(2) Facility Layout Plan

The Industrial Standardization, Testing and Training Centre

Facilities of the Centre are categorized into the following three blocks based on their functions. The Centre is planned as a three-story building consisting of these blocks.

1. Laboratory block : Laboratories

2. Training/meeting facilities block:
Seminar rooms, Conference room, Canteen, etc.

3. Administrative block: Administration office, Staff rooms, Lecturers' Room, Library, etc.

The laboratories will be located on the first and second floors to facilitate the carrying in and out of equipment and materials. Laboratories which are equipped with heavy equipment and those which are likely to generate vibrations and noises are located on the first floor. Chemical and electrical testing laboratories where light equipment will be installed as well as laboratories which do not require frequent carrying in and out of equipment and materials are located on the second floor. Furthermore, each laboratory should be designed with particular emphasis on its independence. For security purposes, each laboratory should not give easy access to guests and trainees.

All of the seminar rooms and the conference room will be located on the third floor. The conference room, which is to be used mainly for staff members, will be located adjacent to the seminar rooms so that both facilities can be compatible in use with each other, and efficient use of the facilities will be enhanced. The training and meeting facilities block will include a canteen for use by staff members, trainees and guests.

The administrative facilities will be located on the first through third

floors facing the front yard. Staff members, trainees and guests are to enter the building through the entrance hall. The guests are allowed access easily to only the entrance hall, guest corner and the library located adjacent to the entrance hall. The administration office on the first floor, the staff rooms on the second floor and the director's room on the third floor are layed out respectively and are connected by staircase.

The Industrial Metrology Testing Service Centre

This Centre is designed as a two-story building with the following two major functional blocks.

1. Laboratory block : Metrological standards laboratories and Testing laboratories for physical, chemical and electrical experiments

2. Administrative block : Administration office, Staff rooms, Conference room, Library, etc.

For the block layout plan, the building can be divided into the northern part and the southern part. The northern part is used for the administrative block and the southern part for the laboratory block.
Laboratories where heavy equipment is to be installed and those which are likely to generate vibrations and noises will be located on the first floor and the chemical and electrical laboratories will be located on the second floor. This layout of facilities minimizes mutual interference of each laboratory.
The administration office and the entrance hall are located on the first floor, and the conference room and the director's room are located on the second floor. The guest rooms and the library are located on the first floor adjacent to the entrance hall in order to give guests easy access to these facilities. As most of the seminars to be held in this Centre will be small in scale, the seminar rooms will be located on the second floor

adjacent to the conference room so that both rooms may be compatible with each other. This arrangement makes it flexible enough to cope with changes in the scale of seminars. Within this block, no distinction is made between the space exclusively for trainees and those exclusively for staff members.

The floor plans for both Centre buildings are drawn up in accordance with the above facility layout plan.

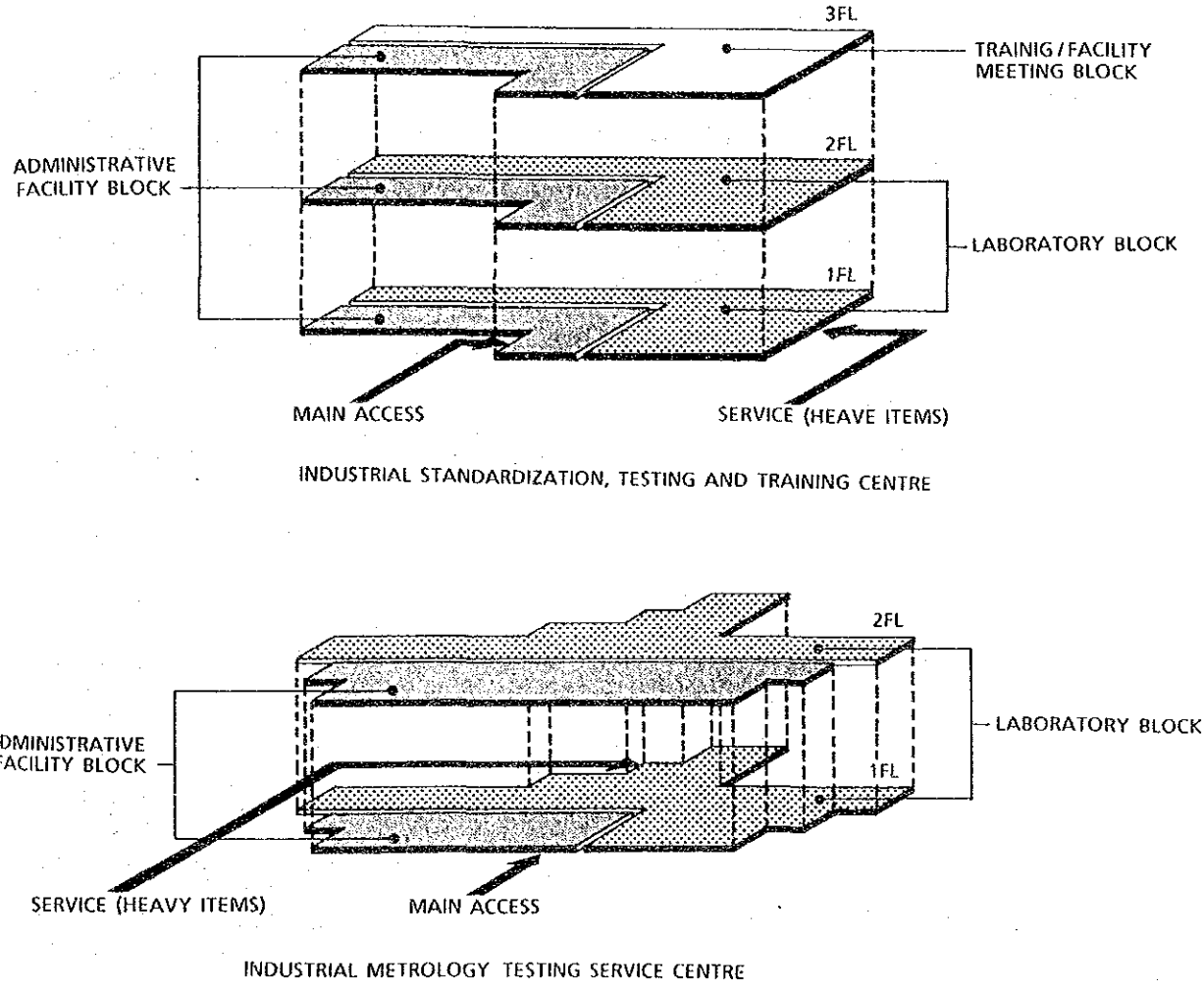


Fig. 4.3-2 Facility Layout Plan

4-3-2 Architectural Plan

(1) Floor Planning

Outline and scale of the main rooms of each of the Centre buildings are as shown below.

The Industrial Standardization, Testing and Training Centre

Each of the blocks constituting this Centre building consists of the following rooms.

1) Laboratory Block

The laboratory block consists of various testing laboratories. The number of testing laboratories is determined according to the testing field conducted in this Centre. And the size of each testing laboratory is determined according to the layout planning of equipment and furniture within it.

The floor plan is worked out taking the following points into consideration.

1. Laboratories should be prepared for each testing field while aiming to maximize efficiency in testing activity and equipment utilization.

2. Laboratories which are likely to generate vibrations and noises and those which are sensitive to vibrations and noises should be located as much far away from each other as possible.

3. Special laboratories should be provided for testings in which combustible gases and solvents will be used, testings which will generate poisonous gases, testings which will generate radiation and testings which have the possibility of causing fire.

4. The widths of the corridors should be determined by taking into consideration the frequency of transfer of test specimens and transport of testing equipment, as well as the convenience for staff members' evacuation in case of emergency.

The scale of each room and the outline of testing activities in each room are as follows.

Mechanical Testing Laboratory

Testings of mechanical strength, durability, wearproofness, etc. will be conducted in this laboratory. Since these testings, conducted by the use of heavy equipment, will generate vibrations and noises, this laboratory should be located on the first floor.

Workshop

Preparation work for testing of metals and insulators, such as cutting and preparing test pieces and test jigs will be done in the workshop.

Precision Measurement Room

Dimension measurements of machines and structural testings will be done by optical and mechanical methods in this room. Materials to be tested in this room include metals, auto-parts and electric wires.

Dark Room (A)

Optical characteristics of safety glass, mainly as auto-parts, will be measured in this room. This room needs to be free from dust.

N.D.T. Laboratory

Non-destruction testing of welds will be conducted in this room. Since an X-ray room will be attached to this room, minute care should be taken in designing this room to ensure its safety.

Development Room

Black-and-white photos taken in the laboratories will be developed and

printed in this room. This room will be designed to be in N.D.T. Laboratory

Mechanical Reliability Testing Laboratory

Testing of the reliability of plugs, sockets and packing materials as well as testing of the mechanical strength of safety helmets will be conducted in this laboratory.

Calorimeter Room

Air-cooling capability and electricity consumption of air conditioners will be measured in this room. Since a mock-up house is to be constructed in this room, the ceiling height must be 6 meters or more.

Environment Testing Laboratory

Weatherproof testing of various materials and machines against heat, temperatures, humidity, salinity, ozone, etc. will be conducted in this laboratory. This laboratory needs to be located on the first floor since large-sized equipment will be carried directly into it. Also the effective ceiling height must be 5 meters or more.

Rainproof Testing Laboratory

Rainproof testing of various types of equipment will be conducted in this room. Waterproofing material shall be used for floor finishing since it is very likely that water may splash in the room during testing.

Anechoic Room

Acoustic characteristics of audio/visual equipment and levels of noises from electrically-powered equipment will be measured in this room. An operation room for conducting acoustic measurements by transmitting and receiving signals will be attached to this room.

Flame Testing Laboratory

Flame testing of polymers, rubber and other materials will be conducted in this room.

Air Delivery Room (1), (2)

There are two air delivery rooms prepared, one for measuring air delivery of ceiling and desk fans and the other for measuring air delivery of ordinary fans.

Electrical Testing Laboratory

Performance testing and safety testing of electric heaters, electrically-powered equipment, fluorescent lamps and incandescent lamps will be conducted in this laboratory.

Electronic Auto-Parts Testing Laboratory

Reliability and performance of electronic auto-parts will be tested in this laboratory.

Electronic Testing Laboratory

Performance, sefty and durability testings of electronic products will be conducted in this laboratory.

Dark Room (B)

Optical characteristics of fluorescent and incandescent lamps will be measured in this room. This room is attached to the Electrical Testing Laboratory since the measuring work done in this room is closely related to testing conducted in the Electrical Testing Laboratory.

Chemical Testing Laboratory

Chemical characteristics of foods, fodder, veneer and tapioca will be measured in this laboratory.

Analysis Room

Measurements and analysis of metallic elements contained in metals and foods will be conducted in this room.

Open Space

This room will be used for conducting testing of heavy, thick, long or large test specimens and those likely to generate dust. It will also be utilized for temporarily storing materials and test specimens to be transported into the workshop and laboratories. Accordingly, this space should be located on the first floor so that it can be approached directly by vehicles.

Calibration Room

Calibration of electrical instruments, length measurement instruments and many other instruments which are used in the Centre will be done in this room.

2) Training/Meeting Facilities Block

This block is located on the third floor and consists of the following rooms.

Seminar Rooms

These seminar rooms are to be used for training programmes which are scheduled in the following 5 years. The number and scale of seminar rooms are determined in accordance with the contents of the training schedule described in 3-3-1. The number and scale of seminar rooms are as shown below.

Room Capacity	Required No. of Rooms	
	1~5 years	6years~future
5 Seats	3	—
10 Seats	—	3
15 Seats	2	—
30 Seats	—	2
50 Seats	—	—

On the basis of the above, the seminar rooms of this Centre are planned as follows.

Seminar Room (1) ..... No. of Occupants: 30- 50
(the room should be divided into two parts with removable partitions, each part accommodating 15 trainees)

Seminar Room (2) ..... same as Seminar Room 1

Seminar Room (3) ..... No. of Occupants: 15

Conference Room

The conference room with a seating capacity of 50 to 60 is planned. This room, which will be used for staff meetings mainly by senior and middle ranking staff members, will also be used as a seminar room. Accordingly, it is located adjacent to seminar rooms. Basic audio-visual equipment such as microphone and video systems will be provided for discussion-type conferences with guest engineers.

Canteen

This building will become most crowded when all the seminar rooms are in use, namely in the following 5 years when a total of 182 persons (107 staff members and 75 trainees) will stay in this building. The seating capacity of the canteen is set at 60 on the assumption that

all the staff members and trainees use the canteen in three rotations. A kitchen and a stock room will be attached to the canteen.

3) Administrative Block

Facilities belonging to this block will be located on the first through the third floors facing the front yard. The facilities in this block include:

Entrance Hall

The entrance hall has a two-story ceiling height with a reception and exhibition corner.

Library

The library will house books on industrial standards, related data and other reference materials, which staff members, trainees and visitors can utilize. The library is located on the first floor adjacent to the entrance hall for the convenient access of visitors. The number of seat is set at 16 on the assumption that about 10% of the maximum total number of persons accomodated in this building will use it. Judging from the number of books presently housed by TISI, the number of books to be housed in this library is estimated to be 2,500 to 3,000. An open access library system will be adopted.

Computer and Copy Unit (CPU)

Various data will be processed by the use of microcomputers and word processors. Manuscripts of reports and teaching materials will also be prepared at this facility. This room is designed also for reproduction of reports and teaching materials, and is located adjacent to the library so that the books housed in the library can be utilized for printing and preparing the teaching materials.

Administration Office

The administration office should accommodate a total staff of 9, 3 for

the administration section and 6 for the training section. A public address control board, an electric control board, etc. will be installed at a corner of this office to ensure safety control for the building.

Staff Rooms

This is a room which accommodates a total of 60 senior and middle ranking technical staff. In this connection, space for paper work will be secured in each laboratory in anticipation of future increases in the number of technical staff.

Lecturers' Rooms

The following Lecturers' rooms are provided in accordance with the requirements of the training program.

1. Chief lecturer's room : A single room with a space for meetings by lecturers

2. Senior lecturer's room : A single room for exclusive use by the senior lecturers

3. Lecturers' room : A large room for lecturers, which includes 8 compartments with low partitioning panels

The Industrial Metrology Testing Service Centre

Each of the blocks constituting this Centre building consists of the following rooms.

1) Laboratory Block

The laboratory block consists of laboratories and testing laboratories. Laboratories are for maintaining and controlling metrology testing standards quantities and conducting calibrations while testing laboratories are for conducting testings for R & D purposes. The required number of rooms is determined in accordance with the scope of activities to be carried out at this Centre and the scale of each room is determined according to the layout plan of equipment and furniture within it. Basically laboratories and testing laboratories are laid out so as not to be mixed, whereas rooms in which heavy equipment and materials will be handled and vibrations are generated are located on the first floor.

The layout plan is worked out taking the followings into consideration.

1. A laboratory for each kind of standards and a testing laboratory for each technical field should be provided.

2. Laboratories and testing laboratories where heavy equipment will be installed and heavy materials handled should be located on the first floor.

3. Rooms likely to generate vibrations and noises and those which must be free from vibrations and noises should be located as much far away from each other as possible.

4. Rooms where inflammable materials will be handled and which have the possibility of fire as well as those which have the possibility of generating poisonous gases should exclusively be used for those purposes for safety reasons.

5. Corridors should be wide enough to facilitate transfer of test specimens, transportation of equipment and staff members' evacuation in emergency.

The required scale of each of the laboratories and testing laboratories as well as activities to be conducted in each of them are as shown below.

Length Laboratory (1), (2)

Maintenance and control of secondary length standard measuring equipment and calibration of length measuring devices such as straightedges, tape measures and level gauges will be done in the laboratories.

Mass Laboratory (1), (2)

Establishment and maintenance and control of mass secondary standards and calibration of balance weights and mass spectrometers will be conducted in the laboratories.

Force Laboratory

Establishment and maintenance of force secondary standards and calibration of force gauges for use with material testing equipment will be conducted in this laboratory.

Pressure Laboratory

Establishment and maintenance of pressure secondary standards and calibration of pressure gauges will be conducted in this laboratory.

Volume Laboratory

Establishment and maintenance of gas/liquid secondary standards and calibration of chemical stereometers, water tanks, gas meters, etc. will be conducted in this laboratory.

Anechoic Room

Establishment and maintenance of sound secondary standards as well as calibration of sound-level meters and sound pressure-level meters will be conducted in this laboratory.

Vibration Laboratory

Establishment and maintenance of vibration secondary standards and calibration of vibrometers will be conducted in this laboratory.

Electrical and Electronic Laboratory

Establishment and maintenance and control of electricity primary standards and calibration of voltmeters, galvanometers, resistors, wattmeters, signal generators, frequency meters, etc. will be conducted in this laboratory.

Temperature Laboratory

Establishment and maintenance and control of temperature primary standards and calibration of electric thermometers will be conducted in this laboratory.

Photometry and Radiation Laboratory

Establishment and maintenance and control of photometric primary standards and calibration of illuminometers, integrating photometers, etc. will be conducted in this laboratory.

Chemical Testing Laboratory

Mainly testing of chemical materials and their compositions will be conducted in this testing room.

Shown below is the outline of the chemical testing to be done in this testing laboratory.

- Mechanical strength, quality and weatherproof testing of plastics, paints, etc.

- Ingredient analyses and purity testing of inorganic gasses.

A preparation room is provided adjacent to this testing laboratory for simple manual analyses, preparation of distilled water and liquid waste treatment.

Biochemical Testing Laboratory

Ingredient and composition analyses of food, structural and composition analyses and content measurements of organic compounds, etc. will be conducted in this testing laboratory. This testing laboratory will be located adjacent to the Chemical Testing Laboratory so that both laboratories share part of the equipment and materials. This will contribute to effective use of the facilities. The following analyzing rooms are attached to Biochemical Testing Laboratory and the Chemical Testing Laboratory.

- GC-MS Room : for conducting structural and ingredient analyses of organic chemical compounds

- Electron Microscope Room : for conducting structural and microbial analyses of chemical compounds by the use of an electron microscope

- Flame Testing Laboratory : for conducting analyses of metals and inorganic ions

- Spectrophotometry Room : for conducting structural and ingredient analyses of chemical compounds by the use of an infrared spectrometer, a fluorescence spectrophotometer, etc.

- Laser Raman Room : for conducting structural analyses of organic chemical compounds by the use of a laser Raman spectrophotometer

Mechanical Testing Laboratory

Strength of metals and metal welds will be tested in this testing laboratory. This testing laboratory should be designed to allow for direct carrying in of large-size equipment and materials.

Precision Measurement Room

Optical and mechanical measurements of dimensions and structural testing will be conducted in this room.

Workshop

This room will be used for preparing test specimens. It should be located on the first floor adjacent to the Mechanical Testing Laboratory since it will generate noise and dust.

Environment Testing Laboratory

Weatherproof testing of equipment and materials against heat, temperatures, salinity, ozone and so on will be conducted in this testing laboratory. The ceiling height must be 5 meters or more since large-size equipment will be used in this testing.

Electrical Testing Laboratory

Performance, safety and durability testing of electrical products, electronic products, fluorescent lamps, incandescent lamps, etc. will be conducted in this testing laboratory.

N.D.T. Laboratory

Non destructive testing of welds will be conducted in this facility. An X-ray room and a development room will be attached to this testing laboratory.

2) Administrative Block

Facilities belonging to this block will be located on the first and second floors of the front part of the building.

Entrance Hall

The entrance Hall is designed to have a two-story-high ceiling and to obtain adequate natural lighting. Two guest rooms are attached to the entrance hall and an exhibition corner is provided within it.

Library

The library will house books on industrial standards, related data and other reference materials, which staff members, trainees and visitors can utilize. It is located on the first floor adjacent to the entrance hall for easy access. Judging from the number of books presently housed by TISTR, the number of books to be housed in this library will be 2,500 to 3,000. This library will be an open access library for common use by staff members of the Centre, trainees and general visitors. The number of seats is set to be 12 on the assumption that about 10% of the total number of persons accommodated in the building, which will be 110 to 150, will use the library.

Administration Office

The administration office is planned to accommodate a total staff of 9, 4 in the administration section and 5 in the training section. The office should be large enough to allow for future increases in the number of staff.

Staff Rooms

The staff rooms are planned to accommodate a total of 51 middle and high ranking technical staff. Staff rooms should be close to each laboratory to shorten traffic routes within the Centre.

The room areas of the two Centres are as shown in the table below.

The Industrial Standardization, Testing and Training Centre

Name of Room	Area (m^2)
Mechanical Testing Lab.	79
Workshop	50
Precision Measurement Room	65
Dark Room (A)	65
Open Space	259
Mechanical Reliability Testing Lab.	61
Environment Testing Lab.	224
Air Delivery Room (1), (2)	101
N.D.T. Lab.	65
Rainproof Testing Lab.	65
Chemical Testing Lab.	151
Analysis Room	43
Flame Testing Lab.	65
Electronic Auto-parts Testing Lab.	65
Dark Room (B)	48
Electrical Testing Lab.	211
Electronic Testing Lab.	65
Anechoic Room	160
Calorimeter Room	194
Calibration Room	130
Stock Room	184
Staff Rooms (for 60 staff, consisting of two rooms)	204
Administration Office (for 9 staff)	68
Director's Room	51
Secretary's Room	17

Name of Room	Area (m^2)
Training Material Preparation Room	32
Meeting Room	34
Lecturers' Room (10 lecturers)	181
Conference Room (seating capacity of 50)	104
Seminar Room (1) (seating capacity of 30 to 50, devided by removable partition)	104
Seminar Room (2) (〃)	104
Seminar Room (3) (seating capacity of 15)	51
Canteen (seating capacity of 60, including a kitchen)	104
Library (16 seatings, 3,000 volumes)	61
CPU (copy machine, micro computer)	73
Others (Entrance Hall,Corridors, Toilets, Mechanical Room etc.)	1,662
Total	5,200 m^2

The Industrial Metrology Testing Service Centre

Name of Room	Area (m^2)
Length Lab. (1), (2)	194
Volume Lab. (inlcuding Tank Room)	221
Mass Lab. (1), (2)	118
Force Lab.	130
Pressure Lab.	103
Vibration Lab.	65
Temperature Lab.	130
Photometry and Radiation Lab.	130
Electrical and Electronic Lab.	212
Mechanical Testing Lab.	86
Workshop	58
Precision Measurement Lab.	50

Name of Room	Area (m^2)
N.D.T. Lab.	74
Environment Testing Lab.	118
Flame Testing Lab.	65
Electrical Testing Room Lab.	83
Chemical Testing Lab.	194
Biochemical Testing Lab.	351
Anechoic Room (inlcuding Preparation Room, Observation Room)	151
Staff Rooms (for total of 51 staff, consisting of three rooms)	194
Stock Room	164
Administration Office (for 9 staff members)	89
Director's Room	59
Secretary's Room	18
Meeting Room	53
Lecturers' Room	65
Conference Room (for staff meeting with seating capacity of 50)	118
Seminar Room (for 30 to 50, to be separated into two rooms with removable partition)	107
Library (12 seatings, 3,000 volumes)	53
CPU (copy machine, micro computer)	53
Others (Entrance Hall, Corridors, Toilets, Mechanical Rooms, etc.)	1,694
Total	5,200 m^2

(2) Elevation Planning

This project consists of two completely independent Centres. There is a clear boundary line drawn between the plots for the two Centres. There are also clear differences between the two buildings in terms of internal functions. And one will have three stories, while the other will have two stories. However, since the two buildings will be constructed simultaneously as one project, it is important to give the two buildings a unified exterior appearance in drawing up their elevations.

Therefore, the finishing materials and the range of colors for their external walls should be unified and the external walls should be finished in accordance with unified details. This arrangement will put in order the entire site environment.

(3) Section Planning

It is important to take note of the following points in section planning for the two buildings.

1. Measures against flooding

The project site is currently a swamp. Being poorly drained, the site is covered with water during the rainy season. However, the project site will be banked before the construction starts and the ground level will be raised by 1.5 meters. Also, a drainage system will be arranged around the project site which will set the bottom level of the drains higher than the mean sea level of the Gulf of Thailand. Therefore, measures against flooding will be almost satisfactory. However, the measures against flooding for the project site need to be safer than that as the facilities are to be equipped with very costly equipment.
Judging from the present conditions of the facilities near the project site, it is concluded that the level of the first floors of the buildings should be 1.5 meters higher than the ground level. This will make the level of the first floors of the buildings about 3.0 meters higher than the mean sea level of the Gulf of Thailand.

2. Protecting the buildings from rainwater

In order to prevent rainwater from getting in the building while securing adequate natural ventilation by keeping the windows open even on rainy days, balconies or eaves should be installed above the windows and other openings of the buildings. As long as the rain does not get into the

building, the balconies could be allowed to become wet provided that they are used only for maintenance of the buildings.

3. Screening direct sunlight

The buildings will lie on an east to west axis and their openings will face north or south. At each place which will be exposed to strong sunlight, a louver will be installed with balconies to screen it.

4. Securing natural lighting

In drawing up the section plan, particular emphasis will be placed on securing natural lighting as much as possible. Since long center corridors are not avoidable in the floor plan of the buildings due to the functions of laboratories and testing laboratories, special arrangements are necessary to secure adequate natural lighting in the corridor. Therefore, the central part of the corridor should open to the two-story-high ceiling of the entrance hall so as to allow the natural lighting from the entrance hall to the corridor.

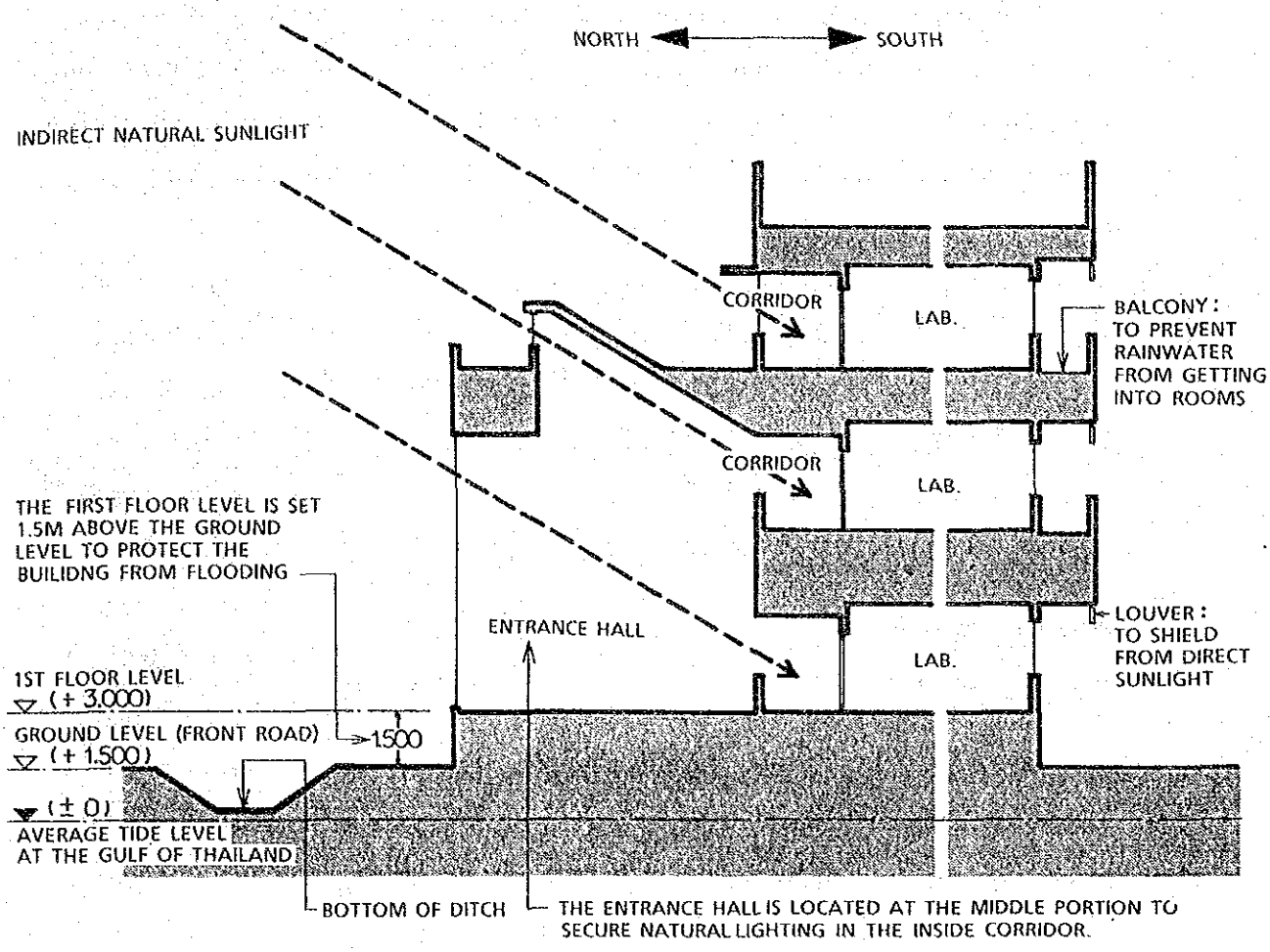


Fig. 4.3-3 Sectional Planning

4-3-3 Structural Plan

(1) Outline of the Buildings

This project consists of one building for conducting a variety of testings related to industrial standardization and another for maintaining and managing industrial metrological standards and conducting R & D activities for development of industrial products. The scale of each building is as shown below.

- The Industrial Standardization, Testing and Training Centre

  No. of stories : 3 above ground (with a penthouse)

  Floor height : 1st floor ..... 5.0 m

  2nd floor ..... 4.5 m

  3rd floor ..... 4.0 m

  Building height : ..... 16.75 m

  Total floor area : ..... 5,200 m^2

- The Industrial Metrology Testing Service Centre

  No. of stories : 2 above ground (with a penthouse)

  Floor height : 1st floor ..... 5.0 m

  2nd floor ..... 4.5 m

  Building height : ..... 13.75 m

  Total floor area : ..... 5,200 m^2

(2) Outline of the Structure

1) Superstructure

The buildings will be three-storied and two-storied respectively. However, as various heavy equipment is to be installed, the live load

to work on their floors will be comparatively large compared to usual buildings. Furthermore, many of the equipment to be installed require anti-vibration. In consideration of these factors as well as the necessary construction period and the construction and economic requirements, the superstructure of these buildings should be of reinforced concrete structure.

2) Foundations

According to the soil investigation report on the proposed construction site, a very soft clay layer exists up to 12m below the ground surface and is still settling several centimetres a year. A layer of medium soft clay goes down to 17m followed by a stiff clay layer with an N value of about 10. From 21m a very stiff clay of silty sand with an N value of about 25 exists. In light of the ground conditions, the foundations of the buildings should be pile foundations which will be supported by the very stiff silty sand clay layer below 21 meters. The precast concrete pile driving method will be employed as the piling method in consideraton of the work period, the economic requirements, etc. In examining the bearing capacity of the pile, its negative friction should be considered.

For the foundations and underground beam, anti-sulphate concrete will be used considering the measures against salt in the soil.

(3) Structural Materials

1) Concrete

Foundation : anti-sulphate concrete

design standard strength Fc=210kg/cm^2

Superstructure : ordinary concrete
design standard strength Fc=210kg/cm^2

2) Reinforcing bars : 16mm or less SD 30 Fy=3,000kg/cm^2
19mm or more SD 40 Fy=4,000kg/cm^2

(4) Structural Design Criteria

The structural design for these buildings will be conducted in accordance with the Structural Design Calculation Standards of Japan.

(5) Design Load and External Force

1) Dead load

The value of dead load will be calculated on the basis of the total weight of the structural, finishing and other materials actually used.

2) Live load

The value of live load will be calculated in accordance with the By-Laws of the Bangkok Metropolis (Control of the Construction of Buildings 1979) and the Building Standards Act of Japan.

3) Seismic force

Thailand belongs to none of the world's major earthquake belts and no damage by earthquake has been reported in the past. Accordingly, no consideration will be given to seismic design.

4-3-4 Utility Plan

The Industrial Standardization, Testing and Training Centre and the Industrial Metrology Testing Service Centre are to be administered by different government agencies. Accordingly, it is necessary to separate the utility system for each of the buildings so that there may be a clear distinction between the two buildings in their respective responsibility for payment of public utility charges, as well as for operation and maintenance of the equipment installed.

(1) Electrical Facility Plan

1) Power Supply System

Each of the buildings receives 24kV of electric power from the Metropolitan Electricity Authority (MEA), which is transformed to low voltage electric power at the substation, and then distributed to each load. The construction work of the 24kV power line up to the power receiving point (located near the eastern boundary of the site in the case of the Industrial Standardization, Testing and Training Centre and near the northern boundary of the site in the case of the Industrial Metrology Testing Service Centre) is included in the scope of work by the Thai side. After the power receiving point, the construction work within the site is included in the scope of work by the Japanese side.

- Power receiving electric system:
  3-phase 3 wire 50Hz 24kV

- Low voltage power electric system:
  3-phase 4 wire 50Hz 380-220V
  (transformer capacity: approx. 1,000kVA)

3-phase 4-wire 50Hz 190V-110V

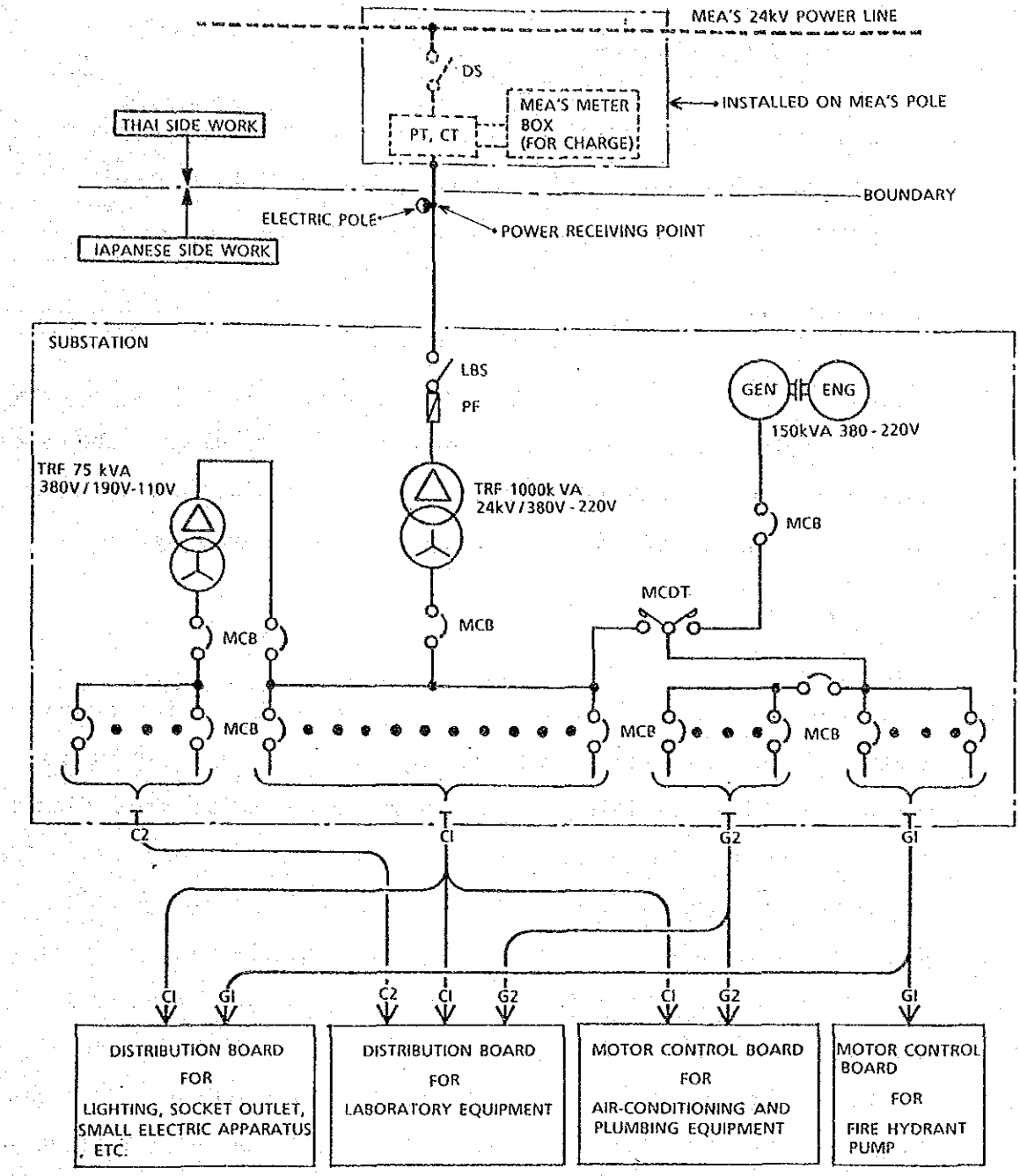
(transformer capacity: approx. 75kVA)

There are some testing equipment which require special voltage other than the above voltage, high-stable power sources, uninterrupted power sources, etc. Special power source equipment such as transformers, voltage regulators, CVCF, UPS, etc. will be provided for those testing equipment in the scope of the testing equipment work.

2) Generator System

Frequency of power failure in the area is relatively low (estimated at about 5 times a year). On the other hand, the time required to recover power supply is as long as 1 to 2 hours. However, some testings to be conducted in the projected facilities will require uninterrupted power supply. To meet the testing requirements of the facilities, a power generator will be installed as an emergency power source for such testing equipment, emergency lights and fire hydrant pumps. The capacity of the power generator will be 150kVA, calculated on the assumption that operation of the testing equipment will be stopped while the fire hydrant pumps are in use.

The outline of the power supply system and construction demarcation are shown in Fig. 4.3-4



LEGEND

DS	:	DISCONNECTING SWITCH	TRF	:	TRANSFORMER
PT	:	POTENTIAL TRANSFORMER	MCB	:	MOLDED CASE CIRCUIT BREAKER
CT	:	CURRENT TRANSFORMER	MCDT	:	DOUBLE THROW MAGNETIC CONTACTOR
LBS	:	LOAD BREAK SWITCH	GEN	:	GENERATOR
PF	:	POWER FUSE	ENG	:	ENGINE
C1	:	COMMERCIAL POWER 380V - 220V	G1	:	GENERATOR POWER 380V - 220V
C2	:	COMMERCIAL POWER 190V-110V	G2	:	GENERATOR POWER 380V - 220V (NOT TO BE SUPPLIED WHEN FIRE HYDRANT PUMP STARTS)

Fig.4.3-4 Outline of Power Supply System Diagram

3) Power Supply for Testing

A laboratory distribution board capable of supplying 3 phase 380V, single phase 220V and/or single phase 110V electric power to testing equipment will be installed in each laboratory.

4) Socket Outlets

Socket outlets will be installed at necessary places in each room as power supply devices for small electric apparatuses. The socket outlet circuit is connected to the laboratory distribution board to facilitate control of the power source in each laboratory.

5) Lighting System

In principle, all lighting fixtures will be equipped with fluorescent lamps. In places with a high ceiling, mercury lamps may be used to enhance lighting efficiency. In rooms where noise from discharge lamps, such as fluorescent lamps and mercury lamps, may affect testings, incandescent lights or electromagnetic shielding lights will be used. Some of the lighting fixtures, installed in rooms such as the anechoic room where it is impossible to secure natural lighting and in the corridors, will be connected to the power generator circuit to ensure safe walking at the time of power failure. The design target illumination level by type of facility is shown in Table 4.3-1. The illumination level should be enough in rooms where visual precision measurements and the like are to be conducted.

Lighting fixtures for director's room, the conference room and the like will be the recessed-mounting type and those for the administration office, the laboratories and the like will be the surface-mounted type or pipe-suspended type.

Table 4.3-1 Design Target Illumination Level

Name of Rooms	Design target illumination level (Lux)	JIS illumination level (Lux)
Administration Office	300~400	300~750
Seminar Rooms	300~400	200~750
Laboratories	300~500	300~750
Laboratories (visual precision)	750~1000	750~1500
Canteen	150~300	150~300
Stock Rooms	50~100	50~150

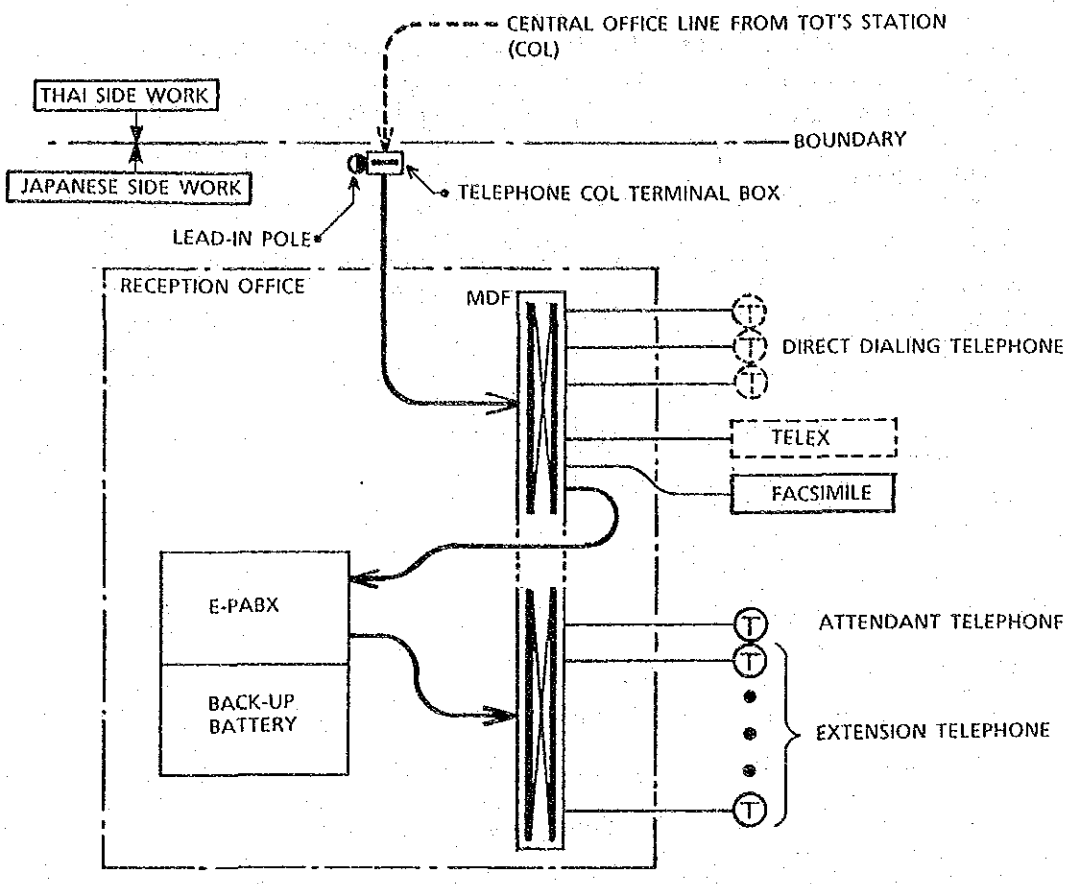
6) Telephone System

An electronic PABX will be used. Its capacity will be 10 central office lines (COL) and about 80 extension lines. It is expected that required number of COL from the Telephone Organization of Thailand (TOT) to each building will be 15 lines in total, 10 lines for E-PABX and 5 lines for direct dialing telephones (not through E-PABX), facsimile and telex equipment. Construction of COL cables from TOT's station up to the lead-in pole located near the boundary of the site and the installation of direct dialing telephones and telex equipment are included in the scope of work by the Thai side.

Extension telephones will be installed in the following rooms.

Director's Room	Testing Laboratories
Secretary's Room	Chief Lecturer's Room
Administration Office	Senior Lecturer's Room
Staff Rooms	Lecturers' Room
Conference Room	Canteen
Library	

The outline of the telephone system diagram and the construction demarcation are shown in Fig.4.3-5.



Note 1. Construction of central office line cables to the telephone terminal box from TOT'S station is included in the scope of the work by Thai side.

2. Direct dialing telephones and telex equipment are inlcuded in the scope of the work by Thai side.

Fig.4.3-5 Outline of Telephone System

7) Public Address System

A public address system will be provided for general and emergency announcements in the building. Its main equipment (microphone, amplifier, etc.) will be installed in the administration office on the first floor to send messages to the laboratories, staff rooms and so on.

8) TV Master Antenna System

A TV antenna will be installed on the roof of the building and antenna outlets will be installed in the following rooms.

Director's Room	Lecturers' Rooms
Administration Office	Library
Staff Rooms	Electrical Testing Laboratory
Conference Room	Electronic Testing Laboratory
Seminar Rooms	Electrical and Electronic Laboratory

Supply and installation of TV sets are included in the scope of work by the Thai side.

9) Fire Alarm System

An automatic fire alarm system will be provided because early detection of a fire is of vital importance in the light of the nature of the functions of the facilities and the value of equipment installed there. The control panel will be installed in the administration office on the first floor and a detector will be installed in each room. Since Thailand has no installation regulation on the automatic fire alarm system, the projected system will be installed in accordance with the provisions of the Fire Service Act of Japan.

10) Lightning Protection System

Since the project area is frequently hit by lightning, a lightning protection system will be installed to prevent damage due to lighting.

(2) Air Conditioning Systems

1) Design Temperature/Humidity Conditions

1. Design outside temperature/humidity conditions

Conditions indicated in the ASHRAE Handbook should apply to this project.

- Outside dry-bulb temperature .... 36°C (DB)
- Outside wet-bulb temperature .... 28°C (WB)

2. Design room temperature/humidity conditions

Laboratory, Administration Office, Seminar Room, etc.

- Dry-bulb temperature ..... 27°C ±2°C (DB) (standard value)
- Relative humidity ..... RH60% ±10% (standard value)

When the outside temperature exceeds 36°C (DB), "the outside air temperature -8°C (DB)" should be the standard value.

Length Laboratory (1) and Mass Laboratory (1)

- Dry-bulb temperature ..... 27°C ±0.5°C (DB)
- Relative Humidity ..... RH50 ~ 60% ±5%

2) Cooling Equipment

Air-cooled chilling units for supplying chilled water to air conditioners, air-cooled packaged type air conditioners and air-cooled separate type air conditioners will be installed.

3) Air Conditioning Equipment

In principle, individual air conditioning systems will be installed in each room since temperature/humidity conditions and periods of time each air conditioner is used will differ from one room to another.

1. Laboratories, administration office, etc.

   An air-cooled separate type air conditioner and an air-cooled package type air conditioner will be installed in each room.

2. Special laboratories

   A combination air conditioning system with an air-cooled chilling unit to supply cilled water, an air conditioner equipped with an electric reheater and a humidifier will be employed to satisfy the required conditions of constant temperature and humidity.

4) Ducting System

A single duct system of air supply/air return will be employed for the air conditioning system which requires temperature distribution, pressure control, air flow control, noise control, etc.

5) Piping System

Pipes for circulation of chilled water by air-cooled chilling units, refrigerant pipes between the indoor and outdoor units of air-cooled packaged type air conditioners and air-cooled separate type air conditioners, and pipes for discharging condensed water from air conditioners will be laid.

6) Ventilating System

Mechanical ventilating equipment will be installed in rooms such as the laboratories, toilets and pantries, which require forced ventilation.

In consideration of anticorrosive, FRP-made exhaust fans will be installed in some chemistry-related laboratories.

7) Automatic Control System

For in each air conditioning system, room temperature will be controlled by an indoor temperature sensor, a room-type thermostat or a return air thermostat.

On the other hand, special systems which require constant temperature and humidity conditions will be controlled by a room-type thermostat /humidity sensor.

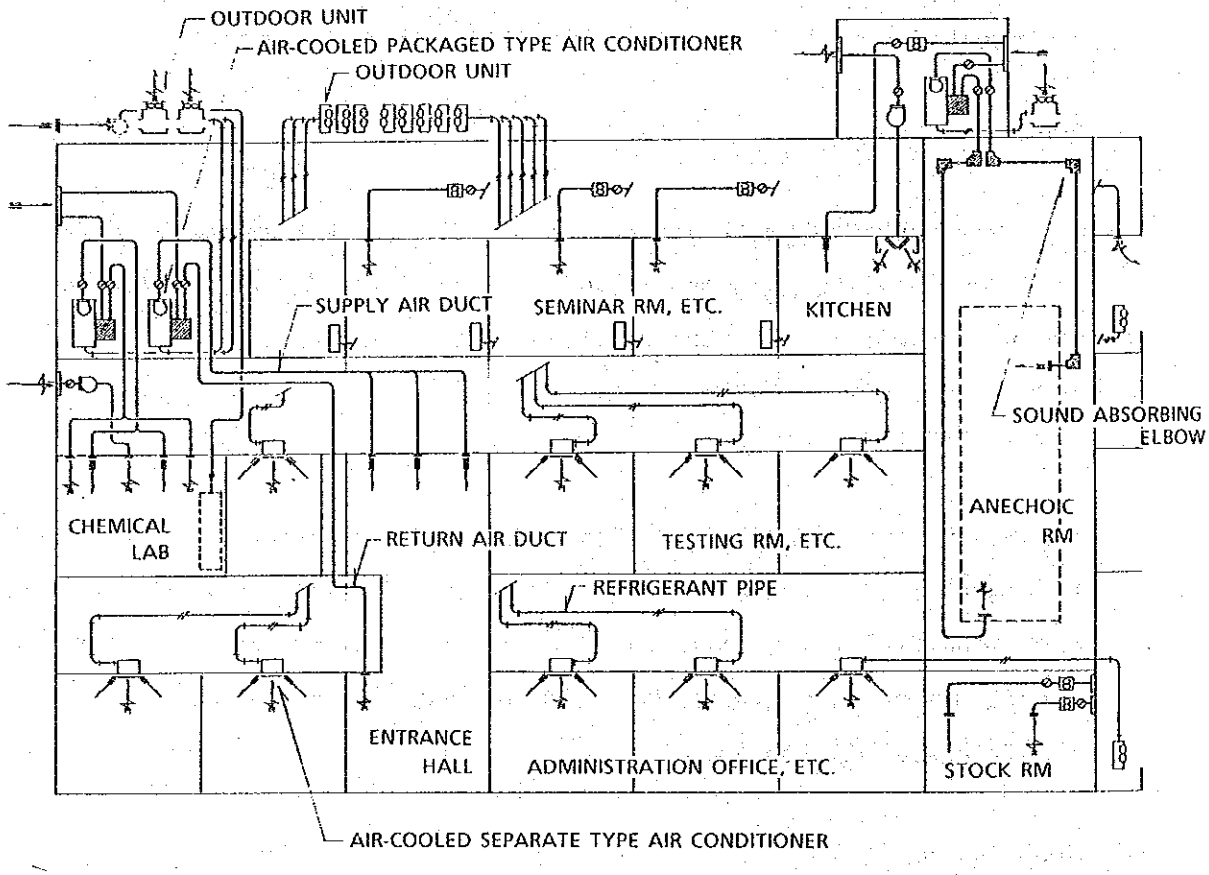


Fig.4.3-6 Schematic Diagram of Air Conditioning System for The Industrial Standardization, Testing and Training Centre

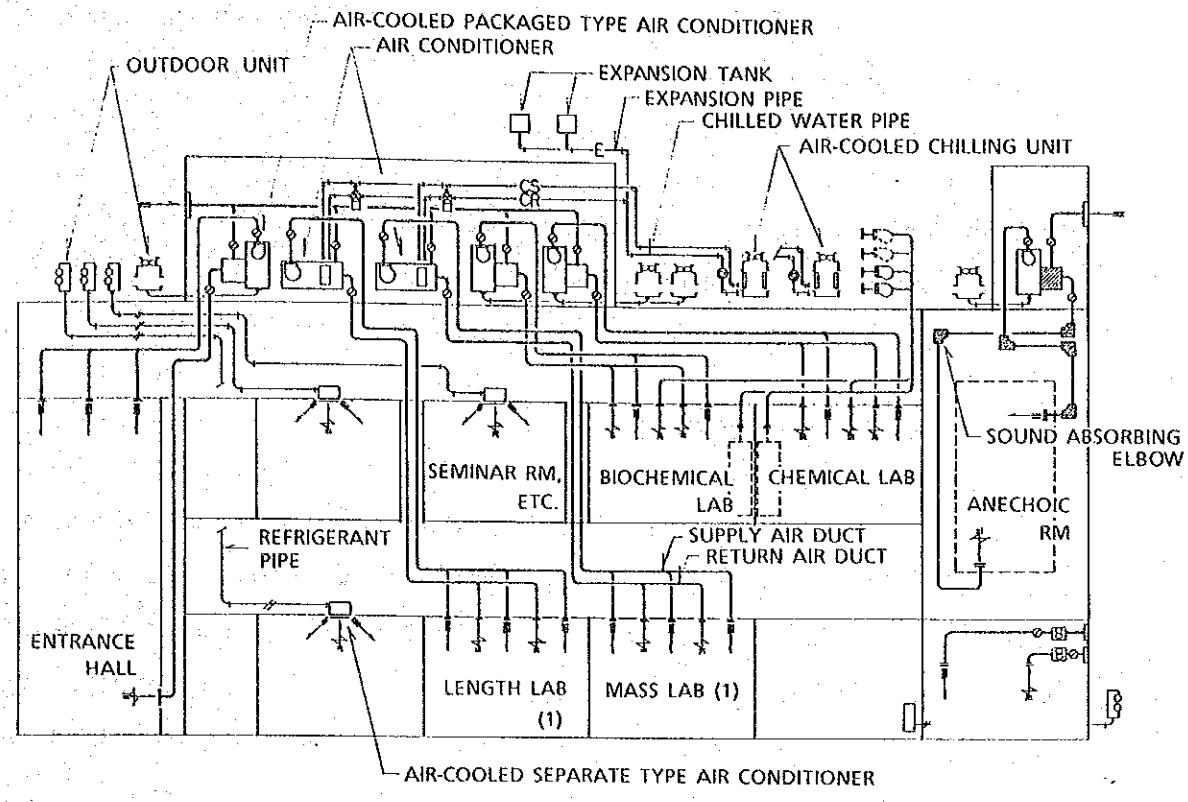


Fig.4.3-7 Schematic Diagram of Air Conditioning System for The Industrial Metrology Testing Service Centre

(3) Plumbing and Sanitary System

1) Water Supply System

Water service pipes with 100mm dia. which will branch off from a city water main pipe (300mm dia., average water pressure 1kg/cm^2) located near the north side boundary line of the site will lead into each reservoir tank. The water will be pumped up to each concrete-made elevated tank by lift pumps, and will be distributed to the desired areas of the buildings by gravity. The reservoir tanks will be installed above ground instead of underground in consideration of the soil and sanitary conditions for the project site. Humidifying water for the following equipment will be treated by water softener.

The Industrial Standardization, Testing and Training Centre

- Calorimeter Room unit
- High-Low temp. and humidity chamber

The Industrial Metrology Testing Service Centre

- High-Low temp. and humidity chamber
- Air conditioner for Length Lab. (1) and Mass Lab. (1)

2) Drainage and Air Vent Systems

Household waste water from the two buildings will be discharged directly into the main sewer pipe laid on the south side of the project site. However, it will be impossible to discharge household waste water into the main sewer pipe by gravity since the level of the main sewer pipe is high. Therefore waste water tanks will be installed, from which the waste water will be pumped up into the main sewer pipe.

On the other hand, waste water discharged from chemistry-related laboratories will be neutralized in neutralizing facilities and then added to household waste water.

In principle, hazardous chemicals such as undiluted solutions of reagents, solvents, cyanides and heavy metal, which will most likely corrode or transform drainage pipes and which might cause environmental pollution, will be stored in specific containers installed in laboratories after use.

Since rainwater from the site will be discharged into open ditches located around the site by gravity, the rainwater draining system within the project site will be open gutters.

3) Sanitary Fixture Installation

Sanitary fixtures, water closets, urinals and washbasins etc. suiting local custom will be installed.

(4) Other Facilities

1) LP-Gas Supply System

Equipment for supplying LP-gas to the kitchen and some of the laboratories will be installed. LP-gas will be supplied from cylinders after pressure adjustment by the use of a pressure regulator.

2) Fire Extinguishing System

Since Thailand has no well-established regulations to enforce the Fire Service Act yet, on indoor fire hydrant system and portable fire extinguishers which are in compliance with the provisions of the Fire Service Law Enforcement Order of Japan will be installed in both Centres.

3) Kitchen Equipment Installation

Kitchen equipment for preparation of light meals, such as sinks, work tables, gas ranges, a freezer/refrigerator will be installed.

4) Pipes for Special Gases

Pipes for supplying nitrogen gas, argon gas, etc. for testing equipment will be laid.

5) Cooling Water Piping Facilities

Cooling water supply pipes, a cooling tower and a circulating pump will be installed for the High-Low temp. and humidty chamber and the calorimeter room unit which will be included in the equipment work.

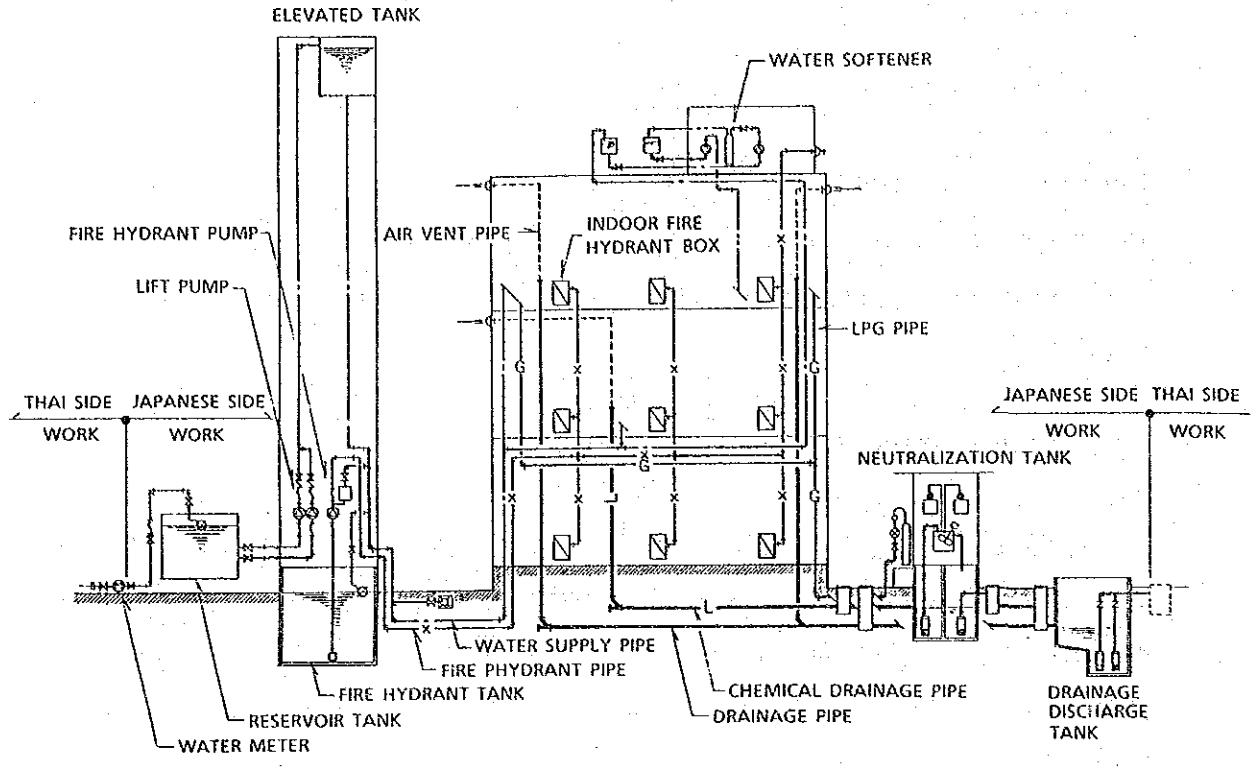


Fig. 4.3-8 Schematic Diagram of Water Supply, Drainage Fire Hydrant and LP Gas Supply System for The Industrial Standardization, Testing and Training Centre

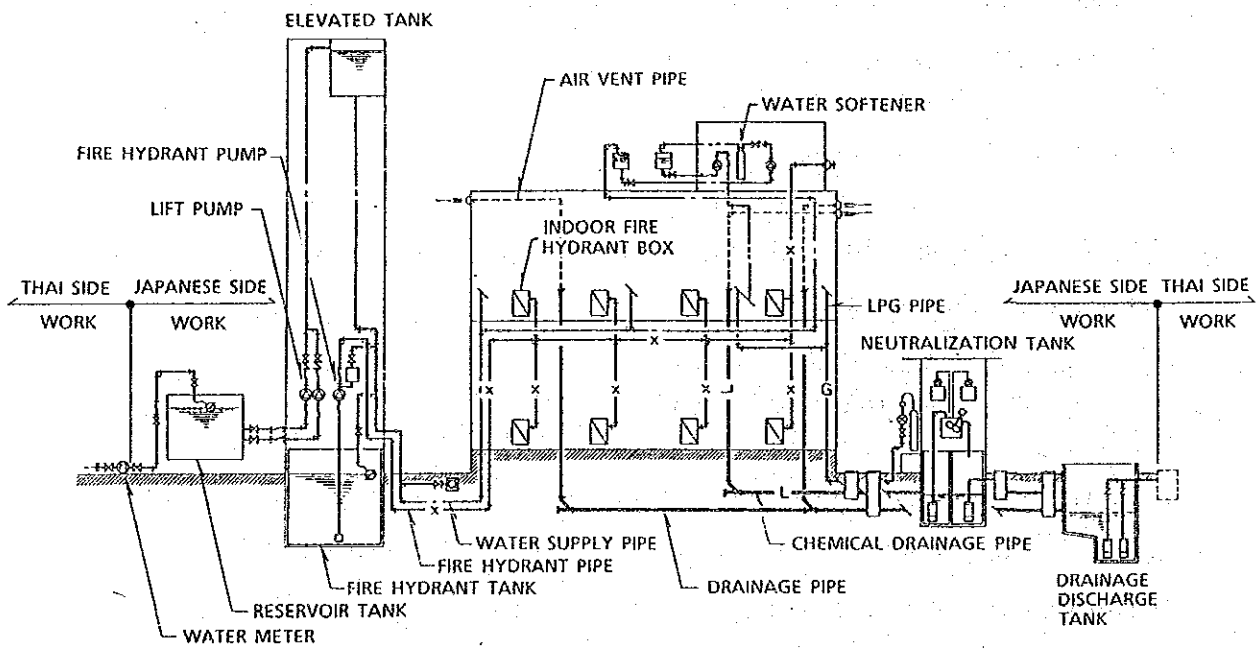


Fig. 4.3-9 Schematic Diagram of Water Supply, Drainage, Fire Hydrant and LP Gas Supply System for The Industrial Metrology Testing Service Centre

Table 4.3-2 Schedule of Piping Materials

Classification	Name of materials
Water supply pipes	High density polyethlene pipe BS HEAVY
Drainage pipes	PVC pipe TIS-17
LP gas pipes	Galvanized steel pipe BS Midium
Fire hydrant pipes	Galvanized steel pipe BS Midium
Refrigerant pipes	Cupper pipe TYPE L
Chilled water pipes	Galvanized steel pipe BS Midium
Special gas pipes	Stainless steel pipe (SUS304) JIS G 3448
Cooling water pipes	Inside PVC lining Steel pipe

4-3-5 Building Materials Plan

The building materials for this project will be selected primarily from local products after a comprehensive examination of local climatic conditions, required quality, local construction situation, the construction schedule, construction costs, maintenance and operation costs, etc.

(1) Structural Materials

A reinforced concrete structure which is common in Thailand will be adopted in this project. Ready-mixed concrete will be used since it is readily available in Thailand and its stable supply is assured. Locally manufactured reinforcing bars and ready-made PC piles will be used for structural materials.

(2) Exterior Finishing Materials

1. Roof

The roof of the building will be reinforced concrete flat slabs with protection concrete and an insulation layer on asphalt waterproofing membranes. This design is adopted with the consideration of damage on waterproofing membranes caused by strong sunshine. This very effective waterproofing and insulating method is common in Thailand.

2. Exterior Walls

The external walls will be finished mostly with ceramic tiles and partially finished with plastic paint. Exterior walls of the existing buildings are mostly finished with paint on cement mortar. Since paint finishing is poor in waterproofing efficiency and is likely to be stained with rust and moss, it will be necessary to repaint the walls every three to four years to keep good appearance. Repainting requires additional costs such as those for scaffolding and increases the maintenance and operation costs. For this reason, ceramic tile will be mainly used for exterior wall finishing and plastic paint will be used for walls which will not be directly exposed to rain. Both ceramic tiles and plastic paint can be procured locally.

(3) Interior Finishing Materials

1. Floors

Floors of the administration offices, seminar rooms, corridors and most of the laboratories will be finished with plastic tiles, which are manufactured locally and which are available in many colors and patterns. Plastic tiles are used widely in Thailand because they are easy to maintain and are inexpensive. Floors of those laboratories which require

waterproofing capacity will be finished with vinyl sheets, which can also be procured locally.
Floors of the facilities such as the entrance hall which need to look dignified will be finished with terrazzo tiles or ceramic floor tiles.

2. Interior Walls

Interior walls will be finished with interior plastic paint which allows easy removal of stains caused by chemicals and machine oil. Interior plastic paint is easy to handle, resulting in a short period of painting work, and walls painted with it look fine. Walls of the toilets and pantries will be finished with ceramic wall tiles in consideration of their waterproofing capacity and durability.

3. Ceilings

In principle, suspended ceilings will be provided in every room to maintain good heat insulation or acoustic environment. Most of the existing facilities are equipped with these suspended ceilings. Ceilings for the main rooms will be finished by acoustic mineral boards with a light-gauge steel bed. Calcium silicate boards which are highly resistant to water will be used for toilets. Aluminum strips will be used for parts of the entrance hall and the eaves.
All the above-mentioned materials can be procured locally.

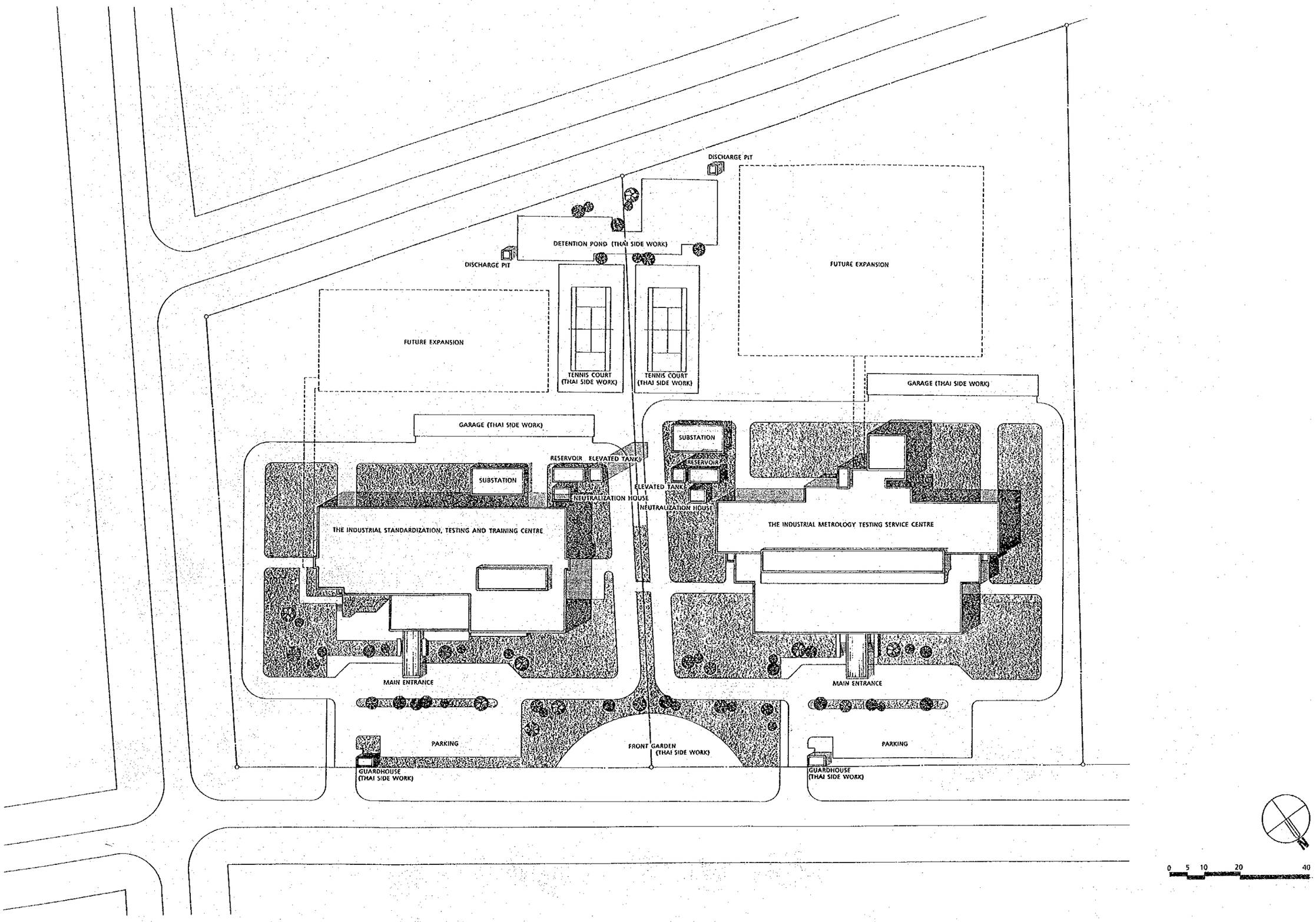
4. Doors and Windows

Windows for the outside openings of the building will be Thai-made aluminum sash windows. In Thailand, wooden, iron and aluminum sashes are commonly used, however aluminum sashes are becoming increasingly utilized. Thai-made aluminum sashes are not very efficient in terms of waterproofing or airtightness. Therefore, minute care must be taken when installing aluminum sash windows in those laboratories which need an airtight environemnt and in places which will be directly exposed to rain and wind.

Since the project site is only 1.8 km away from the coastline, color aluminum sashes which are durable against saline damage will be used. Interior doors of the main rooms facing the corridor will be light steel and those between two rooms will be wooden.

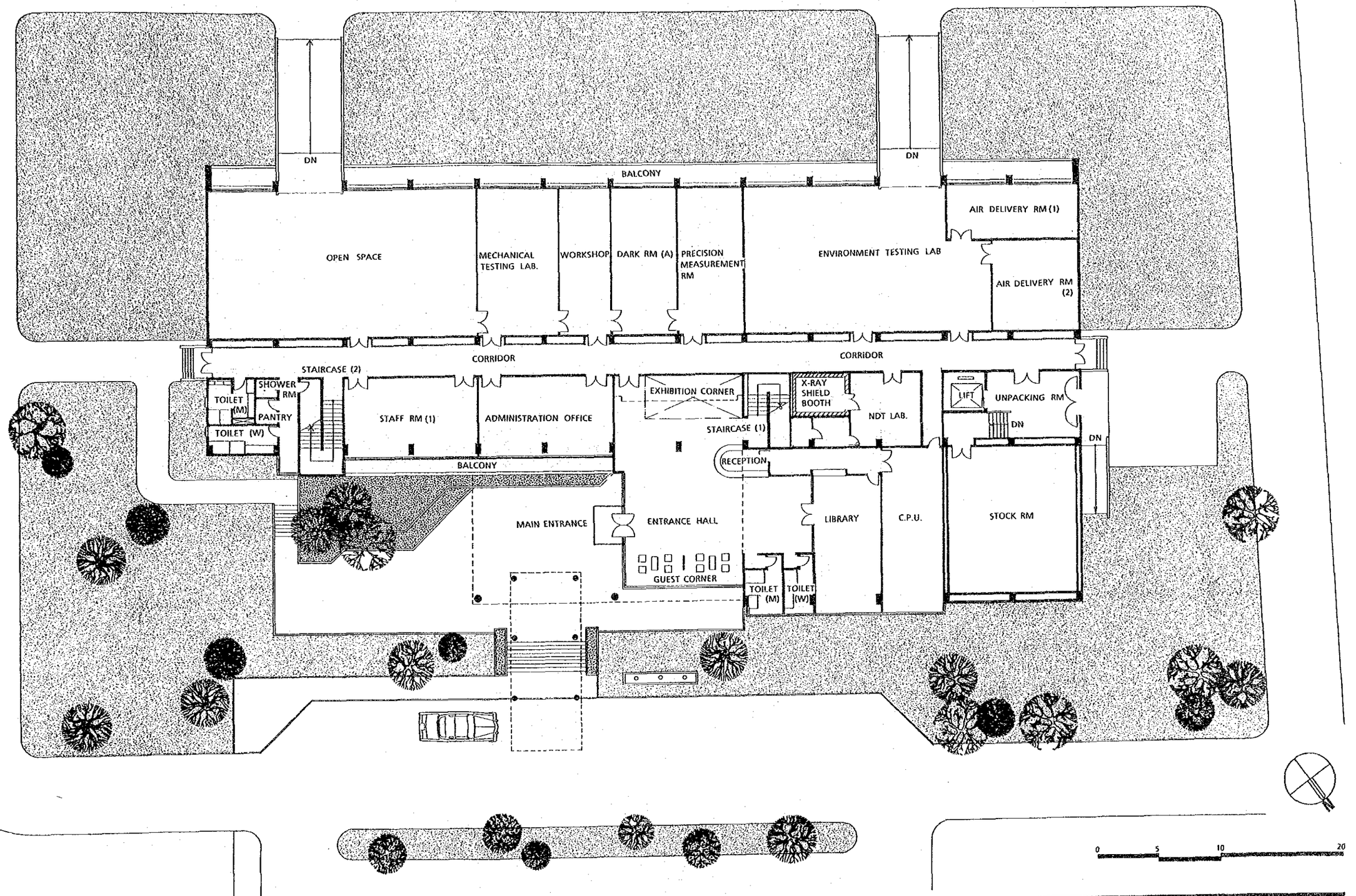
4-3-6 Basic Design Drawings

01 Site Plan
(The Industrial Standardization, Testing and Training Centre)
02 1st Floor Plan
03 2nd Floor Plan
04 3rd Floor Plan
05 Elevation
06 Elevation
07 Section
(The Industrial Metrology Testing Service Centre)
08 1st Floor Plan
09 2nd Floor Plan
10 Elevation
11 Elevation
12 Section



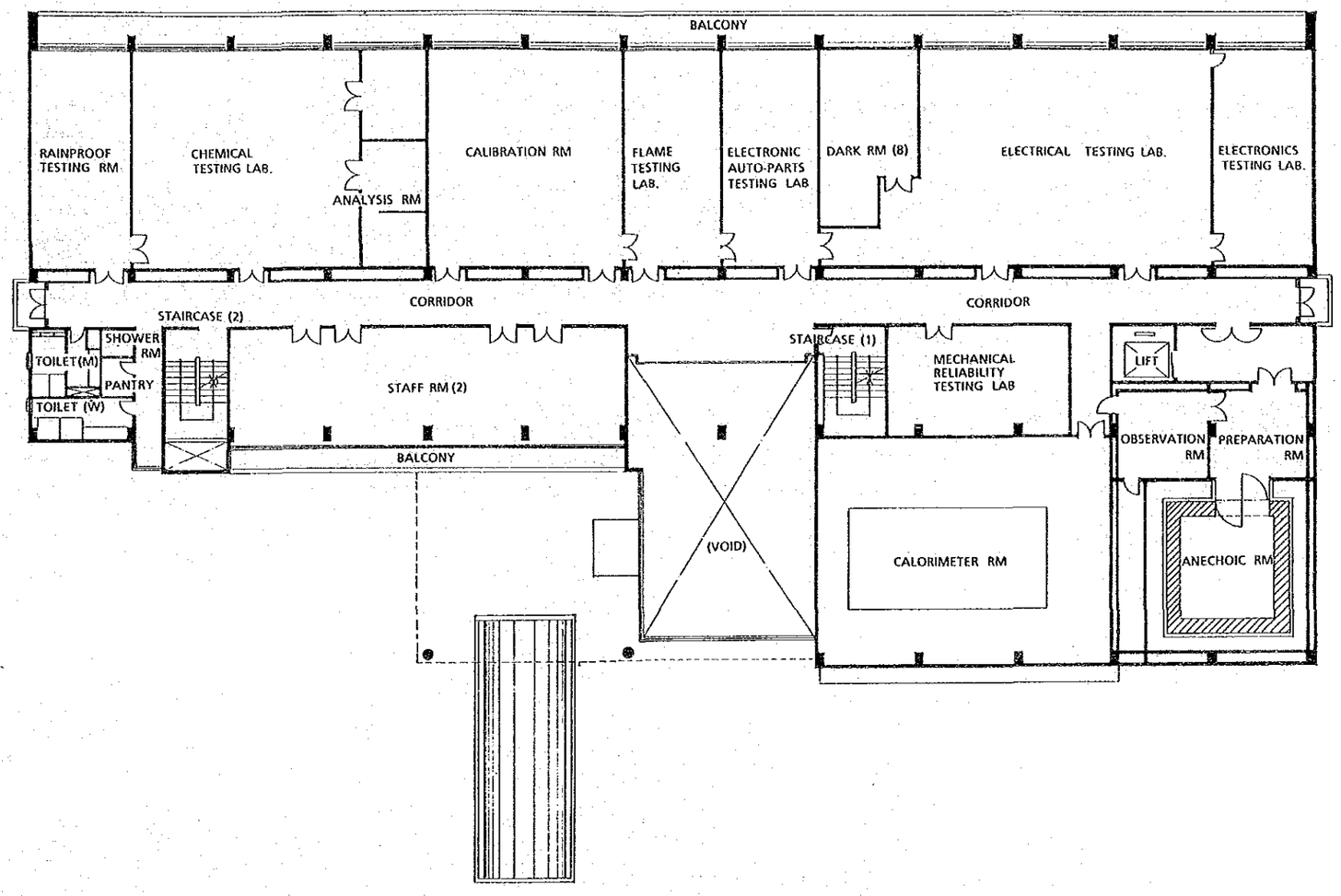
THE INDUSTRIAL STANDARDIZATION, TESTING AND TRAINING CENTRE
THE INDUSTRIAL METROLOGY TESTING SERVICE CENTRE

SITE PLAN **1**



THE INDUSTRIAL STANDARDIZATION, TESTING AND TRAINING CENTRE

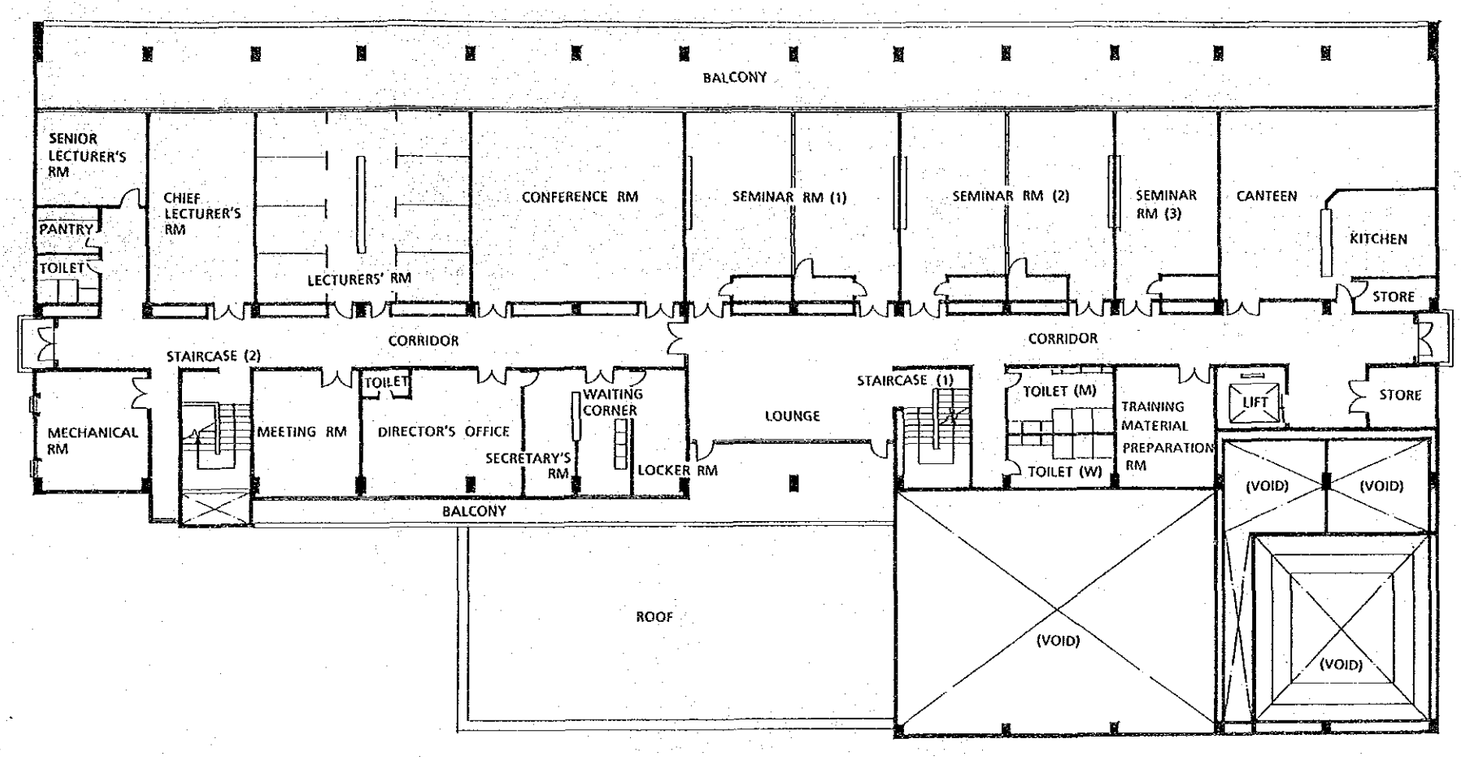
FIRST FLOOR PLAN 2



THE INDUSTRIAL STANDARDIZATION, TESTING AND TRAINING CENTRE

SECOND FLOOR PLAN

3



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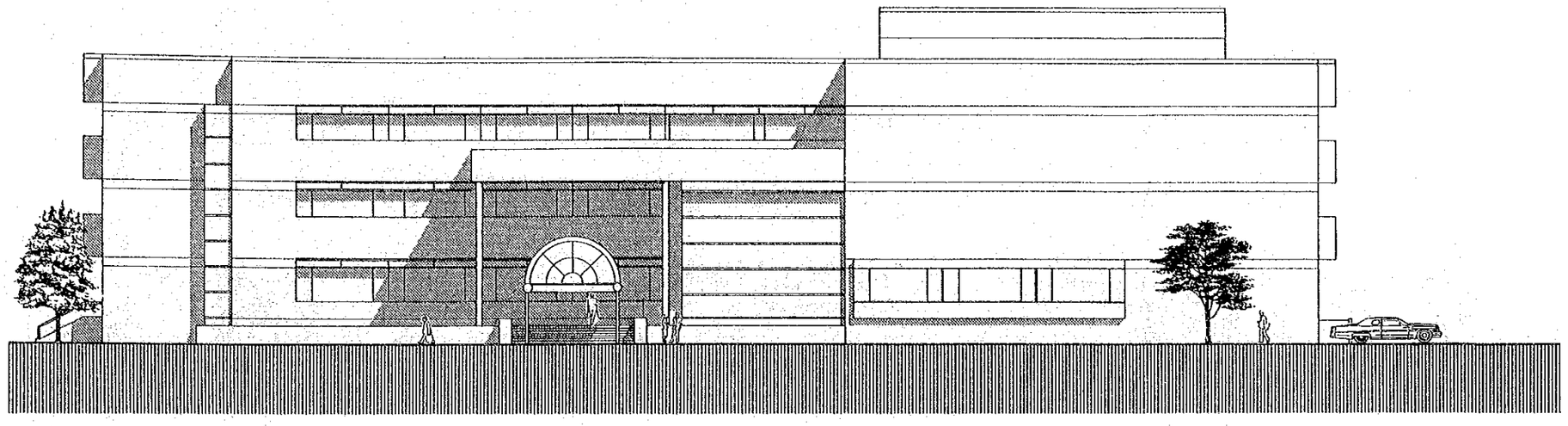
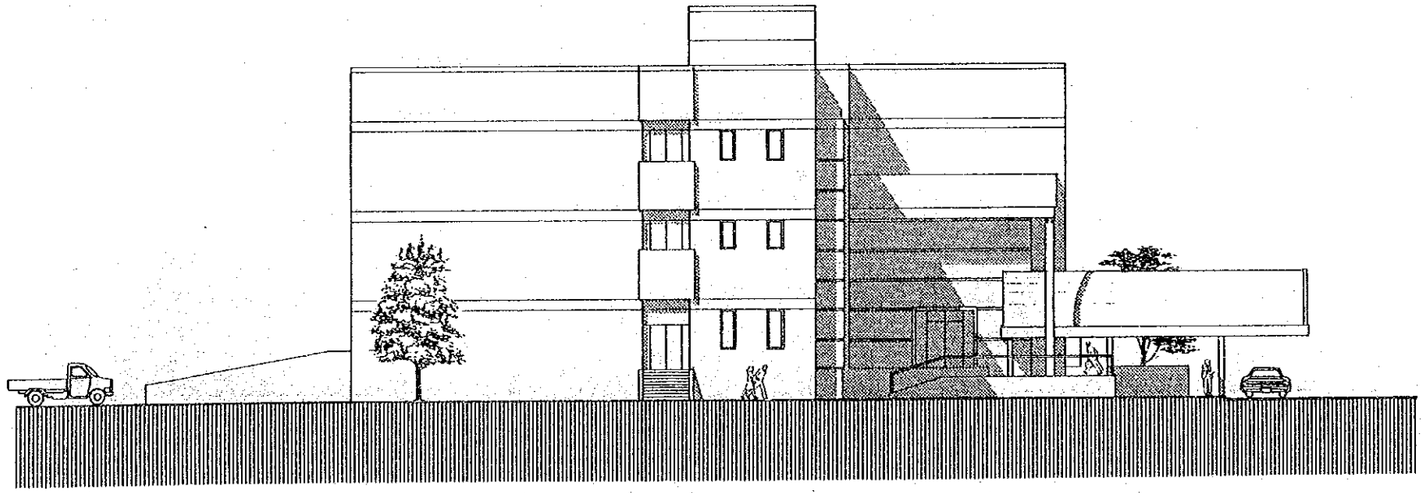
THE INDUSTRIAL STANDARDIZATION, TESTING AND TRAINING CENTRE

THIRD FLOOR PLAN

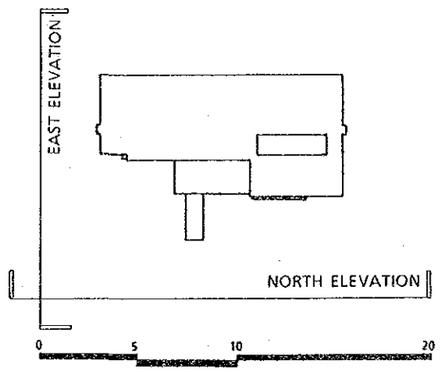
4

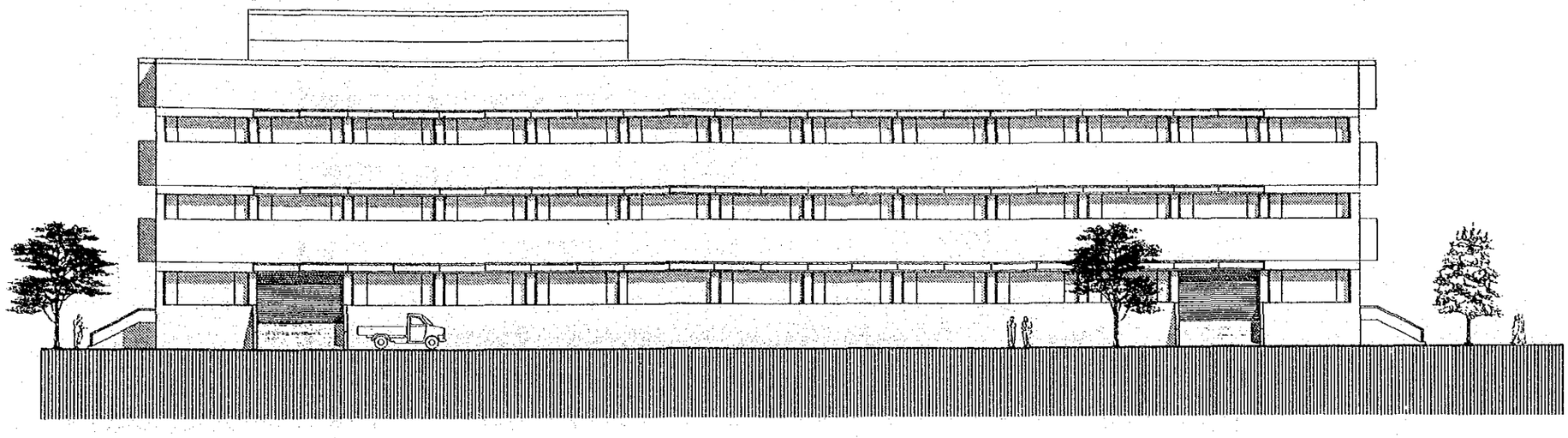


NORTH ELEVATION

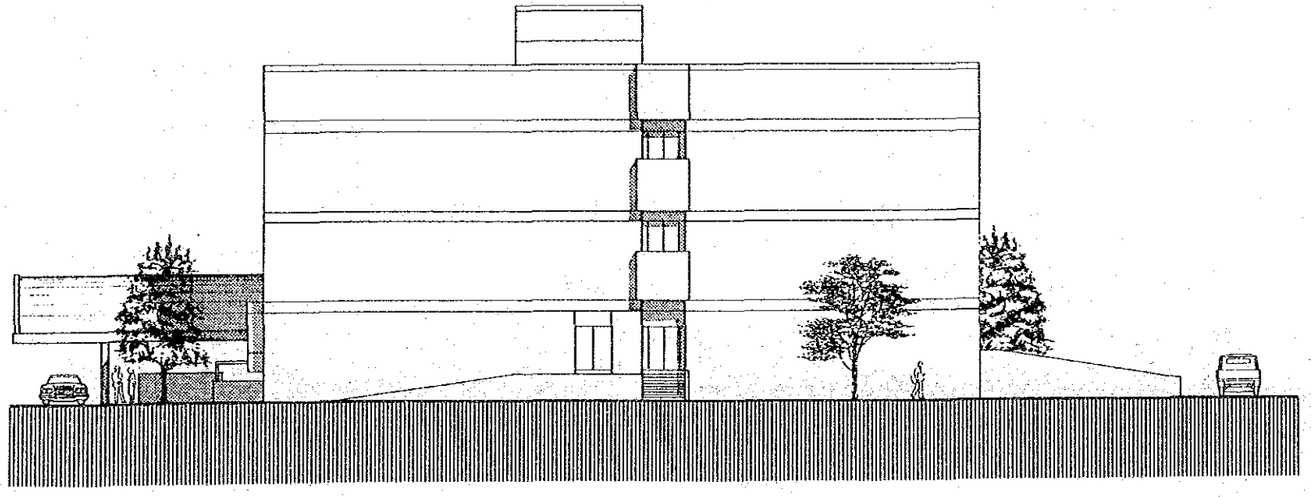


EAST ELEVATION

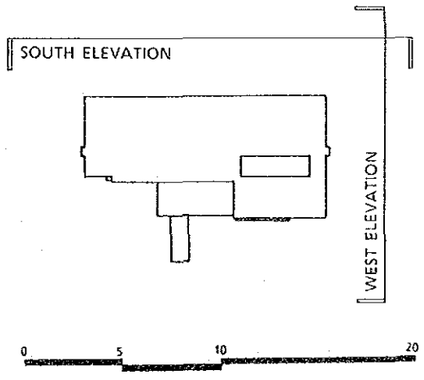


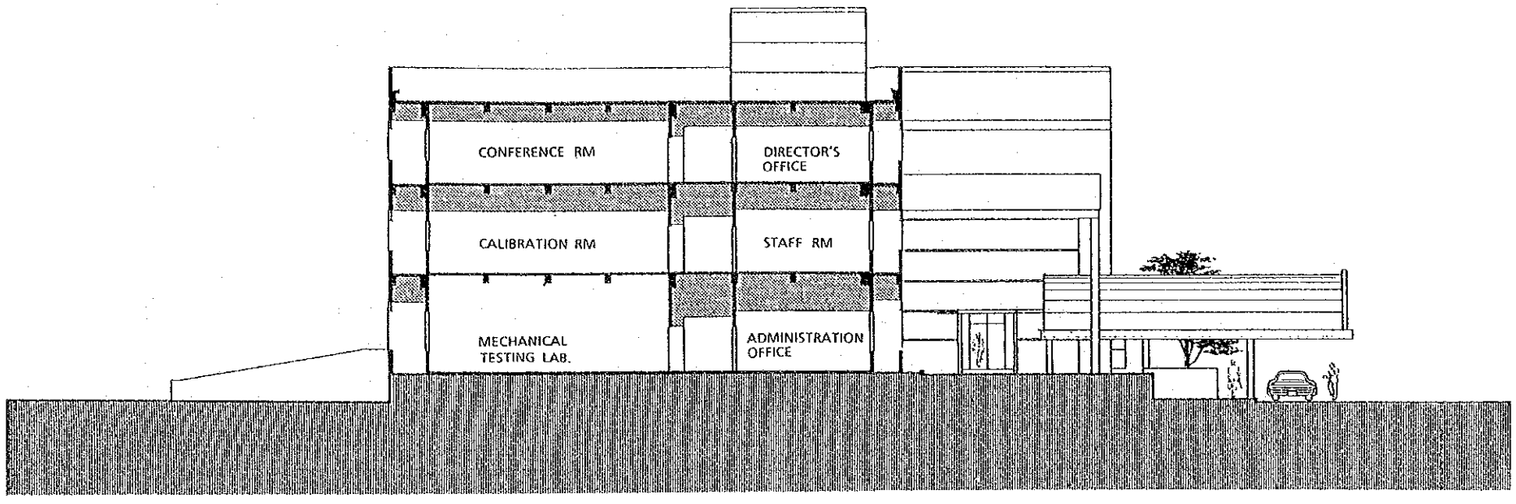


SOUTH ELEVATION

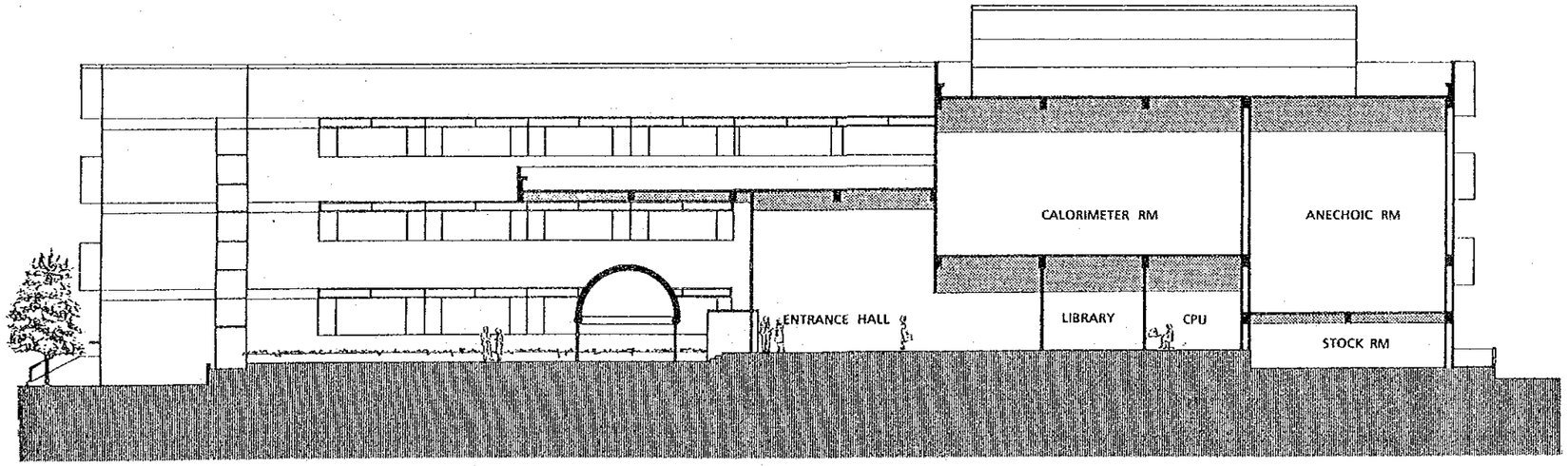


WEST ELEVATION

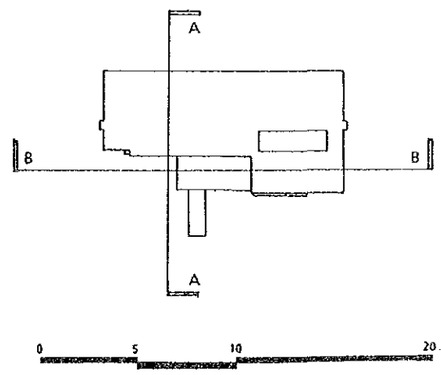


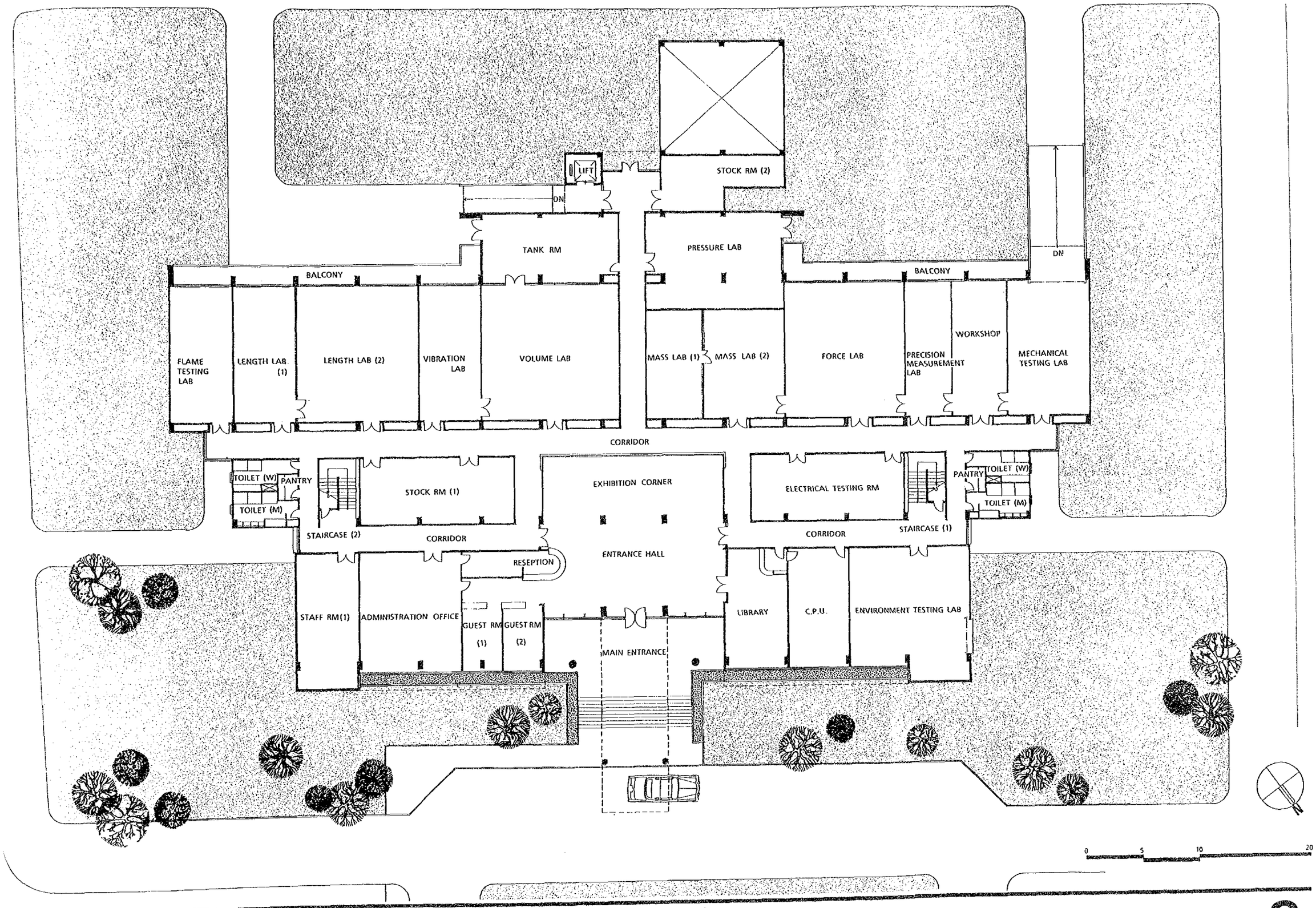


SECTION A-A



SECTION B-B

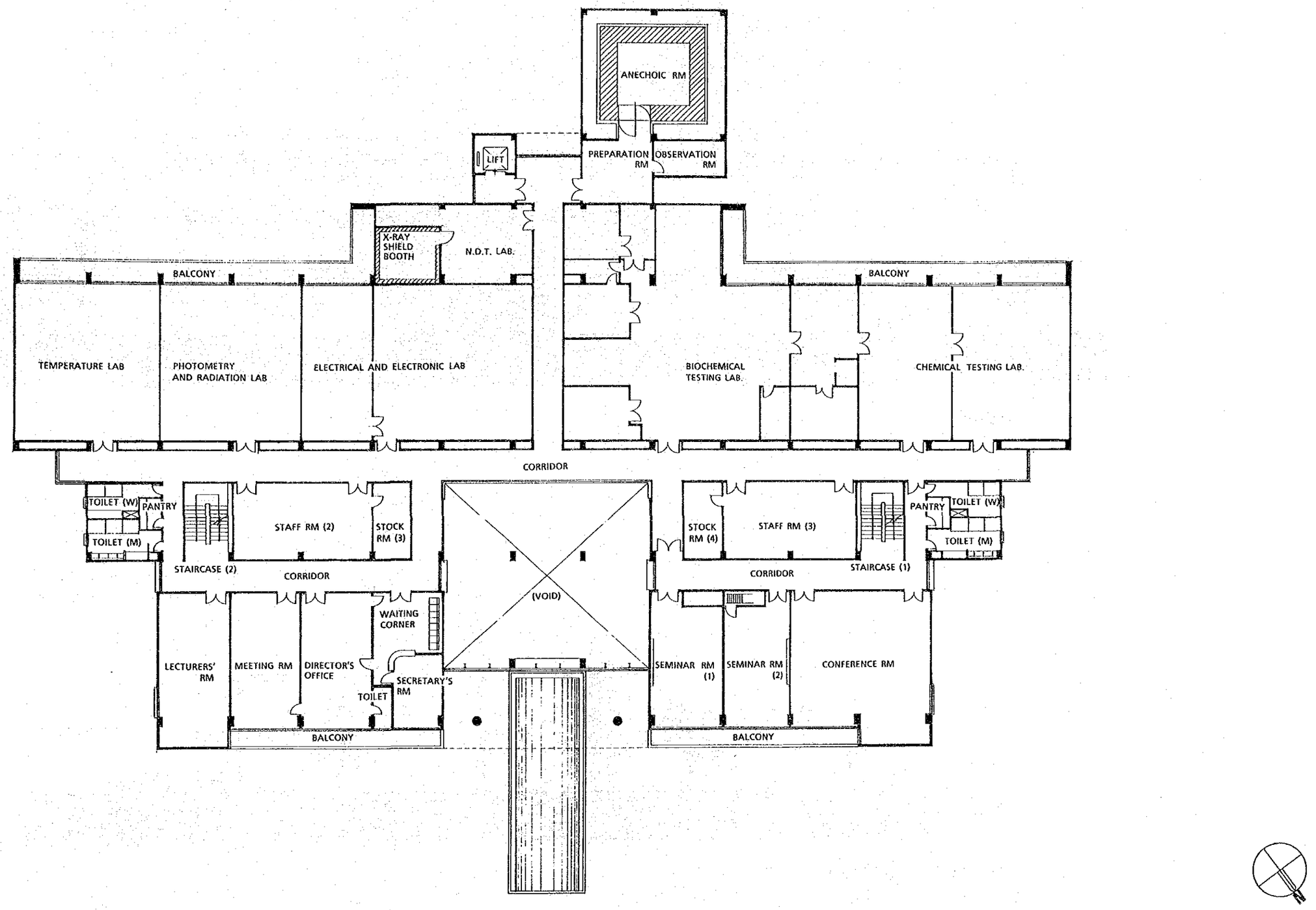


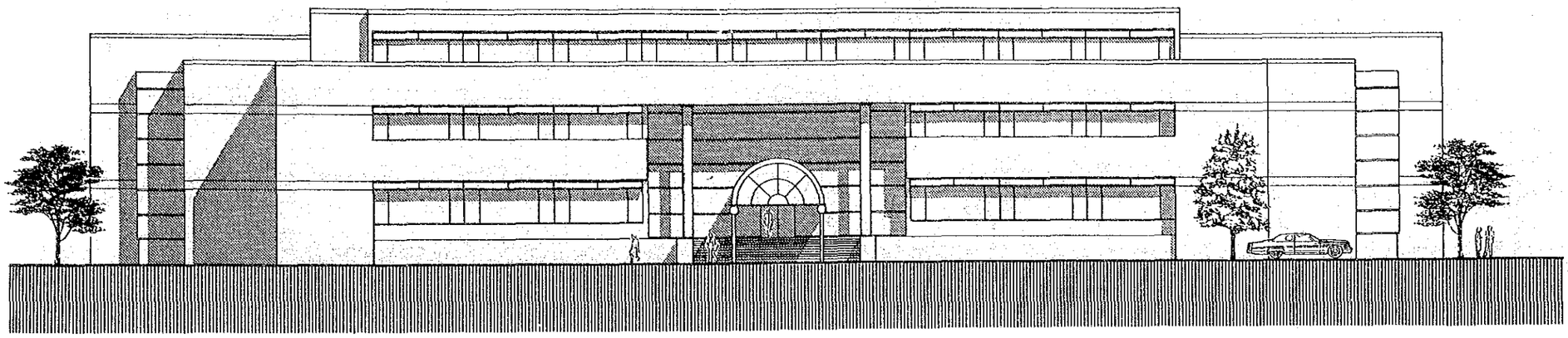


THE INDUSTRIAL METROLOGY TESTING SERVICE CENTRE

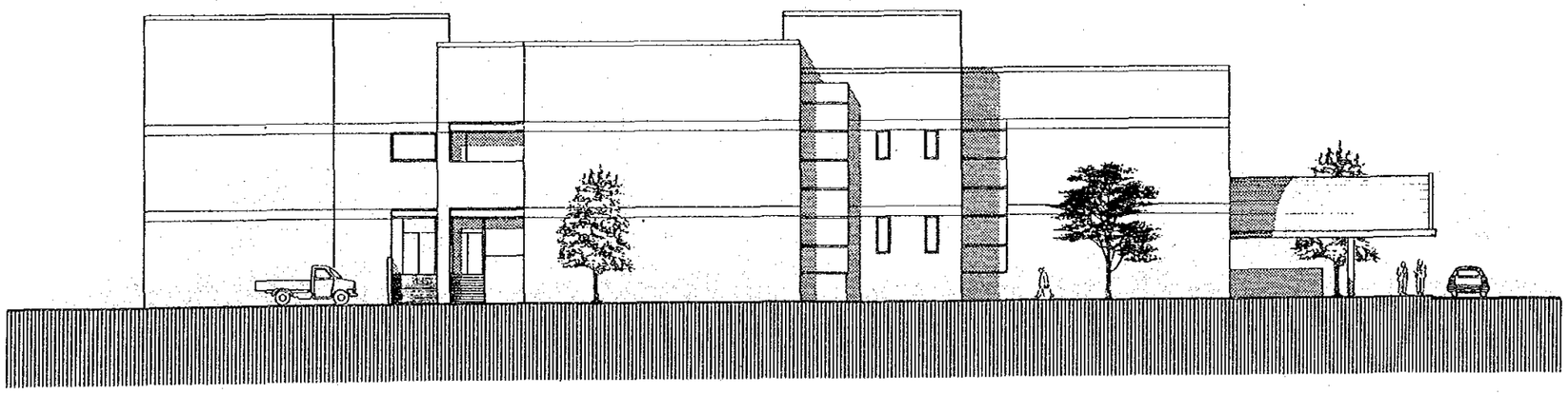
FIRST FLOOR PLAN

8

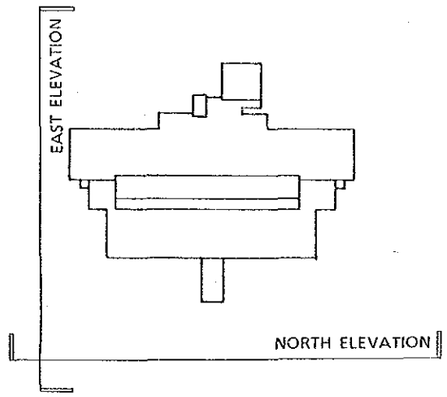

ANECHOIC RM
LIFT
PREPARATION RM
OBSERVATION RM
X-RAY SHIELD BOOTH
N.D.T. LAB.
BALCONY
BALCONY
TEMPERATURE LAB
PHOTOMETRY AND RADIATION LAB
ELECTRICAL AND ELECTRONIC LAB
BIOCHEMICAL TESTING LAB.
CHEMICAL TESTING LAB.
CORRIDOR
TOILET (W)
PANTRY
TOILET (M)
STAFF RM (2)
STOCK RM (3)
STAIRCASE (2)
CORRIDOR
(VOID)
STOCK RM (4)
STAFF RM (3)
CORRIDOR
STAIRCASE (1)
PANTRY
TOILET (W)
TOILET (M)
WAITING CORNER
LECTURERS' RM
MEETING RM
DIRECTOR'S OFFICE
SECRETARY'S RM
TOILET
BALCONY
SEMINAR RM (1)
SEMINAR RM (2)
CONFERENCE RM
BALCONY
0
5
10
20

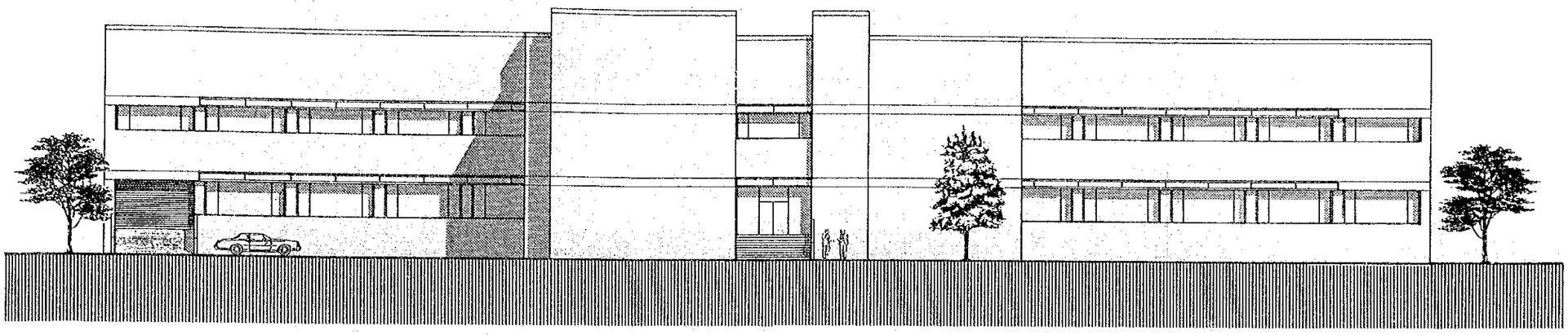


NORTH ELEVATION

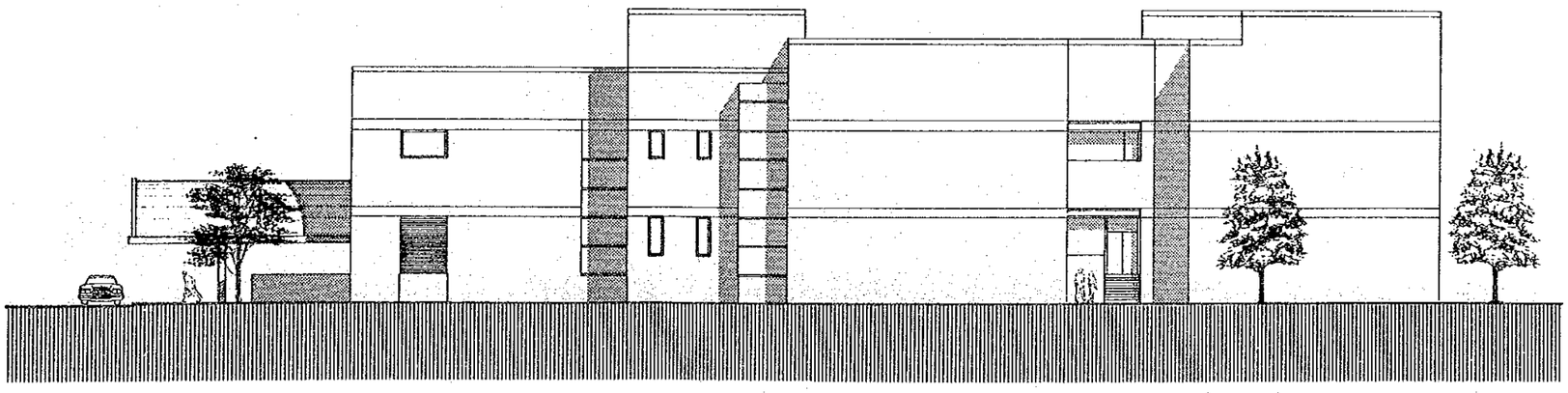


EAST ELEVATION

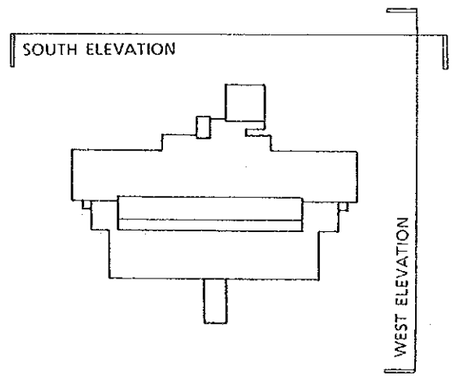




SOUTH ELEVATION



WEST ELEVATION



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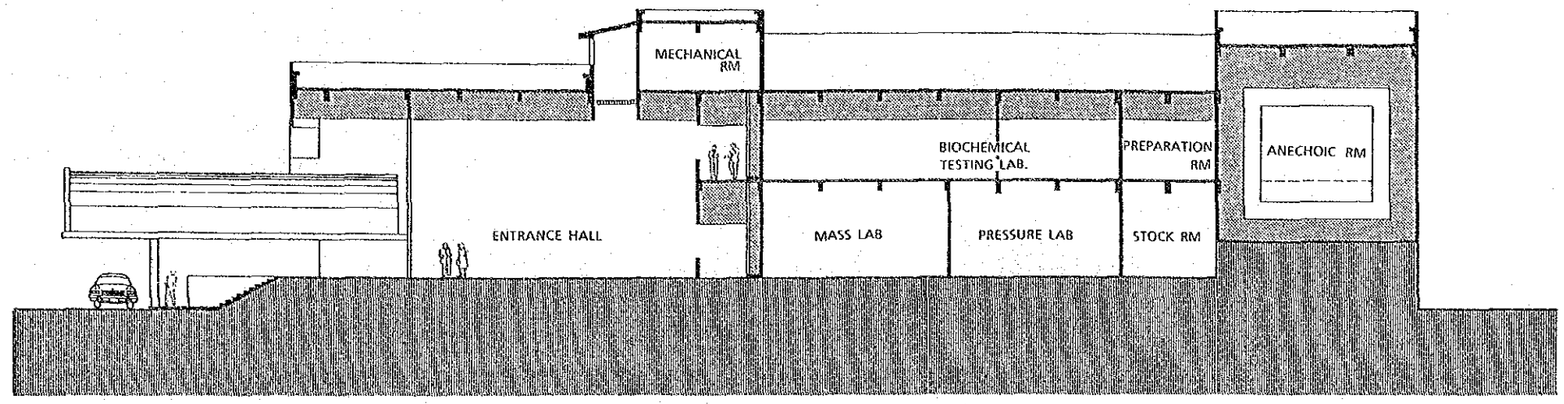
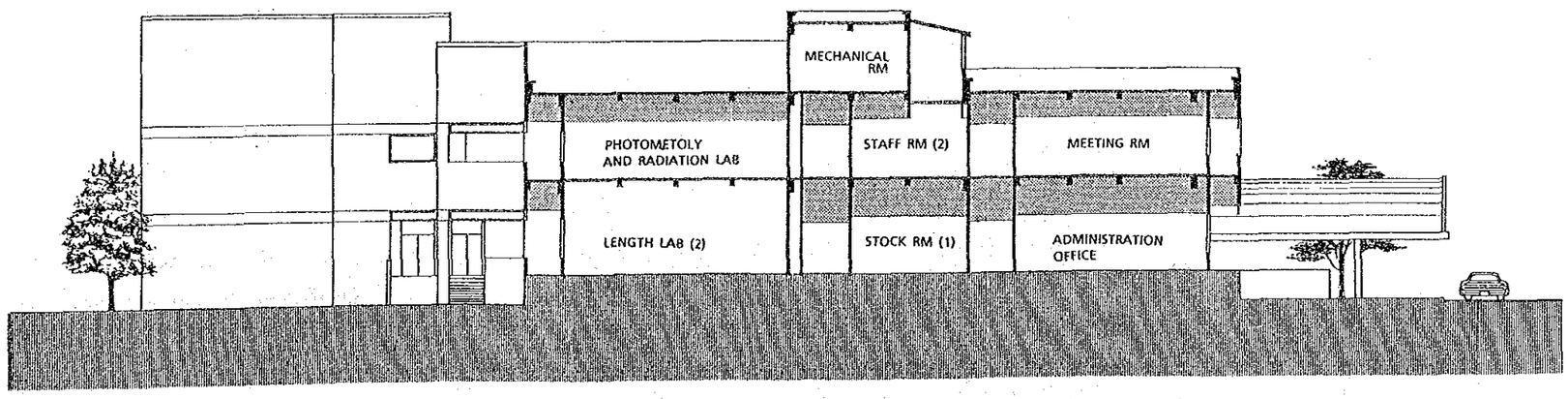
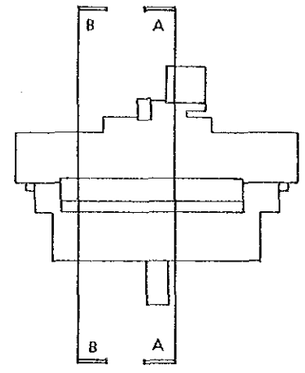


SECTION A-A



SECTION B-B



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4-4 Basic Equipment Plan

4-4-1 Basic Guideline for Selecting Equipment

In planning on equipment, the basic guideline followed in selecting the equipment is to be as follows:

(1) The Industrial Standardization, Testing and Training Centre

1) Testing Equipment

1. Pick out test items corresponding to each compulsory standard and standards expected to be compulsory in the near future.

2. Decide the type and number of testing equipment used for the test items picked out above.

3. Follow the steps of 1 and 2 above with respect to other voluntary standards based on which relatively frequent tests have been performed in the past 3 years or for which tests can be expected to increase with the progress of industrialization.

4. Survey the existing equipment installed in TISI, to consider suitability for transfer to the Centre.

5. The number of each type of testing equipment is, in principle, to be the total number which is decided by 2 above. However, number of testing equipment should be minimized taking testing sequence into account in case when same equipment can be used for several test items.

When number of test samples is very large, necessary number of testing equipment should be calculated based upon such idea that by the number of the equipment these test samples can be satisfactorily coped with, in order to conduct testing efficiently.

The following is the reason of calculating number of each equipment. Taking the 3-year averages for the period 1985-87 in the numbers of certification tests performed in the different domains, and extrapolating the increases to 5 years hence, at a rate that should bring the total increase to 3,500 the result is as presented in table 4.4-1.

Table 4.4-1 Expected Number of Tests (Averaged over 1985-1987)

Category	No. of Tests	After 5 Years	Increment
Chemical	258	461	203
Mechanical	265	473	208
Agricultural products	286	511	225
Plastics	30	54	24
Electrical	637	1,137	500
Consumer products	410	733	323
Pulp and paper	39	70	31
Metal	1,074	1,917	843
Civil engineering	595	1,062	467
Construction	237	423	186
Textiles	1	2	1
Non-metal	350	626	276
Foods	301	538	237
Electronics/ communications	3	5	2
Total	4,486	8,012	3,526

With a view to estimating required increases of testing equipment, statistical studies of 38 standards for which expected time between application for testing and issue of test results have been specified. For each of these standards, the longest period during which the relevant equipment would be occupied was identified, and the number of tests that could be performed per year on the equipment was calculated, assuming a working year of 300 days. The result for the

number of tests given in the preceding Table 4.4-2, estimated for 5 years hence, is as presented in Table 4.4-2.

Table 4.4-2. Ratio of Expected Increment against Number of Tests Possibly Handled per Year

TIS standard	Category	Number of tests handled per year	Increment	Ratio
7	Electrical	43	3	0.07
11	Electrical	43	169	3.98
17	Consumer products	100	75	0.75
20	Metal	300	163	0.54
23	Electrical	25	128	5.10
24	Metal	300	239	0.80
27	Mechanical	60	72	1.20
30	Chemical	150	3	0.02
49	Metal	100	70	0.70
64	Electrical	43	1	0.03
78	Chemical	150	72	0.48
86	Electrical	43	2	0.05
92	Electrical	150	13	0.09
118	Electrical	43	15	0.36
146	Mechanical	300	6	0.02
196	Mechanical	60	6	0.11
211	Metal	300	191	0.64
226	Electrical	43	6	0.15
236	Electrical	60	26	0.43
248	Metal	150	2	0.02
254	Mechanical	150	2	0.02
276	Metal	150	3	0.03
279	Electrical	60	4	0.07
291	Mechanical	300	5	0.02
293	Electrical	43	31	0.72
300	Mechanical	300	1	0.01
309	Consumer products	150	127	0.85
325	Metal	300	1	0.01
343	Metal	300	1	0.01
366	Electrical	150	31	0.21
369	Mechanical	100	7	0.08
476	Pulp and paper	60	10	0.17
496	Non-metal	150	64	0.43
520	Non-metal	150	42	0.28
531	Consumer products	21	7	0.31
539	Chemical	150	4	0.03
540	Chemical	150	33	0.22

Now in case ratio are less than 1, a single testing unit can handle

the expected increase of test demand and in case the ratio exceeds 1, additional testing units should seemingly be considered. The ratio in Table 4.4-2 would serve as criterion for judging the necessity of multiplying the testing units in order to handle the increase of testing demand in the 5 years to come. It is seen, however, that only in a very few cases does this ratio exceed 1. It was further found that in all these cases of ratio exceeding 1, the testing equipment in question was of a type that was capable of testing multiple samples simultaneously, and further considering duplication between test items in similar standards, a single testing unit can handle expected increase of testing demand. And accordingly, testing equipment whose minimum number is decided by item 5 above can cope with expected increase of testing demand.

2) Standardization Equipment

Decide the type of eqipment from the scope of training equipment necessary to cover the training programme proposed for technical cooperation, for the envisaged number of trainees and for the curricula envisaged.

3) Equipment for the Certification

1. Estimate the volume of administrative work requiring to be handled on the premise that 3,500 applications for certification would have to be handled.

2. Consider the appropriate office equipment used for the purpose of rationalization of office works.

(2) The Industrial Metrology Testing Service Centre

1) Metrological Equipment

1. In respect of quantities to be covered by primary standards, examine the types of standards and systems for maintenance and management that should be required.

2. In respect of calibration services, estimate the number of requests that would be received annually 5 years hence, and the scope and substance of these requested calibration services, to estimate the grade and volume of calibration work expected to be demanded.

3. In respect of existing eqipment currently installed in TISTR, consider transfer to those that are indispensable and transferable, and list up those that are outdated or worn for renewal.

2) Testing Equipment

Pick out domains in which requests for testing are expected to increase in the years to come, and for the domains thus picked out, survey Thai industrial standards, which will serve as basis, as well as the international standards, ISO, IEC and survey pertinent Japanese testing institutions for the equipment. Draw up eligible testing equipment base on the result. The rise in demand for testing is envisaged to amount to 8 percent per year, as set forth in 3-3-2, so that in 5 years, this demand will attain 1.4 times the current rate (to around 5,000 cases per year).

One complete series of testing equipment is envisaged to meet this expected demand.

3) Other Equipment

1. Estimate requirements for other office equipment from the envisaged number of staffs 5 years hence.

2. List up other equipment for operation of the Centre.

4-4-2 Basic Equipment Plan

Main equipment in each domain selected following the procedure described above 4-4-1 is as listed in what follows.

(1) The Industrial Standardization, Testing and Training Centre

1) Equipment for Certification Testing

1. Mechanical

- Basic measuring/testing equipment:
  for basic measuring/testing
- Tensile property test equipment:
  for tensile property testing on the junction, etc.
- Impact test equipment:
  for impact testing on the safety glass, etc.
- Hardness test equipment:
  for hardness testing on material, etc.
- Compression test equipment:
  for compression testing on rubber products, etc.
- Torsion test equipment:
  for torsion testing on the junction, etc.

- Creep test equipment:

  for creep testing on automobile parts, etc.

- Vibration test equipment:

  for vibration testing on the products

- Spring characteristic test equipment:

  leaf spring, etc. for spring characteristic test on leaf spring, etc.

- Friction and wear test equipment:

  for friction and wear testing on automobile parts, etc.

- Specific testing equipment:

  for dynamic characteristic testing on fasten belt, shock absorption testing on helmet, and other testing

- Non distructive testing equipment:

  for testing of weld etc. without distruction of test sample

- Endurance test equipment:

  for endurance testing on the ignition coil, starter motor, etc.

- Pressure test equipment:

  for pressure testing on gas cylinder, etc.

- Optical measuring/testing equipment:

  for optical characteristic testing on the safety glass, etc.

- Noise measuring/testing equipment:

  for measuring/testing of noise

- Testing equipment for tyre and rim:

  for balance testing, tyre testing on type and rim

- Equipment for making jig:

  for making jig used for various kind of testing

2. Electrical and Electronics

- Basic measuring/testing equipment:

  for basic measuring/testing

- Resistance measuring/testings equipment:

  for measuring/testing on low impedance, contact resistance

- Wave form measuring equipment:

  for mesuring of signal, frequency

- Temperature measuring/testing equipment:

  for thermal testing on the electrical products

- Recording equipment: for recording of quantity varied

- Power supply for testing:

  for supplying stabilized power for testing

- Specific testing equipment:

  cord bending test, flame retardant test on material etc.

- Electronic auto-patrs testing equipment:

  for testing on electronic auto-parts

- Thermal and heating test equipment:

  for varing temperature and humidty and for rain test on the products

- Climatic resistance test equipment:

  for rainproof testing, salt water spray test etc.

- Testing equipment for electronic products:

  for measuring signal of electronic products

- Testing equipment for air-conditioner:

  for measuring/testing on aircooling capability etc. of air conditioner

- Air delivery test equipment:

  for measuring air delivery of fans

- Calibration equipment:

  for calibrating testing equipment owned in this centre

3. Chemical

- Metalic element analytical equipment:

  for analyzing metalic element dissolved in can etc.

- Metallic material analytical equipment:

  for analyzing metallic material

- Manual analytical equipment:

  for analyzing manually food etc.

- Test drainage treatment system:

  for treating test drainage

2) Standardization Equipment

- Training equipment:

  for using for training of standardization, quality control and testing

- Equipment for preparing the training material:

  for preparing the training material such as printed material, video tape

- Vehicle:

  for training, roving consultancy and carrying test sample

3) Certification Equipment

- Office equipment:

  for processing office work of certification efficiently

4) Others

- Office equipment:

  for processing general office work efficiently and arranging test data, keeping material, etc.

The current equipment of TISI is as listed in Attached Table 6 attached. This equipment is not used for the functions envisaged for the Industral Standardization, Testing and Training Centre, and is for this reason not to be transferred.

(2) The Industrial Metrology Testing Service Centre

1) Metrological Equipment

- Length:

  Secondary standards on length, equipment for their maintenance and management and equipment for calibraton service.

- Mass:

  Secondary standards on mass, equipment for their maintenance and management and equipment for calibraton service.

- Volume:

  Secondary standards on volume, equipment for their maintenance and management and equipment for calibraton service.

- Pressure:

  Secondary standards on pressure, equipment for their maintenance and management and equipment for calibraton service.

- Radiation:

  Primary standards on radiation which is limited to infrared and ultraviolet region, equipment for their maintenance and management and equipment for calibraton service which is limited to provision for illuminometer and liminous flux meter.

- Acoustic:

  Secondary standards on acoustic, equipment for their maintenance and management and equipment for calibraton service.

- Electrical:

  Primary standards on electrical, equipment for their maintenance and management and equipment for calibraton service.

- Thermometry:

  Primary standards on thermometry, equipment for their maintenance .and management and equipment for calibraton service.

- Vibration:

  No equipment is to be planned. However, the foundation for a shaking machine should be prepared.

2) Testing Equipment

1. Mechanical

- Basic measuring/testing equipment:
  for basic measuring/testing.
- Material property test equipment:
  for testing concerned with material property, such as tensile testing, hardness testing, torsion testing etc.
- Non destructive testing equipment:
  for testing on the condition of inner corrosion, of inner defect, etc. without destruction of test sample
- Equipment for making jig:
  for making jig used for various kind of testing

2. Electrical and Electronics

- Basic mesuring/testing equipment:
  for basic measuring/testing.
- Wave form measuring equipment:
  for measuring of signal, wave form.
- Recording equipment:
  for recording of quantity varied.
- Power supply:
  for supplying stabilized power for testing.
- High voltage test equipment:

for testing insulation resistance at high voltage.

- Thermal and heating test equipment:

  for varying temperature and humidity

- Optical test equipment:

  for testing optical characteristics.

- Testing equipment for electronic products:

  for measuring signal of electronic products.

- Material testing equipment:

  for flame retardant testing on various materials.

3. Chemical

- Polymar and paint analysis equipment:

  for testing mechanical strength, material property, quality of material and climatic resistance on polymar and paint

- Gas analysis equipment:

  for analyzing ingredient and testing purity of inorganic gas

- Food analysis equipment:

  for analyzing amino acid and additives included in food, sugar and protein

- Metallic material analysis equipment:

  for analyzing metallic material

- Microbial analysis equipment:

  for analyzing microbe

- Organic substance analysis equipment:

  for analyzing organic substance

- Manual analysis equipment:

  for analyzing manually food etc.

- Test drainage treatment system:

  for treating test drainage

However, the equipment used for testing which can be conducted with the equipment currently owned by TISTR, is not to be planned except that is outdated.

3) Technical Trainig Equipment

- Trainig equipment:

  for using for training of metrology and testing

4) Other Equipment

- Vihecles:

  for roving calibration service, on-site technical guidance and carrying test sample

- Furniture:

  for arranging test data, keeping material, etc

- Office equipment:

  for processing office work

The current equipment owned by TISTR are listed in Attached Table 7. In principle, all these equipment are to be transferred to the Industrial Metrology Testing Service Centre.