PRELIMINARY DESIGN FOR THE CONSTRUCTION PLAN OF ANIMAL HOUSE FOR THE BIOMEDICAL RESEARCH CENTRE IN THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

FEBRUARY 1978

JAPAN INTERNATIONAL CO-OPERATION AGENCY

PREFACE

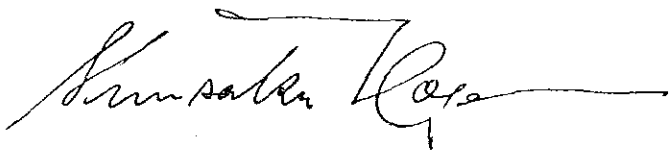
In response to the request of the Government of the Socialist Republic of the Union of Burma, the Government of Japan decided to cooperate in the construction project of Biomedical Research Centre, and the Japan International Cooperation Agency conducted its preliminary designing.

The above project was decided to be executed with the Japanese Government's financial aid of non-reimbursable basis over a period of 3 years starting in 1975. The present report is on the preliminary design of the Animal House (Laboratory Animal Centre) to be established in the final year of the project.

The on the spot survey of the project was carried out during the period from 4th to 12th October 1977. The preliminary design based there upon was duly explained to and approved by the competent authorities concerned of the Burmese Government during the period from 11th to 18th December 1977 before the current report was finalized.

I would like to extend my sincere appreciation to the officers and people concerned of the Burmese Government who have extended close cooperation and assistance to our survey team.

February 1978



Shinsaku Hogen
President
Japan International Cooperation Agency

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1-1 Summarized purposes of construction survey

The construction work of the Biomedical Research Centre in the Socialist Republic of the Union of Burma has been continued since 1975 with the Japanese Government Grant. In addition to the above construction, the preliminary survey for constructing the proposed Animal House has recently been conducted. This report is thus made out for submitting the basic data and preliminary designs required for the construction of Animal House which have been discussed to date by various organizations concerned. The outline of the current report on preliminary designs for Animal House of the Biomedical Research Centre of the Socialist Republic of the Union of Burma is as follows.

- o Preliminary survey for the construction of the Animal House
- o Design principles of the Animal House

1-2 Organization of Survey Team

Leader: Dr. Yoshihiro Hamashima, Professor of Pathology, Medical Department, Kyoto University

Member: Dr. Masaro Nakagawa, Head of the 1st Laboratory for Animal Experiments Department of Veterinary Science, National Institute of Health

Member: Mr. Naoteru Shimazaki, Head of Installations Department, Satow, Architects & Engineers Co., Ltd. (in charge of installations)

Member: Mr. Masaharu Hosoda, Group Chief of Designing Department, Satow, Architects & Engineers Co., Ltd. (in charge of designings in general and construction)

Member: Mr. Moriichi Kanai, Investigation Section, Social Development Cooperation Department, Japan International Cooperation Agency (in charge of administrative control)

1-3 Governmental members of the Socialist Republic of the Union of Burma

Dr. Aung Than Batu	Director General
Dr. Kywe Thein	Assistant Director
Dr. U Khin Maung Tin	Assistant Director
U Aung Khin	Head
U Toe Myint	Head
U Hla Pe	Head
U Soe Lu Gyaw	Research Officer

1-4 Itinerary of Survey Team

October	4th (Tuesday)	Leaving Haneda by JAL 463. Arriving at Rangoon in the evening.
	5th (Wednesday)	Joint meeting of Medical Survey Team. Inspection of the Site at D.M.R. and the existing machinery and tools. Discussions on Animal House Plannings.
	6th (Thursday)	Survey Team Discussions. Explanation on Conceptional Diagrams and Plannings in general. Inspection of Machinery Centre of C.R.C.
	7th (Friday)	Explanation on Preliminary Plannings at D.M.R. Repeated Inspection of the Site after reaching an agreement on Preliminary Plannings. Discussions on Machinery Centre. Survey Team Discussions.
	8th (Saturday)	Survey Team Discussions. Explanation on Animal House Plannings to all members and confirmation thereof. Discussions on final confirmation at D.M.R. Explanation on Animal House by Survey Team and discussions on Minutes of Meetings. Arrangement of information and data. Banquet given by Survey Team.
	9th (Sunday)	Arrangement of information and data.
	10th (Monday)	Final discussions at D.M.R. Final confirmation of Minutes of Meetings. Presentation of Report on Survey Results to Japanese Embassy. Banquet given by D.M.R.

October 11th (Tuesday)	Leaving Burma by TG 302 and staying overnight at Bangkok.
12th (Wednesday)	Back to Japan by JAL 472.

1-5 Minutes of the Meetings exchanged between Japanese Survey Team and Department of Medical Research

The above Minutes of the Meetings detailed hereunder were mutually confirmed by the members of both the Japanese Survey Team and the Department of Medical Research and exchanged between the two parties.

Subject 1. Basic Design of Animal House and Instrumentation of Biomedical Research Centre.
2. Equipment for Biomedical Research Centre.

o Japanese Survey Team	o Department of Medical Research
1. Professor Yoshihiro Hamashima, Leader	1. Dr. Aung Than Batu, Director-General
2. Dr. Masaro Nakagawa, Member	2. Dr. Kywe Thein, Assistant Director
3. Mr. Seiichi Kanai, Member	3. Dr. U Khin Maung Tin, Assistant Director
4. Mr. Masaharu Hosoda, Member	4. U Aung Khin, Head
5. Mr. Naoteru Shimazaki, Member	5. U Toe Myint, Head
	6. U Hla Pe, Head
	7. U Soe Lu Gyaw, Research Officer

Discussions were held 5, 6, 7, 8 October and 11th October 1977.

1. The Director-General first presented the basic requirement and function of the proposed Animal Services Centre and background information on present Animal Services at Department of Medical Research.

   The Animal Centre would supply high quality strain of animals in sufficient quantity for future needs of the Department of Medical Research and research workers in other Institutions, and as stock to other Institutions in Burma. The Centre would mainly stock small

laboratory animals of good quality for research, but should have provision for limited supply of Specific Pathogen free animal.

Facilities should also be present for experimental work on animals under suitable conditions.

2. The site and basic design of the Animal Supply Centre was then extensively discussed.

An understanding was then reached regarding the site of the building and basic design, dimensions of the Animal Centre building as shown in attached diagram (Page 3-8).

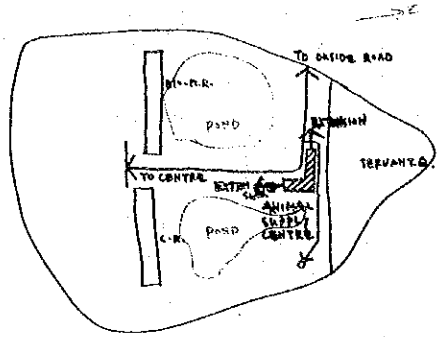
Should there be a need to cut down costs, the Experimental Animal Rooms could be reduced in number.

3. In view of the priority given to the need for an adequate Animal Centre as given in attached diagram it was understood that funds probably would not be available for a separate Instrumentation Centre building. However certain items of equipment would be made available for strengthening the present Instrumentation Division as per attached Tentative. List given on page (9) from the Japanese Grant. Should adequate funds become available from the Japanese Grant, a separate Instrumentation Centre building would be reconsidered.

4. A List of Instruments and Equipment for the Biomedical Research Centre, Library, and Animal Services Centre and Instrumentation Services was presented for discussion by the Department of Medical Research. The attached list was then generally agreed upon, subject to alteration according to latest prices.

5. It was agreed by both sides that the understanding reached above will be subject to subsequent agreement by the competent national authorities.

No. 1



TOTAL TRANSPORTATION SYSTEM.

No. 2

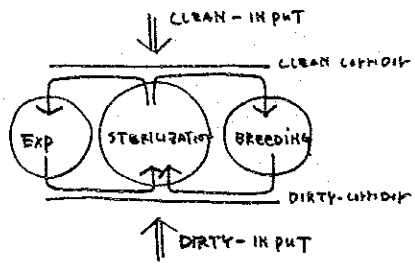


DIAGRAM OF CORRIDOR SYSTEM

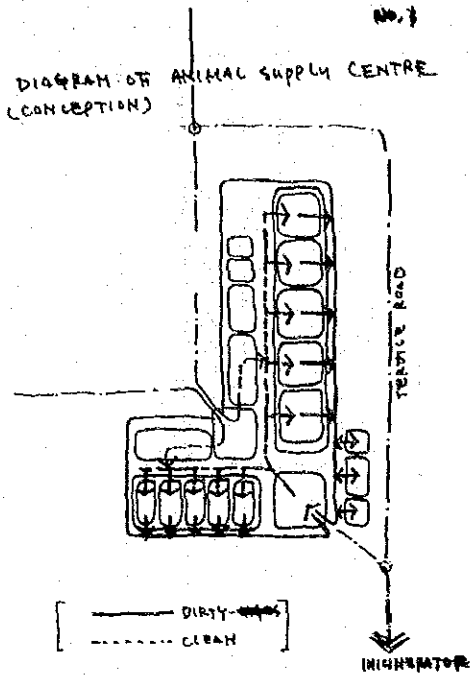
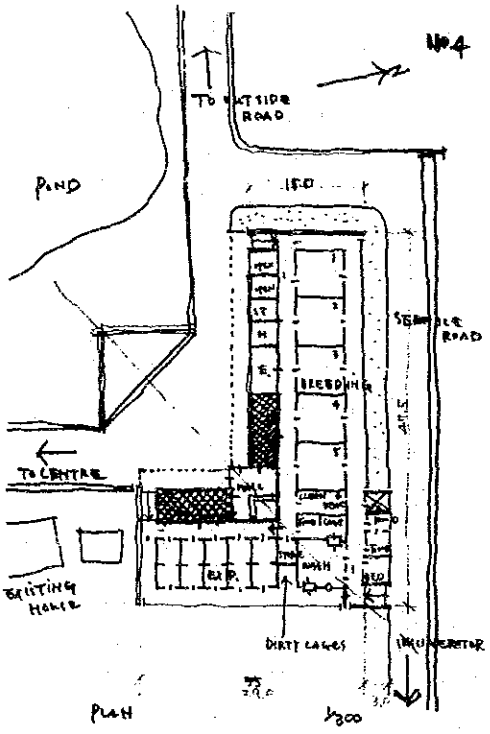
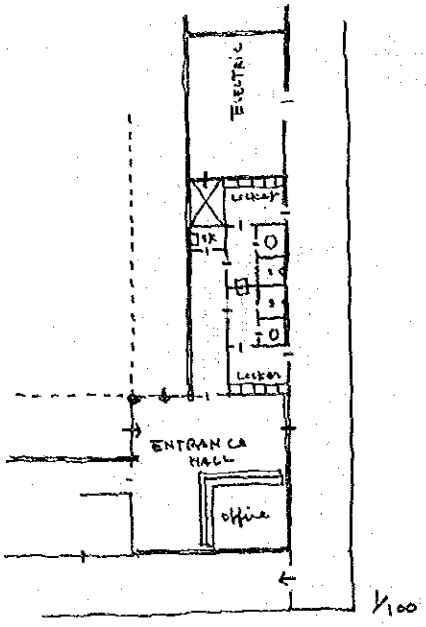
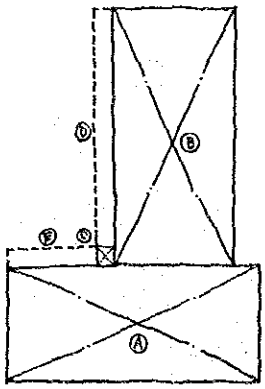


DIAGRAM OF ANIMAL SUPPLY CENTRE
(CONCEPTION)
DIRTY
CLEAN


POND
TO CENTRE
DIRTY CAGES
PLAN



DETAILS OF WATER SECTION



A = 32.° x 15.° =	480.00	A+B+C =	973.75
B = 32.5 x 15.0 =	487.50	D+E =	105.00
C = 2.5 x 2.5 =	6.25		
D = 30.° x 2.5 =	75.00	TOTAL	1078.75 m²
E = 12.° x 2.5 =	30.00		

1-6 Minutes of the Meetings exchanged between Japanese Survey Team and Department of Medical Research regarding Draft Report of Animal House

o Japanese Survey Team

1. Dr. Masaro Nakagawa, Head of the 1st Laboratory for Animal Experiments Department of Veterinary Science, National Institute of Health.
2. Mr. Masaharu Hosoda, Group Chief of Designing Department, SATOW Architects and Engineering Co., Ltd.

o Japanese Embassy

1. Mr. Mitsuo Takamatsu
   Second Secretary

o Department of Medical Research, Ministry of Health, Burma

1. Dr. Aung Than Batu, Director-General
2. Dr. Kywe Thein, Assistant Director
3. Dr. U Khin Maung Tin, Assistant Director
4. U Toe Myint, Head of Division
5. U Soe Lu Gyaw, Research Officer
6. U Kyaw Thi, Deputy Project Manager,
   Biomedical Research Centre Construction Project

Meetings were held on the 13th, 14th, 15th, 16th December 1977.

1. A Japanese Survey Team and the Department of Medical Research had previously held Meetings from the 5th to 11th October 1977 in Rangoon, and had come to an understanding upon certain basic points and concepts regarding the Animal House (Laboratory Animal Centre) to be constructed as part of the Biomedical Research Centre from the Japanese Government Grant, and the minutes of the Meeting had been mutually approved.

2. Based on the previously agreed basic points and concepts, the Japanese Team presented further detailed items concerning the basic data and Preliminary Design of the Animal House, for consideration and agreement, as appended in Annex 1 pages 1-57.

3. After discussions both sides came to an understanding regarding the items and contents of Annex 1 pages 1-57, subject to the corrections and alterations given in Annex 2.

4. It was agreed that the understanding reached above will be subject to confirmation by the competent national authorities.

ANNEX 2

Corrections and Alterations to Annex 1

1. Page 1 (2-1)

Line 7 - to substitute "members of the Department of Medical Research" in place of "governmental staff".

2. Page 1 and 2 (2-1-2)

To delete the words starting from "the cost fluctuations" to "Socialist Republic of the Union of Burma and Japan".

3. Page 2 - Line 12

To delete the words "and flexible social conditions" and add "and other factors" after materials.

4. Page 2

To insert "for the Japanese authorities to decide first the amount of funds to be allotted for the Animal House" in place of "to decide the total cost in the first place".

5. Page 3

Roofing for Incinerator in place of building of Incinerator.

6. Page 4

To delete all and substitute (A).

7. Page 5

To delete all and substitute (B).

8. Page 17 (2-4-2)

To delete "Supply of information" - - - - - - - - - - to "animal species" and substitute the following:

The Laboratory Animals Supply Centre will serve as a central animals breeding centre and will supply high quality strains of laboratory animals.

It will also serve as a national laboratory animal service, the functions of which will be:

1. to supply laboratory animals to the Department of Medical Research and also to all Institutes in the country which need them for research, diagnostic or teaching purposes.
2. to disseminate information regarding the husbandry of laboratory animals
3. to develop suitable cages for laboratory animals locally
4. to develop diets made from indigenous ingredients for the various animals,
5. to investigate problems which arise, whether in the nature of disease or experimental failure; and
6. to provide training in animal technology
7. to be able to supply ultimately Specific Pathogen Free and Germ Free laboratory animals.

9. Page 33

To delete "unless various kind" - - - - - - - to - - - - - - "in minds".

10. Page 35

To insert after the words A or B Heavy Oil "or kerosene".

11. Page 38 (2-7) The Department of Medical Research stated that

12. Page 39 (2-8) it is not in a position to give comments with respect to Cost Estimate and Working Schedule.

13. Page 40

It was agreed that the site of Animal House on this Site Plan may have to be shifted slightly (to the west or north) depending on further detailed data regarding ground contour, etc.

14. Page 41

It was agreed to make the following alterations in the drawings

1. To put a vestibule in part of the space for Experimental Inf. Room.
2. To put an office room in part of the space for the Hall.
3. To have a door opening to the exterior in the north dirty corridor.
4. To have a door in the north dirty corridor leading to the Food Stores.
5. If necessary to alter the wall between Machine and Electricity Room, and have their door opening to the south dirty corridor.
6. To specify as S.P.F. Room the room for clean benches.

15. Page 53

To insert "will" need after "they" in the 18th line and delete "have" and "along with the construction of the Biomedical Research Centre".

CHAPTER 2 Preliminary design

2-1 Design principles

This is a plan of Animal House to be constructed on the site of the Biomedical Research Centre in the Socialist Republic of the Union of Burma. The outline of the current project is conformable with the planning concept agreed upon through mutual discussions between the members of Japanese Survey Team and the members of the Department of Medical Research of the Socialist Republic of the Union of Burma during a period from 4th to 12th October, 1977 (refer to Chapter 1-5, 1-6).

2-1-1 Working objective

The above Animal House will be established on the northern end of the site of the Biomedical Research Centre.

The scheduled construction works are as follows.

o Construction work		as per specified
o Installation work	Machinery (air conditioning, ventilation) installation work	-do-
	Water supply and drainage equipment work	-do-
	Electric work	-do-
o General outdoor work		-do-

2-1-2 Construction dimension and determination criteria

Approximately 10% fluctuations will have to be taken into consideration for the annual cost of materials and manpower. Thus, in view of the time of initiating the construction as well as the selection of materials and other factors, it is impossible to finally determine the entire cost of the construction work under the present stage (as of February 1978).

Such being the circumstances, there is no other alternative for the Japanese authorities but to decide first the amount of funds to be allotted for the Animal House and allow the construction dimension to be flexible in the preliminary designs and finally confirm them at such a time when working designs be completed.

Although the final construction dimensions are shown hereunder, an extent of construction works that could be executed within the approvable maximum cost may be classified with the following criteria.

A. Minimum extent of works to be executed (minimum requirement)

B. Extent of works that will be decided finally (work not finalized as yet)

C. Extent of works to be executed with the expenditure of the Socialist Republic of the Union of Burma (minimum requirement)

However, regardless of the time of initiating the construction works, the ground levelling and drainage works around the site should be done in an earlier stage.

Fig. 1 Classified Construction Dimensions

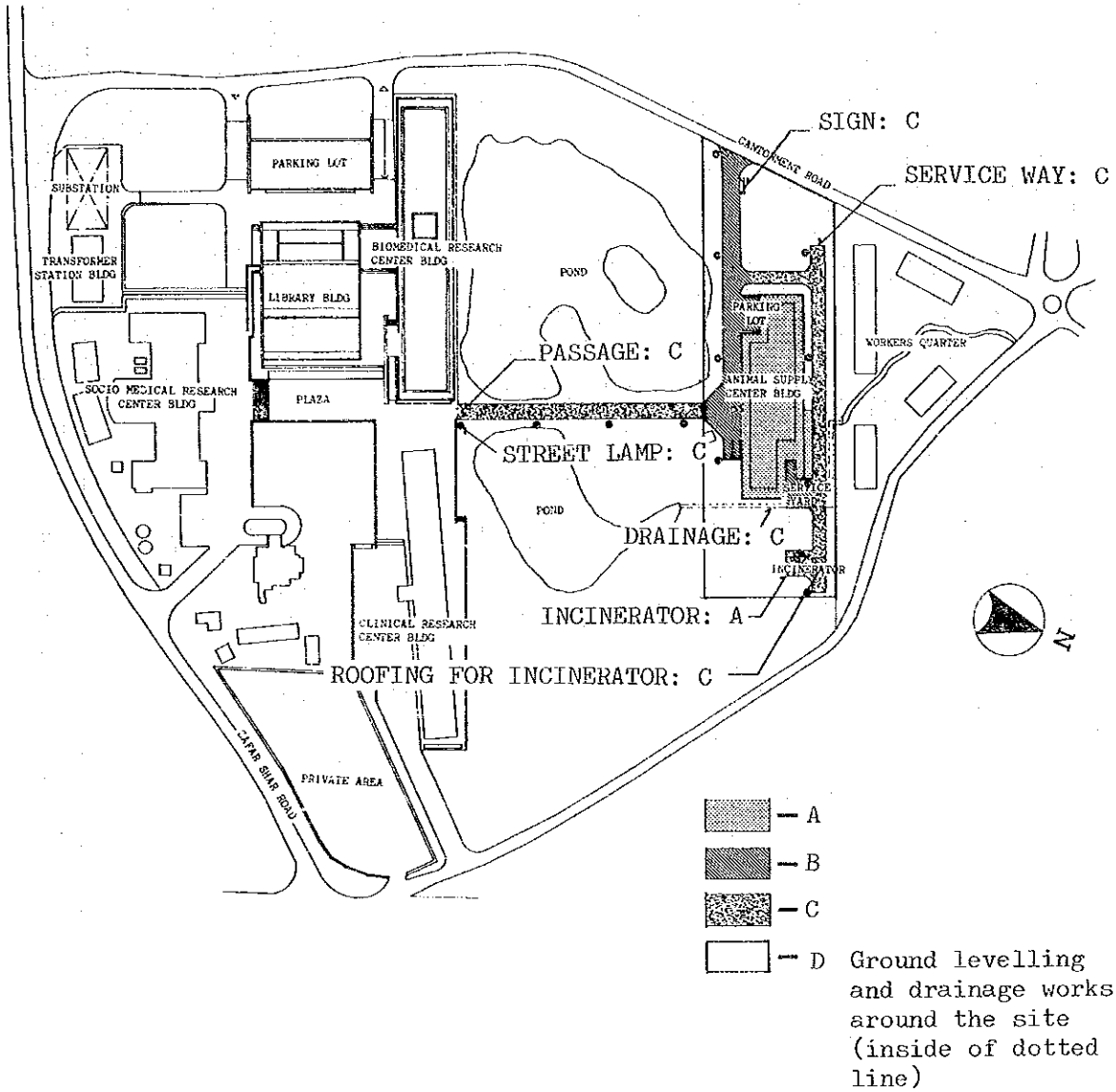


Table 1 Detailed organization chart of the Department of Medical Research

(Projected till 1981-82)

BIOMEDICAL RESEARCH CENTRE	CLINICAL RESEARCH CENTRE	SOCIO-MEDICAL RESEARCH CENTRE	CENTRAL BIOMEDICAL LIBRARY CENTRE & INFORMATION	BIOMEDICAL INSTRUMENTATION CENTRE	LABORATORY ANIMALS SUPPLY CENTRE	ADMINISTRATION	RESEARCH UNIT	RESEARCH GRANT	RESEARCH FELL
Virology Research Division	Clinical Research Division	Epidemiology Research Division	Library Operations Division	Engineering Services Division	Laboratory Animals Husbandry Division	General Administration			
Immunology Research Division	Experimental Medicine Division	Biometric Research Division	Special Services and Research Division	Medical Instrument Servicing & Maintenance Division	Auxiliary Services Division	Foreign Affairs & Planning			
Pathology Research Division	Therapeutic Research Division	Environmental Division	Public Information and Publication Division	Bioengineering Research and Development Division	Laboratory	Procurement & Stores			
Bacteriology Research Division	Parasitology Research Division	Health Practice							
Biochemistry Research Division	Experimental Surgery and Research Modules								
Physiology Research Division	Pharmacology Research Division								
	Biophysics Research Division								
	Nuclear Medicine Unit								
	Patient Study Room								
	Nutrition Research Division								
	Goitre Research Unit								

2-2 Functional layout of Animal House and required research and Administrative staff

Table 2 Research and Administrative staff

Serial No.	Name of Department	Total staff at present (1967-1977)	Projected till 1981-82
1.	Research Staff		
	1.1 Bacteriology Research Division	8	8 + 2
	1.2 Biochemistry Research Division	7	7 -
	1.3 Immunology Research Division	8	8 -
	1.4 Pathology Research Division	6	6 -
	1.5 Physiology Research Division	11	11 + 1
	1.6 Virology Research Division	10	10 + 1
2.	Library Staff	7	7 + 16
3.	Animal Supply Centre Staff	7	7 + 11
4.	Instrumentation Centre Staff	11	11 + 23
5.	Store Staff	4	4 + 3
6.	Administrative Staff	50	50 + 34

2-3 Land use planning

2-3-1 Design point of view

The Biomedical Research Centre of the Socialist Republic of the Union of Burma covers the entire biomedical research activities to be carried out at Biomedical Research, Library and Substation buildings now being built (as of February 1978), and the existing Sociomedical and Clinical Research buildings including Animal House subject to the current 3rd term construction plan.

Therefore, the concept on basic designs covering the construction plans for the existing buildings and facilities including those now being constructed will be reflected on the current project for Animal House, whereby the utilization of the entire site be finalized.

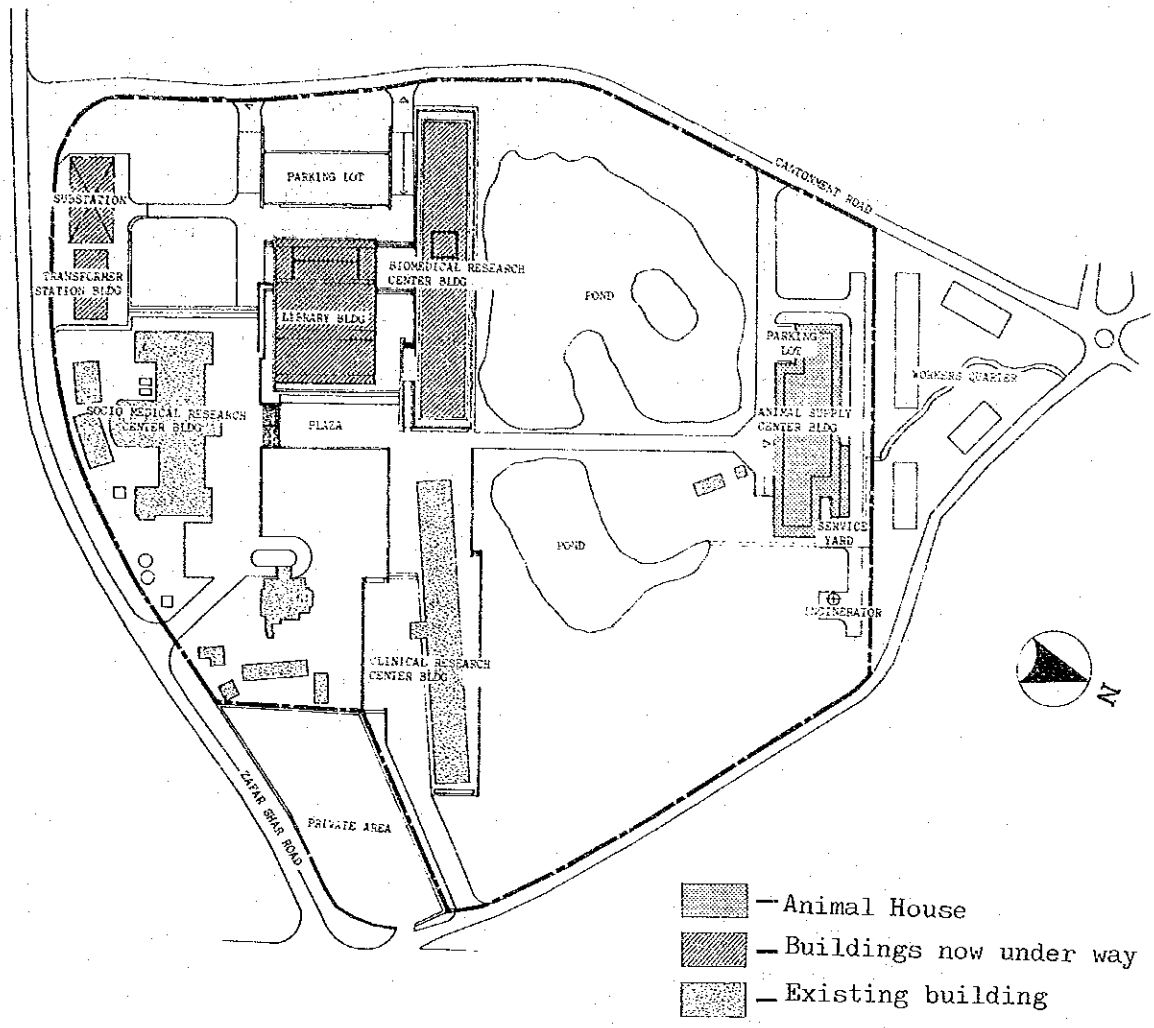
The overall utilization of the site will be studied with the following factors, and the frame forming this very concept is implicating an entire picture of the planning concept to be carried over to the 2nd term construction plan.

1. Zoning —will properly distribute functions of respective facilities to the site, thereby deciding an extent of land utilization, density, purposes and allocation of building volume.

2. Traffic system —will functionally operate respective facilities being allocated to the entire site most effectively.

3. Landscaping —will set up the collective scenes matching with the natural environment embracing the allocated facilities and those already existing thereby visually unifying the environment in and out of the site.

Fig. 2 Facilities classified by the construction periods



2-3-2 Zoning

Zoning taken up in the current project may be composed of the allocation of functions of the existing systems in the land use. The reason is that the allocation of purposes and activity of the given facilities on the utilizing land is reflecting the entire research activities. Zoning thus classified is shown hereunder.

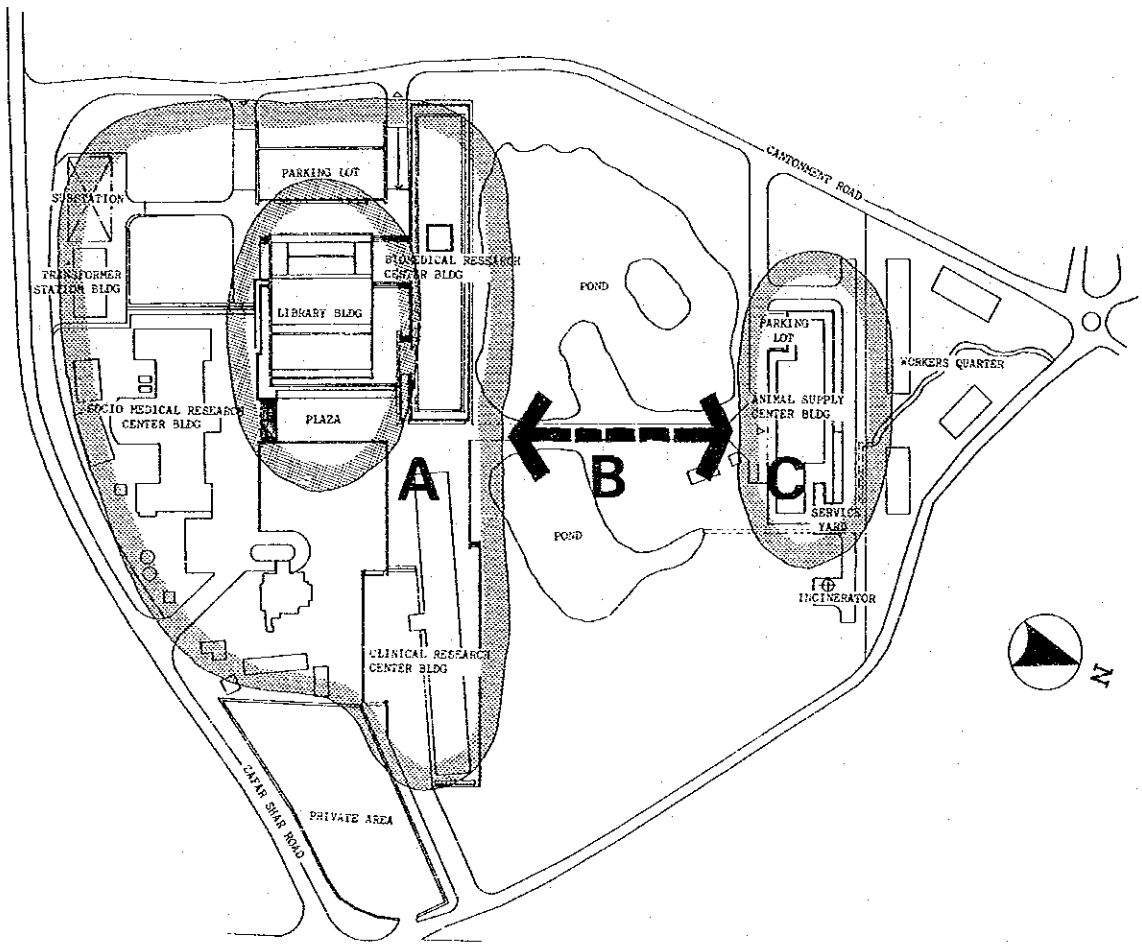
A zone — Zone for facilities (including public facilities and library) centering on medical research activities.

B Zone — Rest zone as being a static space.

C zone — Zone where Animal House is allocated (the current project)

There exists a servant quarter of about 0.3 ha. on the northern end of the site, but this is independent of the current construction project. Hereunder are given detailed descriptions on respective zones.

Fig. 3 Zoning



A zone — This particular zone where research activities will be carried out is grouped depending on the characteristics of function (similarity in research activities).
What is aimed at by such a grouping are the effective management and maintenance of research activities.
Major facilities composing A Zone, namely, Sociomedical, Clinical and Biomedical Research buildings, are the centre of the Biomedical Research Centre functions, and the pivotal of all the research activities. These facilities have to be independent in their activities while assisting mutual research activities.
On the other hand, a number of facilities (such as library and square, etc.) supporting the above research activities are being planned to be located on the centre of A zone so that such facilities could be used more effectively for research activities.

B zone — This quiet and green space is a so-called "rest zone" which forms a buffer area, visually linking A and C zones, and also a place where the natural environment embracing ponds and trees should be preserved exclusively. Particularly, this zone fulfills its function of removing bad smell and noise from Animal House.

C zone — Animal House subject to the current project will supply animals not only for the experiments by Biomedical and Clinical Research Laboratories but also the research institutions other than the Biomedical Research Centre.
The production and breeding are not the only role given

to this Animal House since experimental researches will also be carried out at this Animal Centre. Thus, C zone has to be separated from other zones because of the functional independence of Animal House.

Nevertheless, this zone is closely linked with A zone and there will be a heavy traffic of animals and research staffs as well as various service items. Thus, the passage to C zone is not for vehicles but for either human or animal traffic.

Scene of B zone one could command from this passage will give him a visual pleasure while having a break after research works.

2-3-3 Traffic movements

This is a system of all the traffic linking facilities of each zone. The concept on this very system means a dynamic flow which makes it possible for the facilities under respective zoning to fulfill the given functions. It is a flow of vehicle, people, water, energy and information and so on which reflects the whole system in the end. In other words, it is a means to study the current project by converting all the research activities into a flow of elements which could largely be divided into the following 5 different categories.

1. Human being and vehicle
2. Physical items
3. Water
4. Energy
5. Information

The following is a brief study on each one of the above categories. As for the existing facilities, particularly Sociomedical and Clinical Research buildings covered under 4. and 5. categories are equally independent in their systems. Therefore, the facilities linked with the equipment system of Animal House are Biomedical Research, Library and Substation buildings now being established, and it is possible to take out a node of both input and output of these facilities from the location in a drawing, showing a square on the eastern end of Biomedical Research building.

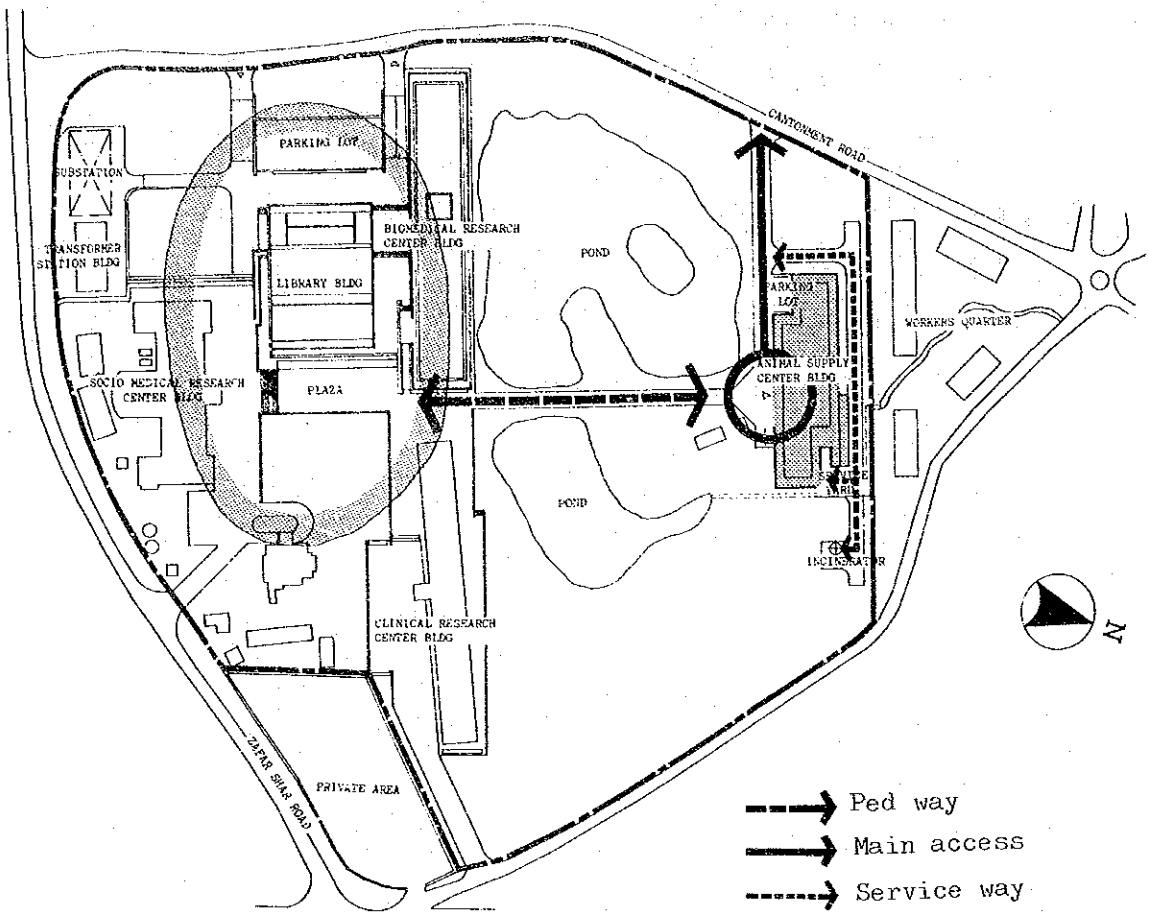
1. Human being and vehicle

   A zone for human being and vehicle traffic was separated from the access to Animal House for the purpose of enabling more effective activities. The surrounding roads on the West side are basically the access for vehicles, while the passages linked with the central facilities are for human beings. Vehicle roads are mainly subject to various services.

2. Physical items

   This flow is included in the above human and vehicle flow. The traffic of physical items (including animals) depends on three lines of passages, namely Main access way, Ped way and Service way. Particularly, incinerated waste of experimental animals will be taken out of the site through the Service way.

Fig. 4 Transportation of human being, vehicle and various items.



3. Water

Water obtained from deep wells outside the site for water supply will be examined at the Biomedical Research Centre and distributed thereafter to NODE through a water tower. Thus, water will be supplied to Animal House directly from NODE through water supply pipes.

Sanitary sewage, waste and experimental soil water have respective drainage systems, but because the total volume is relatively smaller, the drainage will be kept temporarily in a distributing reservoir. The drainage will then go through NODE and flow into CLARIFICATION TANK now under way which is linked with MAIN SEWER PIPES, while storm sewer be

led to open channel grooves around Animal House and then to a pond on the South side. Particularly, since the land becomes swampy because of the poor drainage on the current project site, the distribution system has to be established before the construction of Animal House be started.

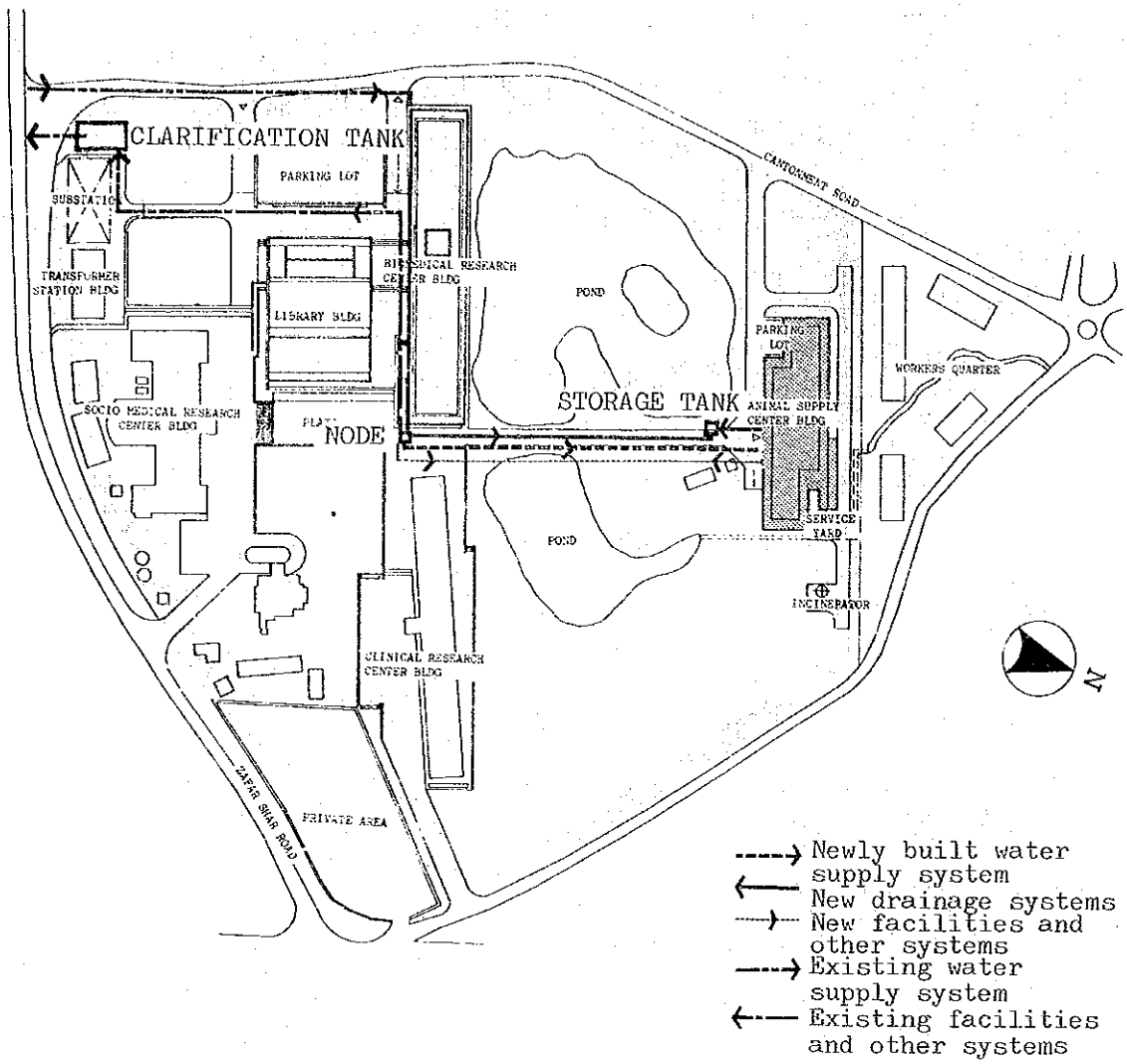
4. Energy

Energies to be supplied to Animal House are electricity and gas (for experimental researches). The power supply will be stable when the construction of SUBSTATION be completed.
When the maximum electric power consumption of Animal House is estimated at 250 KVA, the electric power as high as 6,600 V receivable from SUBSTATION will be stepped down to 400 V and 230 V by a transformer equipped with the Animal House.

5. Information

This is mainly a flow of information through telephone services. No direct central telephone exchange will be established, and calls will be connected with other facilities through a switchboard equipped with Sociomedical Research building. Communications within Animal House will be made by interphones whenever necessary.

Fig. 5 Transportation of water, energy and information.



2-3-4 Landscaping

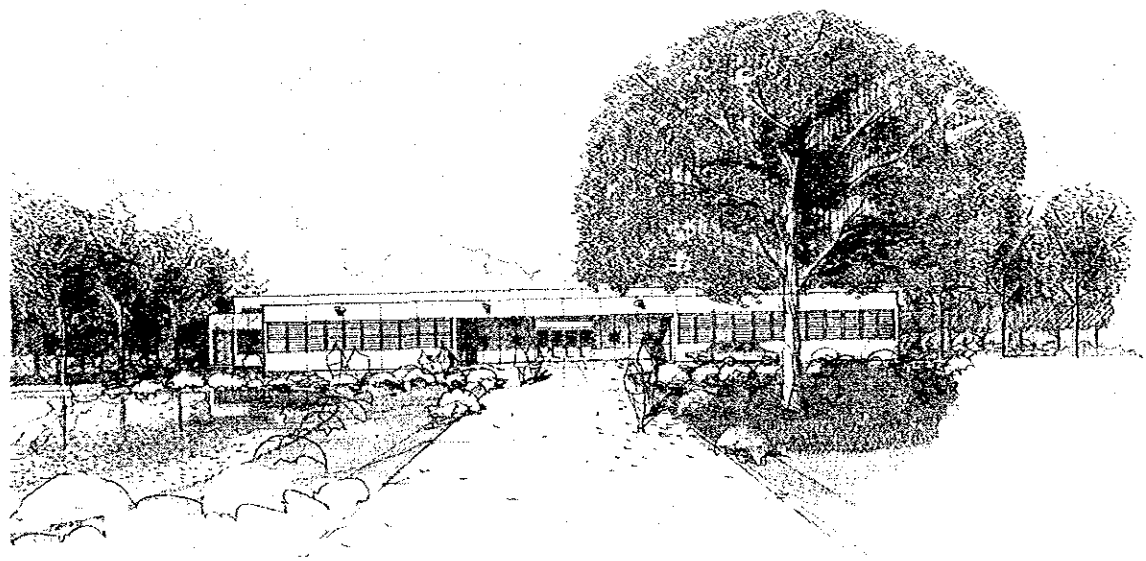
The fundamental viewpoint of apprcciating a landscape is to study AMENITY mainly associated with human being correlated with the surrounding facilities and environments. Thus, the major viewpoint upon treating a landscape in the current project is to examine the physical environments of the existing facilities, attaching an importance to Animal House.

Thus, what is required in the first place is to secure an appropriate outdcor space between the facilities and tc signify a

junction of such a space with ponds, verdure and facilities. It is therefore recommendable to locate facilities on the northern end of the site so as to occupy both edges of ponds to create some appropriate space variation over the entire site.

In the second place, it is required to unite the physical form of Animal House with the rest of facilities, for the physical beauty of the existing facilities that will eventually affect the entire site is taken into consideration, and the physical rythm of the existing facilities thus harmonized will decide the physical form of Animal House in creating an overall landscape on the project site.

Fig. 6 Perspective of Animal House



2-4 Architectural design

2-4-1 Role given to Animal House

Animal House is the supply centre of experimental animals which will help each sector of the Biomedical Research Centre to obtain the experimental materials and the necessary data. The Animal House will fulfill its functions as an overall supply depot in the Socialist Republic of the Union of Burma.

2-4-2 Functions of Animal House

The Laboratory Animals Supply Centre will serve as a central animals breeding centre and will supply high quality strains of laboratory animals.

It will also serve as a national laboratory animal service, the functions of which will be:

1. to supply laboratory animals to the Department of Medical Research and also to all Institutes in the country which need them for research, diagnostic or teaching purposes.
2. to disseminate information regarding the husbandry of laboratory animals
3. to develop suitable cages for laboratory animals locally
4. to develop diets made from indigenous ingredients for the various animals,
5. to investigate problems which arise, whether in the nature of disease or experimental failure; and
6. to provide training in animal technology
7. to be able to supply ultimately Specific Pathogen Free and Germ Free laboratory animals.

2-4-3 Breeding facilities of experimental animals and their classification

The breeding environment of animals (construction of facilities) will be decided by the requirements depending on the type of experimental breeding animals and environmental factors.

Kinds of animal care:

1. Production
2. Breeding
3. Keeping
4. Animal experimentation

2-4-4 Functions of Animal House

A. Breeding area (area for breeding, reproduction and observation)

B. Area for receiving animals (area for inspecting and quarantining animals brought in)

C. Experimental area

D. Area for accommodating various items and storage

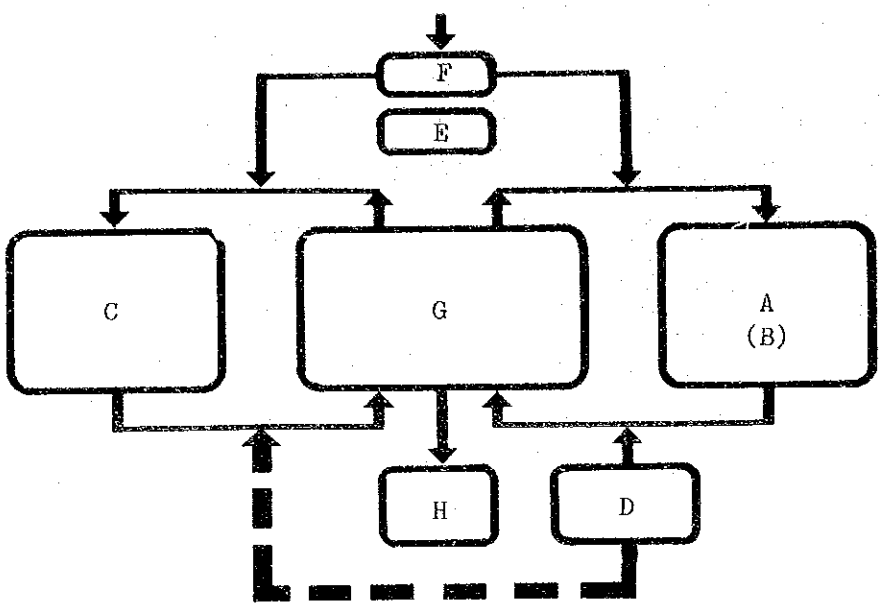
E. Administrative area

F. Shower, locker and lavatory

G. Washing and sterilizing area

H. Incinerated animal carcass and waste disposal facilities

Fig. 7 Functional chart



2-4-5 Breeding rooms of experimental animals

Animal rooms are recommended to be large enough for multi-purposes. When the dimensions of cage and its wheeled stand and their allocation are taken into consideration, the width of a breeding room given in Fig. 7 can be visualized. A part of these axial unit dimensions should conform with that of a laboratory, which will have to be 5-6 m in depth and not less than 3.5 m in height on the average.

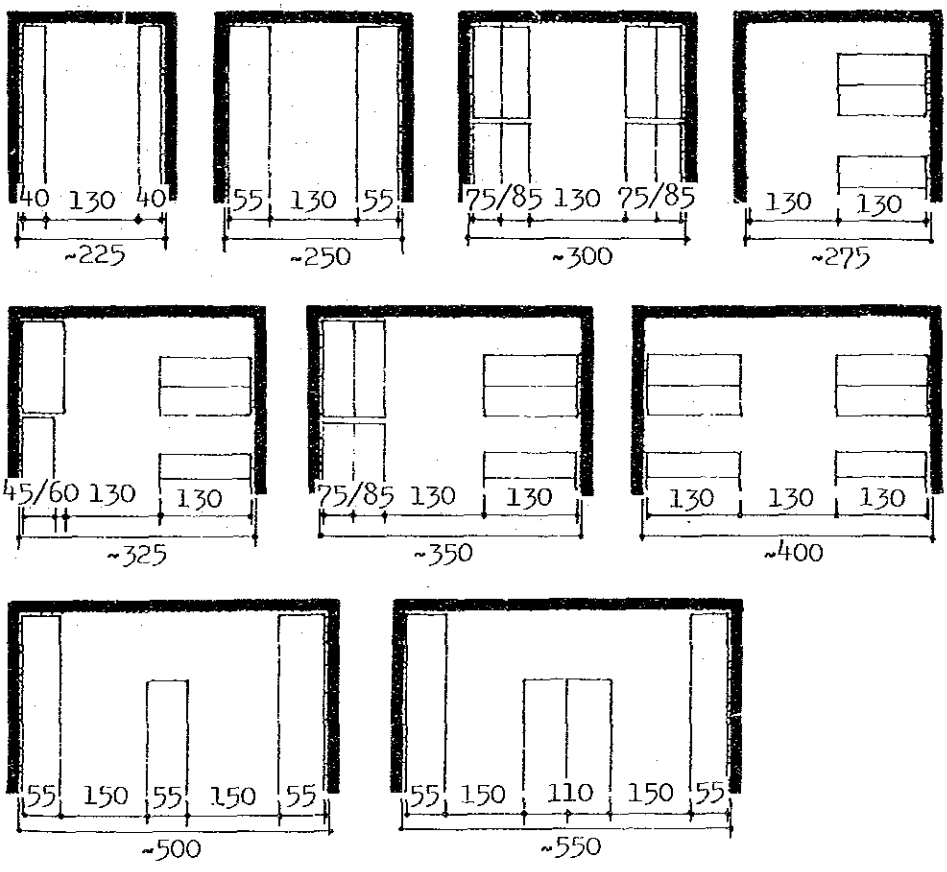
The size of a door has to be decided in accordance with the size of equipment (wheeled stand for cage and its conveyor). Thus, it has to be at least 100 cm for a single door and 140 cm is standardized for a double door.

Viewing windows will be built in either external or internal wall between a corridor and an animal room so that one could see the inside of animal room from outside. However, these windows should not be too large in size for preventing heat or cold from coming in.

Either wall or ceiling has to be easily accessible for cleaning and sterilizing works and the drainage for sanitary sewer or waste should be built in the room. Electric heater may be installed whenever necessary, for the general heating purpose, but warm air heating system will be adopted instead when more heat be required. Generally, the number of air change by an air supply and outlet equipment for Animal House will have to be 10~15 times/hr. on the average. The floor area required for the breeding of experimental animals is generally as follows.

5,000	Mouse	20 m^2
500 - 1,000	Rat	20 m^2
250 - 500	Guinea pig	20 m^2
100	Rabbit	20 m^2

Fig. 8 Allocation of instruments and equipment breeding room of experimental animals and module.



2-4-6 Standard temperature and humidity required for the breeding of experimental animals

The left side Table shows standard temperature and humidity values being adopted in the Western countries, but due to the different climate, natural features and various other conditions in the Socialist Republic of the Union of Burma, standard values given in the right side Table should conceivably be adopted for the breeding plans to be established.

Table 3 Standard temperature and humidity required for the breeding of experimental animals.

Animal species	Temperature			Humidity			Reference	Temperature			Humidity		
	Min.	Opt.	Max.	Min.	Opt.	Max.		Min.	Opt.	Max.	Min.	Opt.	Max.
Mouse	20.0 22.2 21.0	22.2 - -	26.7 24.4 26.7	30 50	50 -	80 55	A.W.I. W. Thorp Inst. L.A.R.	20	26	28.29	30	70	80
Rat	20.0 22.2 21.0	22.2 23.3 -	26.7 24.4 26.7	30 50	50 	80 55	A.W.I. W. Thorp Inst. L.A.R.	20	26	28.29	30	70	80
Humster	20.0 21.0	22.2 -	29.4 24.0	30	50	80	A.W.I. Inst. L.A.R.						
Infant. & child	20.6	-	21.7				"						
Breeding room	22.2	-	23.3				"						
Mormot	15.6 22.2	21.2 -	26.7 24.4	30	50	80	A.W.I. W. Thorp	20	26	28.29	30	70	80
Rabbit & Cat	15.6 18.3	20.0 22.2	26.7 24.4	30 30	50 50	80 80	A.W.I. A.W.I.	20	26	28.29	30	70	80
Monkey	23.9 16.7	24.8 28.2	25.6 37.8	30	50	80	W. Thorp A.W.I.						
Dog. adult	12.8	22.2	37.8	30	50	80	A.W.I.						
Infant. & child	21.1	23.9	35.0	30	50	80	"						
General	18.3 22.2	23.9 -	29.5 25.6	40									

Note: A.W.I.: Animal Welfare Institute; Comfortable Quarters for Laboratory Animals, Oct. 1956.
W. Thorp: The Design of Animal Quarters; J. of Med, Education Vol. 35, No. 1, Jan. 1960.
Inst. L.A.R.: Institute of Animal Resources, National Academy of Sciences, May, 1962.

2-4-7 Number of air change per hour and amount of ventilation

The figures given hereunder are recommendable for the number of air changes (figures indicating the number of times of filling the room volume with the amount of air supply per hour) and the air volume, but they vary depending on the external conditions and requirements for the proposed facilities.

Table 4 Required number of air changes and amount of ventilation
(Fresh open air)

No. of air change	Animal species	Reference
5 - 10	General	ASHRAE Guide 1961.
10 - 15		Guide for Lab. Anim. Core.
6 - 10 - 12	Mouse	(12) Inst. Lab. Anim. Res.

Note: Whether the term "air change per hr" means fresh open air or air supply to Animal House is often obscure, but here it means "Fresh open air".

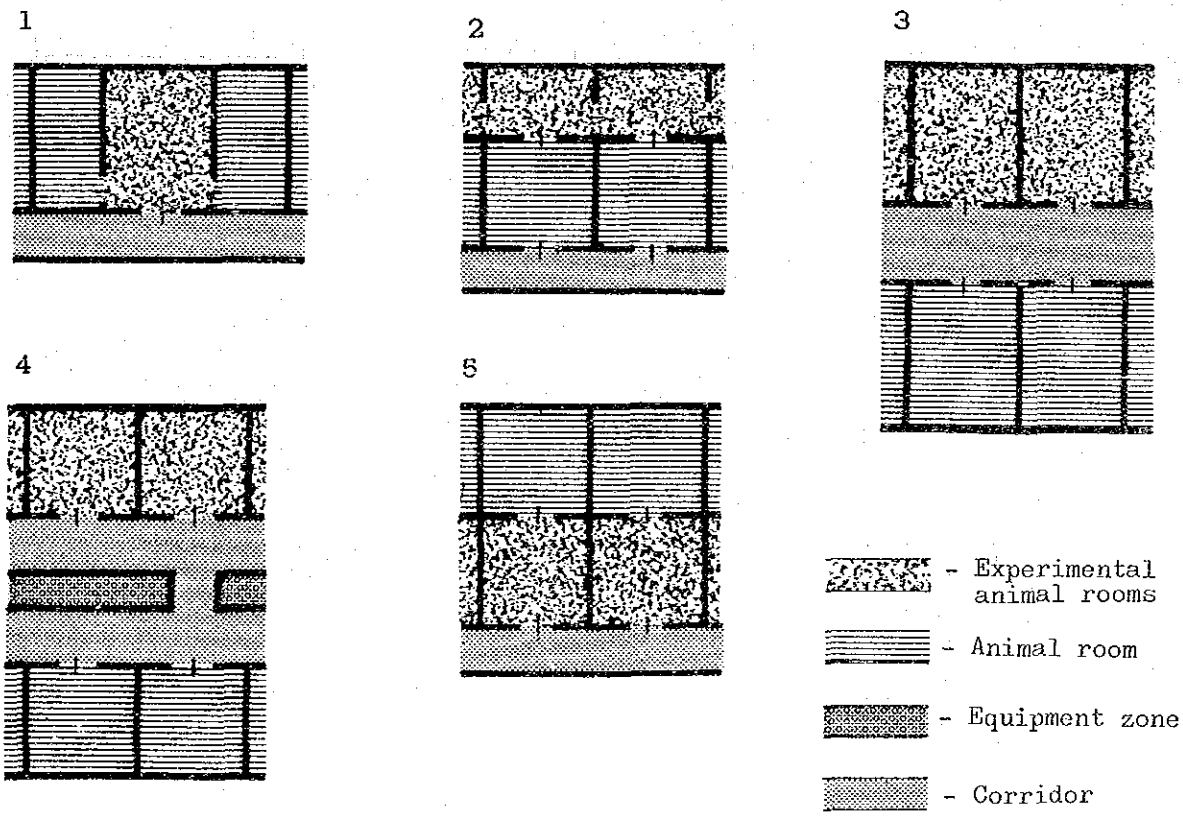
Table 5 Metabolic amount classified by species and required amount of ventilation

Animal species	Weight (g)	Metabolic amount. no. of animals equivalent to that of man	Required for keeping the air fresh		Description
			Air volume (m/NO.)	Amount of ventilation (m/h/NO.)	
Mouse	21	672	0.085	0.85	More moved around at midnight
Rat	200	110	0.113	1.27	
"	400	73			
Hamster			0.113	2.54	
Guinea pig	410	70	0.170	1.7	
Rabbit	2,600	21	0.283	3.2	
Cat	3,000	16	1.0	17.0	Metabolic rate is considered almost same as that of man
Monkey	3,000	16	-	-	
Dog	14,000	5	4.25	4.72	

2-4-8 Allocation of animal rooms and laboratories

It is desirable to have free access between experimental animal rooms and laboratories. It may be an idea to have a laboratory between two animal rooms when the rooms are arranged on the same line. When a building has a corridor in the middle, animal rooms are often arranged on one side and laboratories on the other. In the current project plan, animal rooms will be arranged along the window and treatment rooms on the side of corridor. Arrangement patterns shown hereunder are so proposed for raising up movability and workability within the minimum space of laboratories.

Fig. 9 Allocation of animal rooms and laboratories



2-4-9 Energy production of experimental animals

The following Table shows energy output, body weight and body surface area.

Table 6 Energy Production

Animal species	Body weight (kg)	Body surface area (Square meters)	Energy output *	
			(cal./kg./day)	(cal./square meter/day)
Man	56 - 65	1.65 - 1.83	23.2 - 25.5	790 - 910
Baboon	6.2	0.40	48	760
Chimpanzee	38	1.1	29.2	980
Macaque	4.2	0.31	49.3	675
Rhesus monkey	3.2	0.26	48.4	610
Dog	11.7 - 15.5	0.58 - 0.65	33.5 - 38.5	770 - 800
Rabbit	3.5	0.2	47	810
Guinea pig	0.8	0.07	62	690
Rat	0.2	0.03	130	830
Mouse	0.02	0.005	170	525

Reference

Comparative Biochemistry. (Edited by M. Florkin, H. S. Mason) Vol. 1 Sources of Free Energy. p.495 (1960) Academic Press. New York and London.

W. S. Spector, ed., "Handbook of Biological Data." National Academy of Sciences - National Research Council, Washington, D. C., 1956.

* The energy output values represent basal metabolism.

2-4-10 Project animal production

The dimensions of animal breeding facilities and the number of animal in the annual production were decided in late 1977 in accordance with the supply and demand of animals. However, the current project has to be initially planned in both the construction and equipment to meet an eventual increase of supply and demand in future through the possible reproduction of animals. The following are the number of animal species in the annual production requested by the Government of the Socialist Republic of the Union of Burma and the same currently proposed for the current project.

Table 7 Number of animals requested by the Government of the Socialist Republic of the Union of Burma and Number of animals proposed for the current project

Animal species	(per year)	(per year)
Mouse	10,000	16,000
Rat	5,000	3,800
Guinea pig	3,000	1,200
Rabbit	3,000	1,200

The above figures proposed for the project are based on the production ratio of about one half of the Japanese domestic production. As for larger size of animals, they are expected to be raised and used for experiments. In such a case, the existing facilities may be used, but it will be necessary to plan the construction of additional facilities.

2-4-11 Room dimensions

The floor area required for each animal room is as follows. Each floor area given in an attached Table is merely estimated for the project plan, and thus there may be some deviation in the final plan.

Table 8 Area table

Control Section (General)	Entrance Hall	18		
	Office room	18		
	Locker Lavatory Shower Breeding section	36		
	Locker Lavatory Shower Laboratory section	36		
	Storage room	18		
	Machine room	36		
	Electric room	18		
	Boiler room	18	Total	198 m^2
Breeding Section	5 Breeding rooms	36 x 5 = 180		
	S.P.F. room	18	Total	198 m^2
Laboratory Section	4 Laboratories	18 x 4 = 72		
	1 Laboratory for infectious dieseases	25.5	Total	97.5 m^2
Washing and Sterilizing Section	Washing room	36		
	Working space	36		
	Storage room (equipped with a washing room)	18		
	Storage room and finishing room (Food)	39		
	Storage (Bed)	6	Total	135 m^2
Public use	Corridor	534	Total	534 m^2
	Total		Total	1,162.5 m^2

2-4-12 Flow diagram

The flow of the following 5 items is taken up here. Each one of these items has to be studied as an independent flow for the smooth management of animal rooms without affecting the flow of other items.

1. Research staffs (could also be administrative staffs)
2. Animal (in principle, animals are not expected to be sent in this research laboratory through any outer sources)
3. Equipment (cages, etc.)
4. Feed
5. Waste (animal carcass and feces)

Fig. 10 Research staff flow

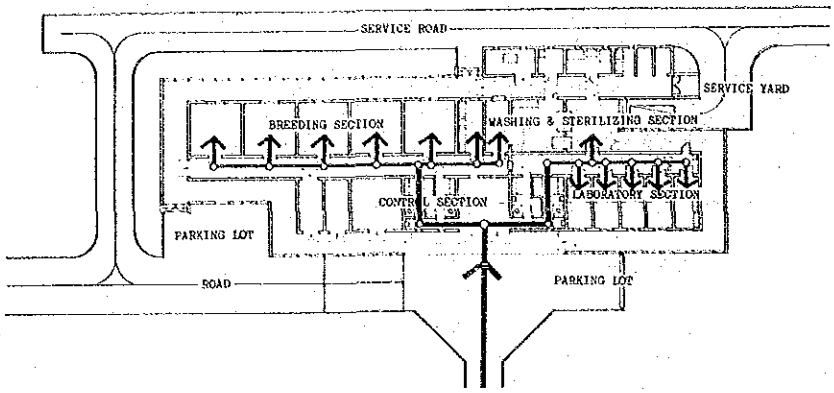


Fig. 11 Administrative staff flow

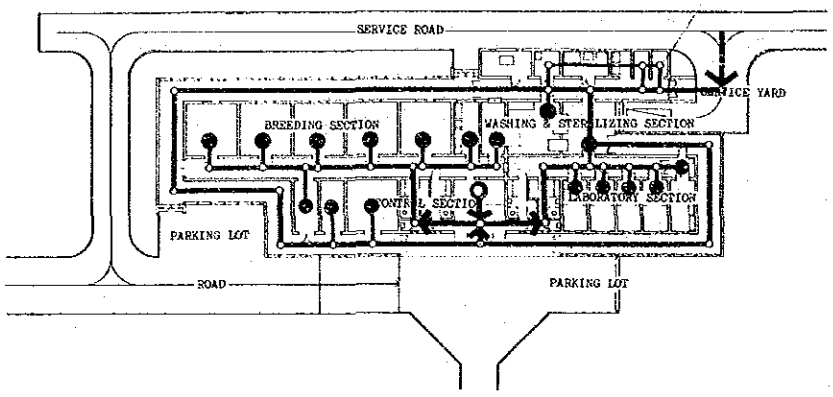


Fig. 12 Tools and instruments flow

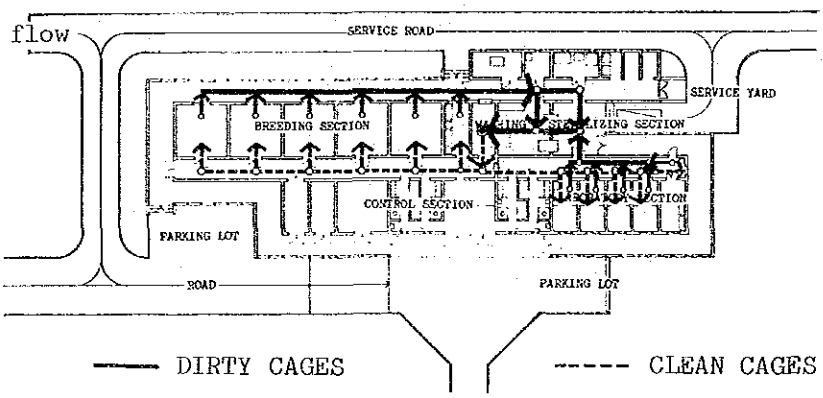
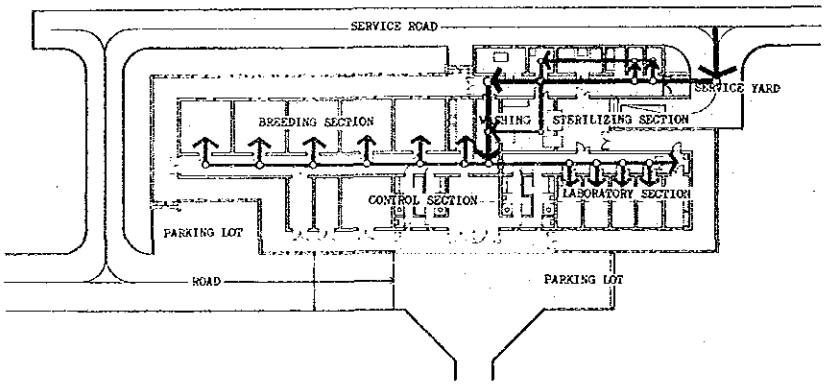


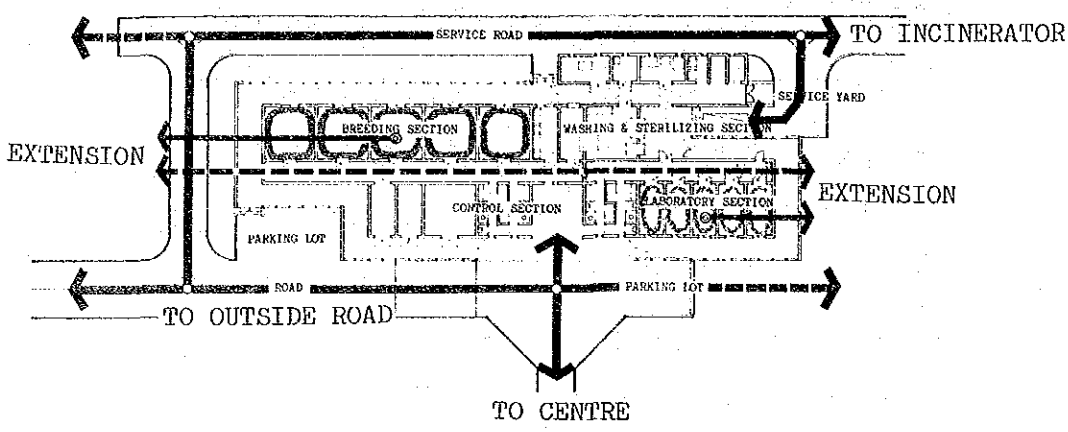
Fig. 13 Feeds flow



2-4-13 Traffic movement and functional diagram

Internal functions of animal rooms can be determined with the effective research activities as well as Animal House environment conformable with the requirements. Such internal functions closely related with an external traffic system will determine an entire functional system of Animal House. Also, a correlation between an axis of external traffic surrounding animal rooms and an axis of internal traffic may form a functional concept of Anima House.
A traffic axis of internal functions being developed toward a direction same as that of external functions (roads) means that an entire building coping with the change of internal functions is at least in a flexible structure. As the result, an axis of flow of various items inside animal rooms will be established in parallel with an axis of external roads.
Internal functions will be divided into breeding room and laboratory on the main axis of clean corridor and contaminated corridor, and each room will be arranged centering around sterilizing and washing rooms. When the concepts on the distribution of these two functions are combined, a basic model of Animal House will be finalized. Furthermore, the resultant internal functions of these animal rooms will be made accessible by the outsiders for the eventual reproduction in future. The following functional distribution is extensible. In other words, this is a concept indicating a system which, in future, will allow some variation of such factors that could hardly be determined at present.

Fig. 14 Traffic system and functional diagram

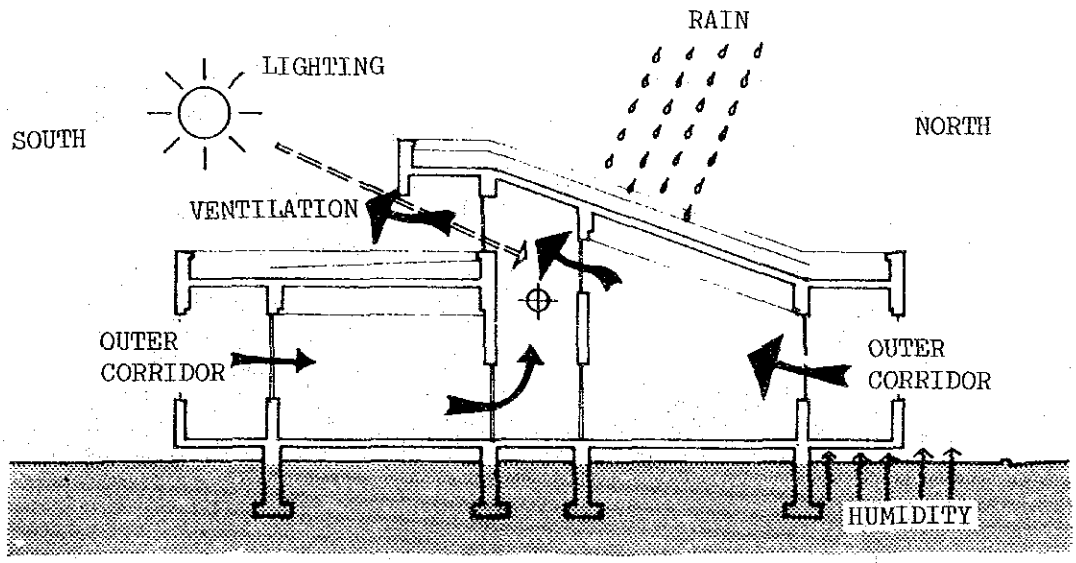


2-4-14 Model and materials

This very model decides the distribution of internal space, but it also has to be a factor clarifying its correlation with an external environment. Particularly, main factors deciding the model in the current project will be influenced with the environmental factors in Burma, for the natural environment (much rain, much moisture and high temperature) as well as social and economic environment (social custom, system and economic conditions, etc.) will have a significant meaning in determining the features of the project facilities. Animals are quite sensitive by nature against their living environment, and thus the Animal House has to be surrounded by an environment far more strict in every sense than that artificially created for facilities to be utilized by human beings. However, animal rooms subject to the current project plan will have to match the

social and economic systems and well harmonize with the natural environment in Burma upon planning this particular facilities. This is a concept based upon the necessity of coping with the minimum requirements for an artificial environment to be created for animal rooms in this country.

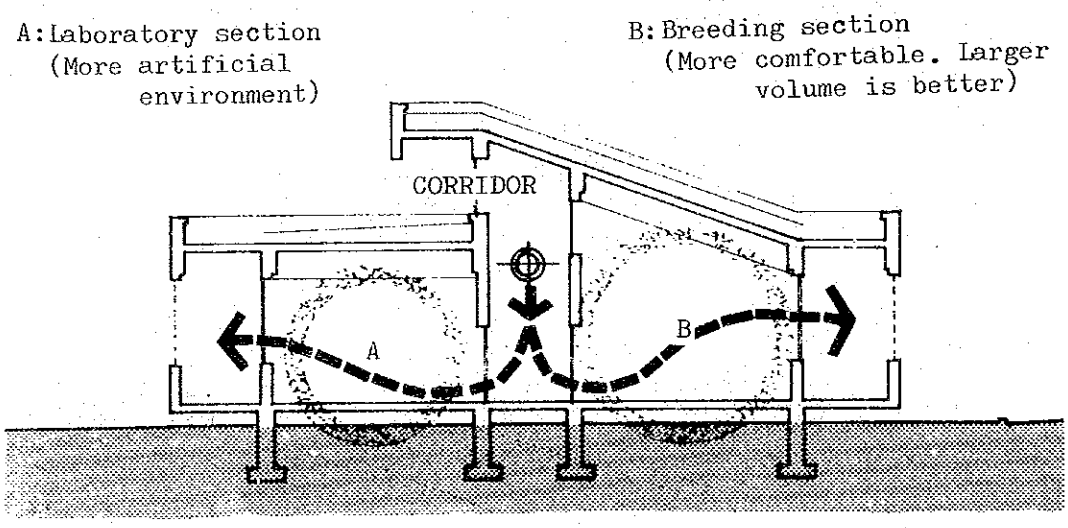
Fig. 15 Building model and natural environment



Floor slab will be floated so that the possible damage due to humidity or water could be minimized. The construction materials and model of Animal House are mutually supplementing. Just as much as the determination of a building model be influenced by various environmental factors in Burma, it is considered necessary to use as many local materials as possible (as long as environmental functions inside the Animal House could be maintained).
(The above is judged from the actual results experienced in the past construction carried out for various facilities of the Biomedical Research Centre).

Most of materials to be used for the subject structure will be procured in Burma. As for finishing materials, the minimum quantity of materials such as paint, tile, etc. will be imported from Japan, and aluminum sash, glass, steel door frame, instruments and equipment will also be obtained from Japan.

Fig. 16 Building model and artificial environment



2-5 Structural design

Since the basic concepts of structural designs, namely the subject structure, should be determined by reproducing the overall plans for the existing facilities and how they have met the actual requirments, the structural designs for the current project have been decided as follows.

The current project will be a reinforced concrete building of a Rahmen structure with a main frame work consisting of beam and column, and bricks locally procured be used for both internal and external curtain type walls. The wall will be resistant in its build for self load as well as external forces such as seismic intensity and wind pressure.

Whatever necessary calculations will be based upon various calculation standards which have been adopted to date by the Institute of Japanese Architects, and the methods currently being employed in Japan will be applied to the actual calculation of allowable stress, elastic stress and proportioning, etc.

As for design loads (load and wind, etc.), the values given in Article 85 of the Building Standards Enforcement Ordinance of the Japanese Government will be applied. The lateral seismic coefficient value for earthquake load will be 0.15 which is given for the facilities now being constructed.

As the result of geological survey carried out for the site, sandy clay obtained from the vicinity of about G.L. -1.00 m was found to be a supporting ground for which a foundation method will be employed.

As the result of soil test (direct shear test), the drawings will be made on the assumption that the bearing capacity of ground is 5.0 t/m^2 for a longer period. Sampling in the soil test was made at D.H. as

deep as 1500 mm whose location was 7.68 m East of Ⓝ and 117.85 m north of ⑥ on the drawing for Biomedical Research Centre Building. The bearing capacity of ground will be confirmed by plate loading tests to be carried out on the excavation surface.

The following materials will be used for the current project.

Concrete	— Not less than Fc = 150 kg/cm^2 in 4 weeks' compressive strength
Reinforcing steel	— Hot rolled steel bar (JIS C3112) equivalent to SD30

2-5-1 Penetration test

The following is the result obtained by the simplified penetration test with the reinforcing steel rods which was carried out by the Construction Corporation in the vicinity of the proposed Animal House on 29th and 30th November 1977. For the above test, a hole 1500 mm square was drilled at three divided times (0-500 mm, 500-1000 mm and 1000-1500 mm). Each settlement produced by the weight of people who stood on the reinforcing steel rod placed thereupon was measured; the total load was 66.07 kg.

1. Soil test starting date — 29.11.77
   Time — 11:30 hr
2. Soil test finishing date — 30.11.77
   Time — 15:20 hr
3. Coordinate position of
   A from Ⓝ line & ⑥ line X = 7,680 mm
   Y = 117,750 mm
4. Level of position A with
   Reference to ±0.0 level — -3650 mm
5. Level of water table — -4850 mm

Table 9 Soil test data

Depth mm	* A Pn mm	* B Pn mm	* C Pn mm	* D Pn mm	* E Pn mm	Weight kg	Remarks
0	100	65	20	30	30	Test rod =13.00 Man =53.07 Total 66.07	* - Position Pn-Penetration Diameter of test rod - 25mm
0-500	30	30	57	42	295		
500-1000	270	310	330	260	200		
1000-1500	55	70	400	40	130		

Fig. 17 Penetration test method

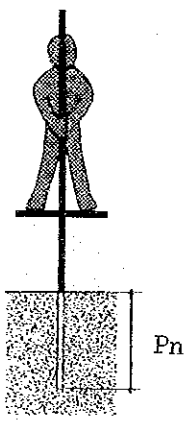
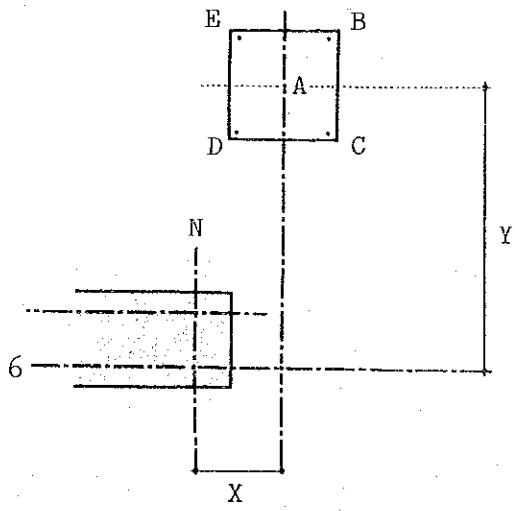
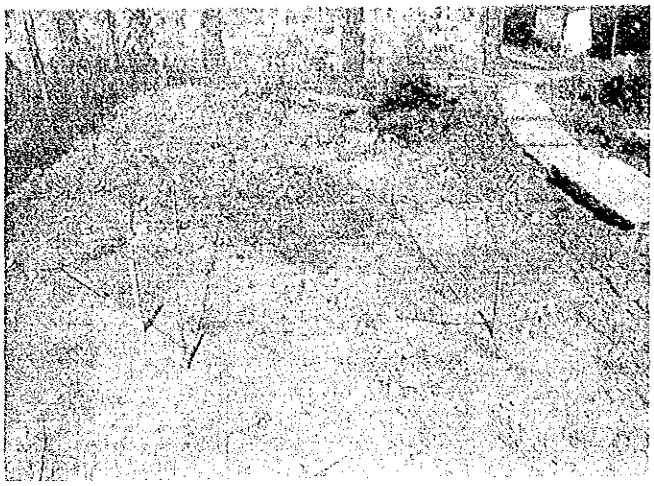


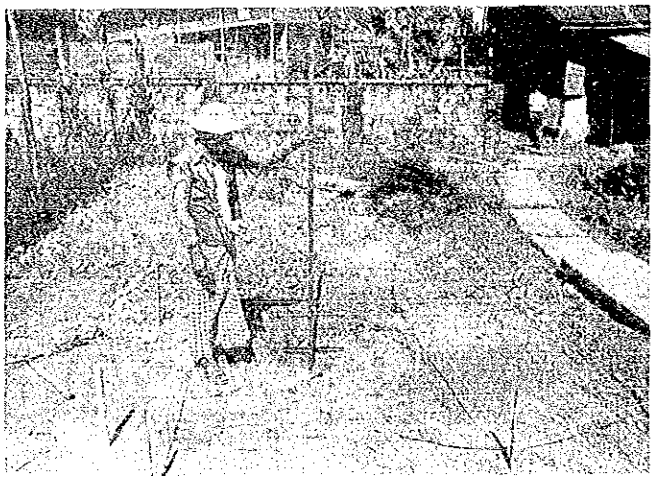
Fig. 18 Site of penetration test



The penetration test was performed in the following order.

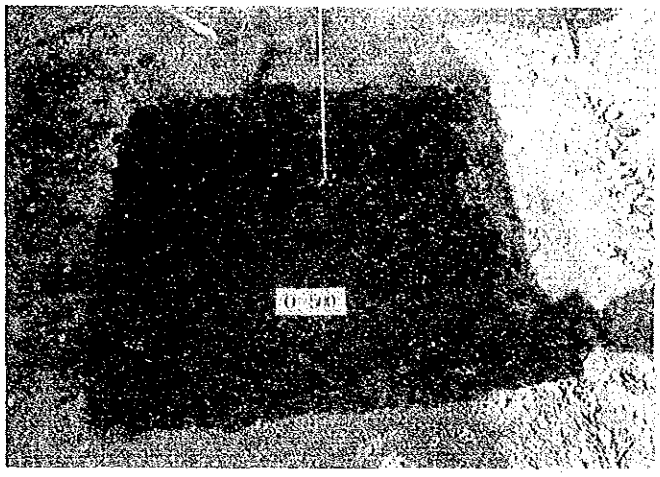


1. The soil test location was a hole of 1500 mm square drilled in the ground extending from a street between C.R.C. building and B.R.C. building now being constructed.

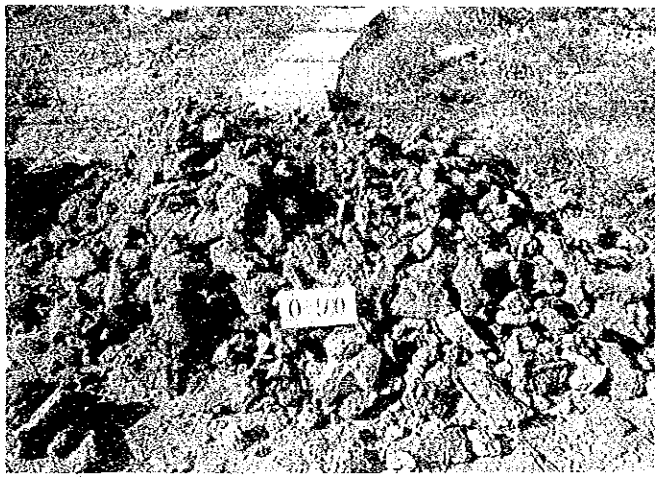


2. Reinforcing steel rods for the test, each in a diameter of 25 mm, were crossed and nothing was attached to its lower end which was flatly cut off.

3. The settlement produced by the weight of a tester who stood on the testing rods was then measured. (The existing ground)

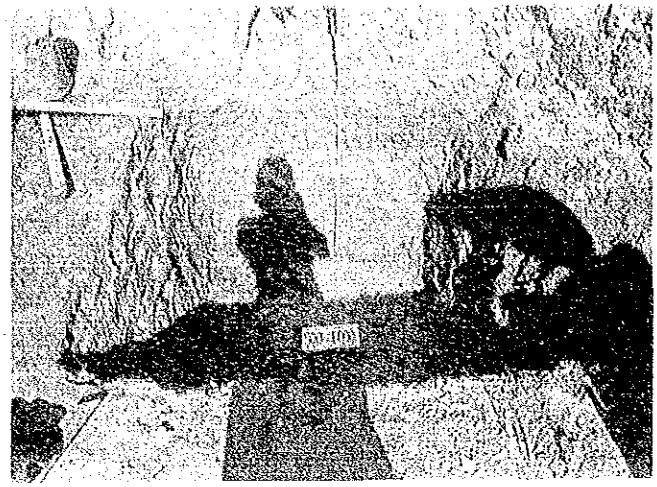


4. In the upper centre of this picture showing the ground as deep as 0--500 mm, water is coming out.

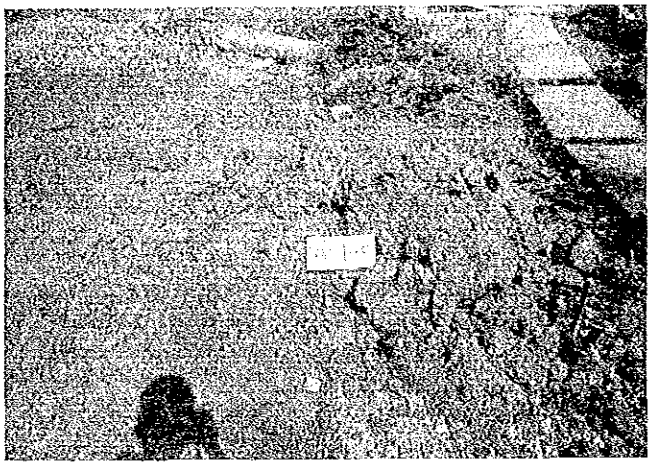


5. The soil of the test site drilled as deep as 0--500 mm seemed to be the surface soil down to 300 mm but clay in the lower layer.

6. The settlement produced by the weight of a tester who stood on the testing rods was measured. (-500 mm level)

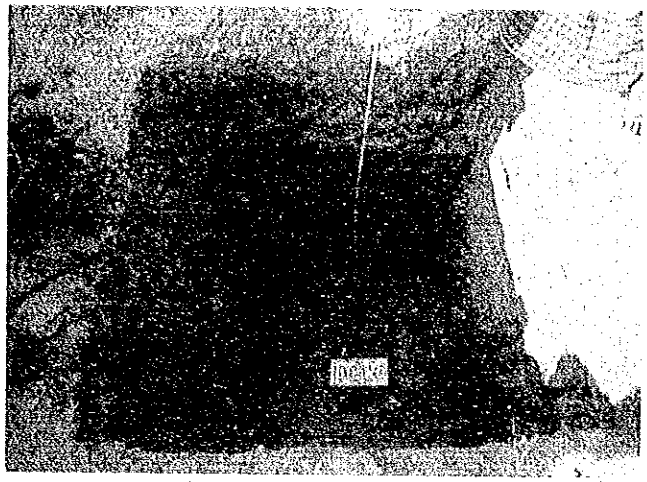


7. When the ground was drilled down to the depth of -500 - -1000 mm, water gushed out in a steady flow.

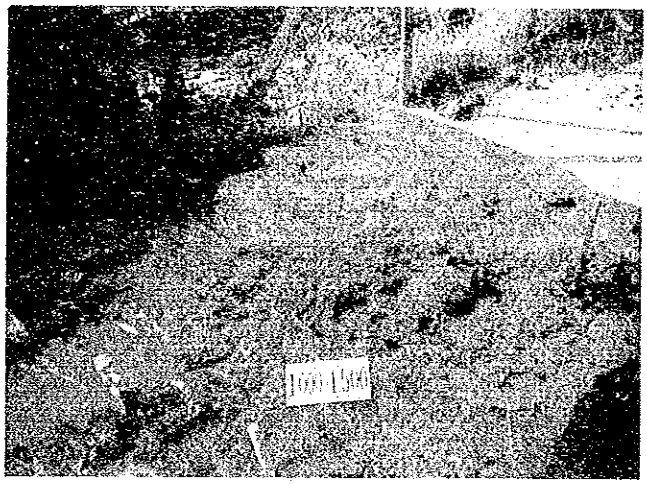


8. The soft clay layer as deep as -500- -1000 mm containing moisture was presumably similar to the soil obtained from the site of Library.

9. The settlement produced by the weight of a tester who stood on the testing rods was measured.



10. The ground drilled down to the depth of -1000 - -1500 mm. The change of soil profile is seen in the vicinity of the -1200 mm level (a little darker portion in the picture), where water gushed out in a steady flow, but it was not seemingly the groundwater but out of the waterway between the bonds.



11. The soil seen in a layer as deep as -1000 - -1500 mm. Though the soil was in a state of sludge containing moisture, it seemed to be a clay layer. The changed portion of soil profile contained reddish brown gravels.

12. The settlement measurement was done with the weight of a tester who stood on the testing rods (-1500 mm level). The test described in 2-5-3 was carried out by the Construction Corporation on this ground level in accordance with the JIS and ASTM standards.

2-5-2 Soil test result

Soil Sample collected from 1.5 m below Ground Level of Burma 1 Medical Research Institute Project.

1. Classification test

   a. Grain size analysis (ASTM-DH22-5HT)

      SAND-Coarse(2.0-0.6)mm = 2%
      -Medium(0.6-0.2)mm =12%
      -Fine (0.2-0.002)mm=36%
      SILT(0.06-0.002)mm =35%
      CLAY(Less than 0.002)mm =15%
      Fine minus No.200 sieve =52%

   b. Atterberg limits (ASTM-DH23-5HT)

      Nonliquid (NL)
      Nonplastic(NP)

   c. Visual classification

      Yellowish Brown to light grey SAND & SILT some clay trace to some fine soft Lateritic Gravel.

2. Moisture content, density & U.C.S. test (JIS-A1216/58)

   a. Institu Moisture Content - 22.5%

   b. Institu Wet Density - 124.3 lbs/cu.ft.

   c. Institu Dry Density - 101.5 lbs/cu.ft.

   d. Unconfined Compressive Strength Value = 980 lbs/sq.ft.

   e. Strain Value (at failure) ..... = 3.6 Percent

3. Direct shear test (Laboratory manual by William T. Lambe)

   a. Angle of Internal Friction ..... = 21°30'

   b. Cohesive Strength Value ..... = 250 lbs/sq.ft.

4. Consolidation test (JIS-A1217/60)

Consolidation % at 0.5 T.S.F. = 2.2
Consolidation % at 1.0 T.S.F. = 3.2
Consolidation % at 2.0 T.S.F. = 4.4
Consolidation % at 4.0 T.S.F. = 6.0
Consolidation % at 8.0 T.S.F. = 7.8

5. Specific Gravity = 2.63 (ASTM-D85H-52)

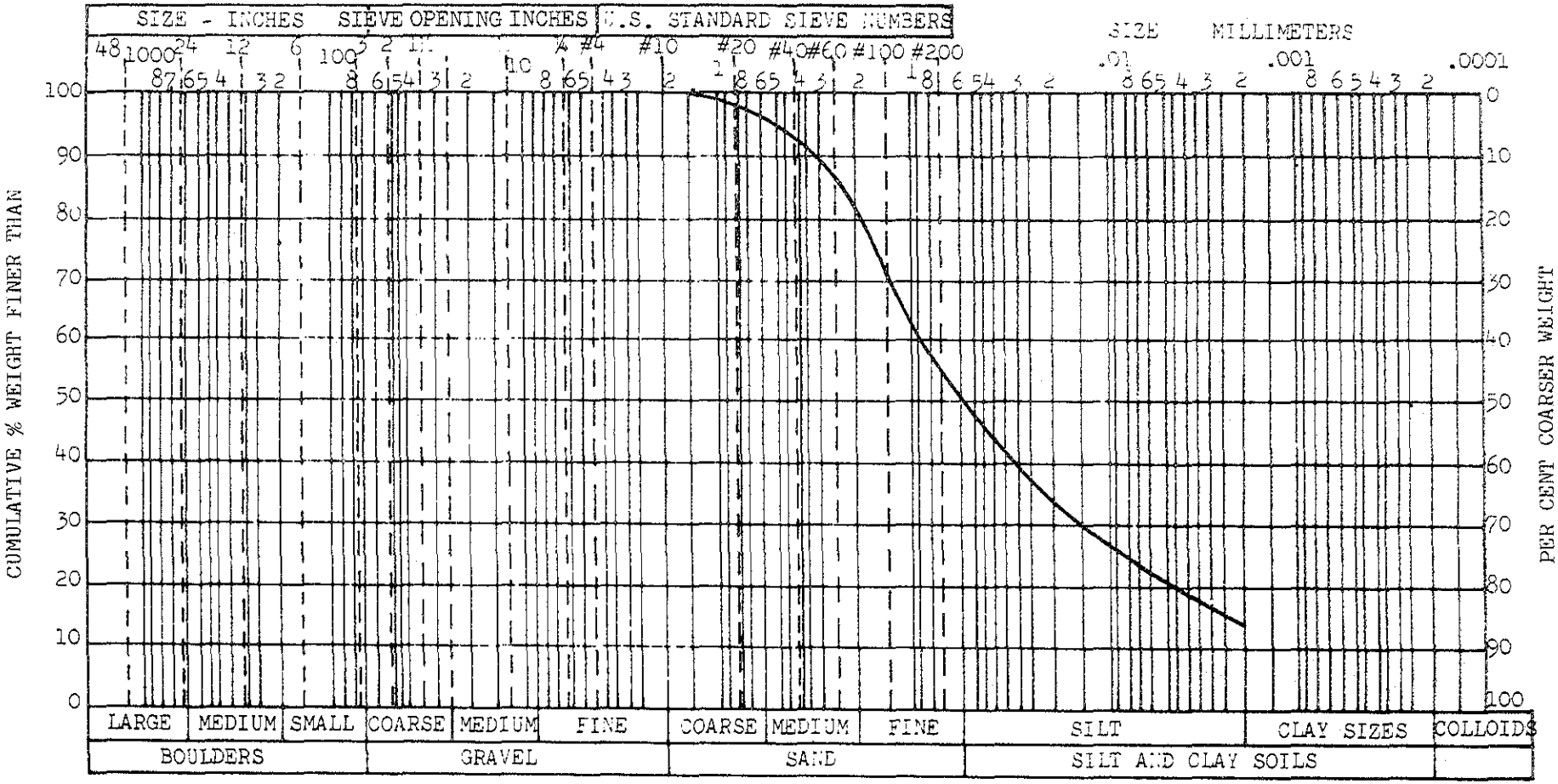
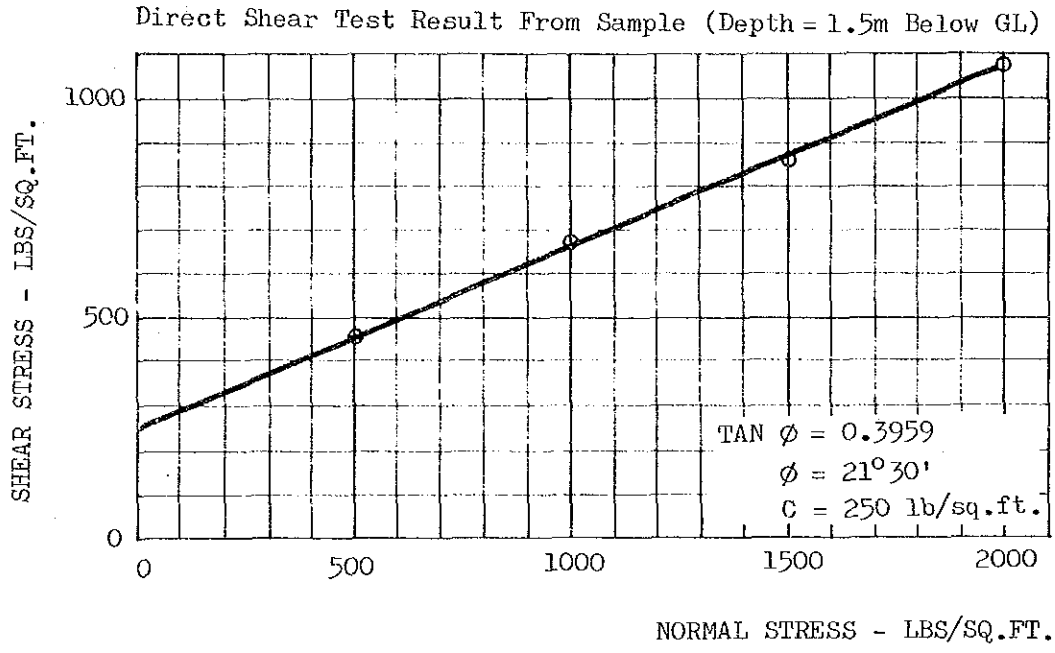


Fig. 19 Grain size distribution

Fig. 20 Direct shear test



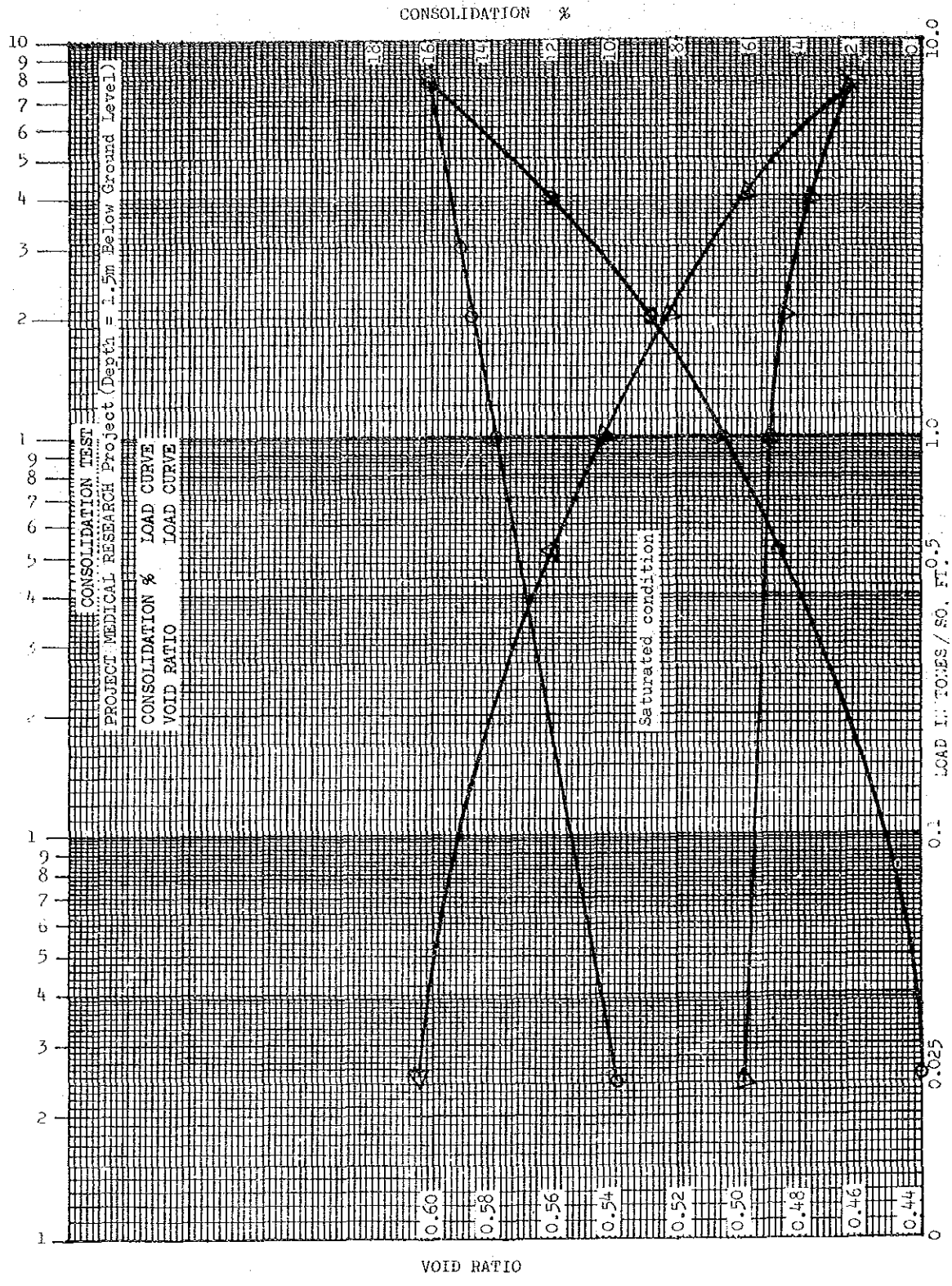


Fig. 21 Consolidation test

2-6 Equipment plan

The following are the elements which decide the equipment for Animal House, and the conditions related with these elements will be finalized with due consideration of various other factors in Burma.

1. Ventilation
2. Temperature
3. Humidity
4. Lighting
5. Disposal
6. Washing
7. Sterilization

2-6-1 Air conditioning and ventilation equipment

Breeding room and laboratory will be air conditioned. The removal of humidity will mainly be aimed at in the air conditioning system rather than the adjustment of temperature. Thus, air conditioner will be installed in each room. The cooled air will be led out to respective rooms by all-fresh-type of packaged air conditioner, and then the air will be exhausted thereafter by ventilator.

Ceiling fans will be set in the rest of rooms and ventilating fans will be employed for a sterilization section, while the natural wind be led into other rooms for ventilation. It is particularly important to adjust the pressure so that the air will not be backflowed from either breeding room or laboratory to corridor.

Sterilization steam will be obtained by burning oil (A or B heavy oil or Kerosene). This steam can be used for cleaning laboratories for infectious disease and hot water for laboratory sinks.

2-6-2 Water supply, drainage and sanitary equipment

1. Water supply

The water supply pipe of the Research building will be divided and directly connected with a water pipe inside Animal House.

2. Drainage

Storm water will be led out to ponds through street inlets along the building. Sanitary sewage, waste and experimental soil water will be stored in a distributing reservoir for about one day, and pumped up to a septic tank for the treatment. The drainage outside the building will be completed before starting the current project.

3. Gas

Gas will not be provided as the partial installations, and a gas generating apparatus will be brought in for the use whenever necessary.

4. Incineration

Incineration equipment will have to be capable of dispose approximately 50 kg of small animals per hour. Foundry pig iron will be used for the body of equipment since an oil burning system will be employed. Although it may have nothing to do with the function, a chimney as tall as 8 m will be erected for the purpose of removing smell.

5. Hot water supply

Electric heater will be used for boiling drinking water and steam for hot water to be supplied to laboratories. A mixing

valve will be used for the supply of hot water to whichever places required. Hot water will not be supplied to washbasin or shower in the general rooms.

2-6-3 Electric power equipment

1. Receiving and transforming

A potential device installed in the building transforming about 250 KVA will supply 3 Ø 4W 400V 1 Ø 2W 230V and 1 Ø 2W 115V for the electric light and laboratory electricity.

A breaker will be operated by an electromagnetic controller. Draft chamber, clean bench and refrigerator being connected with self-excited generator will be cut over automatically.

2. Feeder line and power equipment

Piping and wiring works will be carried out from electric switchboard to power controlling and electric light distributing boards, and wiring works from power controlling board to each electric motor will also be done.

3. Electric light and plug socket installations

Installation of lighting instruments, laboratory and general plug sockets as well as the required piping and wiring works will be done. Lighting for breeding room and laboratory will be around 300 lux and about 200 lux for other rooms. When the service be interrupted, power will be supplied for refrigerator and so on by a non-utility substation.

4. Telephone services

Telephones will be connected with a switchboard for section

party telephones within a station yard which are now being planned to be installed in Research building and Library. Telephones will be installed in breeding, laboratory and control sections respectively.

2-7 Construction cost

The construction cost will be estimated on the following conditions in accordance with the estimated cost of respective materials and machinery based upon preliminary designs. However, the Japanese Government Grant with which the Socialist Republic of the Union of Burma will establish the Animal House belonging to the Biomedical Research Centre shall be allocated as follows.

o Conditions

1. Ordering will be executed in the same manner as was done for the 1st and 2nd term constructions.
2. Materials and machinery will be free from duties same as those obtained for the 1st and 2nd term constructions.
3. Price rise will be absorbed to some extent.
4. Aggregate, cement, lumber, brick, slate and floor tile, etc. will be procured in the Socialist Republic of the Union of Burma.
5. Site will be flatly levelled and no obstacles be remained under the ground.
6. Materials and machinery temporarily provided for the 1st and 2nd term constructions could be used continuously.
7. Electric power and service water supply required for the construction works will be available on the site.

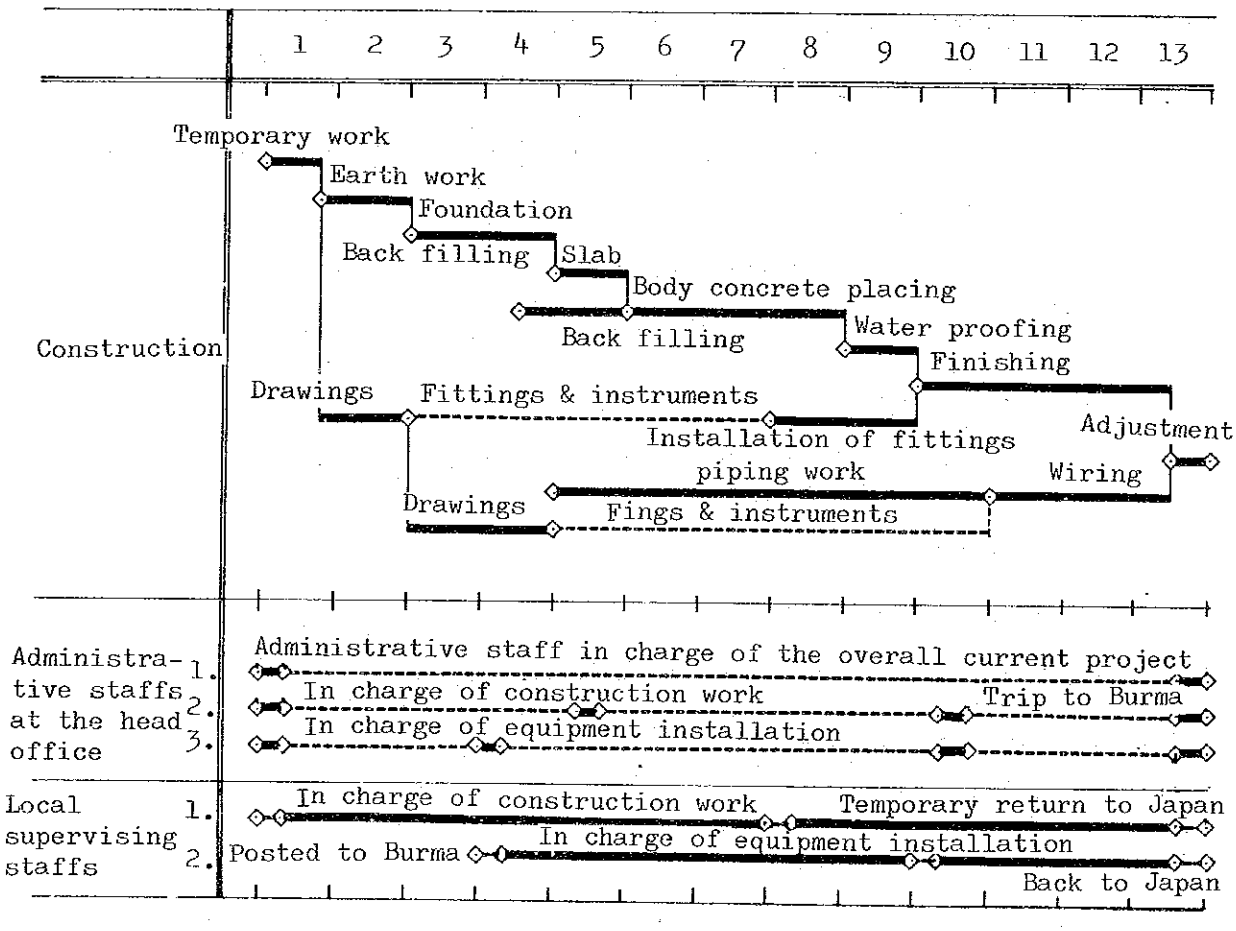
o Classification of costs

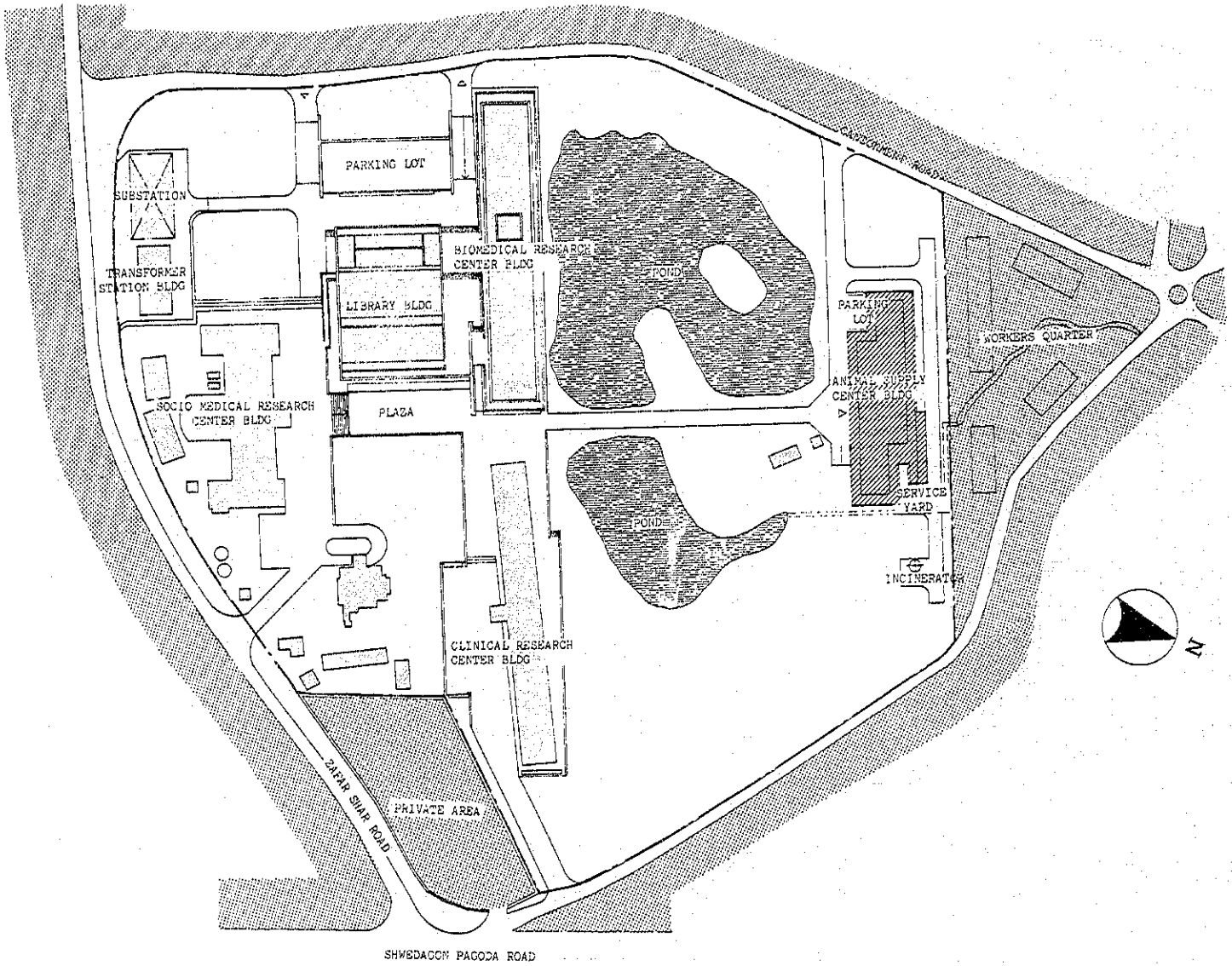
1.	Construction work	:	¥ 217,507,500
2.	Machinery, water supply and drainage equipment work	:	¥ 128,683,500
3.	Electric installation work	:	¥ 76,015,500
4.	General outdoor work	:	¥ 8,167,500
5.	Designing & supervising	:	¥ 69,626,000
	Total		¥ 500,000,000

2-8 Working schedule

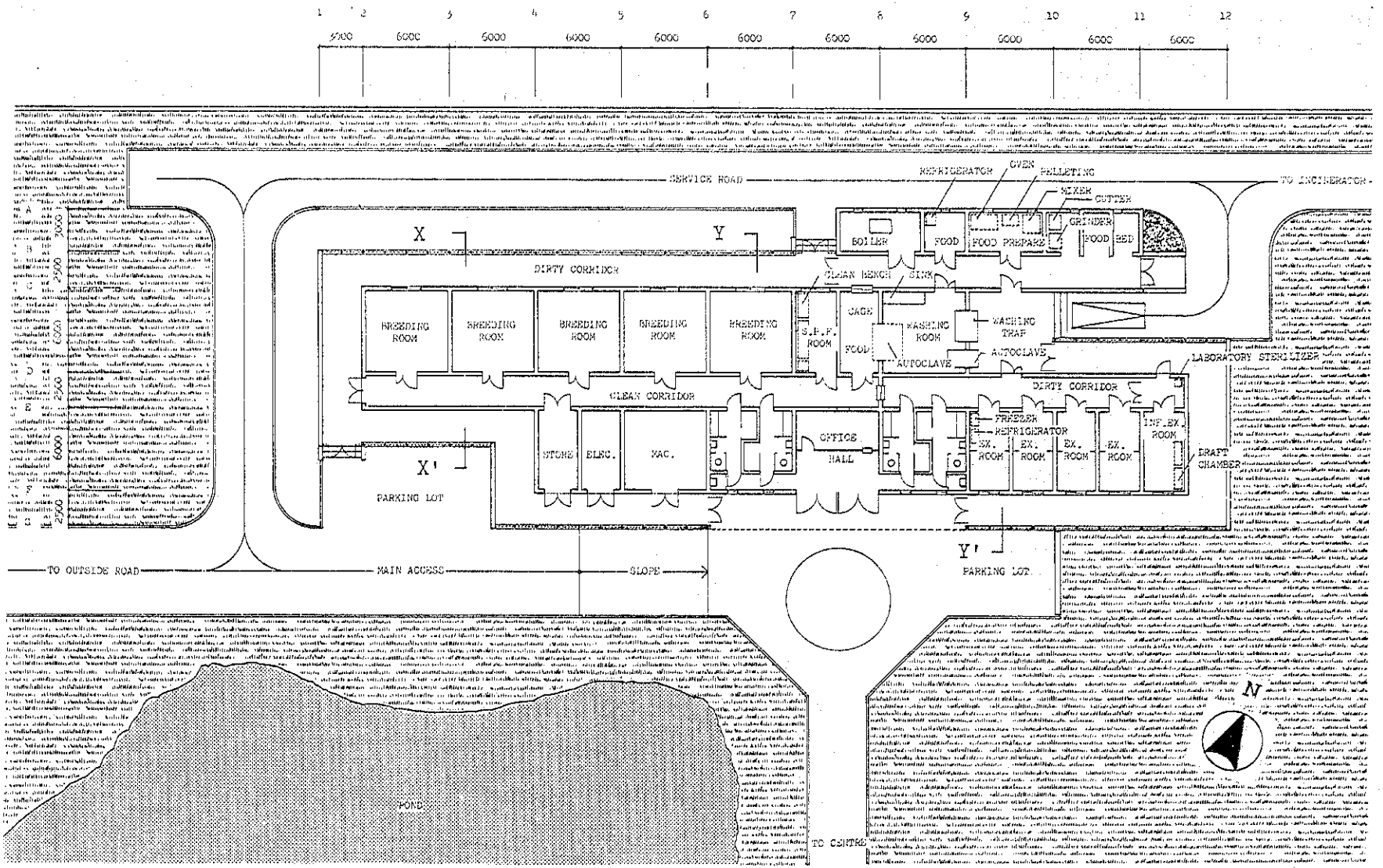
When form materials be procured smoothly, there won't be heavy delays in the working process schedule of the current project related with the Biomedical Research Centre in Burma. It will be possible to obtain such specific products as fittings, instruments and equipment from Japan along with the construction schedule. As for concrete placing, 60 ~ 70 m^3/day will be the maximum level in view of the results obtained in the 1st and 2nd term constructions. Form building and reinforcement works may take 3 times than that generally executed in Japan.

Fig. 22 Working schedule

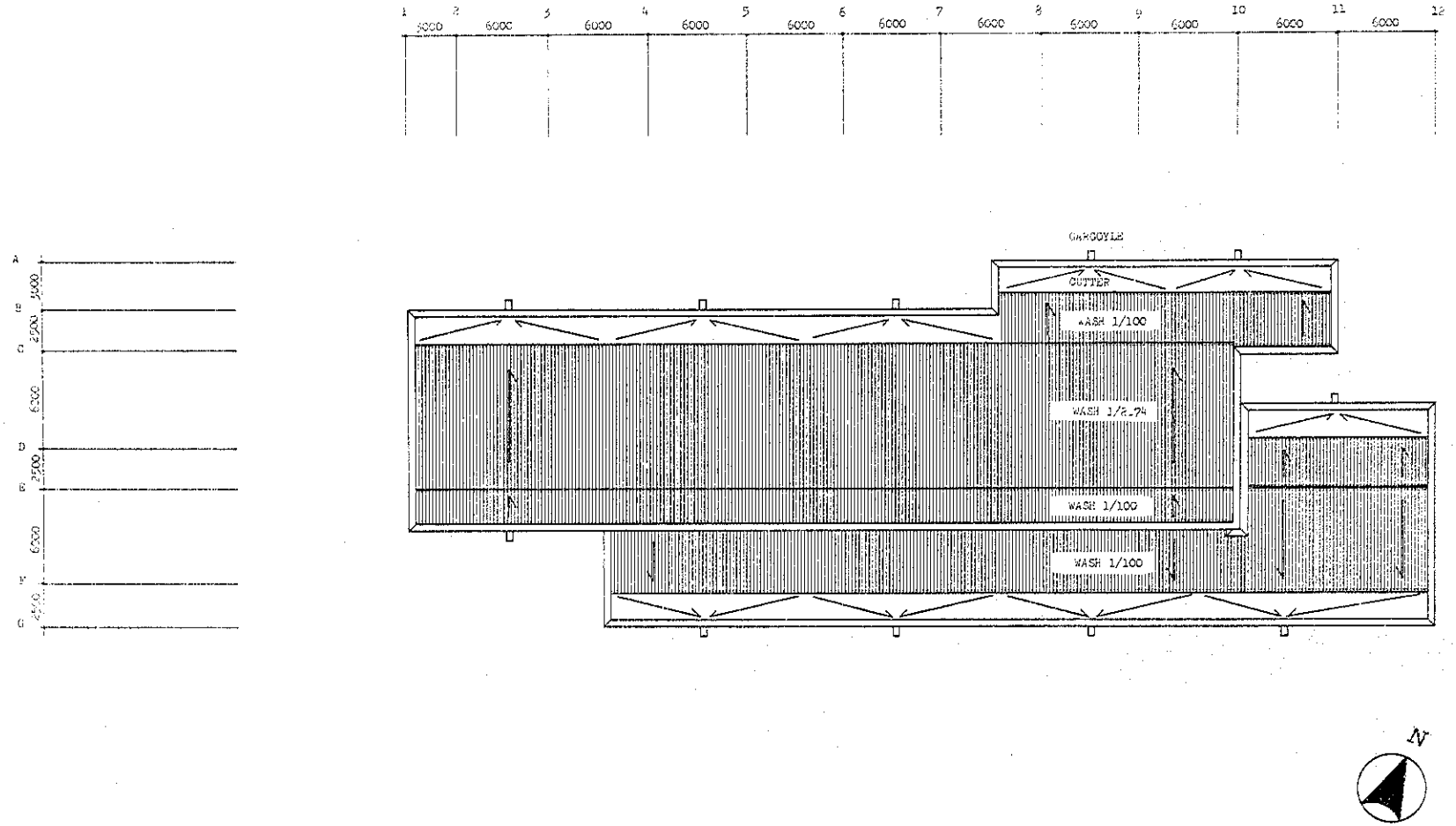




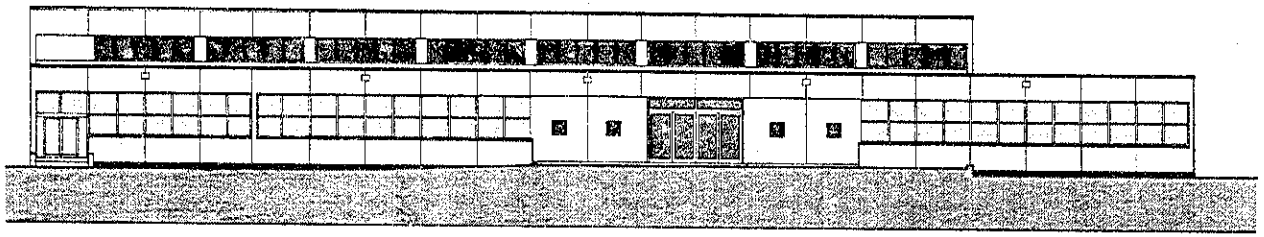
2-9-1 SITE PLAN



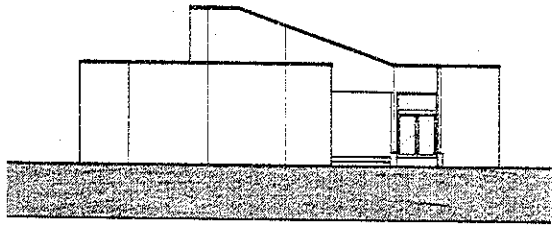
2-9-2 GROUND FLOOR PLAN



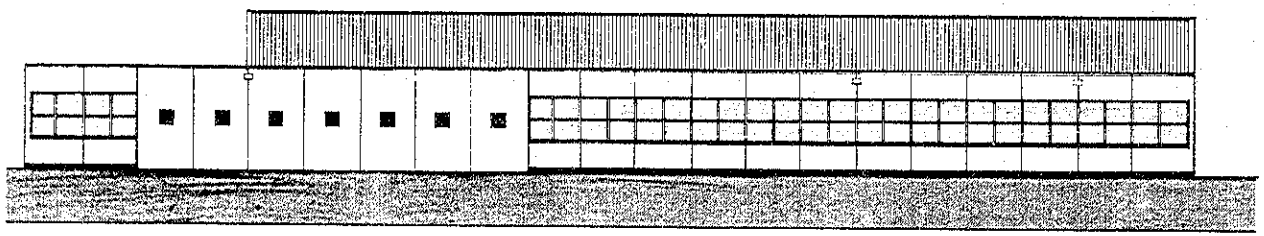
2-9-3 ROOF PLAN



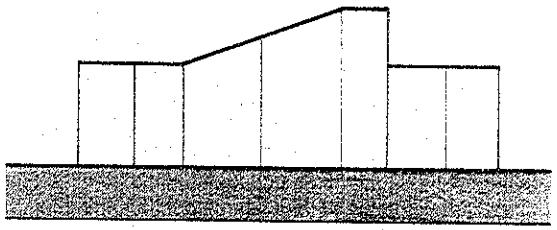
SOUTH ELEVATION



EAST ELEVATION

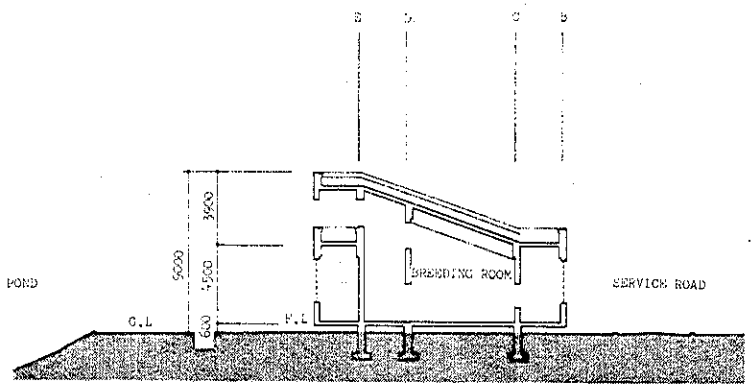


NORTH ELEVATION

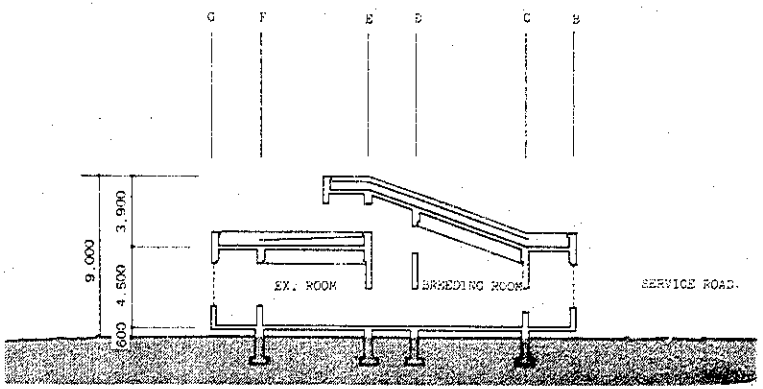


WEST ELEVATION

2-9-4 ELEVATION

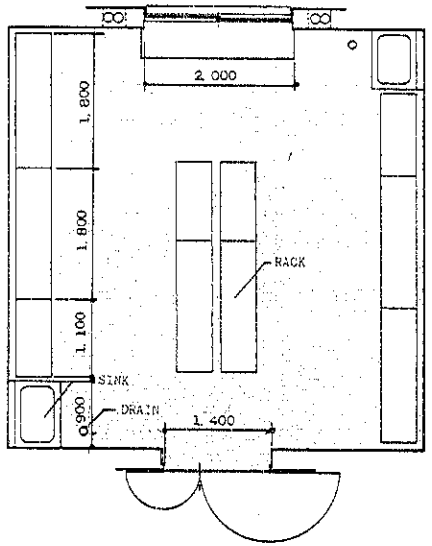


X-X' SECTION

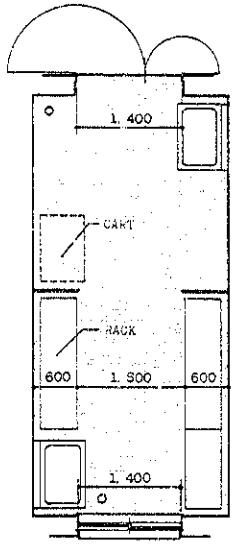


Y-Y' SECTION

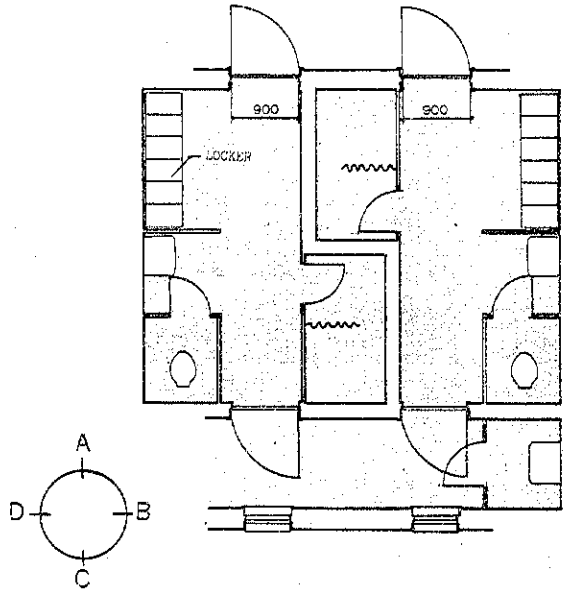
2-9-5 SECTION



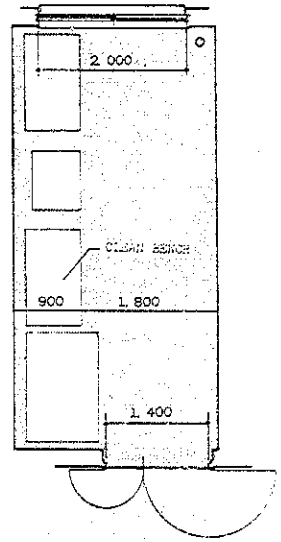
BREEDING ROOM (RABBIT)



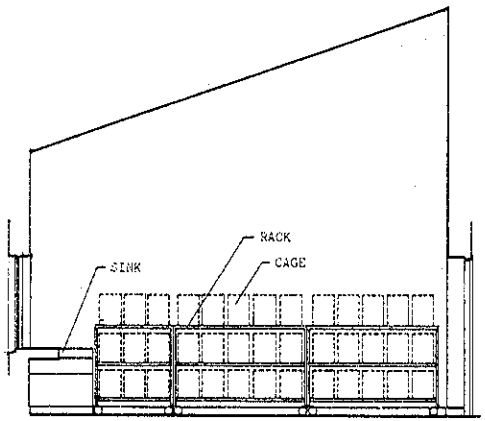
EXPERIMENTAL ROOM (RABBIT)



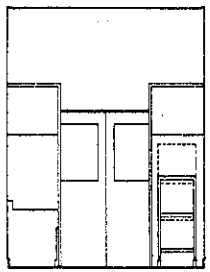
WATER SECTION



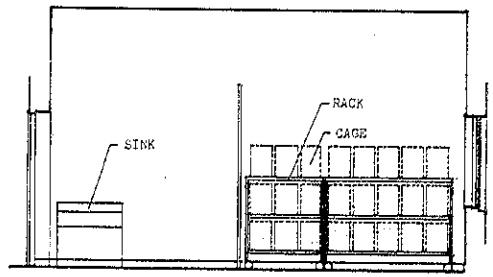
S.P.F ROOM



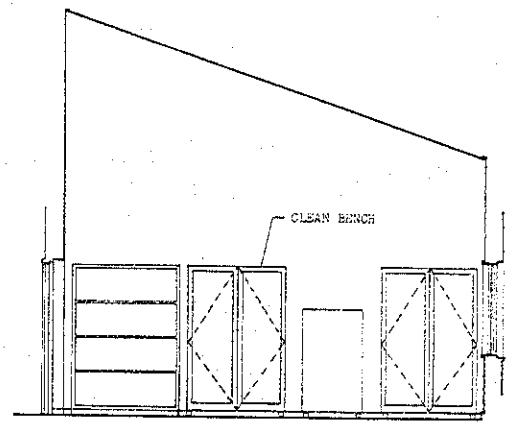
BREEDING ROOM - B



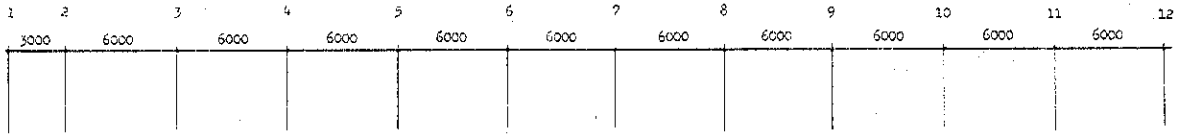
EXPERIMENTAL ROOM - A

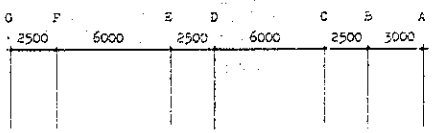


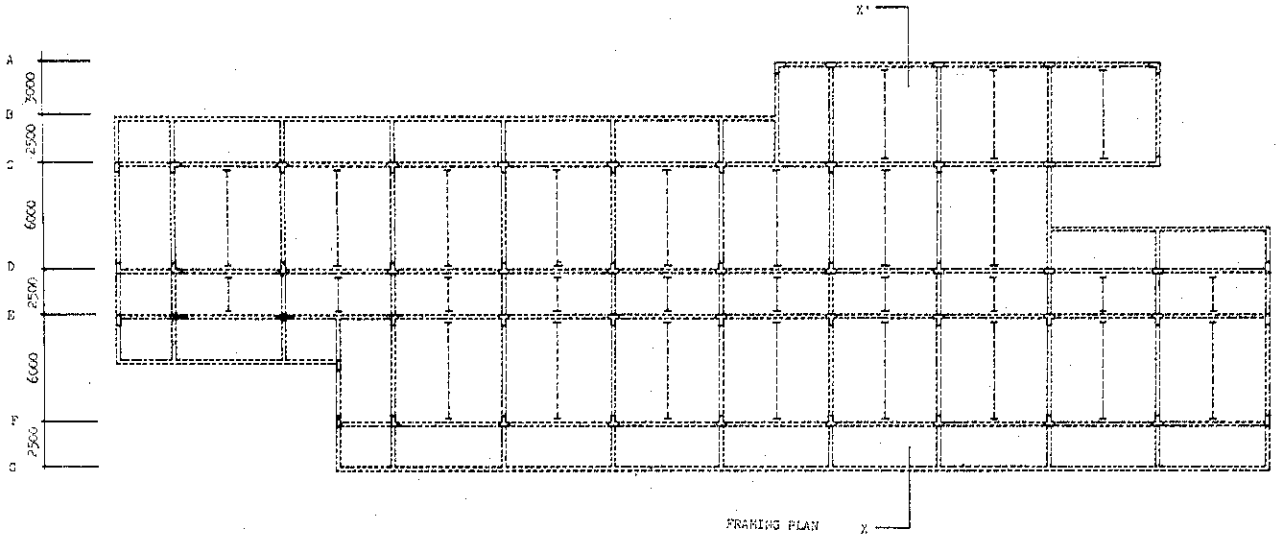
EXPERIMENTAL ROOM - B



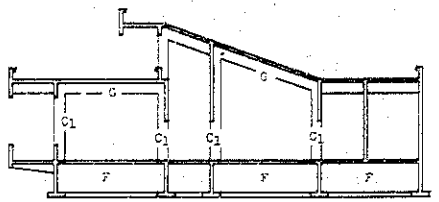
S.P.F ROOM - D



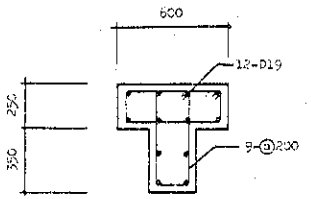




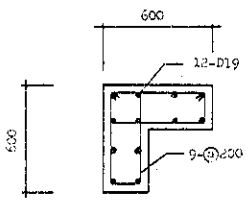
FRAMING PLAN



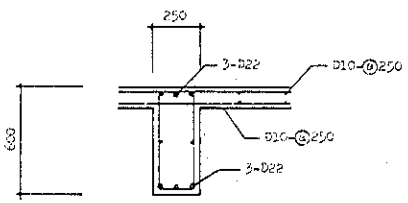
X-X' FRAMING ELEVATION



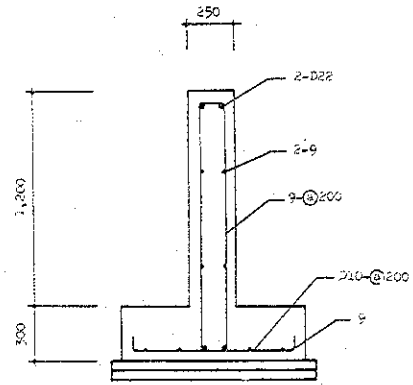
Column, C_1



Column, C_2

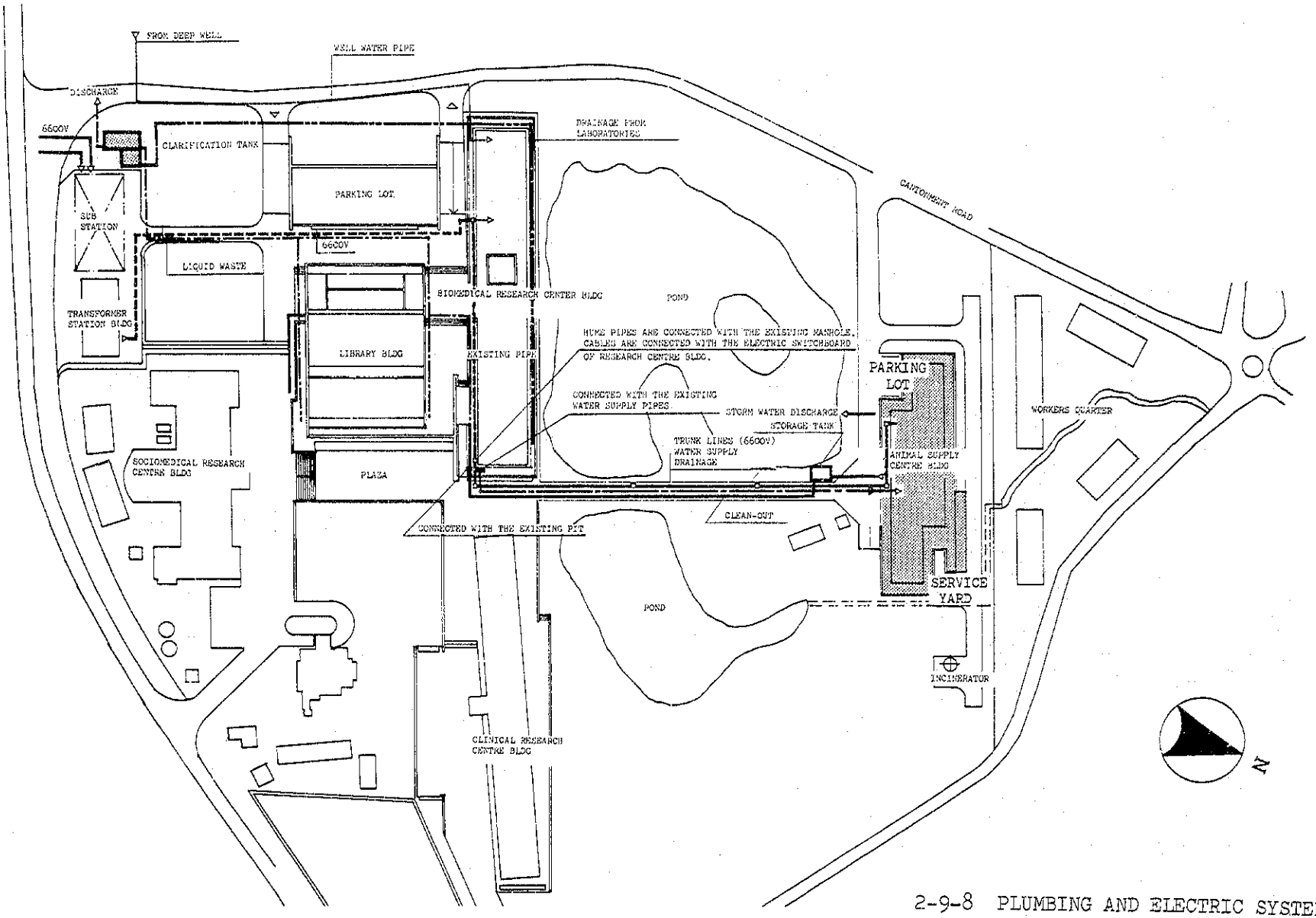


Beam, G

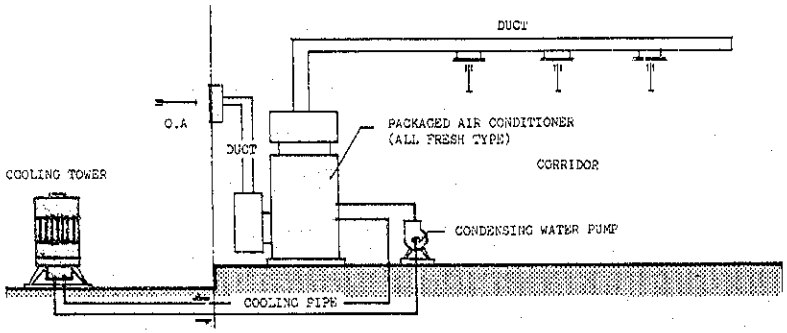


Foundation, F

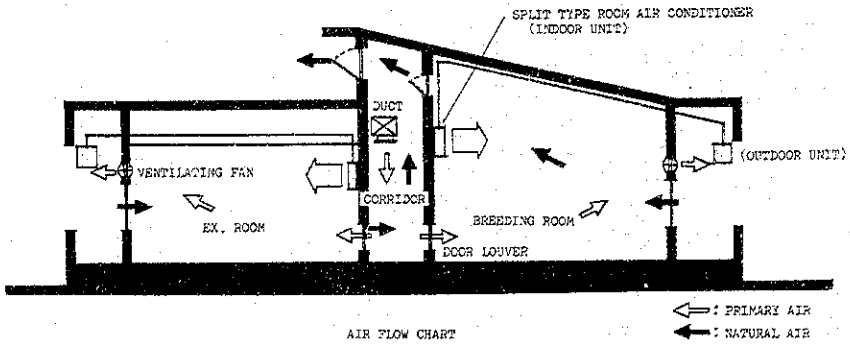
2-9-7 STRUCTURE



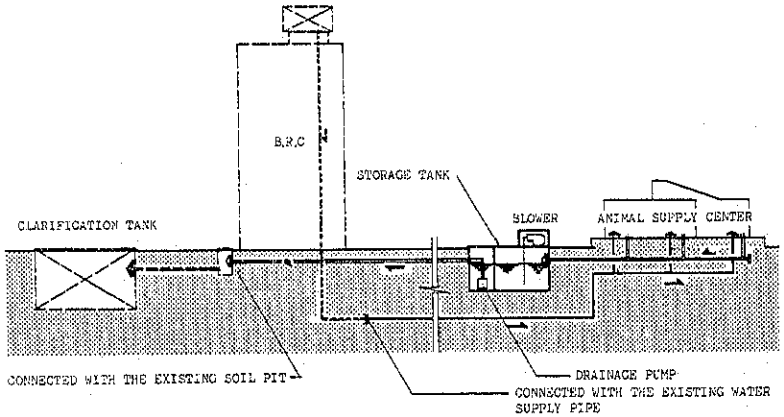
2-9-8 PLUMBING AND ELECTRIC SYSTEM



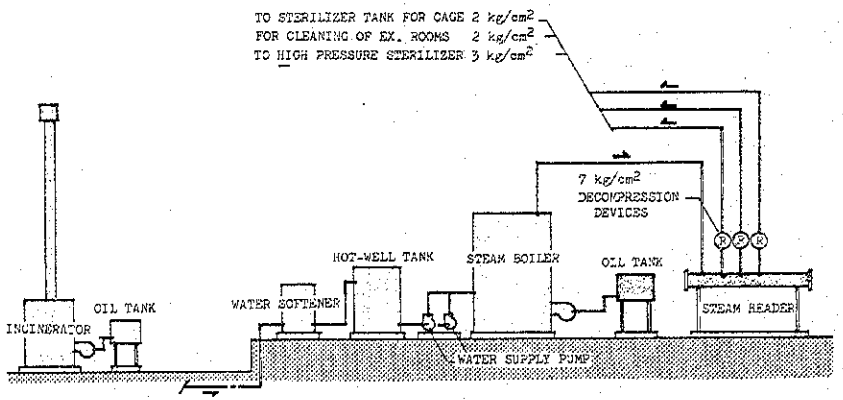
PACKAGED AIR CONDITIONER DIAGRAM



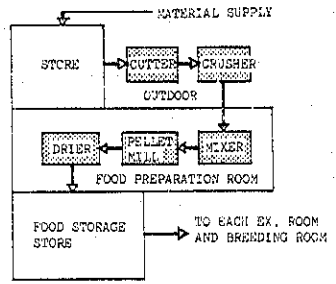
AIR FLOW CHART



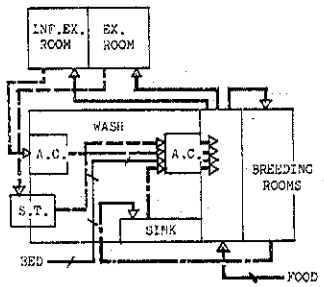
PLUMBING DISTRIBUTION DIAGRAM



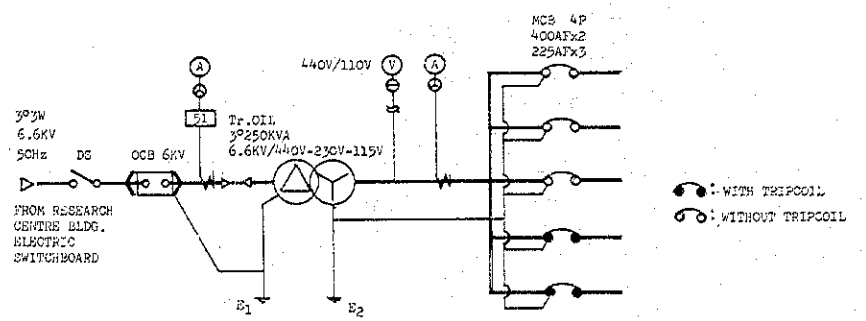
STEAM DISTRIBUTION SYSTEM



FOOD PROCESSING SYSTEM



STERILIZATION SYSTEM



FEEDER SKELETON DIAGRAM

2-9-9 EQUIPMENT FLOW DIAGRAM