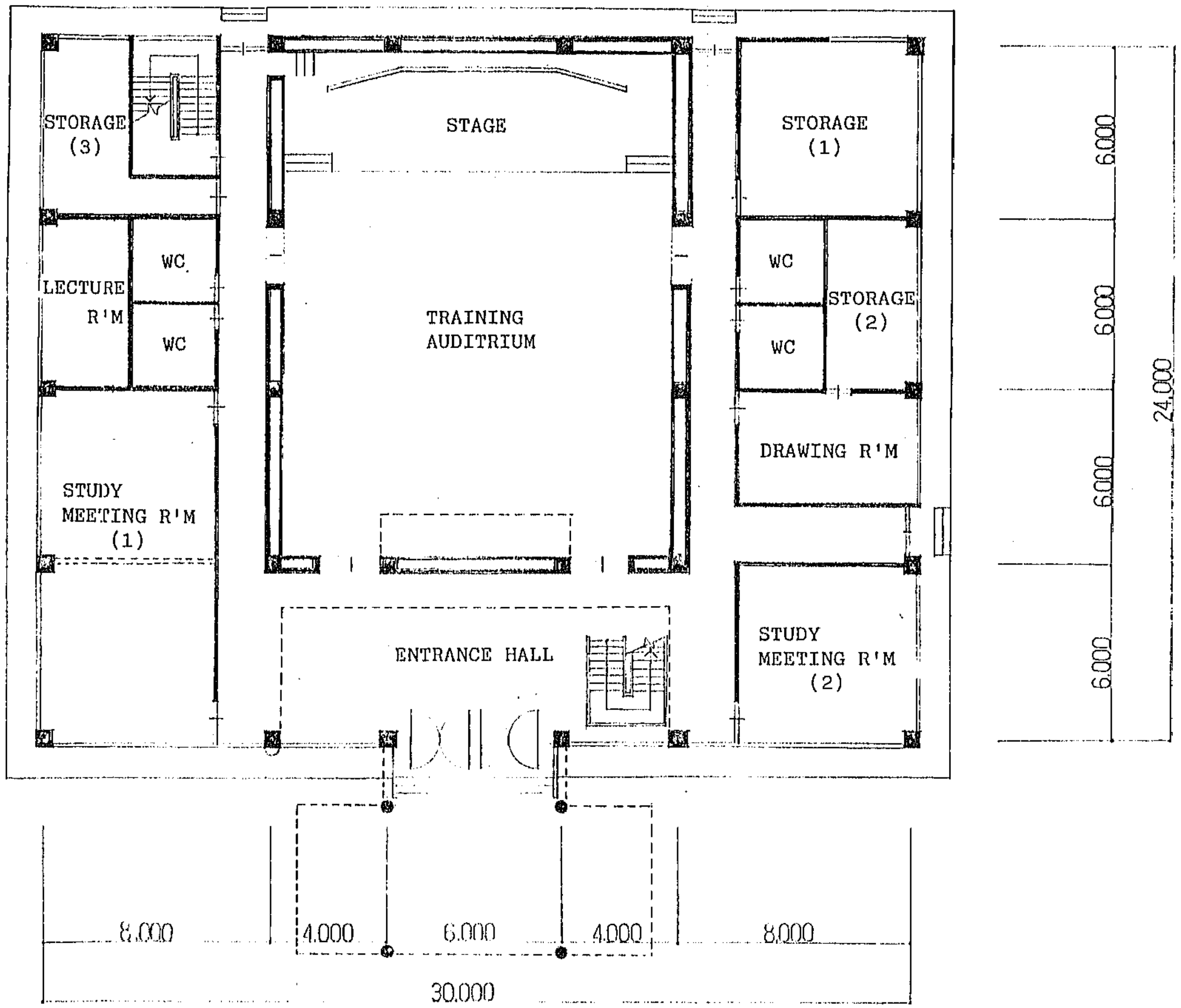


2

FIRST FLOOR PLAN

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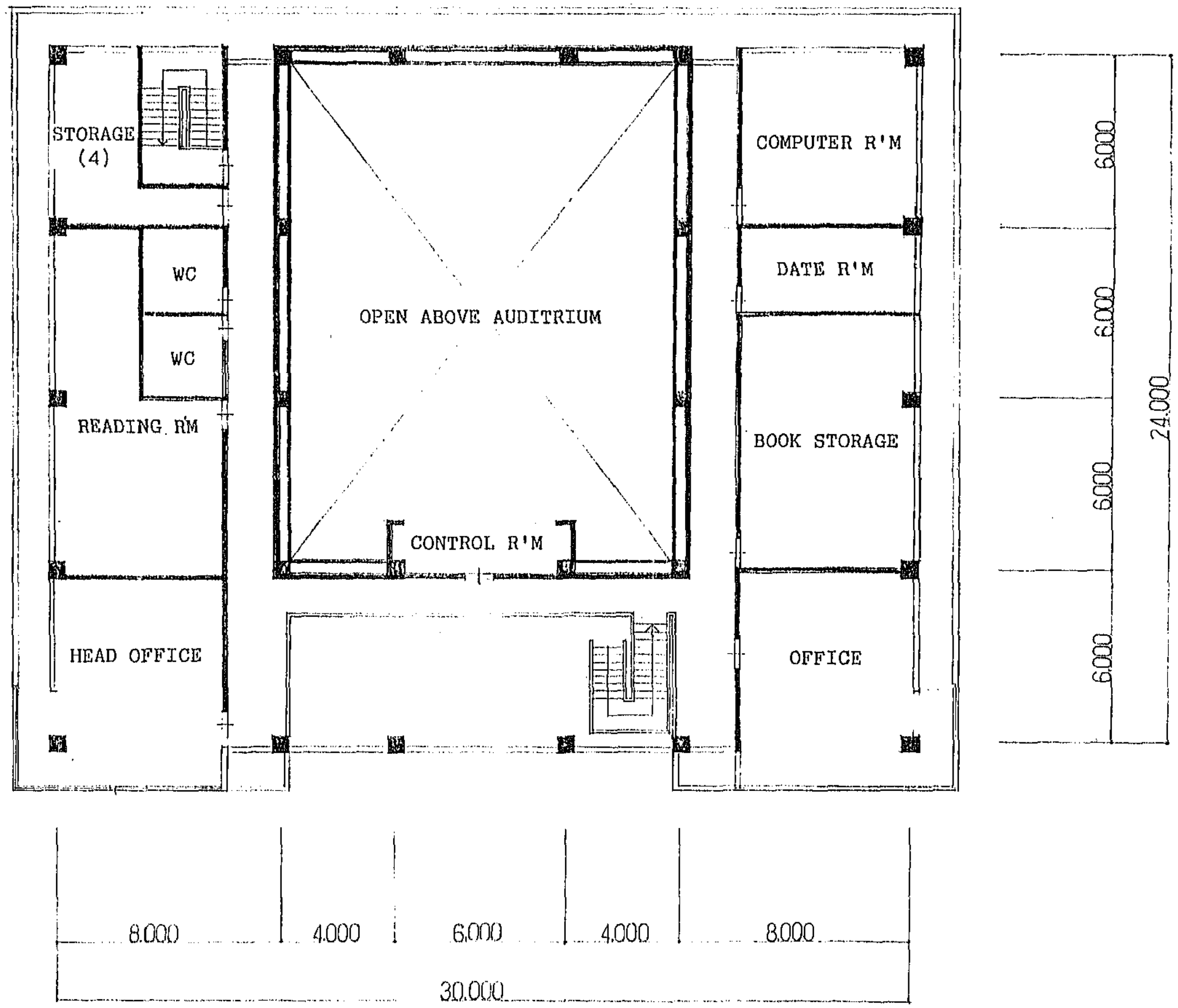


3

SECOND FLOOR PLAN

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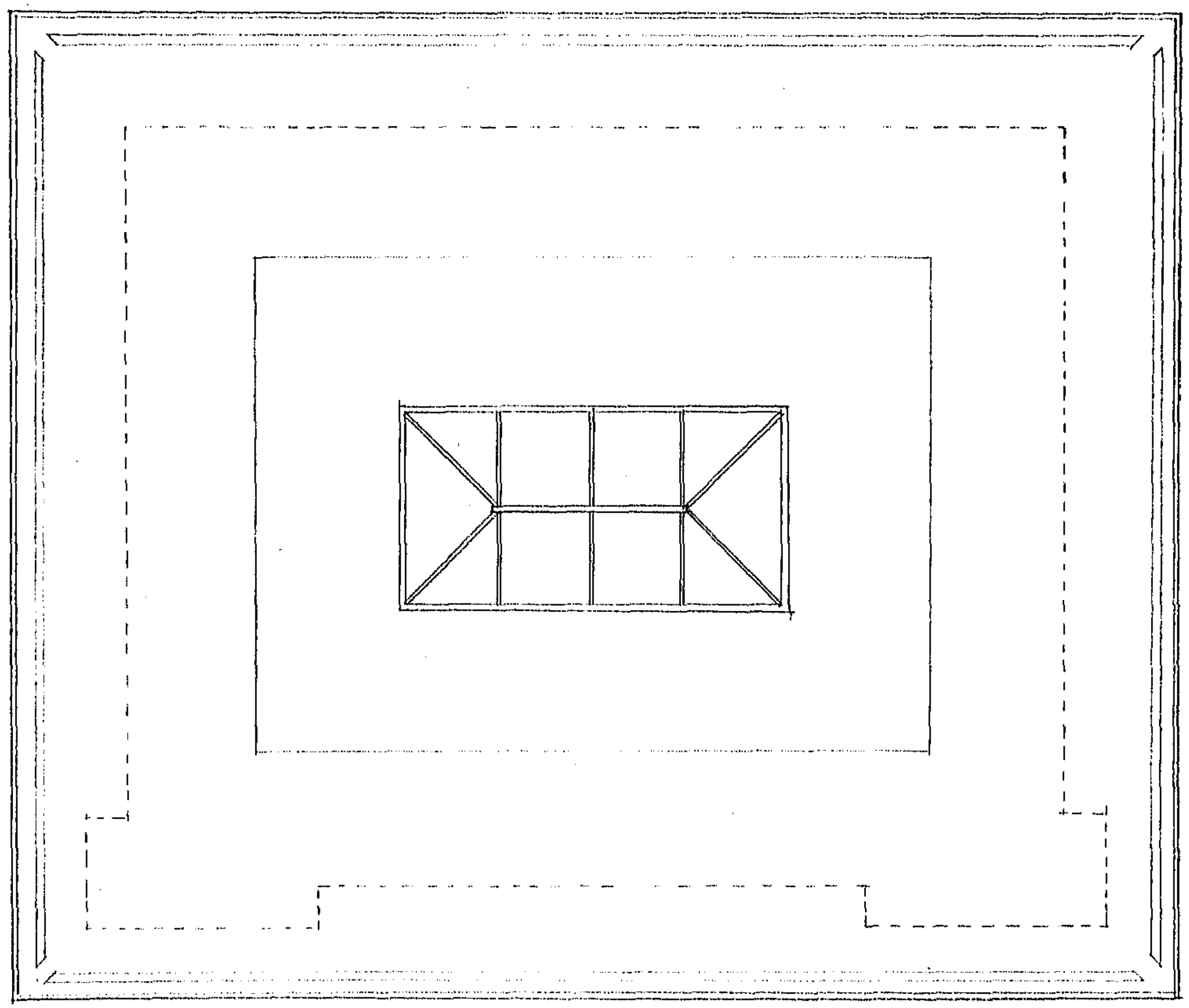

4

ROOF PLAN

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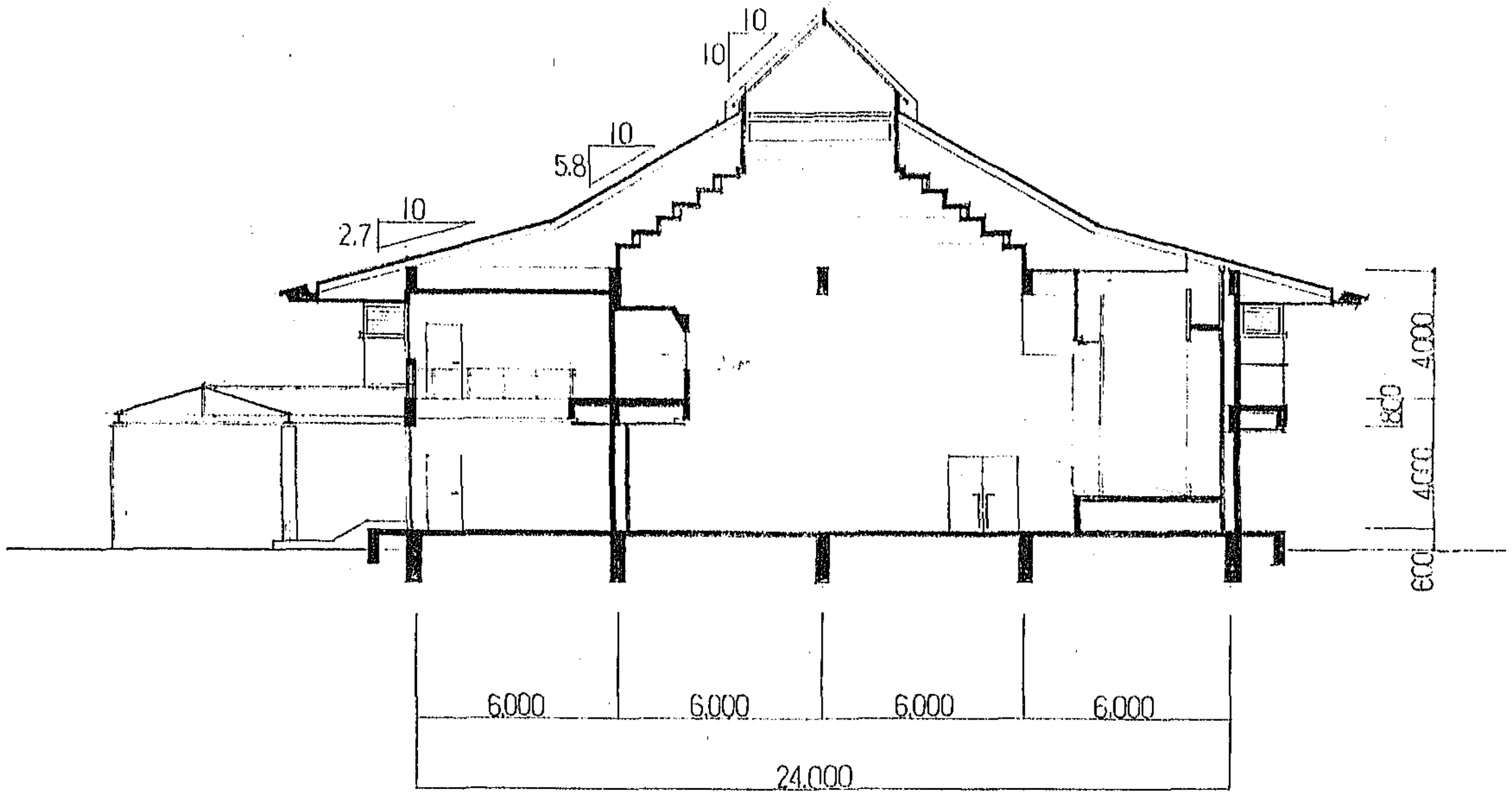


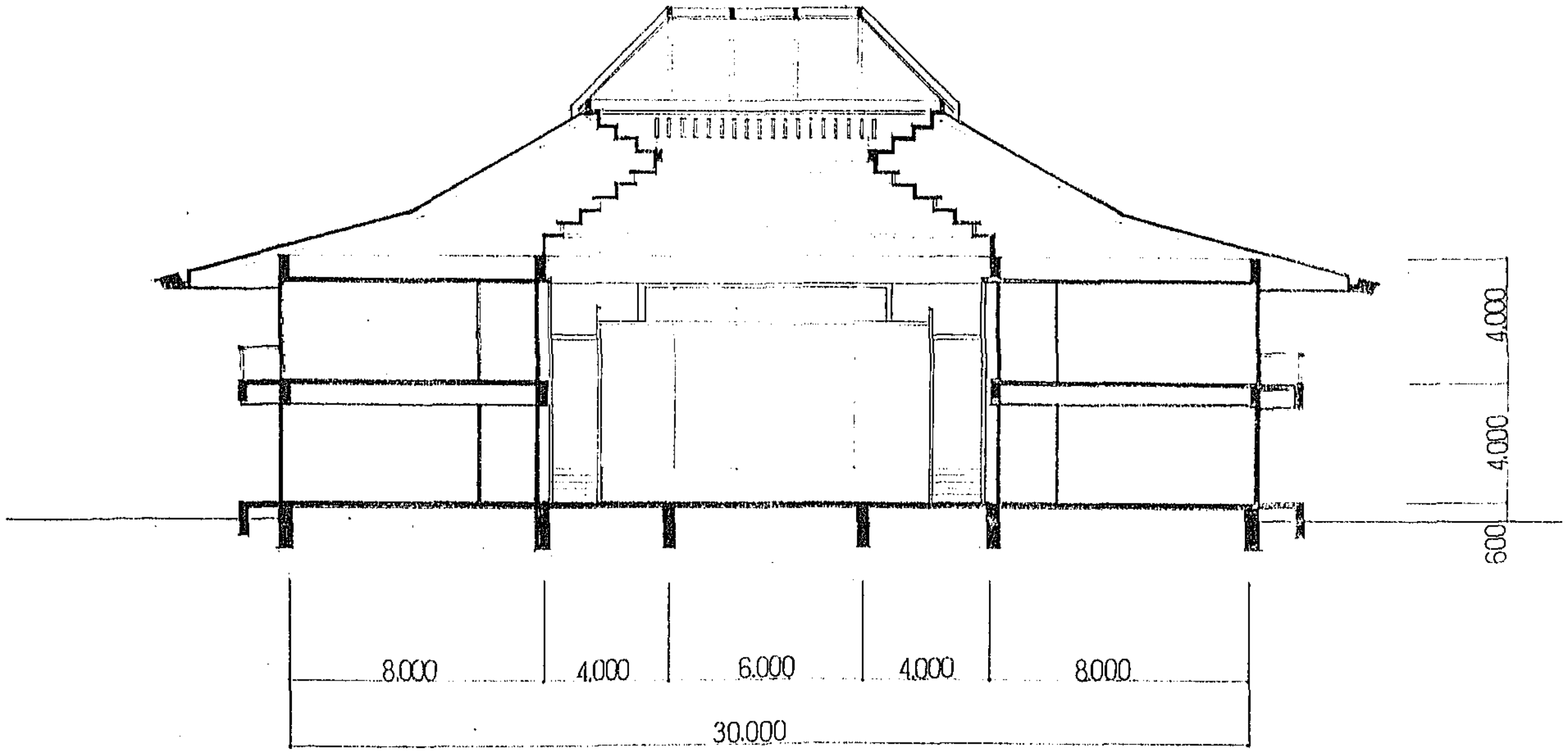


5

SABO INFORMATION CTR.

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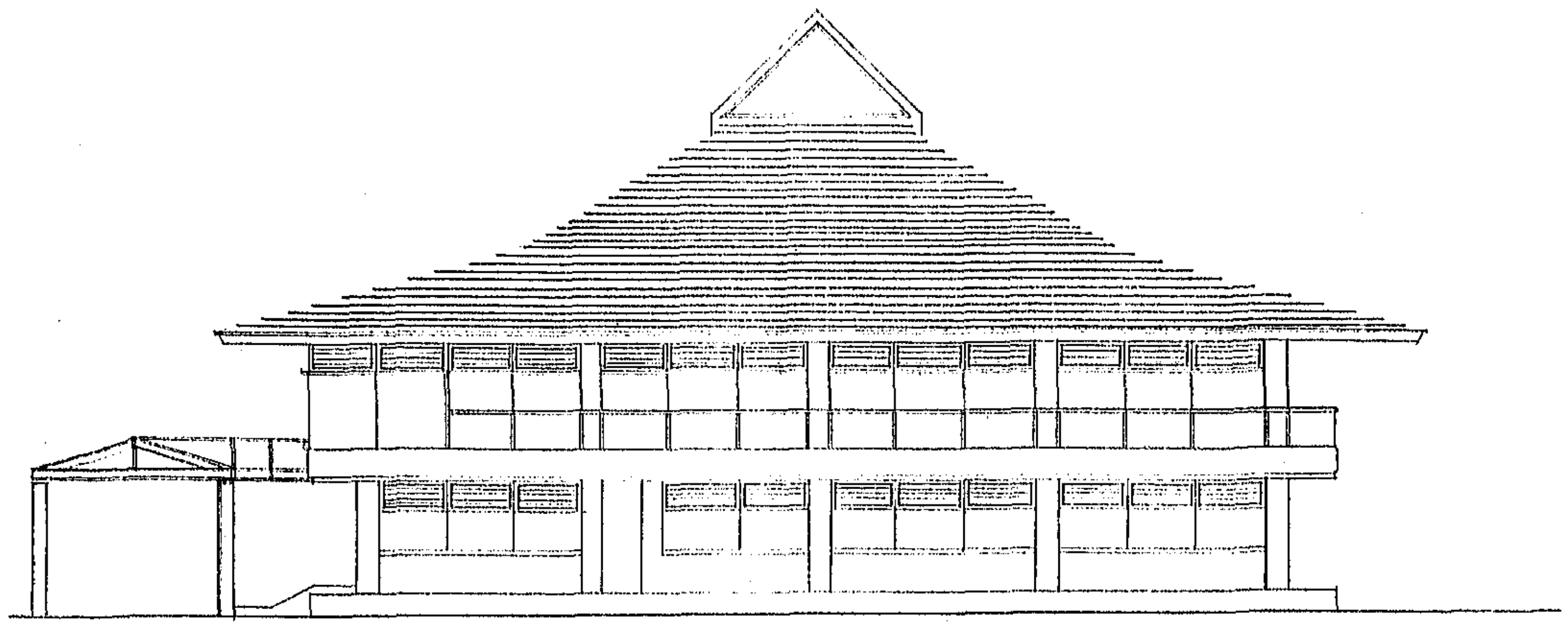
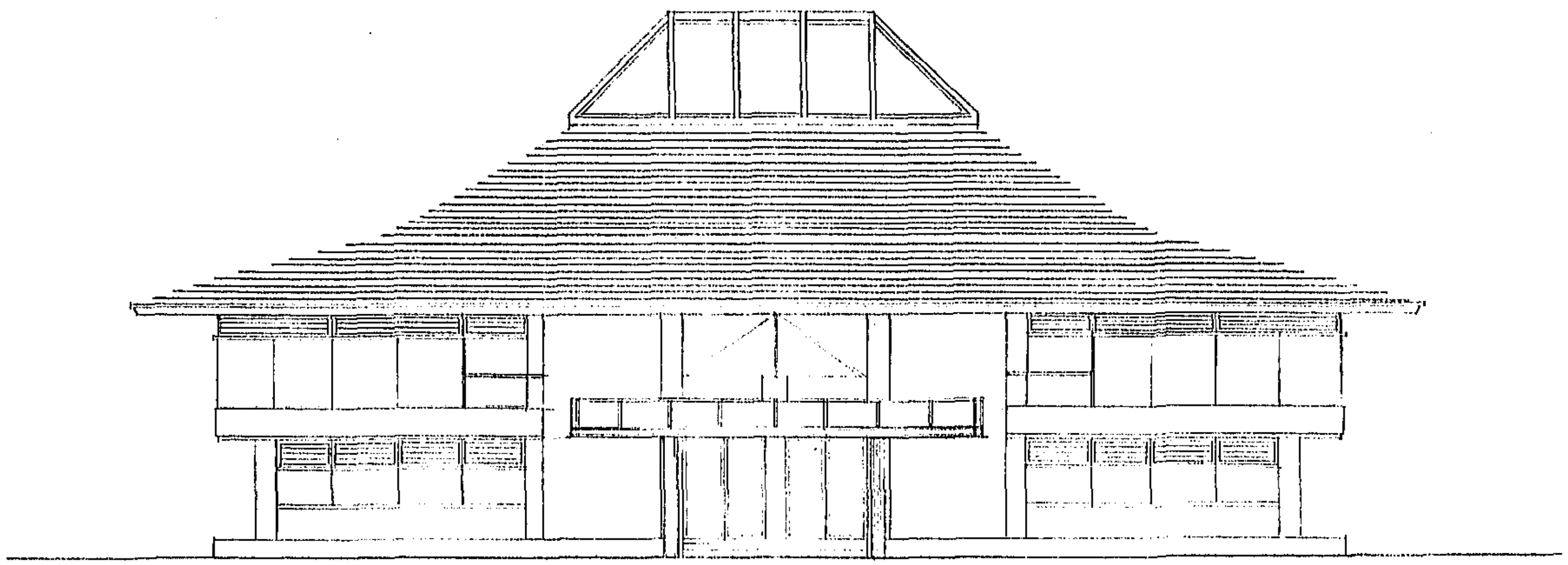
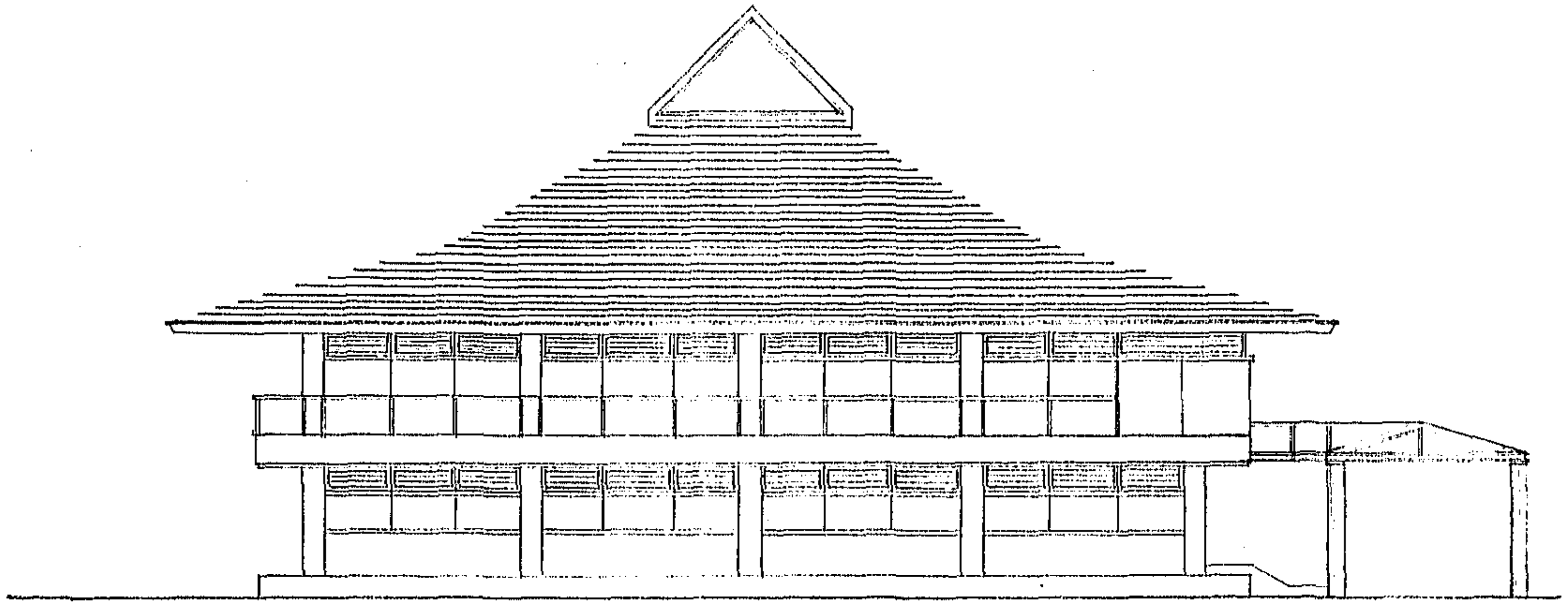


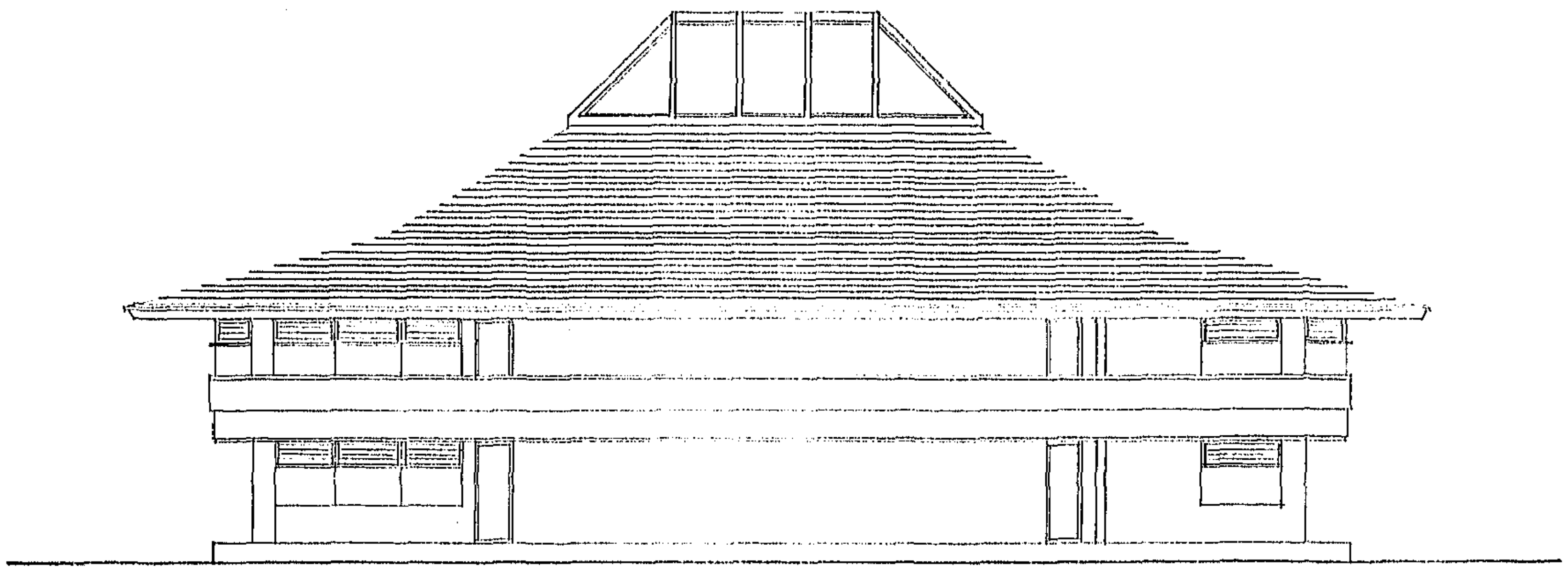


6

SABO INFORAMATION CTR.

ELEVATION S = 1:200

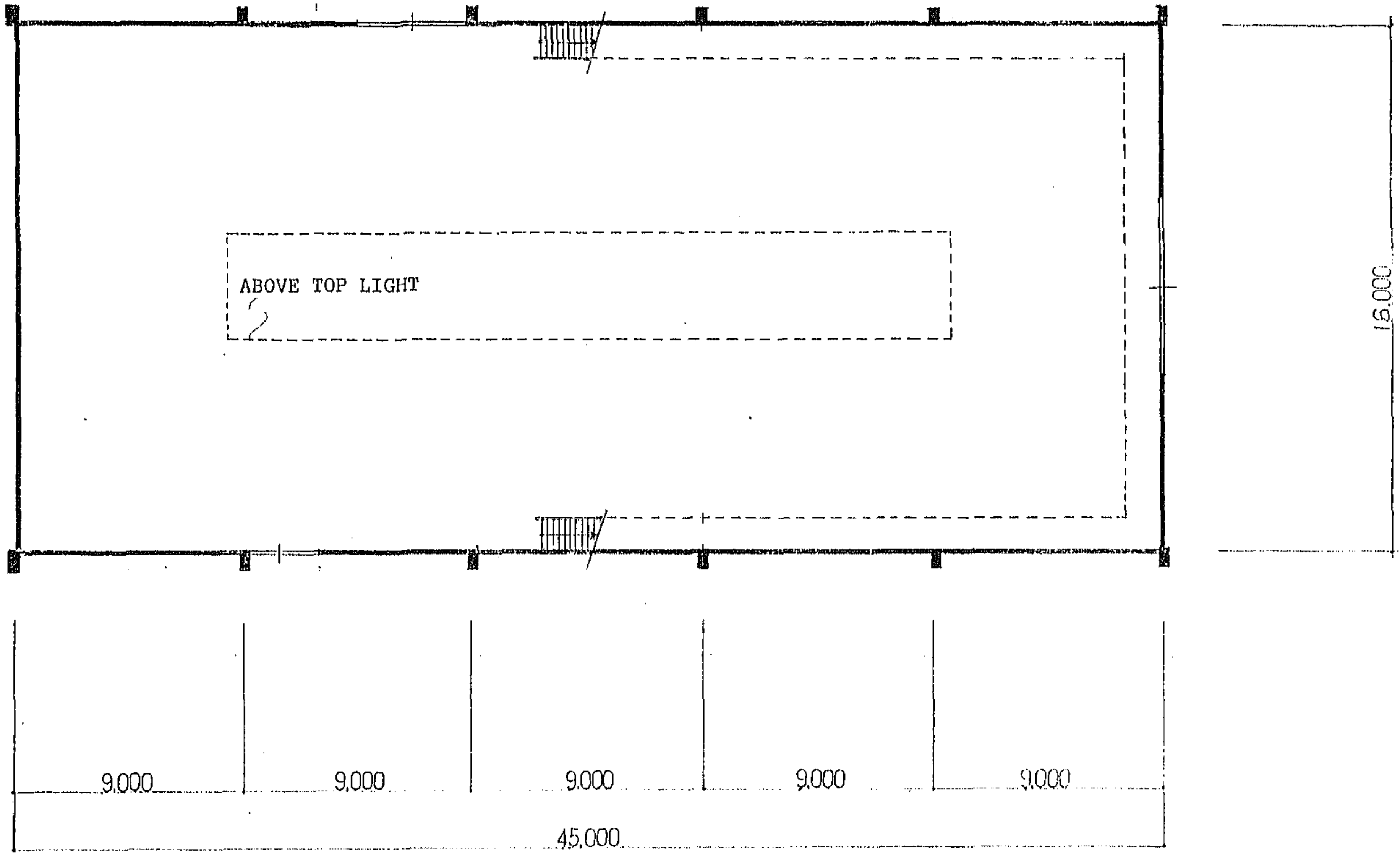




7

SABO INFORMATION CTR.

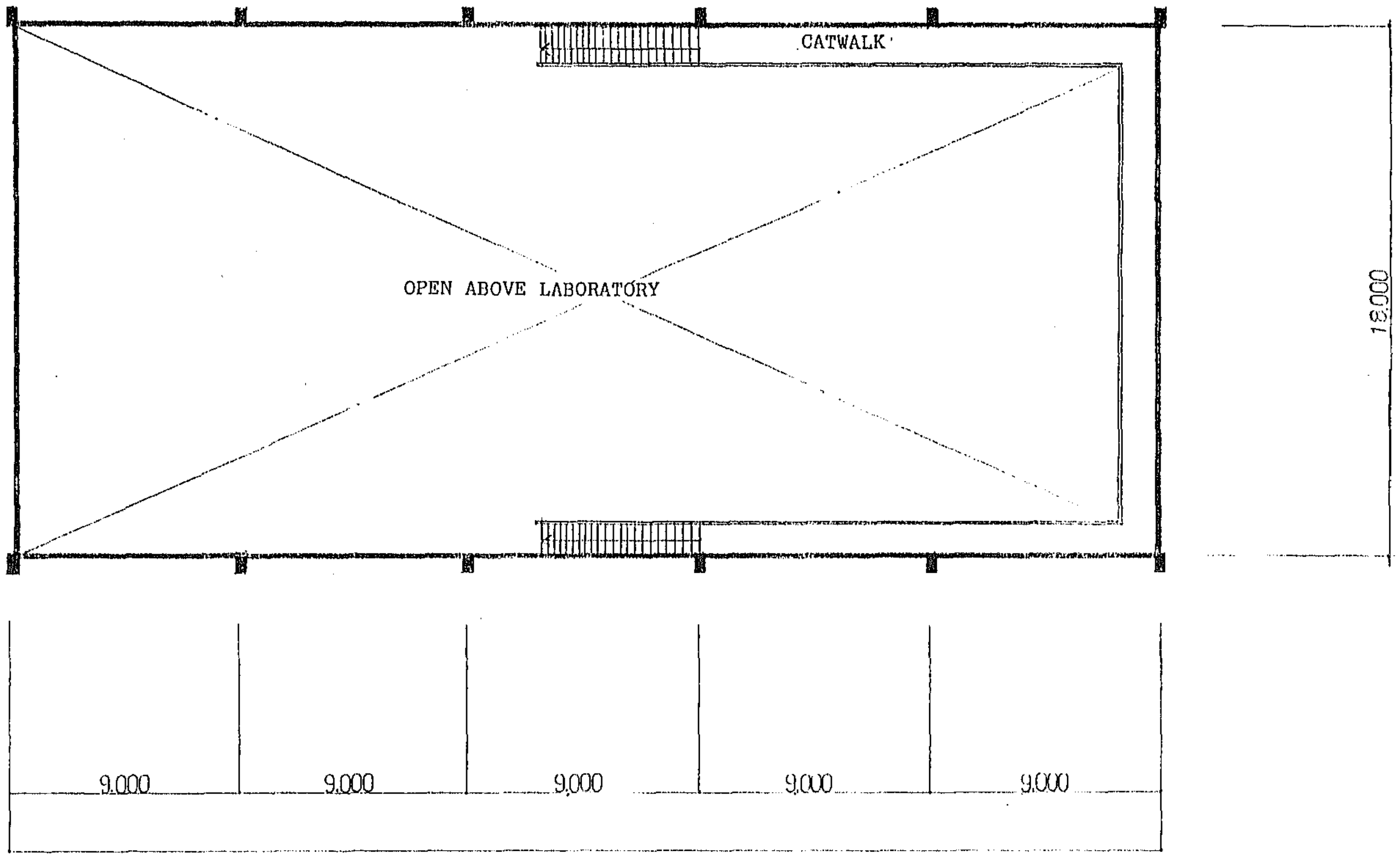
ELEVATION S = 1:200




8

FIRST FLOOR PLAN

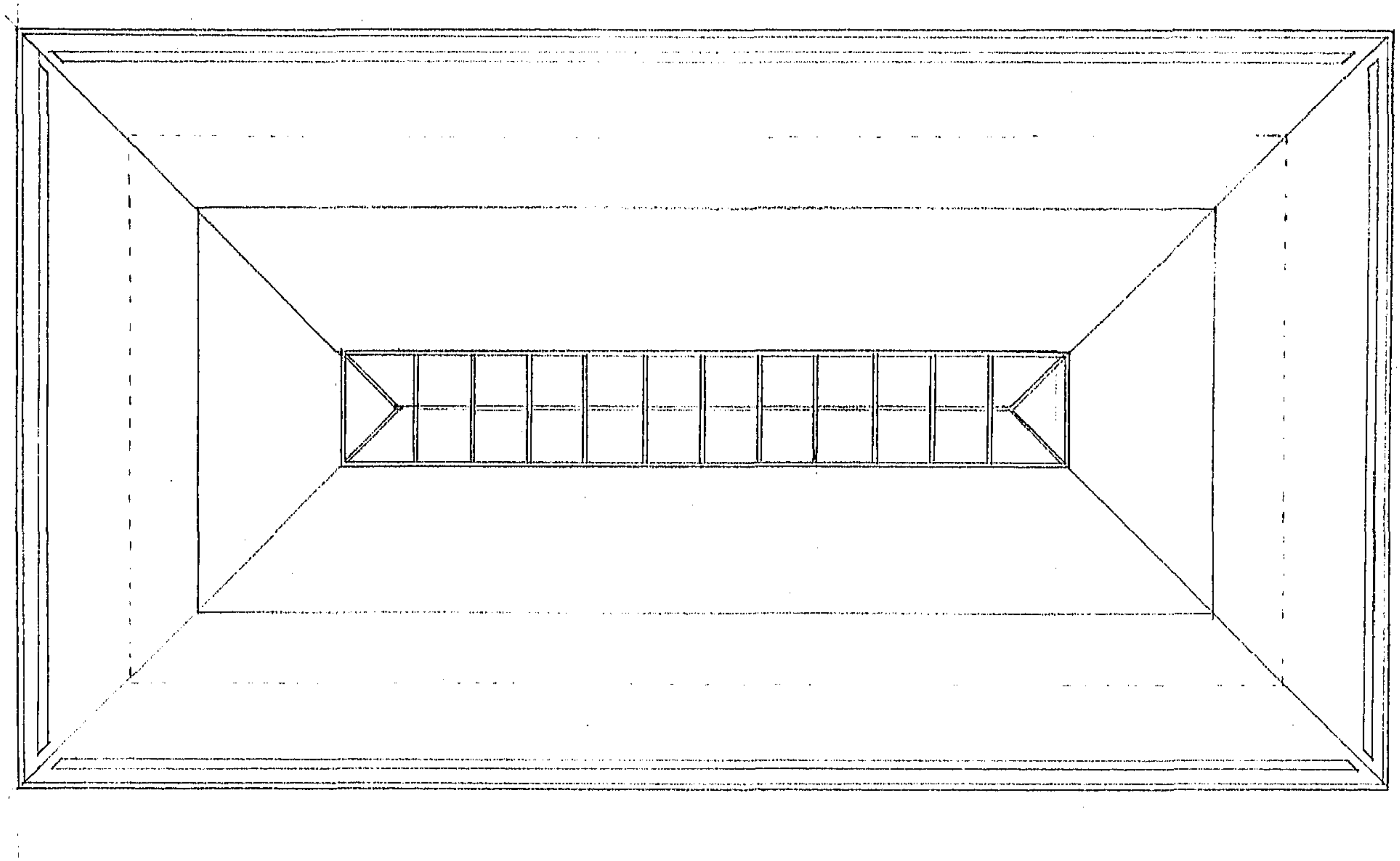
LAHAR LABORATORY S = 1:200




9

MEZZANINE FLOOR PLAN

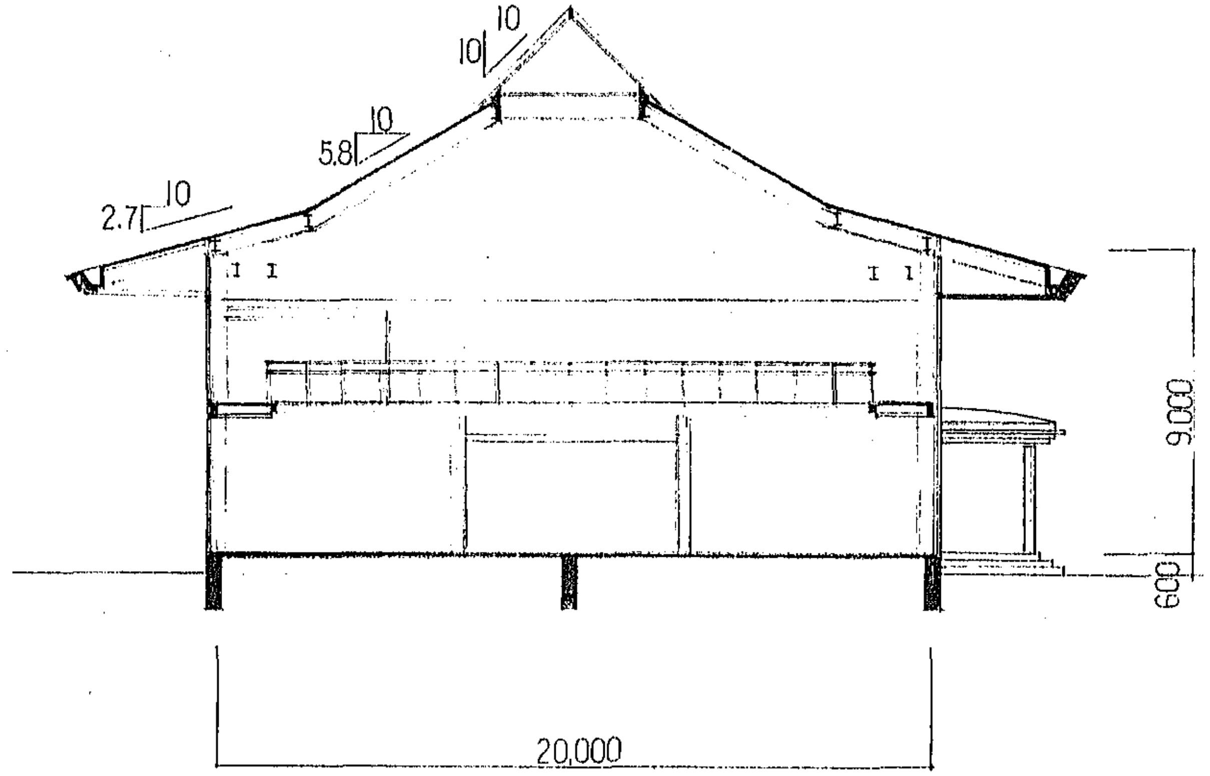
LAHAR LOBORATORY S = 1:200

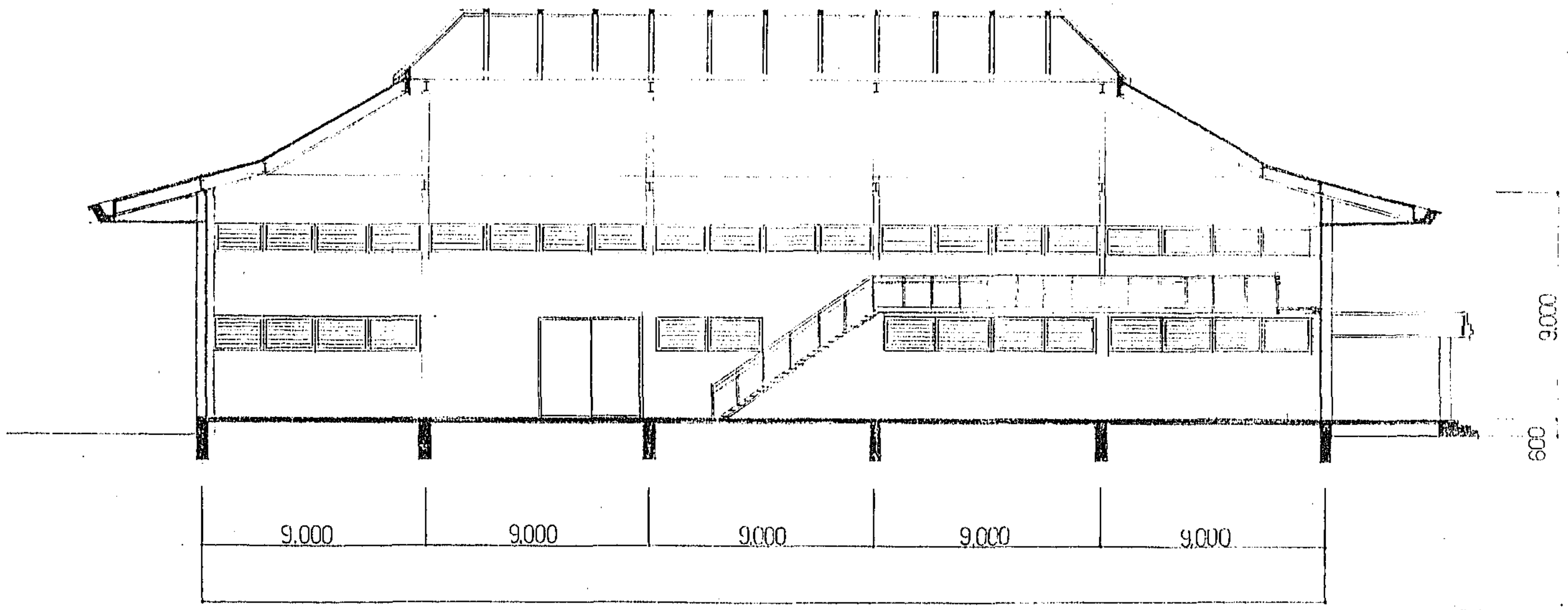


10

ROOF PLAN

LAHAR LABORATORY S = 1:200

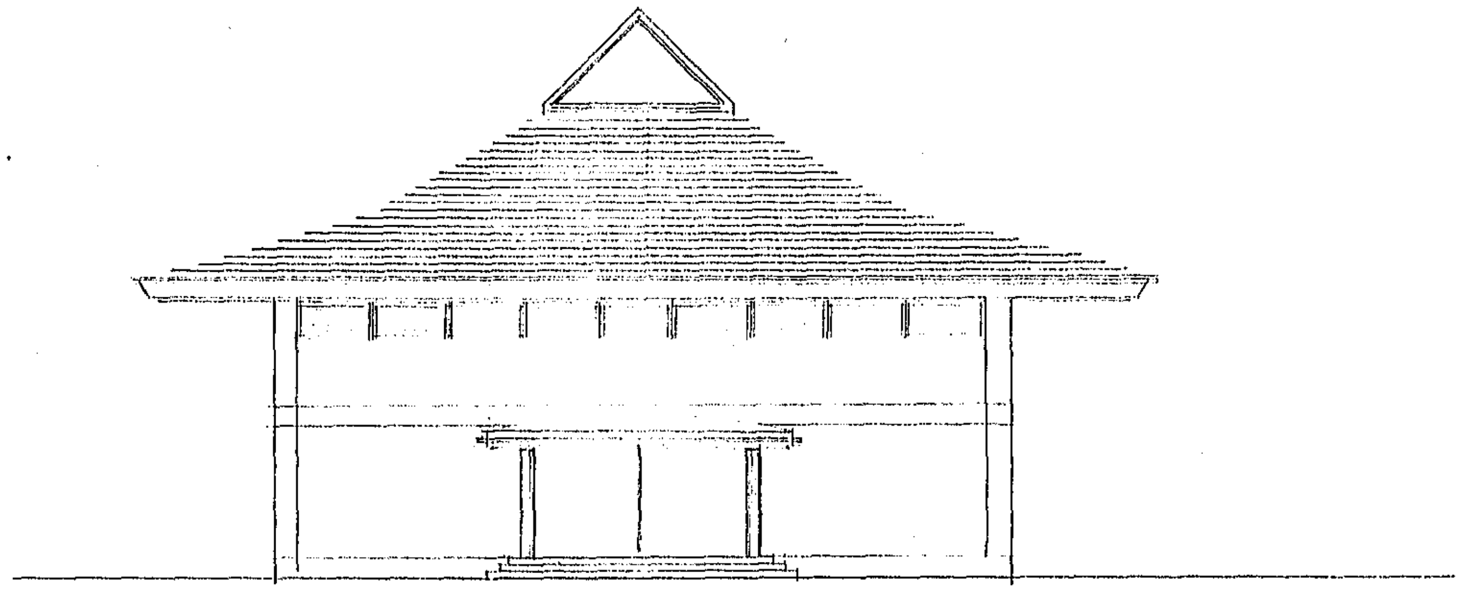


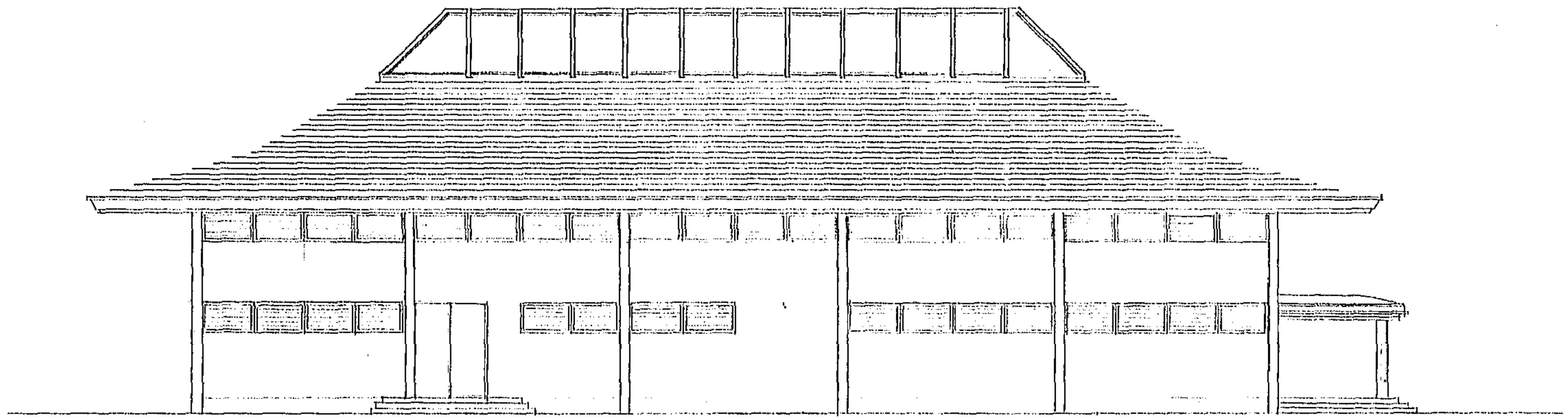




11

LAHAR LABORATORY

SECTION S = 1:200

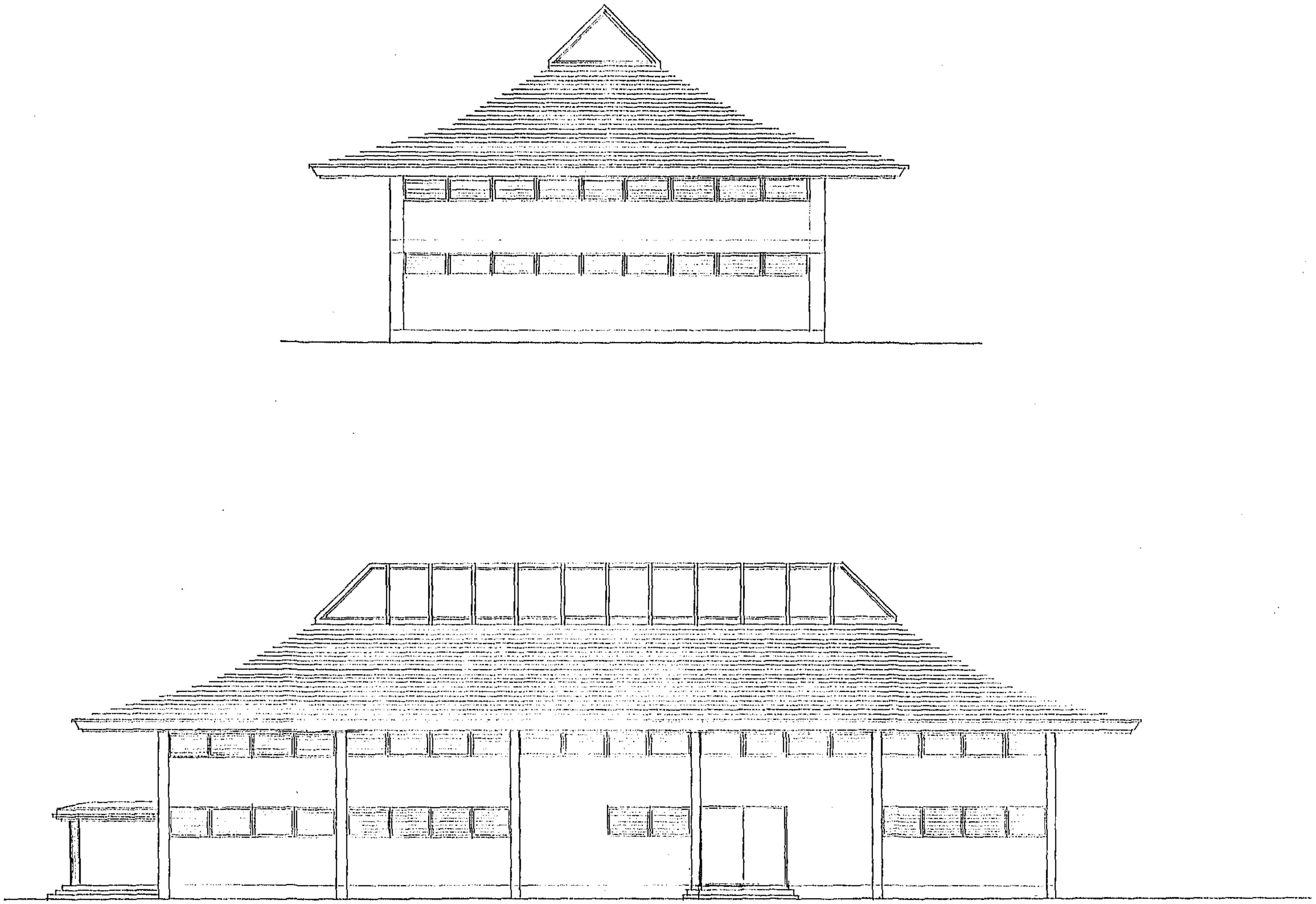




**12**

LAHAR LOBORATORY

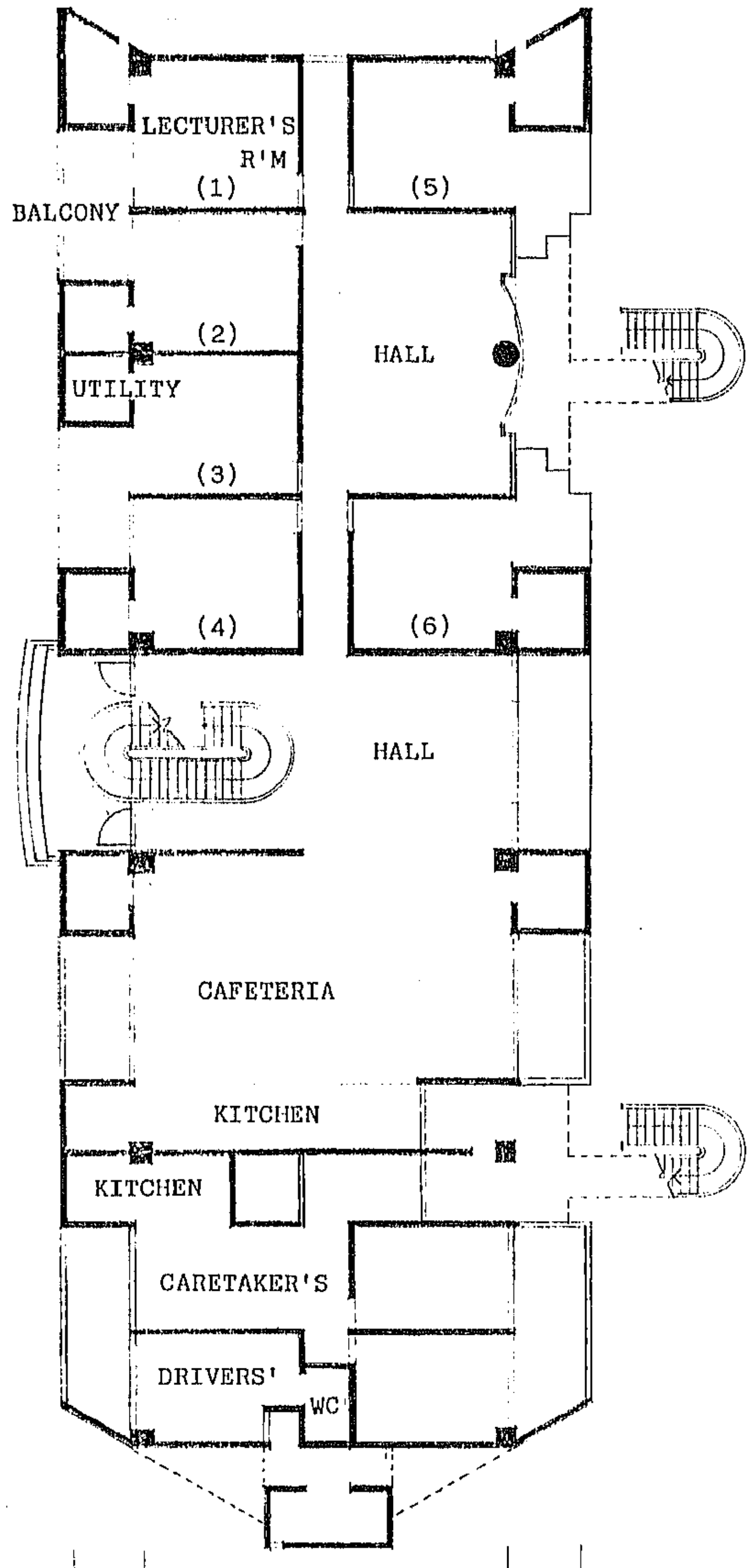
ELEVATION S = 1:200



**13**

LAHAR LABORATORY

ELEVATION S = 1:200



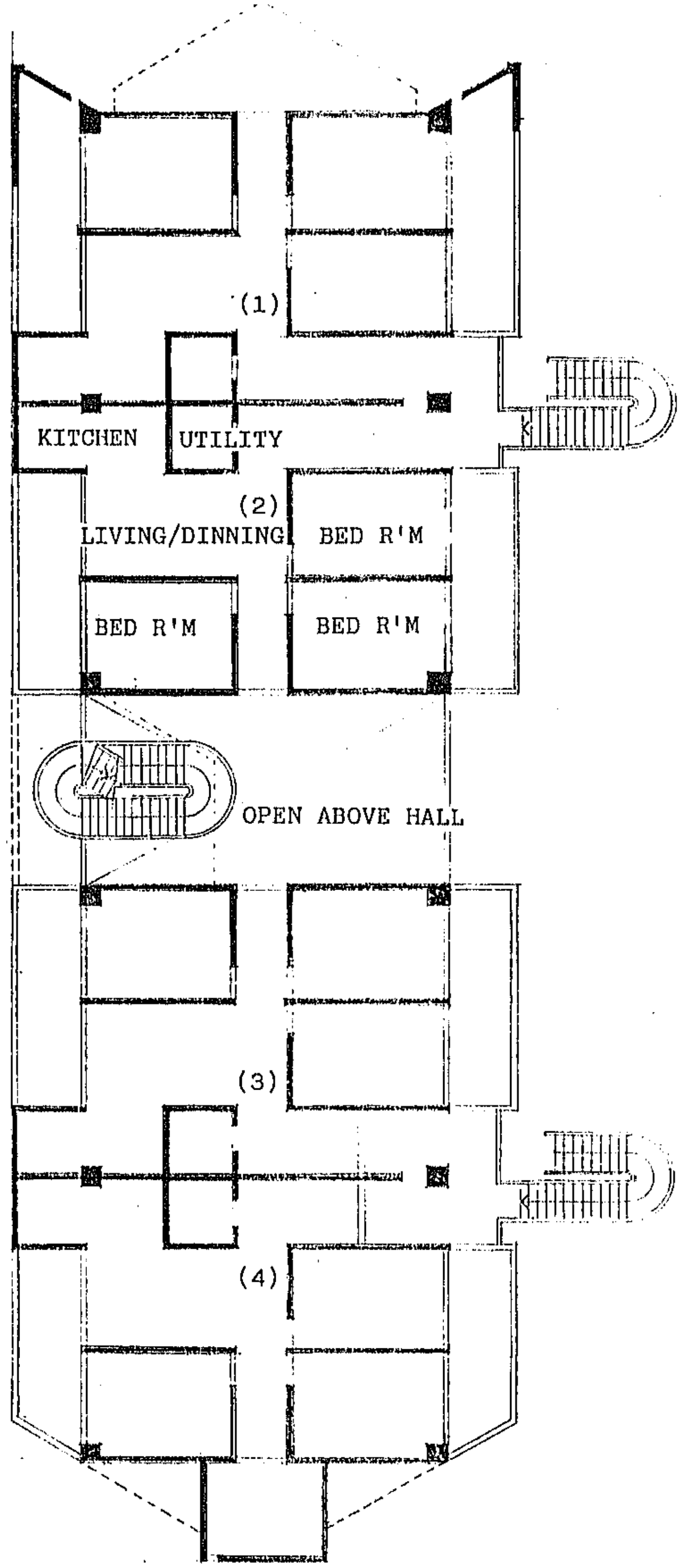

FIRST FLOOR

2,000 10,000 2,000

**14**

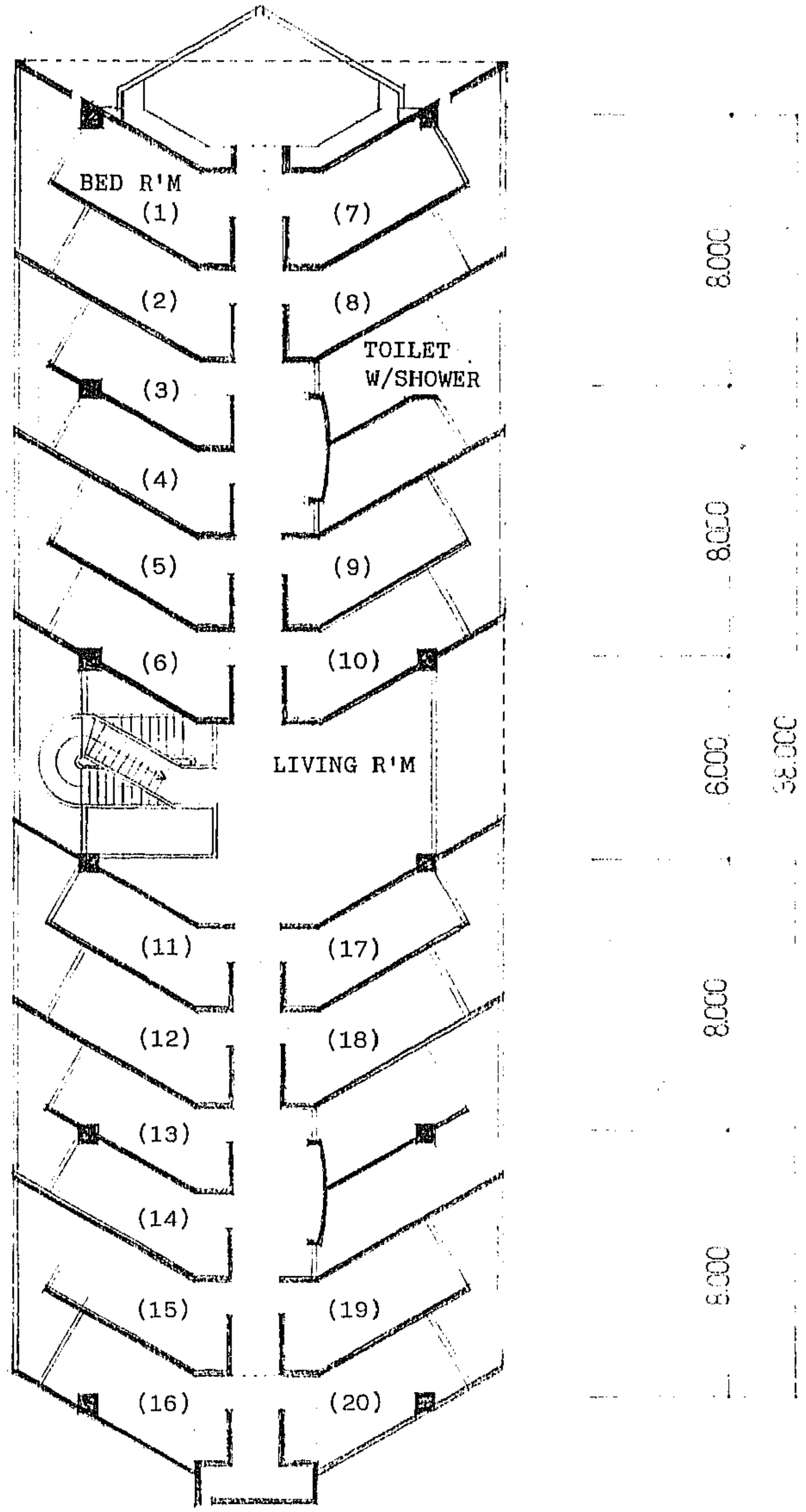
CAFETERIA

LODGING FOR SHORT-TERM LECTURER




SECOND FLOOR

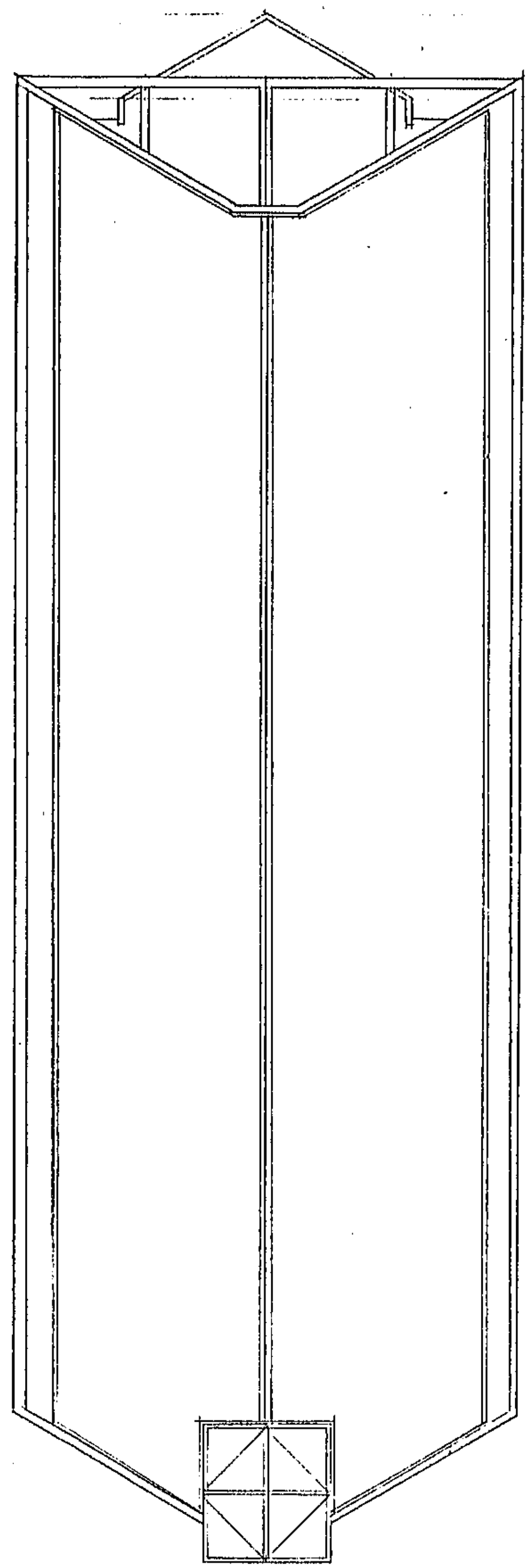
LODGING FOR LECTURER




THIRD FLOOR

LODGING FOR TRAINEE

DORMITORY S = 1:200

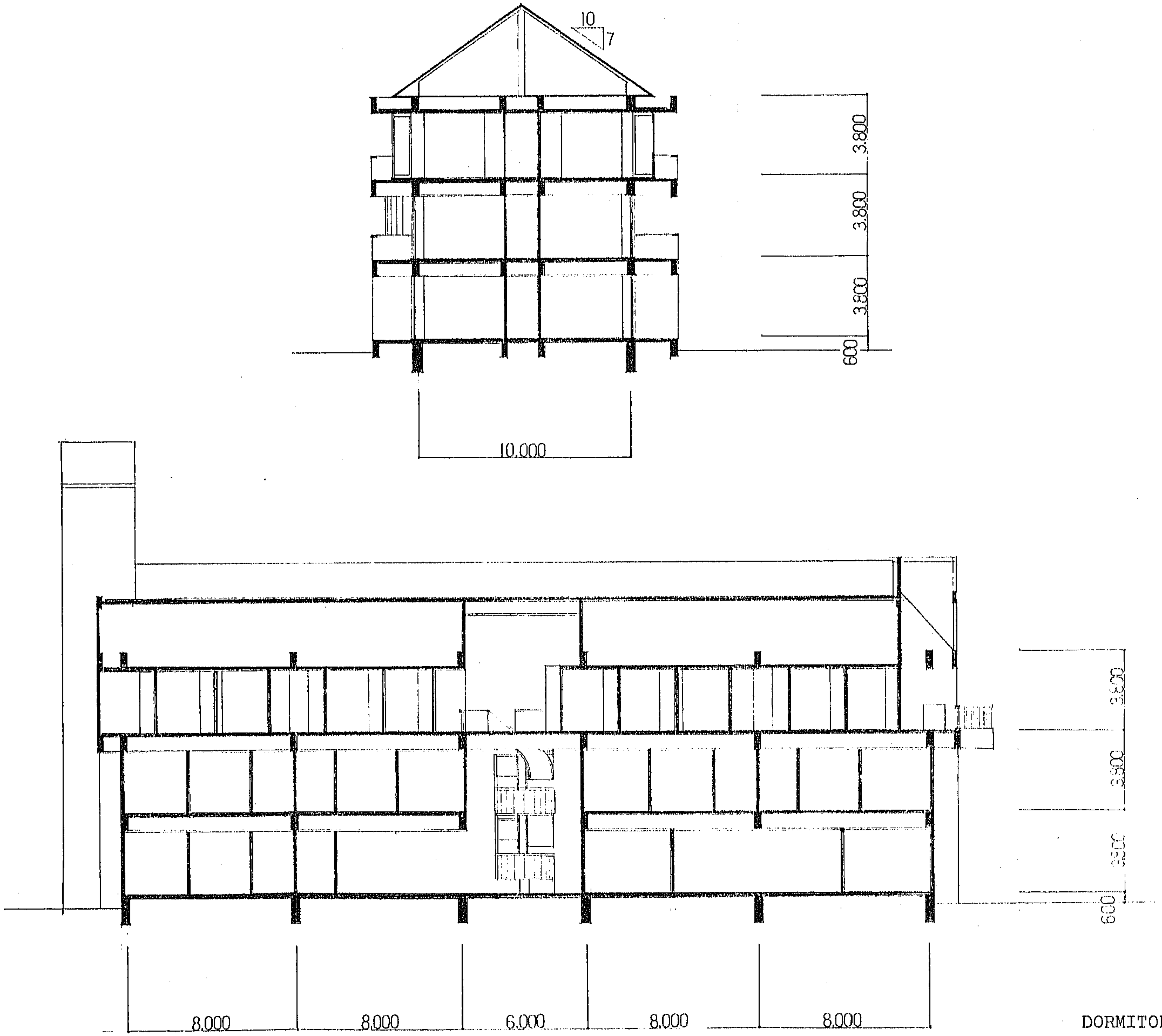


15

ROOF PLAN

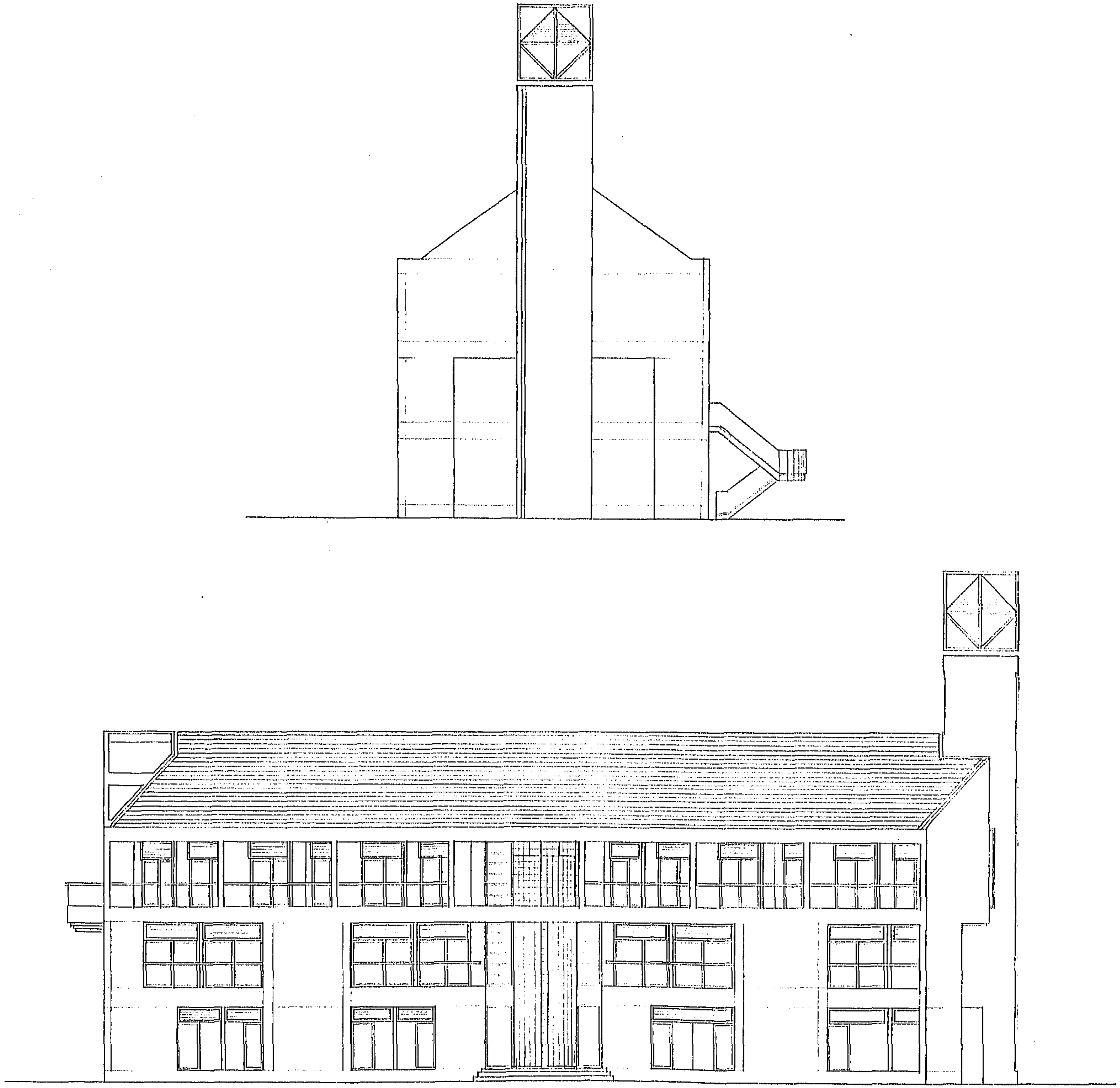
DORMITORY S = 1:200

**16**




DORMITORY

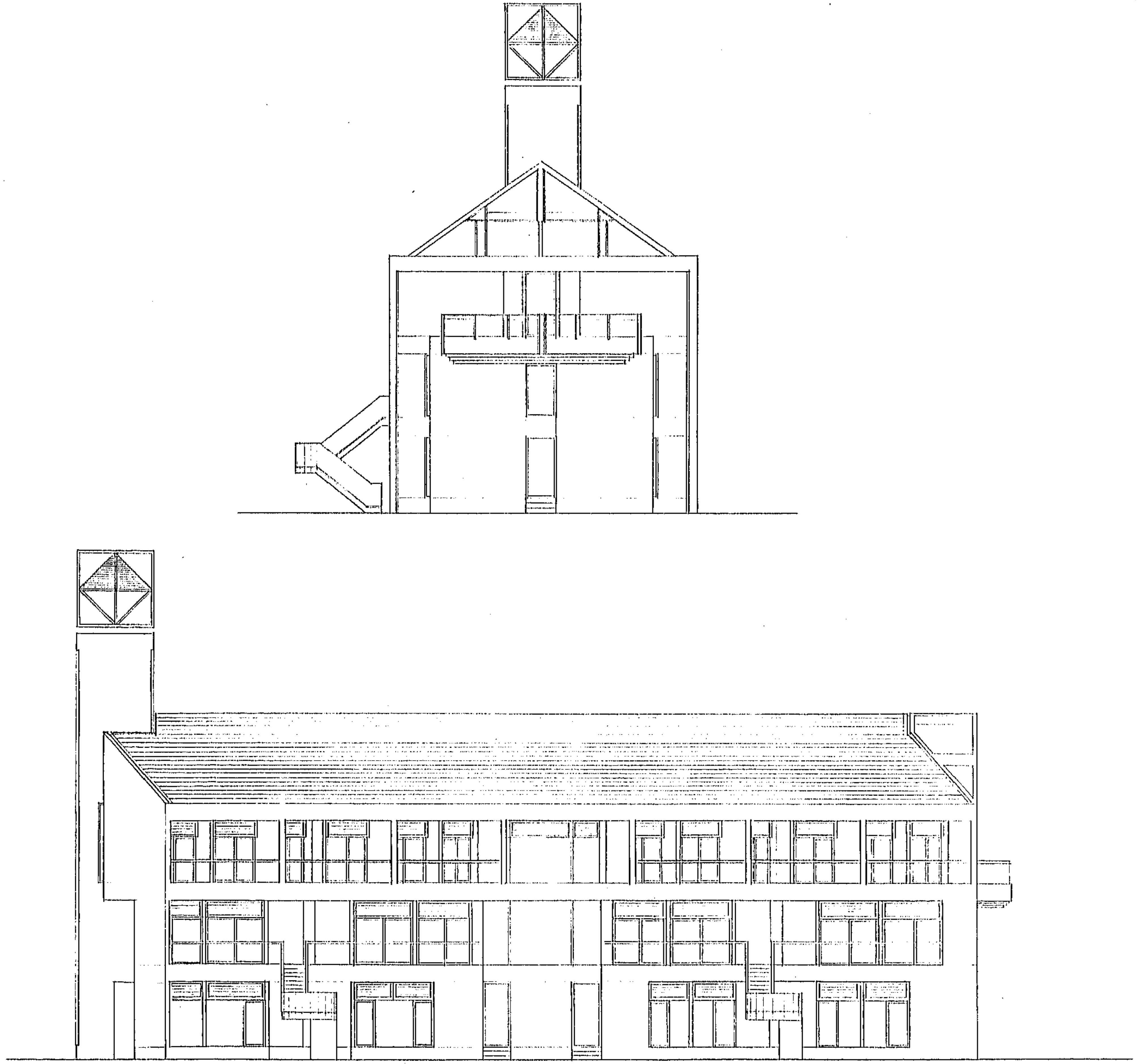
SECTION S = 1:200



**17**

DORMITORY

ELEVATION S = 1:200



18

DORMITORY

ELEVATION S = 1:200

## 5-2 BASIC EQUIPMENT PLAN

### 5-2-1 Basic Design Policy

Basic equipment designing will be done with thorough consideration being given to its planned functions so that it will be functionally, rationally and economically utilized, based on the Improvement Project for the Volcanic Sabo Technical Centre.

The basic equipment design will be based on the study made in Chapter 4 of types, capacity, and size of equipment and the review of their purposes. The basic policy is as follows.

(1) In designing equipment, motor driven parts will be eliminated as much as possible to achieve a reduction in maintenance expenses and simplification of maintenance procedures.

(2) Equipment must be designed to the minimum allowable size while ensuring that the expected functions are not impaired.

(3) Items such as the furniture for the offices and dormitory, which must be arranged by Indonesia, will be excluded from the list of equipment to be supplied.

(4) Equipment which is locally available, will be basically procured locally, with consideration being given to its quality, capacity, maintenance, and after service.

### 5-2-2 Basic Equipment Plan

(1) Equipment for training and sabo technology experiments

Since the artificial rainfall apparatus, the mudflow model generator, the mudflow model flume and the hydraulic model test flume, being the major equipment requested, are all large special-purpose type equipment, an experienced manufacturer capable of providing integrated services from designing through erection and adjustment will be selected, as in the case of plant equipment.

With regard to the other equipment, its quality level will be the same as that of the equipment which has already been employed. Note, however, that motor driven type equipment will be avoided as far as possible, and manually operated equipment will be selected.

(2) Training equipment for mudflow warning system

With regard to the new mudflow warning system, a system which has the same levels of quality and adjustability as that of the system already employed will be selected.

(3) Equipment for data processing and preparation of educational texts

The equipment will be of the same standard type and quality level as that of the equipment already employed. Note, however, that its adjustability and the availability of maintenance services will have to be seriously taken into account.

(4) Equipment for audio-visual education

With regard to the announcing and recording equipment, every item of equipment will be of a standard type, with simplified functions.

(5) Vehicles for training

There will be two types of vehicles available; a bus for 40 passengers and jeeps. Each vehicle will be diesel powered for reductions in fuel costs. The bus will have standard specifications. The jeeps will be equipped with radios as they are also to be used for the mudflow warning system.

(6) Mt. Galunggung mudflow warning system restoration equipment

This equipment will be of the same type and quality as the existing equipment.

(7) Layout plan

A layout plan of each item of model test equipment is shown below. The sabo equipment is shown by the building to which it belongs.

1) Lahar Laboratory

(a) Artificial Rainfall Apparatus
(b) Mudflow Model Generator
(c) Mudflow Model Flume
(d) Hydraulic Model Test Flume

2) Outdoor Hydraulic Model Test Yard

(a) Water supply equipment for above test

3) Existing Hydraulic Model Test Laboratory

(a) Concrete Abrasion Testing Machine

(b) Concrete Impact Testing Machine

4) Existing Soil and Concrete Laboratory

(a) Triaxial Compression Test Apparatus

Each location of the mudflow warning system equipment is described below.

1) Mudflow Observation Equipment

(a) Upper reaches of the Krasak river

2) Electronic-wave Current Meter

(a) Tegalsari station on the Putih river

(b) Kopen station on the Krasak river

3) Ultrasonic Water-level Gauge

(a) Cepagan station on the Bebeng river

4) Additional Radar Gauge Functions, CRT Terminal System

(a) In the computer room of the Sabo Information Centre

5) Word Processor

(a) In the computer room of the existing Administration Building

6) Blue Printing Machine and Copying Machine

(a) In the office of the Sabo Information Centre

7) Audio-visual Educational Equipment

(a) In the control room of the Sabo Information Centre

### 5-2-3 Equipment List

(1) Equipment for Training and Sabo Technology Experiment

| | | |
|---|---|---|
| 1) | Artificial Rainfall Apparatus | 1 set |
| 2) | Mudflow Model Generator | 1 set |
| 3) | Mudflow Model Flume | 1 set |
| 4) | Hydraulic Model Test Flume | 1 set |
| 5) | Water Supply Equipment for Outdoor Model Tests | 1 set |
| 6) | Concrete Abrasion Testing Machine | 1 set |
| 7) | Concrete Impact Testing Machine | 1 set |
| 8) | Triaxial Compression Test Apparatus | 1 set |

(2) Mudflow Warning System Training Equipment

1) VSTC Building-up Equipment

(a) Mudflow Warning Equipment

a) Mudflow Observation Equipment

| | |
|---|---|
| . Wireless radio system | 2 sets |
| . Aerial cable equipment | 2 sets |
| . Still picture receiving system | 1 set |
| . Still picture transmission system | 1 set |
| . Video camera | 3 units |
| . Mudflow sensing equipment | 1 set |
| . Solar power source (for mudflow) | 1 set |
| . Solar power source (for ITV) | 1 set |

b) Electric-wave Current Meter

| | |
|---|---|
| . Observation equipment | 2 sets |
| . Electric-wave current equipment | 2 sets |
| . Safety device | 4 sets |
| . Extension of the existing telemetry observation station | 1 set |

c) Ultrasonic Water-level Gauge

| | |
|---|---|
| . Water-level gauge | 1 sets |
| . Instrument shelter | 1 places |
| . Solar power source | 1 sets |
| . Observation station | 1 sets |

d) Additional Radar Gauge Functions

| | |
|---|---|
| . Additional radar gauge functions | 1 set |
| . Lightning measures | 1 set |

(b) Equipment for data processing and preparation of educational texts

| | |
|---|---|
| a) Word processor | 1 set |
| b) Blue printing machine | 1 unit |
| c) CRT computer terminal | 3 sets |
| d) Copying machine | 1 unit |

(c) Audio-visual Educational Equipment — 1 set

| | |
|---|---|
| a) Echo sounding apparatus | 1 set |
| b) TV monitor equipment | 1 set |

(d) Vehicles for Training

| | |
|---|---|
| a) Bus for 40 passengers | 1 bus |
| b) Jeep | 2 jeeps |

(3) Equipment for Mt. Galunggung mudflow warning system restoration

1) Radar raingauge restoration

| | | |
|---|---|---|
| a) | Hard copy | 1 set |
| b) | Signal processing device PC board | 1 set |
| c) | CRT equipment PC board | 1 set |

2) Telemetry rainfall gauge restoration

| | | |
|---|---|---|
| a) | Telemetry control device PC board | 1 set |
| b) | Console power source | 1 set |
| c) | Typewriter | 1 set |

3) Mudflow sensor station restoration

| | | |
|---|---|---|
| a) | Sensor with cables | 4 sets |
| b) | Sensor testing machine | 2 sets |

4) Strengthening of lightning measures

| | | |
|---|---|---|
| a) | Material for earthing work | 1 set |
| b) | Equipment connection cable | 1 set |
| c) | Safety device | 3 sets |

5) Radar rainfall gauge power source back-up measures

| | | |
|---|---|---|
| a) | Fail-safe power source | 1 set |
| b) | Connection cable | 1 set |

6) Spare parts

a) Consumables

| | |
|---|---|
| . For rainfall level observation station (4 stations) | 20 sets |
| . For mudflow observation station (2 stations) | 10 sets |
| . For monitoring control station (1 station) | 5 sets |

b) Additional supply of delivered spare parts

- Transmitter/receiver equipment 1 set
- For observation station PC board 1 set
- For monitoring control station PC board 1 set
- For radar raingauge PC board 1 set

c) Consumables for radar raingauge

- Floppy disk 250 sets
- Magnetron 40 sets
- TR tube 1 set
- Hard copy paper 25 reams

## 5-3 CONSTRUCTION PLAN

### 5-3-1 Construction Situation and Executional Policy

(1) A characteristic of the planned facilities is that it includes the Lahar Laboratory, which involves a large portion of construction and equipment work and possesses many plant elements.

The equipment to be used in this project includes various types used for the improvement of sabo technology, research and development, technical training, accumulation of data as well as practical training.

The planned equipment includes, other than those which are marketed, custom made equipment designed and manufactured based on the research, development and training plans.

(2) Items requiring special attention in the execution of the project.

1) Adjustment between equipment foundations and building floor.

2) Adjustment of arrangements between building walls and floors for water supply equipment and drainage water treatment.

3) Arrangement and adjustment of the work schedule for commencement of the installation of equipment and any points conflicting with the building work.

(3) Basic execution policy

1) The personnel handling the building and equipment work will have the responsibility and obligation to fulfill the work while maintaining good coordination in their activities.

2) The quality of the building work must be assured.

3) Equipment functions and performances conforming to the specifications must be assured.

4) Not only the supply of facilities but also the transfer of construction technologies shall be attempted.

5) The construction will be carried out while maintaining constant communication and reporting services with Japanese government as well as the relevant local personnel.

6) At the site, smooth execution of the work will be realized by a cooperative system with the owner, the consultant and the contractors at all times.

7) An organization including Japanese staff, local staff and local subcontractors will be clearly identified.

8) The work is to be completed within the specified work period.

### 5-3-2 Scope of Work

(1) Work to be Undertaken by the Japanese Side

1) Facilities

(a) Buildings

| | | |
|---|---|---|
| a) | Sabo Information Centre | 1 building |
| b) | Lahar Laboratory | 1 building |
| c) | Dormitory | 1 building |
| d) | Water supply equipment for outdoor testing | 1 set |

(b) Work items

a) Building work

Foundation, structure and finishing work.

b) Electrical equipment work

Building interior work, service line work within the buildings.

c) Water supply and drainage and plumbing equipment work

Building interior work, well equipment work, sewage tank work, piping work up to the drainage channel.

d) Air conditioning and ventilation equipment work

Building interior work

e) External construction work

Roads, parking lots and street lights within the premises.

2) Equipment

(a) Erection, adjustment and hand-over of equipment will be included in this project.

(b) Equipment items

a) Experimental equipment for sabo technology training

b) Laboratory equipment for forecasting and alarm system

c) Equipment for data processing and text preparation

d) Equipment for audio-visual education

e) Automobiles for training

f) Equipment for resetting the Mt. Galunggung forecasting and alarm system

(2) Work to be Undertaken by the Indonesian Side

1) Items related to building work

(a) Land preparation for construction of facilities

a) Removal of existing buildings and preparation of land (including foundation and concrete slab)
Land subject to removal of existing buildings and preparation
- land scheduled for dormitory construction

b) Earthworks and land preparation
Land subject to earthworks and preparation
- land scheduled for construction of Sabo Information Centre and Lahar Laboratory

(b) Supply of electricity and telephone lines, and water and drainage channels required for the facilities up to specified positions within the premises.

(c) Supply of temporary power and water for the work.

(d) External work (gate doors, fences, planting)

(e) Furniture and furnishings

2) Provision of conveniences

(a) Provision of tax exemption for entrance to, departure from and stay in Indonesia for the Japanese groups and individuals to be engaged in this project.

(b) Provision of tax and customs duty exemption for construction materials and equipment, laboratory equipment, etc., to be brought into the Republic of Indonesia for this project.

(c) Proper maintenance and control of the facilities to be constructed and the laboratory equipment and materials to be supplied in this project.

(d) Obtaining of permission for the building work prior to its commencement.

(e) Securing of a site for a temporary site office, the work area and an equipment and material stock yard required for the construction work.

### 5-3-3 Construction Supervision Plan

(1) Construction supervision system

Because technological and administrative negotiations as well as arrangement with the staff and cooperative technical experts of the existing Improvement Project for Volcanic Sabo Technical Centre will be critical points in carrying out supervision of the construction, it will be necessary to dispatch a full-time site supervisor, having a positive attitude as well as high technological ability, to Indonesia for the duration of the construction period.

1) The full-time site supervisor, who has the proper ability for judgement of site conditions and possesses a flexible decision making ability, will be selected from those who have ample supervision experience.

2) The full-time site supervisor will have a thorough understanding of the construction site, make efforts to create harmony between the Indonesian government agencies concerned and the contractors from both countries, maintain close communication and report to the Indonesian agencies concerned as well as the Japanese Embassy and JICA, and strive for smooth progress of the work.

3) The full-time site supervisor will give special consideration to the arrangement of the buildings and equipment. Construction of high quality buildings, strict observation of the work period, construction technology transfer to the local contractors, etc., will be important duties of the supervisor.

4) The work responsibilities of the full-time supervisor will be as follows.

- Preparation of the periodic reports
  (Reports which clearly show the progress of the construction work.)
- Determination of the layout and level of the buildings
- Witnessing of the soil bearing capacity tests
- Checking and approval of the working drawings, tests for arrangement of reinforcement and supervision of concrete placement
- Checking and approval of the finishing detail drawings and supervision of finishing work
- Holding of regular meetings to carry out supervision of the construction schedule
- Carrying out of completion tests (including equipment and materials) (office tests, test to be witnessed by the owner)
- Preparation of comprehensive reports

5) The chief operations engineer and the persons responsible for each design in Japan will back up the operations of the full-time site supervisor.

They will visit the site whenever necessary to ensure smooth progress and quality construction through meetings on designing and technical guidance as well as to participate in meetings and discussions with the local government agencies concerned and the contractors.

### 5-3-4 Procurement Plan for Construction Materials

Although the local work methods and materials will be adopted as a basic policy in order to reduce construction costs as much as possible, materials which are unable to be locally procured, the accuracy and performance of which are inappropriate, or the costs of which are higher than if they are bought in Japan, will be procured from Japan.

Items and materials which are prohibited for importation into the Republic of Indonesia will be procured locally.

Procurement of local construction materials will be made as close to the construction site as possible however, finishing materials will have to be transported by truck from the large cities.

Most of the materials procured in Japan will be transported over land to the planned construction site after having been unloaded at Jakarta port. It may be necessary, however, to also consider unloading at Semaran port in order to reduce the overland transportation costs.

(1) Materials to be procured locally

1) Building Materials:
Cement, sand, gravel, concrete blocks, steel frames, formwork material, roof tiles, gravel for exposed finish by washing, tiles, aluminum sashes, aluminum jalousie windows, rock wool acoustic panels, glass, woods for bedding and finishing, paints, terrazzo blocks, parquet flooring material, caulking material, gypsum boards, flexible rock wool plates.

2) Electric Work:
Manholes, manhole covers, electric wire, switches, convenient plugs, lighting fixtures.

3) Water supply and drainage, plumbing work:
Manholes, manhole covers, reinforced concrete pipes, cast iron pipes, sanitary earthenware, piping materials, elevated tanks, receiving tanks.

4) Air conditioning and ventilation:
PCV pipe, ventilation fans.

(2) Materials to be procured in Japan

1) Buildings:
Hardware fittings, long vinyl sheets, aluminum louvers, roll screens, white boards.

2) Electric work:
Distribution boards, switch boards, lighting fixtures (portion), pull boxes, fire alarms.

3) Water supply and drainage, and plumbing work:
Valves, pumps, grease traps.

4) Air conditioning and ventilation:
Air conditioners, piping, valves.

5-3-5 Procurement Schedule for Equipment

(1) Locally procured equipment

In principle, Japanese products will be purchased and exported to Indonesia.

In Indonesia, however, there are strict regulations on importation. Items to which these regulations apply must be procured locally. The items to be procured are roughly as follows.

Note that the equipment classified as local procurement items in the estimate of operation costs is listed at local sales prices. Primarily, all the equipment to be supplied under a grand aid program must be exempt from duties. However, the level of tax exemption that will be given to the locally procured equipment is not known at this point. This information is supposed to be made clear when the application is made, after the locally procured equipment has been determined. The fact is, however, that the suppliers' ability to complete the procedures for this application within the short period between bid invitation and actual bidding is extremely doubtful. The level of tax exemption will therefore depend on the efforts of the persons in charge at the Ministry of Public Works. At this time, therefore, the equipment must be estimated at local sales prices.

The major equipment items to be locally procured are as follows.

1) Vehicles
2) Word processor
3) Copying machine

(2) Procurement schedule

Refer to 5-3-6, Implementation Schedule.

### 5-3-6 Implementation Schedule

(1) Construction Work

The actual construction period required for the construction of the Sabo Information Centre building and the Dormitory building will be 12 months after the contractors have been selected.

With regard to the Lahar Laboratory building, 2 months will be required for preparation of arrangement of the equipment and the building. Thus, a period of 14 months will be required for the entire construction.

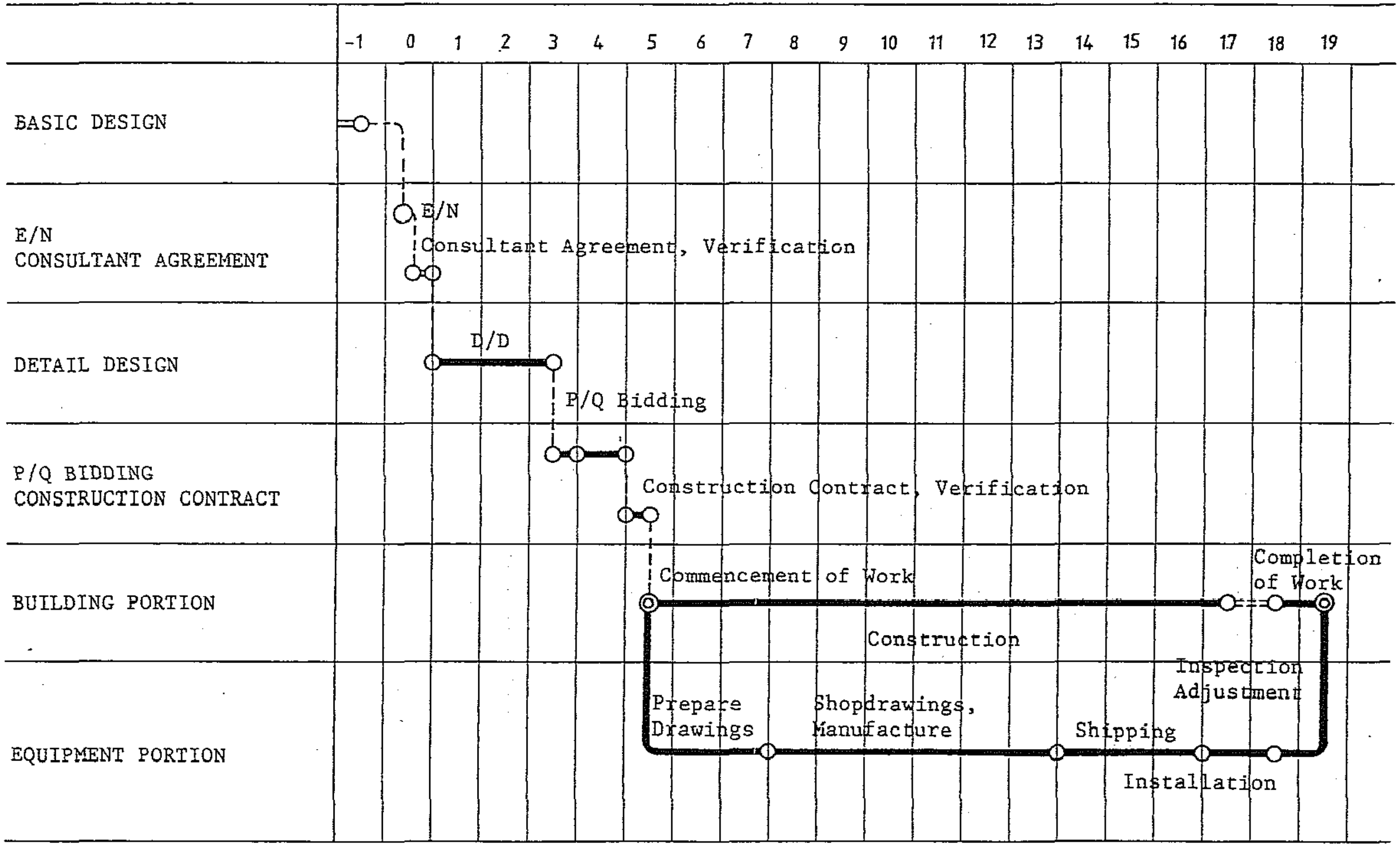
(2) Equipment Work

The equipment work schedule will include, after the selection of contractors, preparation of the equipment fabrication drawings, checking and approval of the drawings, shop fabrication, shop tests, ocean transportation, transport to site, erection and adjustment, inspection and hand-over, in that order.

A 14-month work period will be required after the selection of contractors.

(3) The implementation schedule after Exchange of Notes is shown in the following table.

Project Schedule



## 5-4 MAINTENANCE PLAN

The maintenance system for the facilities shall be in accordance with the Organization and Staff Arrangement Plan (A) of Chapter 3. The equipment maintenance system is outlined below.

### 5-4-1 Equipment Maintenance System

The equipment to be employed in accordance with this plan can be roughly classified into two categories; experimentation and training equipment, and vehicles. As the maintenance condition of the same types of equipment already is generally good, future maintenance is expected to be sound. However, it seems that a systematic approach to maintenance will be required.

(1) Experimental equipment

Although maintenance of experimental equipment is currently performed at each facility, a systematic maintenance approach has not developed, and the methods of maintenance are totally determined by the persons using the equipment. With this approach, maintenance will eventually become unsatisfactory, resulting in the failure of many items. An item by item check list of experimental equipment will be made by each laboratory. For example, it is preferred that the entire staff of a laboratory check and confirm the equipment based on the check list twice a month, probably sometime on a Friday morning. The check list, after being checked and confirmed, will be submitted to the supervisors for verification.

It is also necessary to appropriate in the annual budget approximately 1% of the purchase price as the maintenancae cost of the experimental equipment. The service life of the experimental equipment shall be approximately 8 years. As an allowance for its renewal, the equipment shall be depreciated with consideration to the specified service life.

(2) Vehicles

Presently, control of vehicles is left entirely in the hands of each driver. Because the drivers may be fired if the maintenance condition of his vehicle is unsatisfactory, maintenance conditions of vehicles have so far been satisfactory. However, because the maintenance system is not systematized, a method in which a check list with classified items for regular checking such as at the beginning and completion of work, weekly checking and monthly checking is prepared, checking conducted and data collected and kept for a specified period, as is proposed for the experimental equipment, should be considered. When repairs become necessary, details of repairs as well as the cost of repair work shall be entered in the check list. This list, having been checked, will be kept after confirmation by the supervisors at the end of a week.

### 5-4-2 *Operation and Maintenance Costs*

The expense of operation and maintenance of this centre appears to be less than originally estimated.

The calculation was made for the year 1988, when the facilities of the project will have been completed and the activities of VSTC are expected to be in full swing.

Total amounts of operation and maintenance expense (annual)
Approximately Rp341 million

(1) Personnel Expenses

| | | |
|---|---|---|
| Engineer | Rp175,000 x 12 mos. x 18 persons = Rp37,800,000 | |
| Assistant Engineer | Rp140,000 x 12 mos. x 23 persons = Rp38,640,000 | |
| Technician | Rp 65,000 x 12 mos. x 14 persons = Rp10,920,000 | |
| Total | | Rp87,360,000 |

(2) Training Expenses

Rp14,000 x 40 persons x 100 days　　Rp56,000,000

(3) Testing Equipment Expenses

| | | |
|---|---|---|
| Maintenance expenses | Rp1,260,000,000 x 1% = | Rp12,600,000 |
| Depreciation charge | Rp1,260,000,000 ÷ 10 years | = Rp126,000,000 |
| Total | | Rp138,600,000 |

(4) Vehicle Expenses

Maintenance expenses (including costs of fuel, lubricants, spare parts and repair)

Rp1,500,000 x 6 units = Rp9,000,000

Depreciation expenses Rp108,000,000 ÷ 10 years

= Rp10,800,000

| | |
|---|---|
| Total | Rp19,800,000 |

(5) Utility expenses for facilities

1) Electric Rates

The electric rates used for offices will be applied to installations with an electrical capacity of less than 200 kVA.

(a) Sabo Information Centre

Electricity consumption

96 kVA x 0.6 x 6 hrs. x 25 days = 8,640 kWh

Basic charge

96 kWh x Rp3.680 x 12 mos. = Rp 4,239,360

Metered charge

8,640 kWh x Rp97.75 x 12 mos. = Rp10,134,720

| | |
|---|---|
| Total | Rp14,374,080 |

(b) Lahar Laboratory

Electricity consumption

112 kVA x 0.5 x 6 hrs. x 4 days = 1,344 kWh

Basic charge

112 kWh x Rp3,680 x 12 mos. = Rp 4,945,920

Metered charge

1,344 kWh x Rp97.75 x 12 mos. = Rp 1,576,512

Total Rp 6,522,432

(c) Dormitory

Electricity consumption

28 kVA x 0.6 x 6 hrs. x 30 days = 3,024 kWh

Basic charge

28 kWh x Rp3,680 x 12 mos. = Rp 1,236,480

Metered charge

3,024 kWh x Rp97.75 x 12 mos. = Rp 3,547,152

Total Rp 4,783,632

(d) Existing facilities

Electricity consumption

75 kVA x 0.6 x 8 hrs. x 25 days = 9,000 kWh

Basic rate

75 kWh x Rp3,680 x 12 mos. = Rp 3,312,000

Consumption rate

9,000 kWh x Rp97.75 x 12 mos. = Rp10,557,000

| | |
|---|---|
| Total | Rp 13,869,000 |

2) Gas charge

Gas consumption

13 kg cylinders x 10/mo. x 12 mos. = 120 cylinders

Gas rate

Rp1,800 x 120 cylinders = Rp 216,000

| | |
|---|---|
| Total | Rp 216,000 |

## 5-5 ROUGH ESTIMATE OF CONSTRUCTION COSTS

Rough estimate of work cost to be undertaken by the Indonesian side.

(1) Expenses for the year 1986

| | | |
|---|---|---|
| (a) | Land acquisition cost | Rp31,000,000 |
| (b) | Earthworks<br>Filling, etc. 5,600 $m^2$ x 1.0 m x Rp4,000 | Rp22,400,000 |
| (c) | Demolition cost of existing buildings<br>320 $m^2$ x Rp12,000 | Rp 3,840,000 |
| (d) | Application fee for permission for building work<br>3,854 $m^2$ x Rp4,000 | Rp15,416,000 |

(2) Expenses for the year 1987

| | | |
|---|---|---|
| (a) | Power supply cost | |
| | Users' share 236 kVA x Rp70,000 = | Rp16,520,000 |
| | Bond 236 x 36,000 | Rp 8,496,000 |
| | Subtotal | Rp25,016,000 |
| (b) | External work cost | |
| | Fence 160 m x Rp40,000 = | Rp 6,400,000 |
| | Gate 3 units x Rp 1,300,000 = | Rp 3,900,000 |
| | Planting 500 $m^2$ x Rp30,000 = | Rp15,000,000 |
| | Subtotal | RP25,300,000 |
| (c) | Water supply cost | |
| | Deep well, pump & reservoir, feeder pipe | Rp10,000,000 |
| | Total | Rp132,972,000 |

# CHAPTER 6. PROJECT EVALUTION

## CHAPTER 6 PROJECT EVALUATION

There are numerous volcanoes distributed throughout Indonesia, and many of them are active. There is no way, however, to prevent these volcanoes from erupting or the volcanic materials accompanying the eruptions from being discharged. The sabo project is an undertaking started by the Indonesian government with the aim of eliminating the disasters or damage associated with the mudflows or debris flows which frequently occur when heavy rains carry away these accumulated volcanic materials. The fundamental concepts of the sabo project are to train and educate potential sabo engineers, and to develop new sabo technologies, as well as to improve the existing technologies. The task or role expected of the sabo project is quite important. The Volcanic Sabo Technical Centre, an organization established with the aim of materializing the sabo project concepts, is expected to play an important role.

It is anticipated, therefore, that the implementation of the Improvement Project for "Volcanic Sabo Technical Centre", discussed in this paper, involving reinforcement of the existing facilities, installation of new facilities, and provision of new equipment and materials, will bring about a number of favorable results, as summarized below.

(1) The improvement of the living quarters for trainees and lecturers, one of the major objectives of the current project, will help encourage potential trainees to participate in the training programs, secure a sufficient number of the trainees to attend the programs, and provide a favorable training environment. It will thus greatly contribute to solving the shortage of competent sabo engineers, which is one of the serious problems now confronting Indonesia. As it will also facilitate the invitation of lecturers from other regions or countries, it is expected that the contents of the training programs will become more substantial, and accordingly, the results of the training will be much more fruitful.

(2) In order to improve the existing sabo technologies and to develop proper sabo methods, laboratory test or model test experiments are an indispensable means of understanding the various facts related to sabo engineering, such as the geographic conditions of the site, the relationship between the movement of the ground and the intensity of rainfall, the occurrence of debris flows, and the changes of river bed conditions. The experimental equipment and materials to be furnished under this project will be of great value in the planning and designing of sabo-related facilities as well as in the improvement of sabo technologies. It will also facilitate technological transfer between experts and trainees. The new equipment and materials to be furnished with the Volcanic Sabo Technical Centre, will thus enable the Centre itself to serve as a technical training and development organization and to attain its objective.

(3) The main objective of the Sabo Information Centre, which will be constructed under this project, will be to arrange, process and analyze for further investigations all the sabo-related basic data collected to date. As the Centre will also deal with information and data from various other fields, such as those related to rivers and agriculture, it is expected that the provision of the Centre will have a wide effect on those fields. Another objective of the Sabo Information Centre is to promote sabo technologies by serving as the public relations organ of the Volcanic Sabo Technical Centre. By enlightening the engineers involved in sabo projects and by improving related technologies through its activites, more economical and effective implementation of sabo projects will become possible. This will not only contribute toward the stabilization of the financial condition of the Indonesian government but also make a great contribution towards preserving land and maintaining a sound environment.

(4) The restoration of the mudflow forecasting and warning systems, in particular the Mt. Galunggung system, has been long awaited by the local residents. The restoration of these systems will not only

fulfill the requirements of the Indonesian government by maintaining regional safety and improving the welfare of the local residents, but will also be an important step toward establishing a reliable mudflow forecasting and warning system, which is one of the major objectives of the sabo project. The equipment and materials to be supplied by the Japanese government will help greatly in attaining these objectives.

It can be seen from the above summary of the project evaluation that the improvement of the Volcanic Sabo Technical Centre and the restoration of its related facilities will be in the best interests of the nation because of the accompanying further development of the sabo project, preservaiton of the land, and maintenance of a sound environment. With these matters taken into consideration, it is highly recommended that the project be undertaken as promptly as possible.

In conclusion, it is believed that the assistance to be provided to the Indonesian government in various forms by the Japanese government will not only contribute to materializing the project, but also will help further deepen the friendly relationship between the two countries.

# CHAPTER 7. CONCLUSION AND PROPOSAL

# CHAPTER 7 CONCLUSION AND PROPOSAL

The primary objective of this project is to economically and effectively implement the sabo project being undertaken by the Indonesian government with the aim of protecting its citizens from the frequently occurring mudflow disasters, thereby preventing unnecessary nation-wide losses. To attain this objective, it is planned that various forms of technical assistance be provided by improving the facilities of and providing various types of equipment and materials to the Volcanic Sabo Technical Centre, which was established for the purpose of training potential sabo engineers, improvement of related technologies, and development of proper methods.

As a result of the evaluation of the effects of the project and its expected continuity after the project implementation, it was found that favorable results are expected from the assistance to be provided, that the cooperation of Japan's grant aid program is highly significant and that urgent implementation of the project is necessary.

In implementing the project, the following items are requested to be fully taken into consideration by the Indonesian government.

(1) Increasing of the number of personnel and assurance of human resources

To attain the project objective, it is necessary to increase the number of personnel from the present level. New staff should be fully competent, but it is also desirable that they have a strong desire to assume their mission of supporting the sabo project. All possible efforts should be made to assure and maintain such competent and enthusiastic human resources.

(2) Assurance of operational budget

In order to enable the expanded Volcanic Sabo Technical Centre to fully utilize its functions and develop its activities, it is necessary to secure an adequate budget to continue the operation and maintenance of the Centre.

(3) Best use of equipment and materials

It is desirable that all possible efforts to improve the levels of technologies and to develop proper methods be continued by making the best use of the equipment and materials to be furnished by the Japanese government under this project.

(4) Training of electronic communications engineers

When the future of the sabo project in Indonesia is examined, it can be seen that more electronic communications equipment will be introduced with the improvements in civil engineering technologies, but that this will result in an even more serious shortage in competent electronic communications engineers than at present. In order to establish an appropriate and dependable sabo engineering system, therefore, it is absolutely necessary to commence the training of engineers in the field of electronic communications, in addition to those already participating in the civil sabo engineering training program.

Dispatch of experts for training of electronic communications engineers (request to the Japanese government)

As has been previously mentioned, the training of electronic communications engineers is an urgent necessity for the success of the Indonesian government's sabo project. To train such competent engineers, however, requires special knowledge and expertise in that field, and the Japanese government may be requested by the Indonesian government to dispatch experts for this purpose.

In this regard there is a possibility of future cooperation by the Japanese Government.