

D. MACHINERY AND EQUIPMENT PLANNING

- Needs for each equipment and setting of grade

The basic policy and process leading to the selection of each equipment are as described in Paragraph C, and the needs for installing each equipment are described below.

Also, the basic considerations with respect to grade have been taken up in Step 4 above: However, to be more specific, the grade was selected according to the following policies.

- (1) The equipment shall not be at a level too remote from the current level of technology in Thailand
- (2) The equipment shall not be such that it will become obsolete in a matter of a few years.
- (3) In consideration of maintenance and upkeep, only reliable equipment shall be selected. Those which are too complex and advanced shall be avoided.
- (4) Insofar as possible, the equipment shall be selected from among those of makers who have agency representation or service networks in Thailand or Southeast Asia.

1. CASTING

The popular molding processes, namely, green sand molding process, CO₂ gas molding process, furan process and shell molding process were chosen and the equipment for these were planned for installation in order to improve technologies in this field.

As melting methods, high frequency induction furnace, cupola and crucible were planned so that casting of not only cast iron and cast steel but of non-ferrous metals such as aluminum and copper would also be possible. Particularly for popularizing ductile cast iron, the high frequency induction furnace is indispensable. To make the complicated casting process as easy to understand as possible,

particular attention was given to the layout of the equipment. Equipment large enough in capacity to make the bed for small machine tools was chosen. Items of fairly large size, such as pumps, valve casings can also be produced with the equipment.

2. FORGING

As forging commands low priority and the needs for installing facilities for it at this Institute seemed small as judged from the existing actual situation of the Thai industries, it was decided that it would suffice to relocate existing equipment of ISD and to install newly only a heating furnace.

3. HEAT TREATMENT

It is needless to mention the importance of heat treatment of material in metal-working. For training, therefore, it is necessary to install equipment necessary not only for ordinary heat treatment such as normalizing and tempering which are widely applied to metal-working and related fields, but also for carburization hardening, soft nitriding treatment and non-oxidizing treatment by means of salt bath. With these equipment, heat treatment of heavy duty members for agricultural machinery, machine tool and industrial equipment and hard facing treatment of metal mold and tool can be performed.

High frequency induction hardening equipment and vacuum quenching furnace are not being provided in consideration of the difficulty in operation and high running costs.

4. MATERIAL TESTING AND INSPECTION

In the metal-working industries, the application of raw materials only upon a thorough knowledge of their metallurgical properties and mechanical strength is a most basic requirement. Nevertheless, fact finding surveys of the Thai industries conducted so far have revealed insufficiencies in this respect, and this is a field in which the Thai Government urgently requests the transfer of technology.

Accordingly, material testing and inspection facilities under this project were treated on a priority basis and reductions and deletions of equipment were avoided as much as possible. Sophisticated ones used for research purposes however were avoided while those needed for production activities were included.

By the equipment provided, all the usual analysis, metallography, nondestructive tests and mechanical strength tests are possible.

Also, in consideration of such activities as itinerant technical guidance, arrangements were made to include as many portable equipment and apparatus as possible.

5. WELDING

According to the findings of several surveys conducted in the past, the most widely practiced processing in the Thai medium and small scale industries is sheet metal welding, mostly by general arcwelding. As the industrial level of Thailand advances in the future, it is apparent that welding must also keep pace with it and diversify itself. Accordingly, in planning for this project, equipment capable of various welding processes used for steel structures in shipbuilding, bridge, machinery, rolling stock, pressure container and pipe have been provided. Equipment is capable also of welding stainless steel and aluminum alloy.

6. MACHINING

Machining, along with sheet metal welding, is a process most widely practiced by the medium and small scale Thai industries, but the process being practiced is quite outmoded in which a few old lathes, drills and shapers are used to make articles requiring very little precision.

Emphasis was placed not only on transferring the basic of machining techniques, but also on the training of basic scheduling, process and quality control through the processing of products.

The criteria for selecting machines was predicated on capability to make metal molds and simple machine tools.

The demand for metal mold, particularly for plastics, is increasing yearly in Thailand. The supply of high precision and large metal molds is dependant almost entirely on imports. Improvement of mold processing technology is therefore an urgent task. Machine tool, on the other hand, is listed as one of the target products for promoting the Thai industry, but more than that, as it requires all metal cutting and working technologies, measuring technologies and assembling technologies to complete one set of machine tool, it is considered the most appropriate teaching field. The techniques that are obtainable from making a machine tool are applicable to the techniques of manufacturing other products.

Also included are such equipment as wire cut EDM, jig milling machine, gear grinder, NC lathe and machining center which are not popularly used among the medium and small scale Thai industries yet, but which are surely to be widely used in the future (many have asked for them in the questionnaire survey). Also, with due regard to itinerant technical guidance, we have included as many portable machines and measuring instruments as possible.

7. PRECISION MEASUREMENT AND INSPECTION

Where the Thai medium and small scale metal-working industries are most retarded in improving product quality is in their lack of measuring instruments and lack of technical skill. Enterprises having relatively expensive precision measuring instruments are practically unheard of. At this Institute, measuring and inspection processes will be introduced wherever possible in the training process to implant in the trainees the importance of accuracy control.

Also, diffusion of measuring instruments and technique will be attempted through consigned inspection and itinerant technical guidance.

A high priority was therefore placed on measuring and inspection equipment, and as many as possible are being included.

8. PLATING AND WASTE WATER TREATMENT

As for the plating facility, the one currently installed at ISD will be relocated and used because of the reasons stated before. A new waste water treating system which is an important ancillary equipment in the plating industry, but which is lacking now, will be installed. A supersonic wave cleaning system necessary for surface preparation, which is an important process for improving plating quality, will also be provided.

The waste water treating system is of great importance as a test plant to study both its technical and cost aspects in view of the possibility of consolidating the medium and small scale industries into an industrial estate in the future. In the initial planning stage, the closed system of recycling waste water was considered, but because its operating cost and technology did not seem to suit the current condition, the system of discharging waste water was adopted instead.

9. METAL MOLD TESTING

A minimum of facilities required for testing and confirming whether the mold designed and fabricated is finished in the way it was initially intended will be installed. Injection molding machine for testing plastics molds and press equipment for testing molds for presswork will be installed.

10. COMMON FACILITIES FOR WORKSHOPS

As common facilities for workshops, haulage equipment and equipment which will be used frequently in all shops such as compressed air, oxygen and acetylene gas units will be installed. Special gases as required will also be installed.

Haulage equipment shall be kept to a minimum as the Institute is not a production plant.

11. LOW COST AUTOMATION

Although the Thai industry places priority on labor intensive types of industry, the needs for automation are great in terms of productivity and safety. As the medium and small scale industries have only limited financial resources to cover such capital investment, what they hope for is simple and low cost automation facilities. Education and training in automation is being offered already and the demand for it is likely to increase in the future.

In this design, priority was placed on hydraulic control training equipment. Display panels for itinerant guidance services and some supplementary items with respect to pneumatic control training will be provided.

12. AUDIO-VISUAL AIDS

This Institute is not intended for educating and training beginners for an extended period but for reeducating nucleus engineers, skilled craftsmen and managerial class personnel who are active in their jobs with private enterprises and public institutions. The Institute therefore must offer education and training that will accomplish the most effective results within the shortest possible time. Sometimes arises the problem of loss of valuable technology embodied in staff members may be lost due to transfers or change of jobs to other organizations.

In order to overcome these problems, the Institute will attempt to enhance the effects of its education and training and to accumulate technical know-how by inducing mainly audio-visual educational equipment.

The minimum of equipment required for filming, producing and reproducing video ware will be installed, and will also be utilized for itinerant guidance service and publicity.

13. SOFTWARE

Besides the equipment (hardware) stated above, software composed mainly of audio-visual education material will also be provided under this project. Material to be provided will be those available on the Japanese market, and will be accompanied with English translations as deemed necessary.

Materials that cover managerial techniques, designing and engineering in addition to the processes will also be supplied. Software provided by the Japanese side should be supplemented or revised in the future by the Thai side after the opening of MIDI in order to accumulate technological know-how in a stable form.

14. OTHERS

- * As vehicles are indispensable for itinerant guidance services, field trip and other duties, all-purpose wagon type vehicles will be provided.
- * A minimum number of micro-computer, word processor, typewriter, copying machine which are necessary for preparing education and training materials will be provided.
- * To improve designing and drawing capability, drawing instruments will be provided for use in education and training.

E. EQUIPMENT BASIC DESIGN

Equipment and Reason for Installation

Foundry Facilities (1/4)

No.	Name of Equipment	Quantity	Reason for Installation
C-1	<u>(Melting Process)</u>		
1-1	H.F. Induction Furnace	1	Installed mainly to make ductile cast iron and cast steel products.
1-2	Cupola	1	Installed as a most popular melting system in Thailand and indispensable for guiding technological improvement on cast iron.
1-3	Crucible furnace	1	Installed mainly for use in casting of copper, aluminum and other non-ferrous alloys.
1-4	Ladle	1 set	Installed an apparatus for conveying molten metal from melting furnace to molding shop. Require assorted set of capacities.
1-5	C.E. Meter	1	Installed as an inspection instrument to check the constituents (carbon, silicon, etc.) of molten metal on the spot and is indispensable.
1-6	Pyrometer	4	To measure the temperature of molten metal. Necessary for temperature control of molten metal. Dipping type, digital type and radiation type each with different applications are installed.
1-7	Ladle dryer	1	Installed to heat ladle in advance so that molten metal poured into it will not be cooled off. Necessary for temperature control.
1-8	Balance	3	Installed to weigh material. 3 kinds with different capacity are required.
1-9	Others	1 full set	One full set of jigs, tools & fixtures, kneader with refractory frame, pig casting machine, ladle cart, etc. necessary for melting process is equipped.

Foundry Facilities (2/4)

No.	Name of Equipment	Quantity	Reason for Installation
C-2	<p>(Green Sand Molding Process)</p> <p>Green Sand Molding Equipment</p> <ul style="list-style-type: none"> • Molding Machine • Sand Reclaim Unit • Sand Mixer & Supply Unit • Conveyor, Hopper • Dust Collector, etc. 	1 full set	Installed for improving level of molding technology since the process is the most popular molding method. Facilities are a series of plant such as mixer, sand supply unit, sand reclaiming unit, sand conveying system, etc.
C-3	<p>(CO₂ Molding Unit)</p> <p>CO₂ Molding Equipment</p> <ul style="list-style-type: none"> • CO₂ Sand Mixer • CO₂ Gas Economizer • Flask, etc. 	1 full set	Installed as an equipment for binding molding sand with water glass and CO ₂ gas. Being popular in Thailand for molding core of small to medium sized castings, installation considered necessary for improving technology. Consists of a series of equipment such as mixer, CO ₂ gas economizer, flask, etc.
C-4	<p>(Chemical Binder Sand Molding Unit)</p> <p>Furan Molding Equipment</p> <ul style="list-style-type: none"> • Sand Mixer • Sand Reclaim Unit • Conveyor, Traverser • Dust Collector • Flask, etc. 	1 full set	The method is used for molding relatively large size mold and is likely to become popular from now on in Thailand. Installed for advanced training to prepare for the forthcoming technology. Self curing resin is used as binder. Equipment is a series of plants consisting of machines indicated.
C-5	<p>(Shell Molding Process)</p> <p>Shell Molding Equipment</p> <ul style="list-style-type: none"> • Master Molding M/C • Core Molding M/C • Metal Mold, etc. 	1 full set	Installed for high precision mass production of comparatively small or medium sized products, which is likely to become popular in Thailand in future. Machines for making master mold and core, plus metal mold

Foundry Facilities (3/4)

No.	Name of Equipment	Quantity	Reason for Installation
			are necessary since it is thermo-setting.
C-6	(Sand Testing Equipment)		
6-1	Sand Rammer	1	Installed to make test piece of molding sand.
6-2	Permeability Tester	1	Installed to test permeability of above test piece.
6-3	Ro-Tap Sieve Shaker	1	Installed to measure particle size of sand.
6-4	Moisture Teller	1	Installed to test moisture content of sand.
6-5	Universal Sand Tester	1	Installed to measure pressure resistance of molding sand.
6-6	Mold Hardness Tester	2	Installed for measuring surface hardness of mold.
	Others	1 full set	Jigs and tools, work bench, balance and others necessary for sand testing are provided.
C-7	(Finishing Process)		A series of equipment necessary for finishing the surface of castings.
7-1	Shot Blasting M/C	1	Installed for surface finishing by blasting fine metal particles to the casting skin. It is also used for surface finishing after heat treatment.
7-2	Grinder	1 set	Installed for deburring surface. Both stationary type and electric hand tool type are supplied.
7-3	Inspection Tool	1 set	Equipped to check dimensions of completed castings.

Foundry Facilities (4/4)

No.	Name of Equipment	Quantity	Reason for Installation
7-4	Surface Plate	1	Equipped to check dimensions of completed castings.
C-8	(Pattern Making Shop)		Installed a series of equipment to make pattern for castings.
8-1	Wood Lathe	1	Installed for turning and most widely used.
8-2	Planer	1	Installed for machining the plane of wood.
8-3	Band Saw	1	Installed for cutting wood into required size.
8-4	Router Machine	1	Installed for machining curved surface and has lots of applications.
8-5	Surface Plate	1	Installed for dimensional inspection.
8-6	Others	1 set	Installed such as jigs, tools and fixtures, finishing apparatus, dust collector, etc.

Forging Equipment (1/1)

No.	Name of Equipment	Quantity	Reason for Installation
F-1	Air Hammer	1	Existing equipment in ISD is relocated and used in MIDI.
F-2	Heating Furnace	1	New electric type one is installed as the existing equipment is an outmoded hearth furnace.
F-3	Tools & Jigs	1 set	Installed jigs and tools for holding or nipping forgings.
F-4	Thermometer	1 set	Installed to measure temperature of forgings.

Heat Treatment Equipment (1/2)

No.	Name of Equipment	Quantity	Reason for Installation
H-1	Heating Furnace (Pit type)	1	Installed for heating for normal heat treatment such as normalizing and thermal refining.
H-2	Tempering Furnace (Pit type)	1	Installed for tempering for normal heat treatment.
H-3	Quenching Oil Bath (Pit type)	1	Installed for oil quenching.
H-4	Quenching Water Bath (Pit type)	1	Installed for water quenching.
H-5	Gas Atmosphere Furnace	1	Installed mainly for carburizing treatment. Carburizing is integrated with case hardening and is widely applied.
H-6	Tempering Furnace (Batch type)	1	Installed for tempering after carburizing.
H-7	Wash Cleaning Bath (Deoiling bath)	1	Installed for degreasing and cleaning of the surface of work before heat treatment and also quenching oil. Used on the pit furnace line.
H-8	Wash Cleaning Bath (Batch type)	1	Installed for the batch furnace line for carburization treatment and soft nitriding treatment.
H-9	Salt Bath, High & Medium Temperature	2	Those capable of high temperature iso-thermal treatment are installed as substitutes for vacuum furnace. For heat treatment of die steel, HS steel and stainless steel.
H-10	Soft Nitriding Furnace	1	Installed mainly for soft nitriding of plastics mold.
H-11	Others Duct jigs, chain fan, grinder,	1 set	Installed jigs, tools, inspection instruments, work table, environmental protection equipment necessary

Heat Treatment Equipment (2/2)

No.	Name of Equipment	Quantity	Reason for Installation
	thermometer, hardness tester, surface plate, etc.		for various heat treatment operations mentioned above.

Materials Testing & Inspection Equipment (1/2)

No.	Name of Equipment	Quantity	Reason for Installation
T-1	Vacuum Emission Spectrometer	1	Installed for component analysis of materials. Indispensable for quick grasp and control of components.
T-2	Universal Testing M/C	1	Installed for tensile, bending, and yield strength tests of metal materials.
T-3	Micro Vickers Hdn. Tester	1	Installed for testing distribution of hardness in micro section.
T-4	Vickers Hdn. Tester	1	Installed for measuring Vickers hardness.
T-5	Brinell Hdn. Tester	1	Installed for measuring Brinell hardness.
T-6	Rockwell Hdn. Tester	1	Installed for measuring Rockwell hardness.
T-7	Shore Hdn. Tester	1	Installed for measuring Shore hardness.
T-8	Charpy Impact Tester	1	Installed for measuring impact value.
T-9	Magnetic Particle Detector	1	Installed for detecting flaw (non-destructive test) like surface flaw.
T-10	Ultrasonic Detector	1	Installed for detecting internal flaw of material.
T-11	X-ray Inspection Unit	1	Installed to detect internal flaw of material.
T-12	Microscope	4	Installed to enlarge and observe metal structure.
T-13	Scanning Microscope	1	Installed for observing microstructure.

Materials Testing & Inspection Equipment (2/2)

No.	Name of Equipment	Quantity	Reason for Installation
T-14	Nodularity Detector	1	Installed to determine composition of ductile cast iron by measuring graphite spheroidizing ratio.
T-15	Penetrating Inspection Instrument	1	Installed for simple inspection of detecting surface flow.
T-16	Pure Water Generator	1	Installed as a distilling device of pure water necessary for analysis of composition.
T-17	Workpiece Turning Device	1	Installed for turning workpiece for inspection.
T-18	Others	1 set	Installed balance, reagents, apparatus, etc. for the above tests and inspection.

Welding (1/2)

No.	Name of Equipment	Quantity	Reason for Installation
W-1	AC Arc Welder	10	Most widely used welding process. Installed 10 units for training.
W-2	DC CO ₂ Welder	2	Installed for welding of heavy structure. Will become necessary for Thailand in future.
W-3	TIG Welder	2	Installed for demand on the rise as being used for welding of aluminum, stainless and other non-ferrous metals, too.
W-4	MIG Welder	2	Installed for demand likely to grow in near future as the welding process for high pressure tanks and pipes.
W-5	Submerged Arc Welder	1	Installed as an equipment for education and training of automating welding. Wide general applications as the welding process for general structure.
W-6	Spot Welder	1	Installed for automobile, vehicle and extending to toys as the resistance welding process.
W-7	Semi-auto Gas Cutter	1	Installed for cutting welded member. Semi-automated gas cutter.
W-8	Manual Gas Cutter	3	Manual gas cutter necessary for Thai medium and small scale industries. 3 units equipped for training.
W-9	Grinder	1	Installed for finishing cut face and after welding.
W-10	Plasma Cutting M/C	1	Capable of high speed cutting regardless of ferrous or non-ferrous metal. Installed since its diffusion likely in near future in Thailand, too.

Welding (2/2)

No.	Name of Equipment	Quantity	Reason for Installation
W-11	Welder Unit	9	Installed for setting welder on the floor and necessary for training orderly arrangement and also for operating power source.
W-12	Arc Cover and Bench	8	Installed as work bench for training.
W-13	Welding Platform	1	Installed as a table for training automatic welder.
W-14	Cutting Platform	1	Installed as work table for gas cutting.
W-15 W-16	Tool Cabinet & Rack	2	Installed for storing jigs, tools and materials in custody.
W-17	Wall Crane	1	Installed for conveying heavy weld and for housing automatic welder.
W-18	Exhaust Fan & Duct	2	Installed for sucking and exhausting noxious gases generated during welding. Necessary for health control.
W-19	Gas & Oxygen Regulator	2	Installed as a safety device when Gas and oxygen supply system goes wrong.
W-20	Engine Welder	1	Installed as portable welder with generator with wide applications for places without power supply or for maintenance work.
W-21	Others	1 set	A series of ancillary equipment, jigs, tools and safety gears for each equipment mentioned above is provided.

Machining Equipment (1/2)

No.	Name of Equipment	Quantity	Reason for Installation
M-1	Gear Hobbing M/C	1	Installed for machining gears for agricultural machinery, machine tool and other general machinery.
M-2	Gear Grinder	1	Installed for finishing tooth surface of case hardened gear.
M-3	Horizontal Machine Center	1	Highly efficient in machining square pieces like casing and is making inroad into Thailand. Installed to train how to use it.
M-4	Profile Die Milling M/C	1	Installed for machining product with many curved faces like die.
M-5	Jig Milling M/C	1	Installed as it is indispensable for precise machining of small workpiece, particularly for milling hole with high precision.
M-6	Electric Discharge M/C	1	Special machine for die making finding its way into Thailand. Installed for training of its use.
M-7	Wire Cut EDM	1	Installed as it will find its way to Thailand in near future as die making machine.
M-8	Planer	1	Installed for cutting plane of relatively large workpiece like the bed of machine tool.
M-9	Horizontal Boring M/C	1	Installed for relatively large hole of casing with high accuracy.
M-10	NC Lathe	1	Installed for training of programming for numerical control.
M-11	Vertical Lathe	1	Installed as being indispensable for large cylindrical work like gear blank, pump flange, brake drum, flywheel.

Machining Equipment (2/2)

No.	Name of Equipment	Quantity	Reason for Installation
M-12	Hob Sharpener	1	Installed for grinding hob for gear. Accuracy of gear depends on the accuracy of hob grinding.
M-13	Universal Grinder	1	Installed for grinding various shafts and spindles.
M-14	Tool Grinder	1	Installed for regrinding milling cutter and bite (cutting tool).
	Carbide Tool Grinder	1	Installed for regrinding super-hard bite and cutter.
M-15	Floor Grinder	2	Installed for regrinding of drill, bite and other tools. One for roving technical service.
M-16	Surface Grinder	1	Installed for machining of high accuracy plane of mold and casing, etc.
M-17	NC Programming Kit	3	Installed for improving educational effect of learning how to prepare program for NC machine.
M-18	Precision Surface Plate	1	Installed in the shop to measure and inspect products.
M-19	Universal Grinding Unit	1	Installed as it enables grinding work by attaching it to planer or lathe and has wide applications.
M-20	Cutting Tool, Jig	1 set	Installed as cutting, milling and grinding tools for various machines mentioned above.
M-21	Others	1 set	Assortment of tools, work benches, dust collectors, etc. are installed for machining work.

Precision Measuring and Inspection Equipment (1/3)

No.	Name of Equipment	Quantity	Reason for Installation
PM-1	Involute & Helix Tester	1	Installed for inspecting error in tooth profile and error in lead of gears.
PM-2	Pitch Tester	2	Installed to measure error in pitch of gear. One for roving technical guidance.
PM-3	Tooth Micrometer	2	Installed to measure tooth thickness. One for roving technical guidance.
PM-4	Hob Tester	1	Installed for measuring accuracy after regrinding hob.
PM-5	Grinding Wheel Balancer	1	Grinding wheel which rotates at high speed is dangerous unless the balance is checked and adjusted. Balancer is installed for this.
PM-6	Three Dimension(al) Coordinate(ing) Gauge	1	Relative accuracies of car room, engine case and mold are three dimensionally checked.
PM-7	Roundness Tester	1	Installed to measure roundness of cylindrically shaped workpiece.
PM-8	Screen Projector	1	Installed to measure the profile of gauge, screws, mold curvature, etc.
PM-9	Surface Roughness Tester	1	Installed to measure roughness of surfaces of sliding part, rotating part and other major machine components.
PM-10	Measuring Microscope	1	Installed to measure dimensions, profile, angle, screw, etc. and is capable of measuring by Cartesian coordinates and polar coordinates.
PM-11	Block Gauge	2	Installed for calibration of measuring instruments as the standard measuring instrument. 1 set is for general measurement.

Precision Measuring and Inspection Equipment (2/3)

No.	Name of Equipment	Quantity	Reason for Installation
PM-12	Granite Surface Plate	1	Installed for reference plate for inspection of precision parts and calibration of measuring instruments.
PM-13	Digital Count Height Gauge	1	Installed for precise measurement in the direction of height.
PM-14	Optical Parallel Gauge	1	Installed for precise measurement of parallelness.
PM-15	Optical Flat Gauge	1	Installed to measure planeness.
PM-16	Cylinder Gauge	1	Installed to measure roundness, cylindricalness of inner side of cylinder.
PM-17	External Micrometer	1	Installed for measuring instrument used in measuring length, external diameter, etc.
PM-18	Inside Micrometer	1	Installed for measuring inside surface, internal diameter, etc.
PM-19	Indicating Micrometer	1	Installed similar purposes to above but with dial graduation (memory).
PM-20	3-Point Inside Micrometer	1	Installed for inside micrometer for 3-point measurement.
PM-21	Dial Gauge w/Magnet Base	1	Installed for setting and centering of workpiece; most versatile measuring instrument.
PM-22	Dynamic Balancing M/C	1	Installed as a machine to check the balance of rotary body like brake drum, gear, etc. Indispensable for machinery industry.
PM-23	Screw Thread Micrometer	1	Installed to measure accuracy of screw which is a machine element.

Precision Measuring and Inspection Equipment (3/3)

No.	Name of Equipment	Quantity	Reason for Installation
PM-24	Micro Alignment Telescope	1	Installed to measure squareness, flatness, etc. of large workpiece.
PM-25	Ring Gauge	1	Installed for sampling inspection of mass-produced shaft and spindle. Effective for roving technical service.
PM-26	Digital Precision Level	1	Installed to check horizontalness and measure squareness, planeness, etc. of machine.
PM-27	Precision Square & Plate	2	
PM-28	Square Master	1	Installed for measuring squareness, rectangularness with high precision. Used for calibration as reference measuring instruments, too.
PM-29	Straight Edge	1	Installed as an instrument to check flatness.
PM-30	Depth Micrometer	1	Installed for precision measurement of depth.
PM-31	Rotating Speedometer	2	Installed to measure rotating speed of rotary machine.
PM-32	Phone Meter	1	Installed for diagnosing fault by measuring noise during machine operation.
PM-33	Portable Vibrometer	1	Installed to diagnose fault and failure by measuring vibration during machine operation.
PM-34	Others	1 set	Besides the foregoing measuring instruments of various types, assortment of measuring instruments such as vernier calipers, calipers, scale, jigs, and other necessities are installed.

Plating and Waste Water Treatment Equipment (1/1)

No.	Name of Equipment	Quantity	Reason for Installation
P-1	Waste Water Treatment System	1	Heavy metals contained in waste plating solution are at issue as the source of pollution and then their treatment facilities are installed for the plating shop.
P-2	Ultrasonic Washing Tank	1	Pre- and after treatment affect the plating quality, and this equipment is installed as a relatively advanced treatment method.
P-3	Deionizer	1	Water quality is an important factor in plating and needs strict control particularly in the case of research and experiment. Because of this, a pure water generating unit is equipped.
P-4	Hull Cell Tester	1	Installed as most basic experimenting apparatus in plating.
P-5	PH Meter	1	Installed for pH control of plating solution.
P-6	Thickness Tester	1	Installed to measure plating film thickness.
P-7	Pin Hole Tester	2	Installed to inspect defects in plating film. 1 set is for extension service.

Mold Testing Equipment (1/1)

No.	Name of Equipment	Quantity	Reason for Installation
MD-1	Plastic Injection M/C	1	Installed for testing molds fabricated in the education and training in design and fabrication of plastic mold.
MD-2	Multi-purpose Press	1	Similarly installed for testing of die and mold for sheet metal work.

Common Factory Equipment (1/1)

No.	Name of Equipment	Quantity	Reason for Installation
CM-1	Overhead Crane	1	5 t x 16 m, installed in No. 2 Factory of the machine shop for hauling heavy item like machine tool assembly.
CM-2	Overhead Crane	1	3 t x 16 m, installed in No. 1 Factory.
CM-3	Hoist Crane	2	1 t x 9 m, installed in the lower story of (A) and (B) Factories.
CM-4	Chain Block	2	Installed in the air conditioned machine room and measuring room.
CM-5	Folk Lift	1	Installed for haulage of materials and products inside and outside the factories.
CM-6	Shovel Loader	1	Installed for hauling sand, coke and other granulated stuff in the foundry shop. Can be used for general civil engineering work, too.
CM-7	Compressed Air Station	1	Compressed air is installed for all the factories and centrally controlled at one station.
CM-8	O ₂ Gas Bombe Unit	1	Oxygen and acetylene gas which are frequently used are installed and centrally controlled by the collective distribution system. Other gases are controlled separately by each shop.
CM-9	Acetylene Gas Unit	1	
CM-10	Shop Office Equipment	1 set	Desk, chair, locker, blackboard and other necessities for routine job are provided to the shop office.

Low Cost Automation Training Equipment (1/1)

No.	Name of Equipment	Quantity	Reason for Installation
LC-1	Portable Pneumatic Training Kit	1	A portable set is provided for factory cruising guidance and education and training in local areas on pneumatic control.
LC-2	Additional Equipment to Existing Unit	4 sets	Provided additional equipment to existing one to enable training on more advanced control system.
LC-3	Hydraulic-Electric Training Unit	4 sets	Training units are installed for training on hydraulic control.
LC-4	Pneumatic Sequence Programmer	2	Installed as the equipment for programmed control of sequence of pneumatic equipment to enable more sophisticated control.
LC-5	Air Compressor	1	Installed as supply source of air to the foregoing pneumatic control devices.
LC-6	Others	1 set	Installed other necessities such as sensors for the equipments mentioned above.

Audio-Visual Education Equipment (1/1)

No.	Name of Equipment	Quantity	Reason for Installation
AV-1	Video Editing System	1	Installed as a device to edit raw materials photographed in the office and factory into a complete program and is indispensable for preparing video. Partial modification, combination and sound control also possible.
AV-2	Film Chain System	1	Installed as a device to convert slide films and 16 mm films into video tape, which enables to see various teaching materials in standardized video.
AV-3	Seminar Room System	1	Installed for that educational effect can be enhanced by a seminar room equipped with slide film, 16 mm film, 35 mm slide, OHP, etc. Video system is capable of reproducing any one of PAL/SECAM/NTSC.
AV-4	Video Display System	2	Installed to reproduce video at a scale of a few people so that simple video learning is made possible.
AV-5	Portable Recording Unit	2	Installed as a portable, handy video shooting unit which can shoot even in a small factory.
AV-6	16 mm Film Projector	1	As there are considerable number of teaching materials in 16 mm film, the projector for them is equipped.
AV-7	35 mm Slide Projector	2	2 units are installed for projecting 35 mm slides.
AV-8	Overhead Projector	3	3 units are installed in view of wide applications.

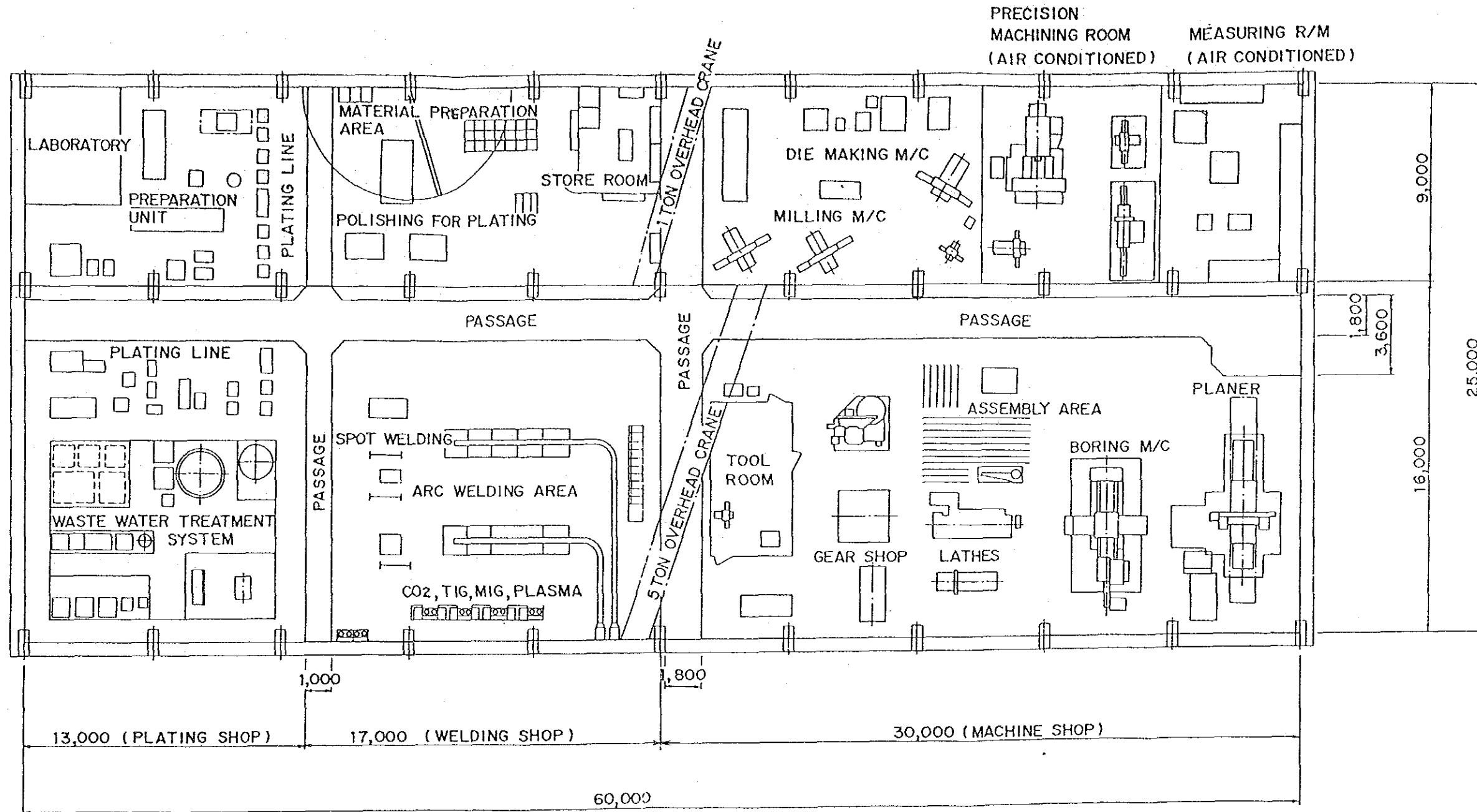
Vehicles and Office Equipment (1/1)

No.	Name of Equipment	Quantity	Reason for Installation
VE-1	Medium Bus	1	Installed for factory observations tour of trainees and other purpose such as extension services 25-30 person loading capacity.
VE-2	Wagon	2	10-14 person loading capacity, installed for extension services, surveys, transportation of goods.
VE-3	Micro Computer	1	Installed as needed for technical calculation, statistics processing, data preparation, etc.
VE-4	Word Processor	1	Installed to improve efficiency in preparing teaching materials, documents and for preserving them.
VE-5	Typewriter (English)	1	Installed as necessary for preparing documents and letters addressed to overseas.
VE-6	Typewriter (Thai)	2	In view of highly frequent use for domestic documents and letters, 2 Thai typewriters are provided.
VE-7	Copy Machine	2	2, one each for A0 and A3 size paper, is installed as indispensable for reproducing teaching materials, drawings and documents.
VE-8	Drawing Equipment	15	To improve designing and drawing ability, drawing equipments are provided for training.
VE-9	Printing Unit	1 set	Installed for printing and binding of teaching materials (text books), etc.

Education and Training Materials (Software)

No.	Name of Equipment	Quantity	Reason for Installation
1.	Teaching materials on casting	1 set	Mainly 35 mm slides, 16 mm films and video tapes. Ones suitable for the contents of education and training are selected and translated into English, but some are in Japanese, expecting translation into Thai by MIDI staff.
2.	Teaching materials on heat treatment and forging	1 set	Same as above.
3.	Ditto in relation to materials and materials testing	1 set	Same as above.
4.	Ditto in relation to sheet metal work, welding, and press-work	1 set	Same as above.
5.	Ditto, in relation to plating & coating	1 set	Same as above.
6.	Ditto, on machining and measurement	1 set	Same as above.
7.	Ditto, in relation to engineering and designing	1 set	Same as above.
8.	Ditto, in relation to equipment maintenance	1 set	Same as above.
9.	Ditto, in relation to control techniques	1 set	Same as above.
10.	Others	1 set	Same as above.

EQUIPMENT DRAWINGS



NOTE :

1. EACH EQUIPMENT TO BE REFERED TO DETAILED DRAWINGS.

PLATING SHOP ----- DWG NO. CTD-85014

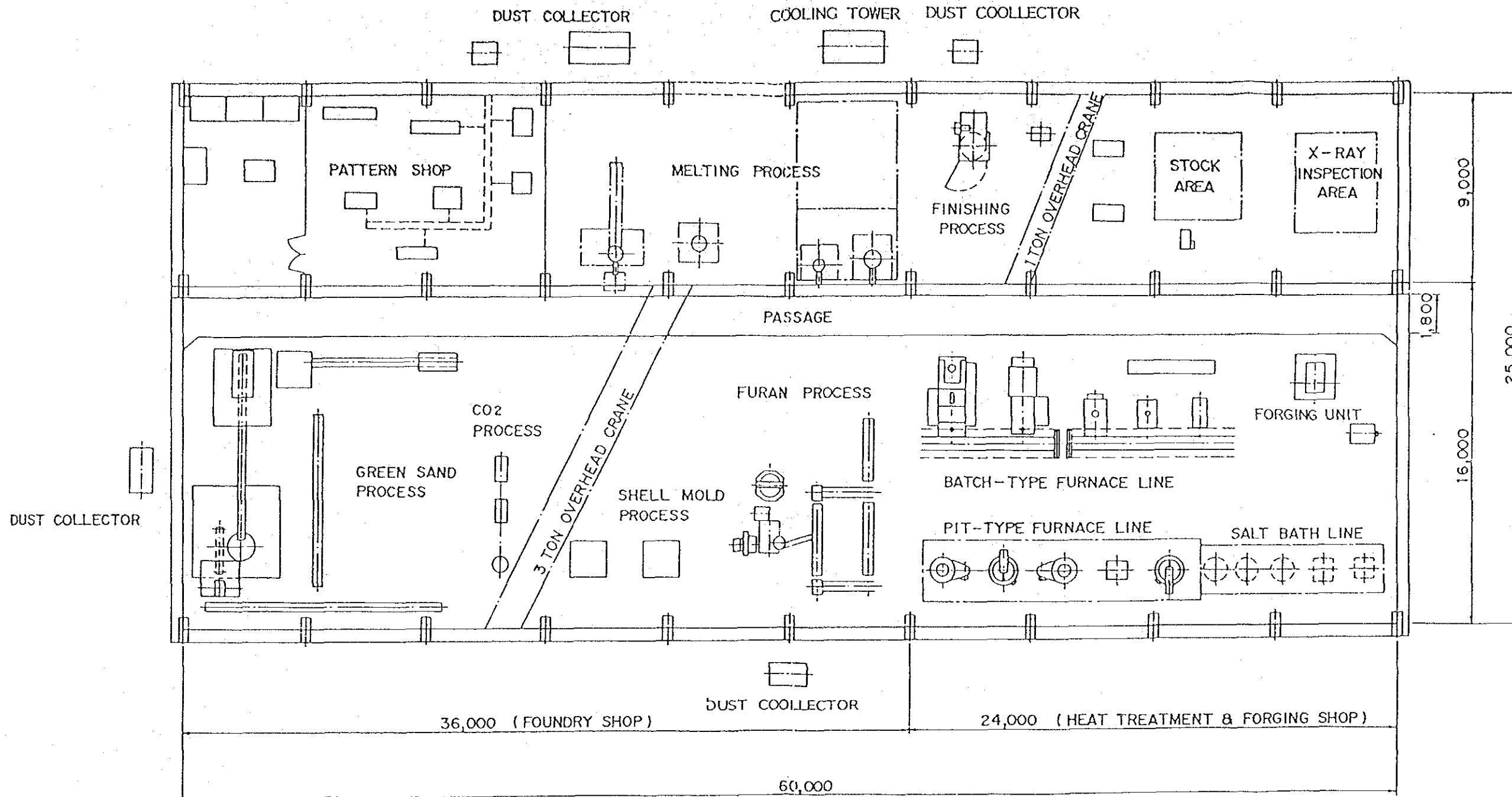
WELDING SHOP ----- DWG NO. CTD-85014

MACHINE SHOP ----- DWG NO. CTD-85015

MIDI PROJECT

LAYOUT OF WORKSHOP (A)

CTD-85010



NOTE :

1. EACH EQUIPMENT TO BE REFERED TO DETAILED DRAWINGS.

FOUNDRY SHOP ----- DWG.NO. CTD - 85012

HEAT TREATMENT & FORGING SHOP ----- DWG.NO. CTD - 85013

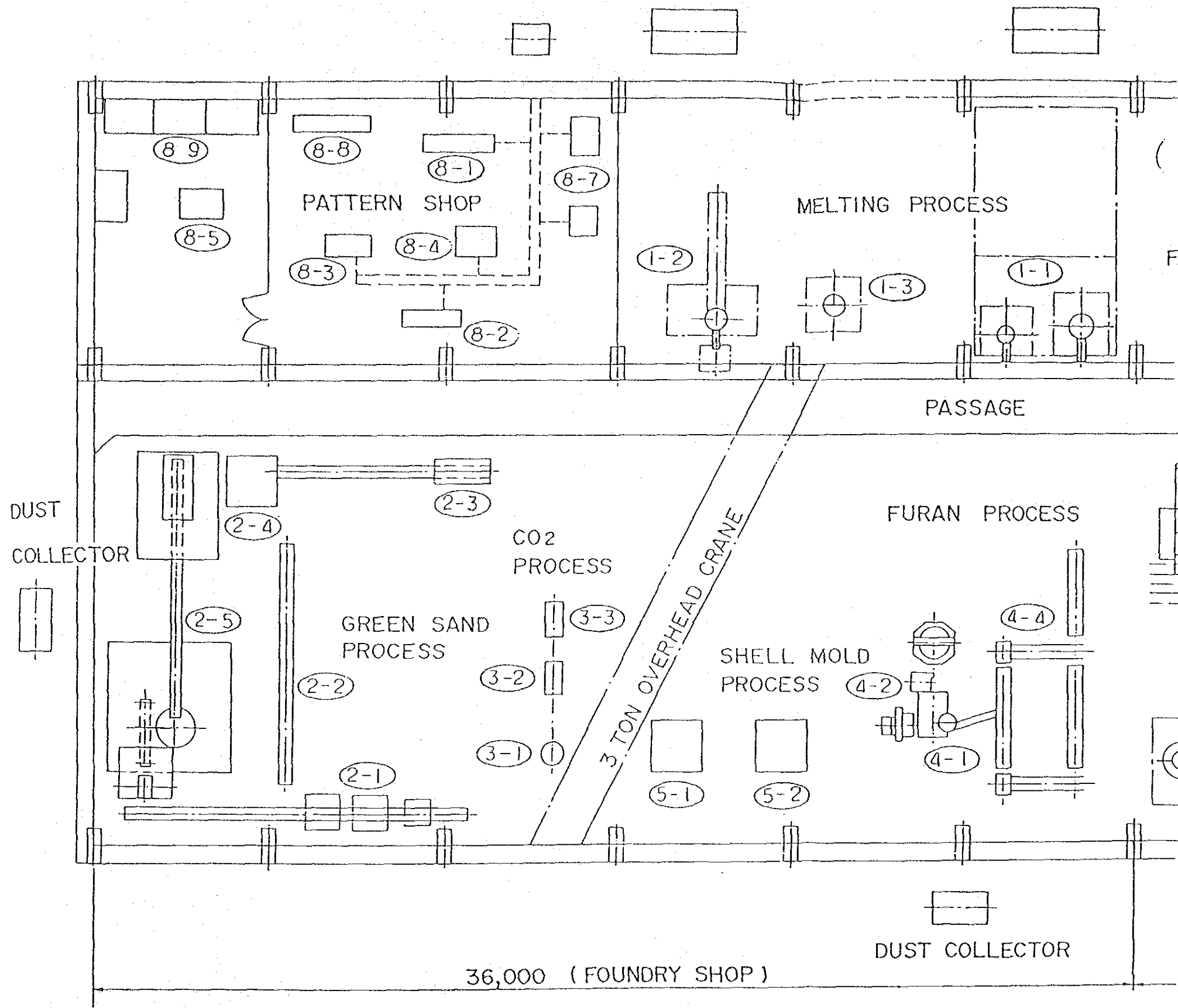
MIDI PROJECT

LAYOUT OF WORKSHOP (B)

CTD - 85011

DUST COLLECTOR

COOLING TOWER



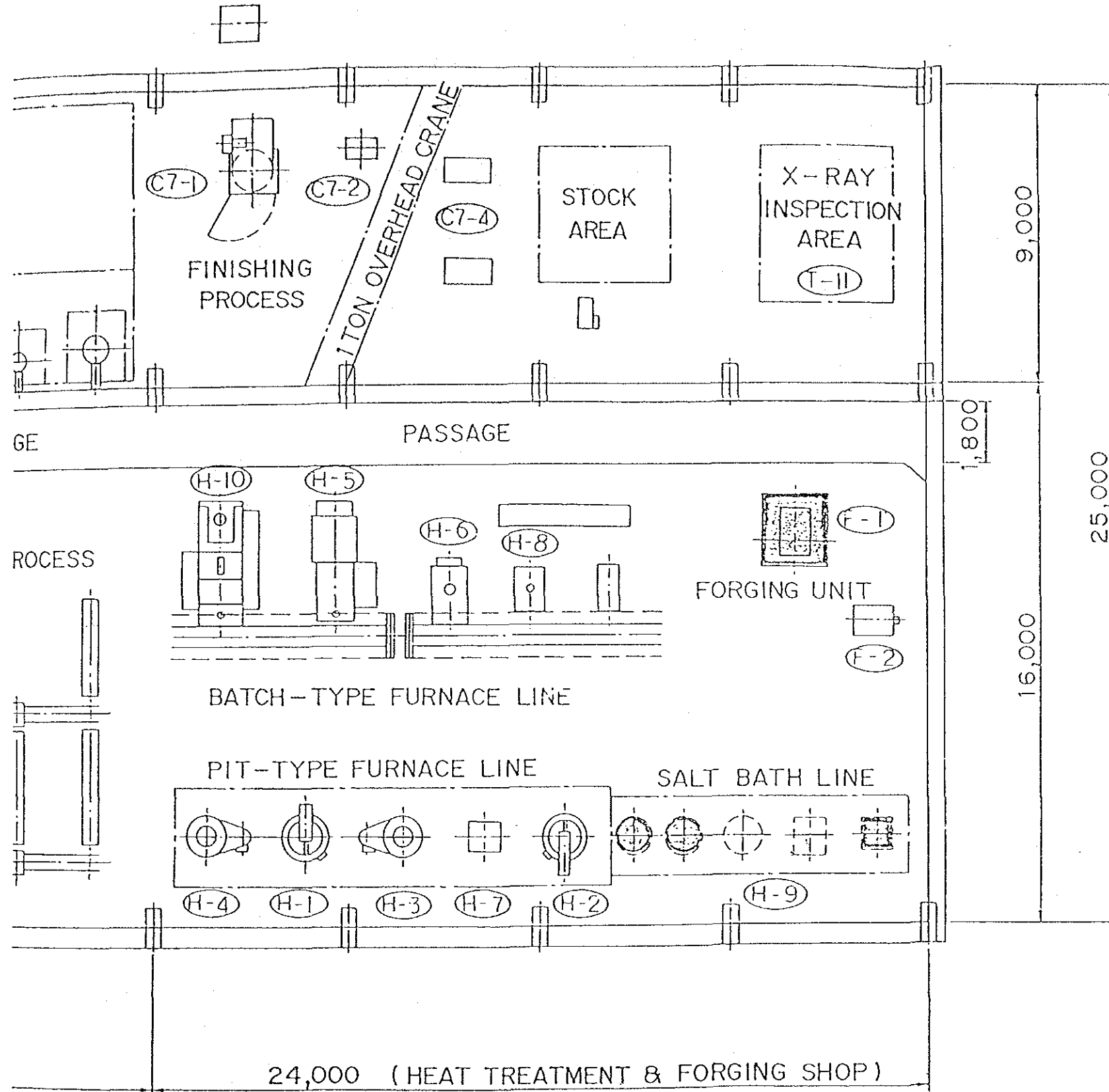
Item No.	Item
1-1	HF Induction Furnace
1-2	Cupola
1-3	Crucible Furnace
2-1	Molding M/C
2-2	Roller Conveyor
2-3	Grate Hopper
2-4	Sand Reclaimer
2-5	Sand Mixer & Supply Unit
3-1	Sand Mixer
3-2	CO ₂ Gassing Equipment
3-3	Flask
4-1	Sand Mixer
4-2	Sand Reclaimer
4-4	Roller Conveyor
5-1	Shell M/C for Mold
5-2	Shell M/C for Core
8-1	Wood Lathe
8-2	Hand Planer
8-3	Band Saw
8-4	Router M/C
8-5	Surface Plate
8-7	Spindle & Belt Sander
8-8	Tool Grinder
8-9	Working Table

36,000 (FOUNDRY SHOP)

FOUNDRY SHOP S=1/150

DWG.NO. CTD-85012

DUST COLLECTOR

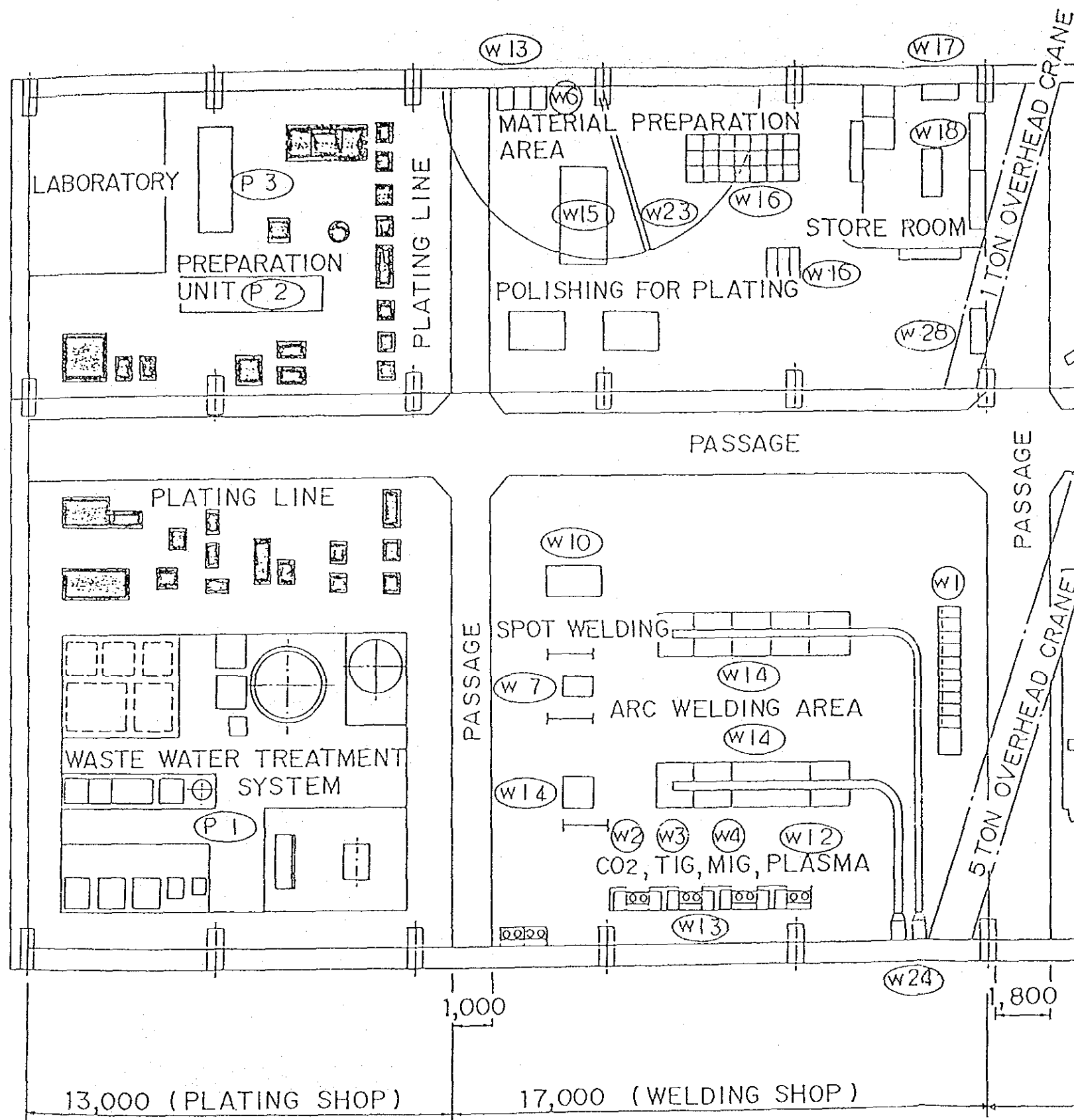


Item No.	Item
C7-1	Shot Blasting M/C
C7-2	Grinder
C7-4	Surface Plate
H-1	Heating Furnace
H-2	Tempering Furnace
H-3	Quenching Oil Bath
H-4	Quenching Water Bath
H-5	Gas Atmosphere Furnace
H-6	Tempering Furnace
H-7	Wash Cleaning Bath
H-8	Wash Cleaning Bath
H-9	Salt Bath
H-10	Soft Nitriding Furnace
F-1	Air Hammer
F-2	Heating Furnace

Note: Coloured facilities will be transferred from the existing heat treatment & forging shop of ISI.

HEAT-TREATMENT &
FORGING SHOP S=1/150

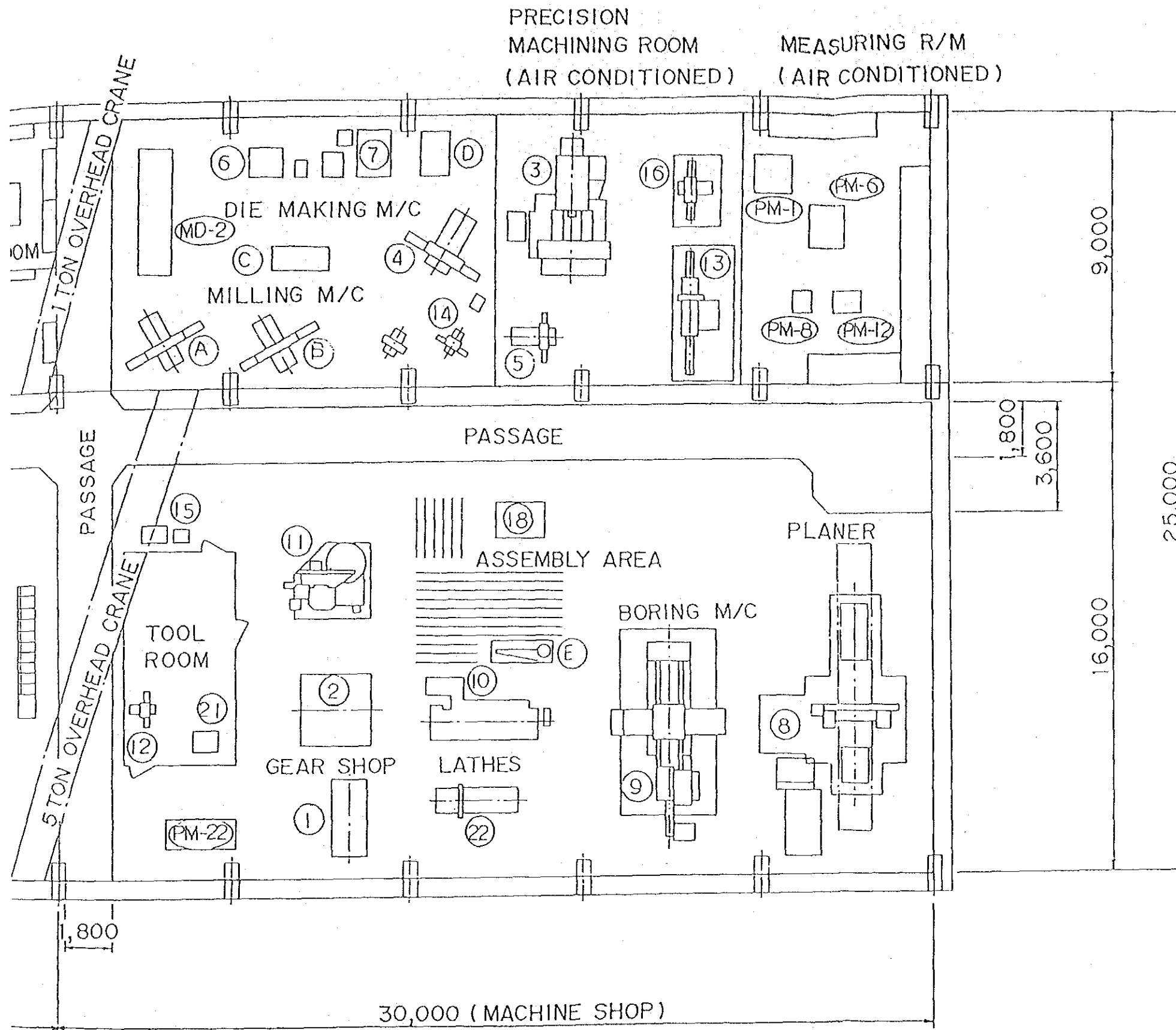
DWG. NO. CTD-85013



Item No.	Item
W-1	AC Arc Welder
W-2	DC CO ₂ Welder
W-3	Tig Welder
W-4	Mig Welder
W-6	Submerged Arc Welder
W-7	Spot Welder
W-8	Semi Auto Gas Cutter
W-9	Manual Gas Cutter
W-10	Grinder
W-12	Plasma Cutting M/C
W-13	Welder Unit
W-14	Arc Cover & Bench
W-15	Welding Platform
W-16	Cutting Platform
W-17	Tool Cabinet & Rack
W-18	Tool Cabinet & Rack
W-23	Wall Crane
W-24	Exhaust Fan & Duct
W-28	Engine Welder
P-1	Waste Water Treatment System
P-2	Ultra Sonic Washing Tank
P-3	De-ionizer

Note: Coloured facilities will be transferred from the existing plating shop of ISI.

PLATING &
 WELDING SHOP S=1/150
 DWG NO. CTD-85014



Item No.	Item
1	Gear Hobbing M/C
2	Gear Grinder
3	Horizontal Machining Center
4	Profile Die Milling M/C
5	Jig Milling M/C
6	Electric Discharge M/C
7	Wire Cut EDM
8	Planer
9	Horizontal Boring M/C
10	NC Lathe
11	Vertical Lathe
12	Hob Sharpener
13	Universal Grinder
14	Tool Grinder
15	Floor Grinder
16	Surface Grinder
18	Precision Surface Plate
21	Carbide Tool Grinder
22	Lathe
A	Vertical Milling
B	Horizontal Milling
C	Working Table
D	Shaper
E	Radial Drill
PM-1	Involute & Helix Tester
PM-6	Three Dimension Coordinate Gauge
PM-8	Screen Projector
PM-12	Granite Surface Plate
PM-22	Dynamic Balancing M/C
MD-2	Multi-purpose Press

Note: Items A, B, C, D and E will be transferred from the existing machine shop of ISI.

MACHINE SHOP S=1/150

DWG NO. CTD-85015

F. PROJECT SITE

1. OWNERSHIP OF SITES

Sites proposed by the Government of Thailand for this Project are properties of the Department of Industrial Promotion, Ministry of Industry.

2. LOCATION

The sites are located in a convenient locality near the Port of Bangkok on the River Chaophraya. The locality is in the southeast district of the city of Bangkok, about 450M south from Soi Kluainamthai near its intersection with Rama IV Road which extends to the southeaster direction from the center of the city.

The paved street on which the sites face to the north is 8.2 m wide. The Industrial Service Division of the Department of Industrial Promotion, Ministry of Industry faces the same street on the opposite side, and the Textile Institute which is also under the same Department is located between the two sites.

The back or south side of the site faces the Paknam Road which is 12 m wide and is a trunk road of the city.

Running parallel to Paknam Road is a canal, and over the canal is an elevated expressway connecting Din Daeng and Bangna. Exit and entrance ramps to the expressway are located conveniently about 500 m from the site.

As the site is less than 4 km from the Port of Bangkok Port, and as the roads thereto are in very good condition, transportation of equipment and material to the site will be easy.

3. LAND CONFIGURATION AND AREAS

The form of one site (Site A) is a trapezoid on which construction of a Main Building, Workshops and a Canteen are proposed to be located.

The form of the other site (Site B) is a rectangle which is longer in the south-northern direction. It is on this site that the construction of a dormitory is proposed.

Land areas of the two sites are as follows:

Site A	17,500 m ²
Site B	7,500 m ²
<hr/>	
Total	25,000 m ²

4. TOPOGRAPHY

The present ground height of each site is about 30cm lower than the heights of surrounding roads. As the elevation of the locality is relatively low, the sites are often flooded during the rainy season. The maximum depth of submergence has been observed as 50 cm.

It is therefore planned by the Government of Thailand to raise the level of the sites by 80 cm deep earthfills prior to commencement of buildings proposed by this Project. This is a normal procedure which is being taken when buildings are constructed in this locality. The Government of Thailand is taking appropriate measures to acquire the necessary budget for this operation within the time constraints.

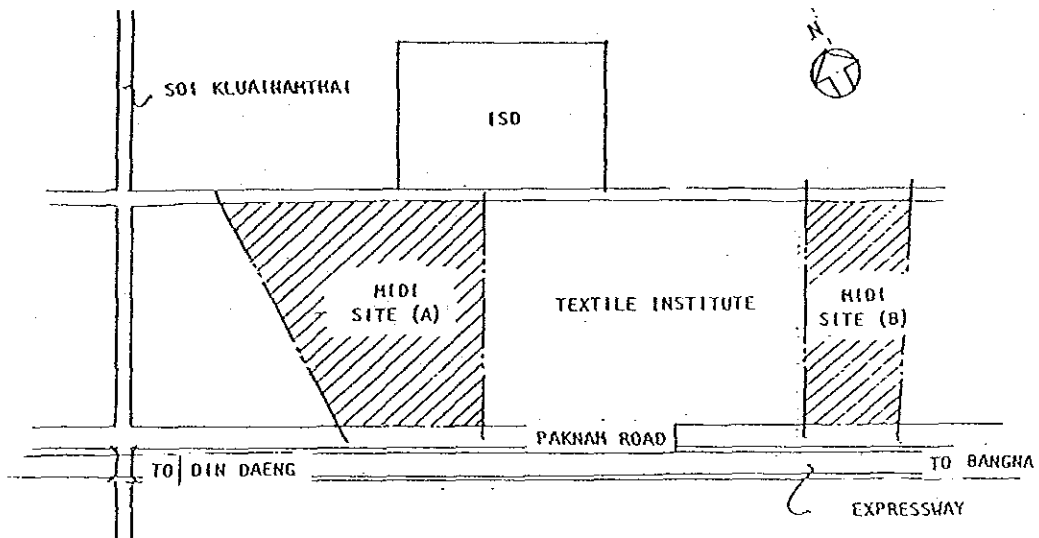
5. EXISTING BUILDINGS AND OBSTACLES

Located on Site A is a 30 years old discarded factory building. This building is to be removed and salvaged by the Government of Thailand before earthfill operations mentioned above are commenced. Removal of the building is to include removal of concrete floor slabs and undergrade structures such as foundations and pilings.

Some shacks are existing on Site B, but will pose no problem to the Project as they will be easily removed by the Government of Thailand.

On both of the sites are palm trees and a number of tropical evergreens. As many of these as possible should be preserved by planning the layout of buildings and facilities accordingly.

SITE LOCATIONS AND CONFIGURATIONS



6. INFRASTRUCTURE

a. Electric Power

Electric power in Bangkok is supplied by the Metropolitan Electricity Authority (MEA). Transmission voltage is 220V, 380V, and 12,000V, frequency is 50Hz.

A MEA substation is located beside the canal at the rear of the site, and an overhead transmission line from this substation exists along the road on the rear side of the sites. As power can be obtained from this line, there will be no problem in securing electric power for this Project.

b. Telephone

Telephone service in Bangkok is provided by the Telephone Organization of Thailand.

An overhead telephone cable line is existing along the road in front of the sites to service existing buildings along the road. There will be no technical problems in obtaining telephone connections from this cable line.

c. Water Supply

Water supply in Bangkok is provided by the Metropolitan Waterwork Authority (MWWA). Though not especially suitable for drinking, this city water can be utilized for miscellaneous service usage.

As water service mains exist along the front road (100mm diam.) and the rear road (200mm diam. and 600mm diam.), all coming from a MWWA pump station about 1 km west of the site, city water can be obtained at the site in sufficient quantity and pressure under normal conditions.

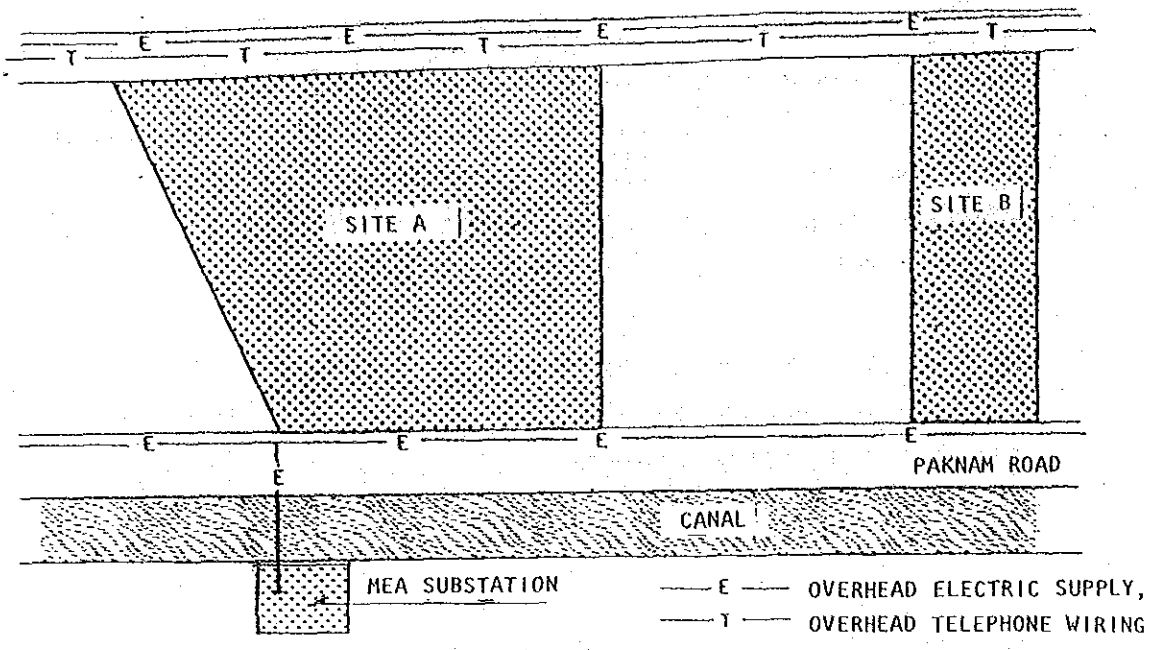
d. Drainage

Though drainage mains of 300mm diam. and 800mm diam. are existing along the road in front of the site, it is the recommendation of the Department of Drainage and Sewerage of the Bangkok Metropolitan Administration that drainage from the sites be discharged directly to the canal at the rear of the sites.

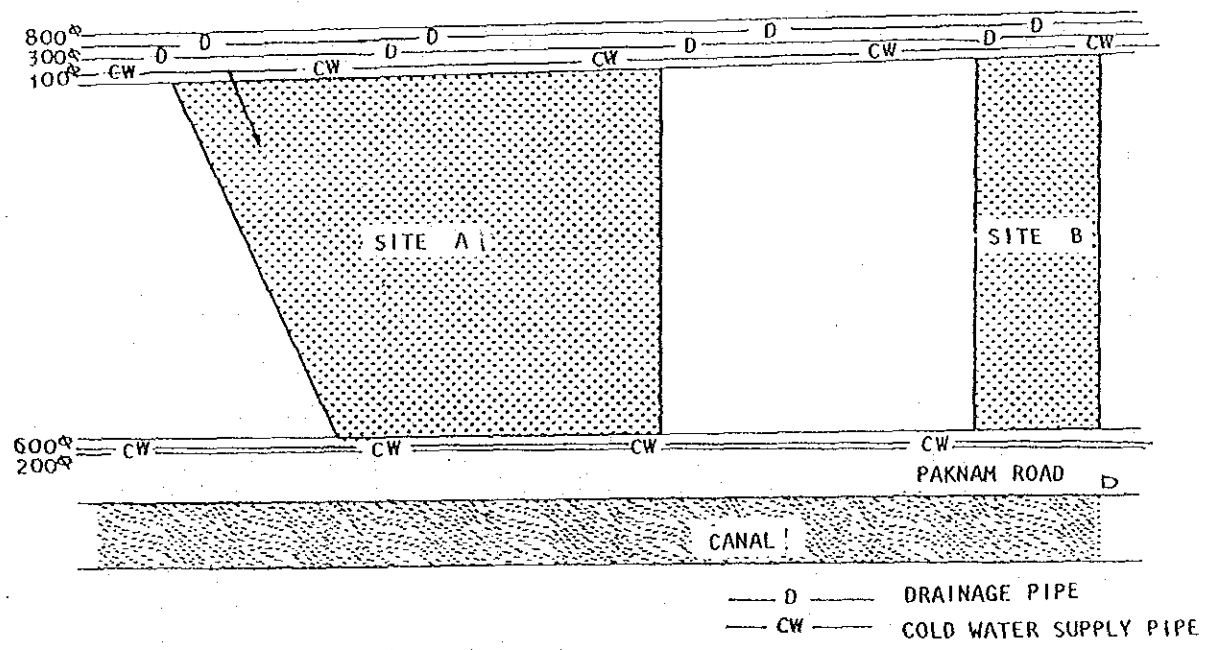
As there are no sewerage system in the locality, sewer must be treated in septic tanks within the sites before being discharged together with normal drainage.

e. Gas

As there is no city gas supply system in the locality, bottled propane gas available on the market can be utilized when required. Gas cylinders normally available are supplied at pressures of 15 kg/cm² and 50 kg/cm².



ELECTRICAL & TELEPHONE WIRING LAYOUT



COLD WATER SUPPLY & DRAINAGE PIPING LAYOUT

G. BUILDINGS AND FACILITIES

1. GENERAL PLANNING CONSIDERATIONS

a. Harmony with Existing Buildings

Harmony in layout and design of buildings is to be considered with existing facilities in the locality. Existing facilities in the locality are the Industrial Service Division (ISD) and the Textile Institute, both under the Department of Industrial Promotion of the Ministry of Industry.

b. Central Function for Metal-working and Machinery Development Institute

Buildings are to be planned and designed to be worthy of the functions of the Institute which serves as the central core of development and research for metal-working and machinery industries.

c. Economy and Ease of Operation and Maintenance

Buildings and facilities are to be planned and designed with main emphasis on attaining required functions within lowest budgetary costs. However, the use of substantial material and finishes is also to be considered for maximum economy and ease of operation and maintenance of the buildings and facilities.

d. Adaptation to Local Conditions

1) Climate

Local temperature, humidity, prevailing winds and solar conditions are to be carefully considered in planning and designing buildings and facilities.

2) Construction Material and Methods

Buildings are to be designed so that maximum utilization of locally available material and building utilities will be possible. Consideration is to be also given to the employment of local construction methods.

3) Ground Settlement

The entire area of Bangkok city located on the Chaophraya Delta is only about 1.0 to 1.5M above sea level. Overall settlement of the ground has always been a general problem with serious effects on construction activities. On an average, settlement observed over the past ten years is in the range of 5 to 10 cm per year.

Precast concrete piling of adequate strength, length and number as determined by subterranean soil boring tests are to be used to permanently support building structures and heavy machinery. Floor slabs resting on earth will be avoided by designing structural floor slabs to be supported by the building itself.

4) Flooding

Bangkok in general is frequented by floods during the rainy season because of its low height above sea level, settlement of ground and inadequate public drainage facilities. Maximum depth of floodwater in the locality of the sites has been observed as 50 cm.

This Project is based on the condition that the overall level of the sites is raised by a earthfill of 80 cm.

The height of ground level floors is to be designed furthermore to be from 1.2 m to 1.5 m higher than the raised level of the ground.

5) Drainage

Drainage system from buildings will be designed so it will not be affected by ground settlement. Drainage pipes will be designed to be supported structurally from the underside of the buildings. Provisions will also be made so they can be visually inspected when necessary.

2. LAYOUT OF BUILDINGS AND FACILITIES

a. General Layout

1) Site A

Please refer to Site Plan (Site A) on page 4-79 of this Report.

The main gate entrance to Site A is being planned at the center of the site facing the north road. This is to facilitate traffic to the Industrial Service Division located on the other side of the same road.

A wide road bisecting the site is planned to run north to south from the main gate. This road is to be the main access to all facilities planned on the site, namely, the Main Building and Canteen on the west side of the road, and the Parking Areas and Workshops (A) and (B) on its east side.

A service gate is also planned at the south end of the bisecting road. Miscellaneous utility facilities can be built along the south boundary of the site close to this service gate.

2) Site B

Please refer to Site Plan (Site B) on page 4-80 of this Report.

It is planned to utilize this site for a Dormitory, future extensions to the Dormitory and for a future athletic field.

The gate entrance to Site B is also planned to face the north road for the same reasons as for Site A.

b. Locationing of Individual Buildings

1) General

Individual buildings are planned to be located to allow, as far as possible, windows and openings to face the north and south directions and to have closed wall areas facing the east and the west sides. This is to take advantage of prevailing winds from the southwest or from the northeast depending on the season. Rays from the low sun during morning and late afternoon hours will be shut out by the walls.

2) Main Building

The Main Building is planned on Site A. As this building is to be the administrative center of the Institute receiving most of the visitors, plans are to locate it near the main entrance gate. This location is also favourable as it is at approximately the same distance from both Workshops without any obstructions inbetween.

3) Workshops

Workshop facilities are planned to be accommodated in two structures on Site A in view of the nature of activities and the shape of the site. In general, relatively clean operations are to be accommodated in Workshop (A), and hot or dusty operations in Workshop (B).

The Workshop (A) is planned at the east side of the site and Workshop (B) at the south side of the site. Access roads are planned completely around these buildings to facilitate easy access for the transportation of equipment and material to required locations within these buildings.

4) Canteen

This facility for staff members and trainees is planned towards the back of the site. Its location is however very convenient to reach from the Main Building as well as from the two Workshops.

5) Dormitory

This facility is planned on Site B.

The Dormitory which is to be used for trainees and visitors is located on Site B with its axis in the east-west direction.

A parking area is provided immediately inside the entrance gate facing the north road. This serves as a buffer zone between the road and the Dormitory.

The southern portions of the site are reserved for future extensions of the Dormitory and for an athletic field. This southern portion of the site faces the noisy Paknam Road and expressway, and is not favorable as an environment for dormitories.

3. ARCHITECTURAL PLANNING

a. Main Building

Please refer to drawings of the Main Building on pages 4-83 to 4-90 of this Report.

1) Function

This building is to be the center facility of the Institute. It is to have rooms for lecture, seminar, audio-visual, exhibition, meeting, teaching staff, advisors and administration. Training and research rooms such as for test and inspection, low-cost automation, quality control, techno-economic research, design and

library will also be provided. Auxiliary rooms such as those for guest reception, storage, utilities and toilets are to be provided as required.

2) Planning of Rooms

Rooms have been divided into two groups according to their required dimensions, and are accommodated in separate wings. The south wing is for the larger rooms, and the north wing for rooms of smaller dimensions. An entrance and utility core containing stairways, a lift and toilets is located between the two main wings.

This building is planned to be a three-storied structure due to space limitation of the site.

3) Passageways and Balconies

Passageways or corridors of each wing are provided with ample widths to facilitate movement of personnel, equipment and materials.

Balconies provided at all window sides of rooms are used as space for the installation of sun-shades and air-conditioning units. These balconies serve as emergency evacuation routes, as well as overhangs to protect rooms below from driving rains.

4) Walls and Fenestration

Exterior wall surfaces of the main wings of this building are to be finished with a local maintenance-free exposed pebble aggregate finish. The central entrance and utility core is planned to be finished with local ceramic tiles.

For windows, aluminum sliding sash and jalousies are to be used for light and ventilation. Steel security grills are to be provided for windows.

5) Roof

A rather steeply sloped gable roof of local accent is proposed. Eave gutters will not be provided due to their uselessness at times of heavy downpours. Graveled side ditches are to be provided beside the building to receive rainwater directly from the roofs.

An overhead water tank is to be installed on top of the central core to supply water to all facilities on Site A by gravity. The tank is to be completely concealed by louvers. As these louver surfaces will be the highest building portions of the Institute, identification symbols or signs can be mounted thereon. They will be very conspicuous from the distance, especially from the elevated expressway.

6) Utilities

Natural cross ventilation through window openings and movement of air by ceiling fans is to be relied upon wherever practicable.

Air-conditioning units are to be provided in rooms where cooling or temperature stability is absolutely necessary.

Those rooms where air-conditioning units are not to be installed will be provided with electric power outlets for future installation of such units.

One lift (capacity of 1,000 Kg) for transportation of training material and equipment to upper floors is to be provided.

7) Grade

It is proposed that the grade of this building be equivalent to standard institutional establishments in Thailand. Stress is to be placed on planning for natural cross ventilation and for operational and maintenance economy.

b. Workshops

Please refer to drawings of Workshops on pages 4-91 to 4-96 of this Report.

1) Function

Workshops are to be the practical nucleus of training and development research in the technological aspects of metal-working and machinery industries. Training machines and equipment for the fields of casting, forging, heat-treatment, machining, welding, plating and precision measurement are to be installed in these workshops.

2) Planning

This facility is planned as two buildings, i.e. Workshop (A) and Workshop (B). Machining and machine fabrication, precision measurement, plating, and welding activities are planned to be accommodated in Workshop (A). Workshop (B) is to be for foundry, forging and heat treatment activities and others which produce large amounts of heat and dust.

Both workshops are to have the same building areas. Spanning units are planned to be 16 m + 9 m transversal and 6 m longitudinal. Number of longitudinal spans is 10 making the length of both buildings 60 m. Width of both buildings is 25 m.

Height of the buildings is to be governed by overhead traveling cranes required at the 16 m portions. Clear height of the cranes is to be 7 m.

Mezzanine floors are to be provided at the 6 m span portions of both buildings for instructor offices, training and study rooms and storages.

3) Walls and Fenestration

Walls of the steel-frame structure of the Workshops are planned to be clad with precast concrete siding. Aluminum jalousie windows are to be provided for intake of natural light and cross ventilation. Steel grillwork to prevent burglary are to be installed at windows in exterior walls.

4) Roof

The roof is a simple gable type. Large exhaust ports are to be provided on the roof with provision to shut out driving rains.

5) Utilities

Wiring and piping to machinery are planned to be installed in pits. General floor areas are to be kept without irregularities to enable efficient and safe operation.

Precision machining and measurement rooms are to be provided with air-condition units to maintain constant temperature and humidity.

In Workshop (B) where high temperatures will be generated by furnaces and heat treatment equipment, and where dust will be generated in the foundry area, a heat-resisting mechanical exhaust system will be installed in the roof.

A treatment system for toxic waste discharged from plating lines will be installed as a model for ideal industrial waste treatment before it is discharged to the outside.

6) Grade

The grade of these workshop buildings is to be the same as similar facilities in Thailand. As some of the machinery to be installed produce large amounts of heat and dust, the provision of natural and mechanical ventilation and exhaust is to be carefully considered.

In rooms or areas where precision machinery are to be installed, enclosure of adequate grade and air-conditioning is to be provided.

Adequate supports or foundations are to be provided for precision and delicate equipment, as well as for heavy machinery.

c. Dormitory

Please refer to drawings of Dormitory on pages 4-97 to 4-99 of this Report.

1) Necessity

The promotion and levelup of technologies in regional metal-working and machinery industries is one of the important roles of MIDI. The provision of a dormitory is most desirable to enable the participation of technicians of the regions.

2) Planning

The Dormitory on Site B is planned as a three-storied building having seven quarters on each floor. A meeting room, laundry and a janitor's room are provided on the ground floor. Eating facilities are not provided as the Canteen on Site A can be utilized.

All living quarters have dimensions of 3.5 m x 5.5 m, and are provided with a washstand, Thai-style toilet and shower. All rooms have windows facing balconies in the direction of seasonal winds for comfort and good ventilation. Windows are economical but efficient jalousie windows, and all rooms are provided with ceiling fans.

The corridors are on the north side open to the exterior.

3) Walls and Roof

The exterior surfaces of walls are to be an exposed pebble aggregate finish for good appearance and easy maintenance. The roof is designed as a gable roof to be finished with local-made roofing tiles.

4) Grade

The grade of this building is planned to the same as other dormitories of similar institutions in Bangkok.

d. Canteen

Please refer to drawing of Canteen on page 4-100 of this Report.

1) Necessity

Though the proposed site of the Institute is conveniently located for its training and research activities, commercial catering establishments are not found in its immediate vicinity. The provision of a simple canteen is most desirable to enable trainees and the staff to eat economically without the waste of time and energy of walking to distant establishments at noontime. It is also quite normal that facilities of this nature are provided at similar institutions in Bangkok.

2) Facilities

The Canteen is planned to serve 140 persons in two shifts. Other than the dining room, a kitchen and two toilets are provided.

A covered outside terrace is also provided for use during good weather.

3) Walls and Fenestration

The southern side window has a large opening to connect the outside with the inside of the room. On a fine day, it is considered that a dinner or party can be opened by setting tables outside.

The roof and outer wall are coordinated in consideration with other facilities in the site, roofing with local-made tiles and finishing the wall with exposed pebble aggregate finish.

Windows other than those facing the terrace are aluminum jalousie windows. Ceiling fans are to be provided.

4) Grade

Grade of this building is envisioned to be the same class as that of similar facilities in Thailand. Windowed sides are however to be provided to prevent the blowing-in of rain during rainy seasons.

4. STRUCTURAL PLANNING

Main buildings of this Institute are the Main Building and Dormitory which are three-storied, and the Workshops and Canteen which are single-story structures. Heavy equipment and sensitive machinery are to be installed in certain parts of the Workshops.

Bangkok is an area with no past records of destructive calamities caused by earthquakes or typhoons. However, the entire area of the city is the very soft soil of the Chaophraya Delta. The results of boring investigations performed recently on the site will be carefully checked and analyzed in the course of designing the structural details of buildings and facilities of this Project.

a. Structural System

Structural system for the Main Building, Dormitory and Canteen are designed as reinforced concrete rigid frames. Steel frame structure has been adopted for Workshop (A) and Workshop (B) in view of the large spans required for their functions.

b. Design Criteria

Structural design standards adopted in Thailand are mostly those of the Engineering Institute of Thailand. Standards of the American Concrete Institute (ACI) and the American Institute of Steel Construction (AISC) are also followed in some cases. For buildings of this facility, however, the Japanese Industrial Standards (JIS) and the Japanese Architectural Specifications (JAS) are being adopted as criteria for structural designing.

c. Design Loads

1) Live Loads

Garage	500 kg/m ² or more
Storage, Library	800 kg/m ²
Meeting Room, Dining Room	400 kg/m ²
Offices	300 kg/m ²
Workshops	1,000 kg/m ²

2) Seismic Forces

As Bangkok is not within any earthquake zone and as no earthquake has been recorded in the past, no considerations have been taken against seismic forces.

3) Wind Forces

In view of wind data recorded in the past, the structures are to be designed to withstand wind velocities of 30 m/sec.

d. Foundation System

From the results of boring tests performed on the site, precast concrete friction and bearing piles are planned to be adopted. Sizes, lengths and quantities of these piles are as follows:

Main Building	(400x400	L=30M	270 pcs)
Workshops	(400x400	L=30M	270 pcs)
Dormitory	(400x400	L=30M	38 pcs)
Canteen	(300x300	L=30M	20 pcs)

e. Structural Materials

1) Concrete

Design Strength: $F_c = 210 \text{ kg/cm}^2$ (3000 psi)
Slump: 15cm (6 inches)

2) Reinforcement Steel

Standard Design Strengths

	<u>Long Term</u>	<u>Short Term</u>
Plain Bars (SR24)	$1,600 \text{ kg/cm}^2$	$2,400 \text{ kg/cm}^2$
Deformed bar (SD30)	$2,000 \text{ kg/cm}^2$	$3,000 \text{ kg/cm}^2$
(SD35)	$2,000 \text{ kg/cm}^2$	$3,500 \text{ kg/cm}^2$

3) Structural Steel

H - sections (SS41)	$1,600 \text{ kg/cm}^2$	$2,400 \text{ kg/cm}^2$
Plates (SS41)	$1,600 \text{ kg/cm}^2$	$2,400 \text{ kg/cm}^2$

5. UTILITY PLANNING

a. General

Thailand regulations are to be applied in designing plumbing and mechanical utilities. In case where there are no regulations, Japanese regulations and criteria are to be applied.

Main planning considerations are listed below:

1) Low operation and maintenance costs

- Individual package cooling system
- Adoption of energy saving lighting fixtures
- Energy saving distribution of electric switches

2) Safe and easy operation and maintenance

- Adoption of fiber reinforced plastic (FRP) water tank
- Gravity water supply and drainage system
- Exposed plumbing lines
- Electrical distribution panels in steel boxes
- Electrical wiring in conduit pipes

3) Priority to locally made equipment and materials

- Cast iron, concrete and PVC pipes
- Sanitary equipment
- Sewage treatment tanks
- Manholes and manhole covers
- Electric wire and cables

4) Adoption of serviceable equipment

Local servicing agents to be available in case of equipments made in Japan

- 5) Provision of spare parts and consumables which cannot be easily procured locally

Fuses, pilot lamps

Fluorescent, incandescent and mercury bulbs

Valves, cocks

b. Electric System

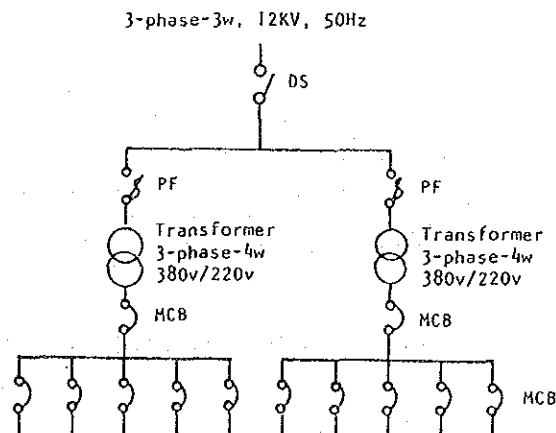
1) Receiving and Transforming Facilities

Electric power from MEA is to be received as 3-Phase, 3-Wire, 12 Kv, 50 Hz via aerial cable at an outdoor substation. This power is to be converted to be supplied as 3-Phase, 4-Wire, 380/220 V to the required outlets.

Rough estimated connected load is in the range of 800 to 1,000 Kilowatts. Two sets of 400 or 500 Kva transformers will be required.

2) Power Feeder System

Power supply from the substation is to be fed by underground cables to each building. Power is to be distributed to end outlets within buildings through distribution panels located as required.



Transforming facility program chart

3) Lighting and Convenience Outlets

Main lighting fixtures are to be fluorescent in general. Incandescent and mercury vapour lamps are to be used to supplement fluorescent lights as required.

The criteria for illumination levels at table-top level are to be 300 Lux for offices, testing rooms, etc., and 200 to 300 Lux for working areas in Workshops.

Switches for lighted areas are to be subdivided as much as possible to save power costs.

Mercury vapour type outdoor lamps are to be provided as required.

Convenience outlets are to be provided on walls at more than 2 locations in each room or at more locations as will be required.

4) Telephone Facilities

An interconnecting telephone system is to be provided for communication within the Institute as well as to the outside. The main switchboard is to be installed in the Main Building.

5) Television Antenna

Television antennae will be provided for the Main Building and Dormitory. Room outlets are to be provided as required.

6) Automatic Fire Alarm System

Fire detection system is to be provided and coupled with manual alarm stations in corridors for warning. Monitor panel is to be installed in the Main Building to indicate fire sources.

7) Lightning Arrester

Lightning rods will be installed on the roof of the Main Building.

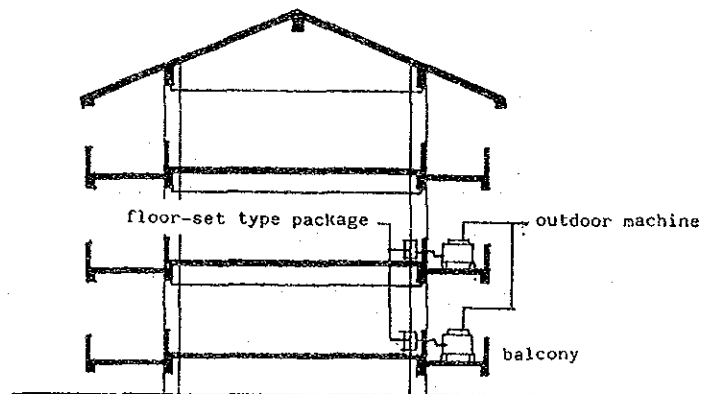
c. Air Conditioning and Ventilation

Localized air-conditioning units are to be provided in rooms where precision machinery is installed to eliminate adverse temperature fluctuation. Units are also to be provided for important and heavily populated rooms.

Air-conditioning units are planned to be air-cooled package air conditioners with separate indoor and outdoor units.

Design temperature and humidity levels are to be as follows:

	Indoor	Outdoor
Temperature (Centigrade)	27	35
Humidity (Relative)	60%	70%



The following are rooms proposed to be air-conditioned:

Main Building

- 1F Testing and Inspection Room
- Lecture Room
- 2F Low Cost Automation Room
- Advisor's Room
- 3F Library
- Audio-visual Room
- A/V Seminar Room
- Director's Room
- Guest Room

Workshops

Precision Machinery Room

Sand Test Room

X-ray Room

For rooms without air conditioners, ceiling fans are to be installed to circulate room air. Natural draft and cross ventilation is also to be provided by architectural means such as sliding aluminum windows and jalousies.

d. Plumbing

1) Water Supply

Individual water supply systems will be needed for the two sites. In both cases, use of city water is to be limited to miscellaneous and industrial uses.

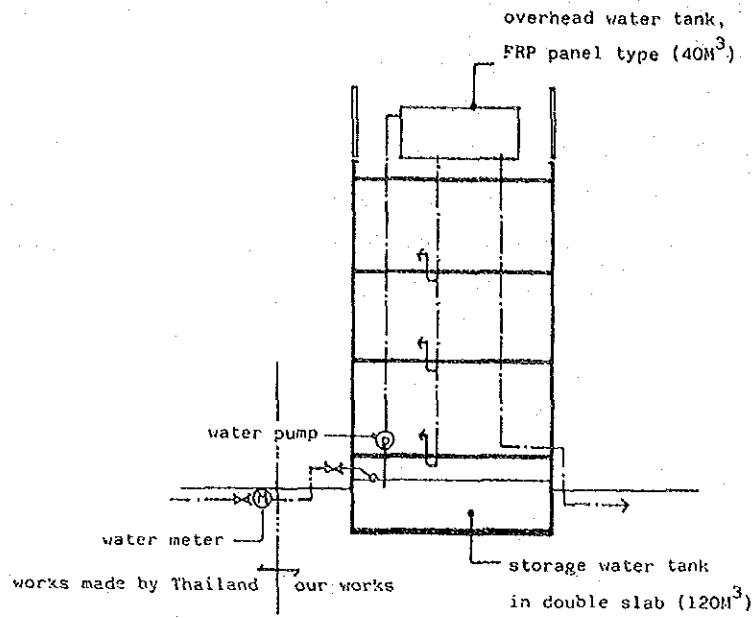
On Site A, a reservoir tank and an elevated tank is to be installed at the Main Building. Water is to be obtained from the Metropolitan Water Works Authority, stored in the reservoir tank and pumped up to the elevated tank on the roof. Supply to end locations is to be by gravity from the elevated tank.

Estimated amount of water required for Site A is as follows:

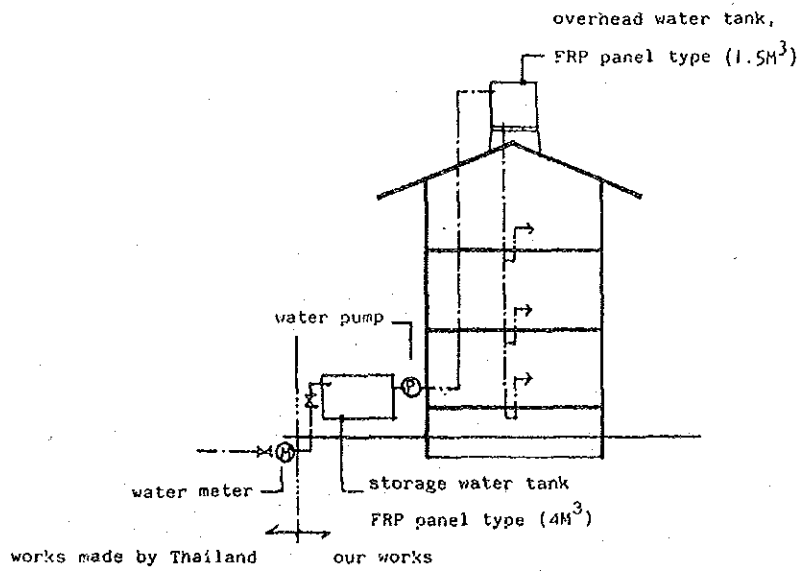
Industrial water	32 m ³ /day
Miscellaneous water	18 m ³ /day
Total	50 m ³ /day

The capacity of the reservoir tank will therefore require 100 m³ which is a two-day supply, and the capacity of the elevated tank 40 m³.

On Site B, capacities of the reservoir and elevated tanks will be 4 m³ and 1.5 m³ respectively.



Site A



Site B

2) Drainage

On both sites, treated sewage and miscellaneous drainage will be discharged together to the nearby canal by pumps.

The industrial waste water created on Site A will be treated by a treatment plant before discharge.

3) Sanitary Fixtures

Water closets are to be an equal mixture of local and western style fixtures. Fixtures are to be procured locally.

4) Fire Fighting Equipment

Though there are no definite local regulations, fire extinguishers will be provided at critical locations.

5) Sewage Treatment

Septic tanks will be provided for both sites to treat sewage before it is discharged together with miscellaneous waste water.

Nominal capacities of septic tanks are planned to be for 155 persons on Site A and for 40 persons on Site B.

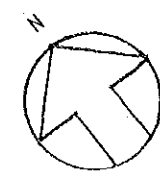
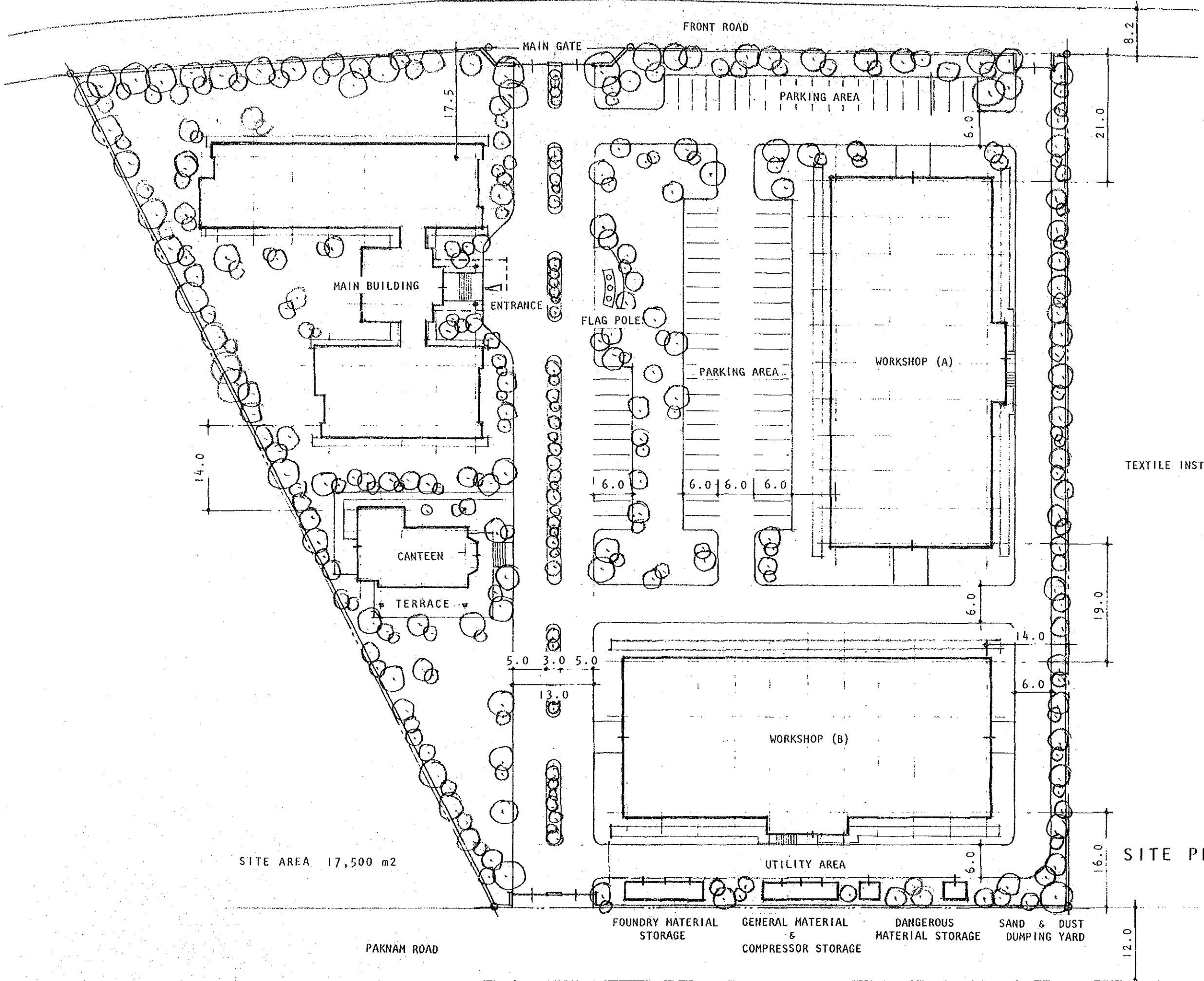
6) Gas

Provisions will be made for a LPG gas supply system for the Canteen.

e. Broadcasting Equipment

- 1) A speaker system will be installed at major locations on Site A to enable broadcasting from the administration office in the Main Building.

- 2) An automatic timer and chime function will be provided for the broadcasting amplifier so that time signals can also be broadcasted.

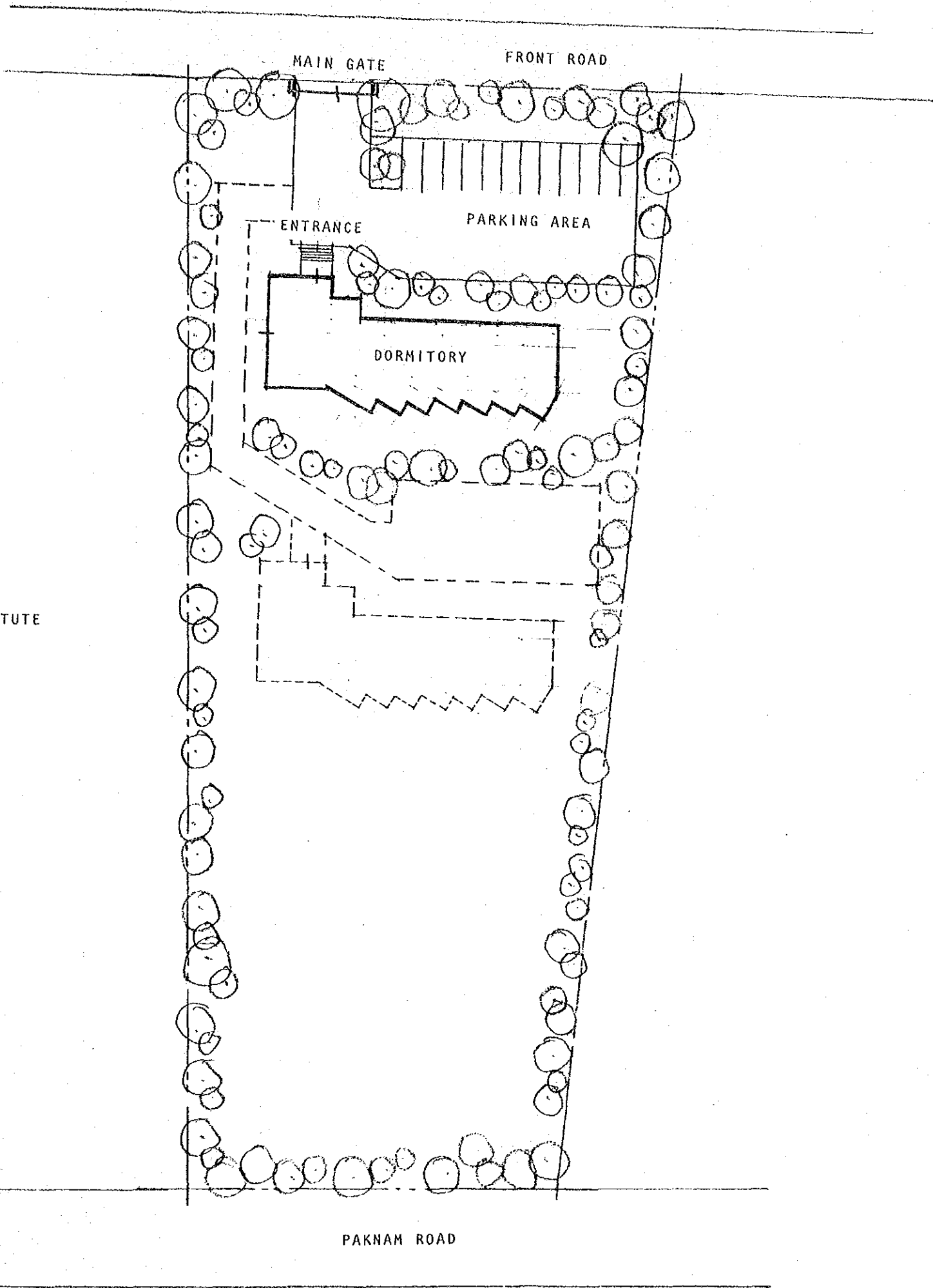


TEXTILE INSTITUTE

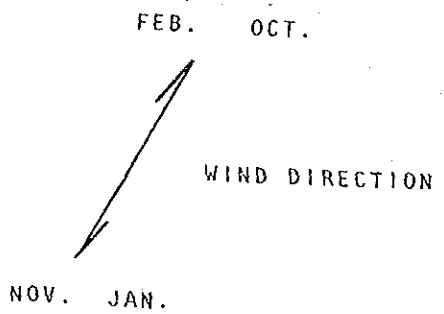
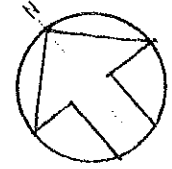
MIDI PROJECT

SITE PLAN (SITE A)

S= 1 : 600



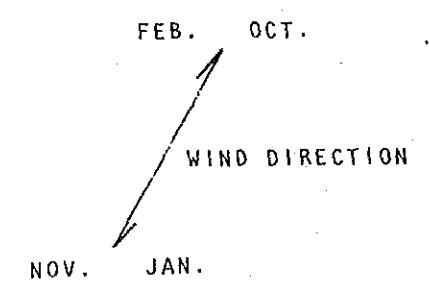
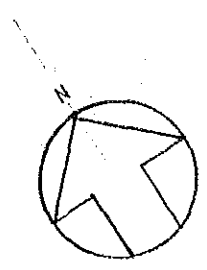
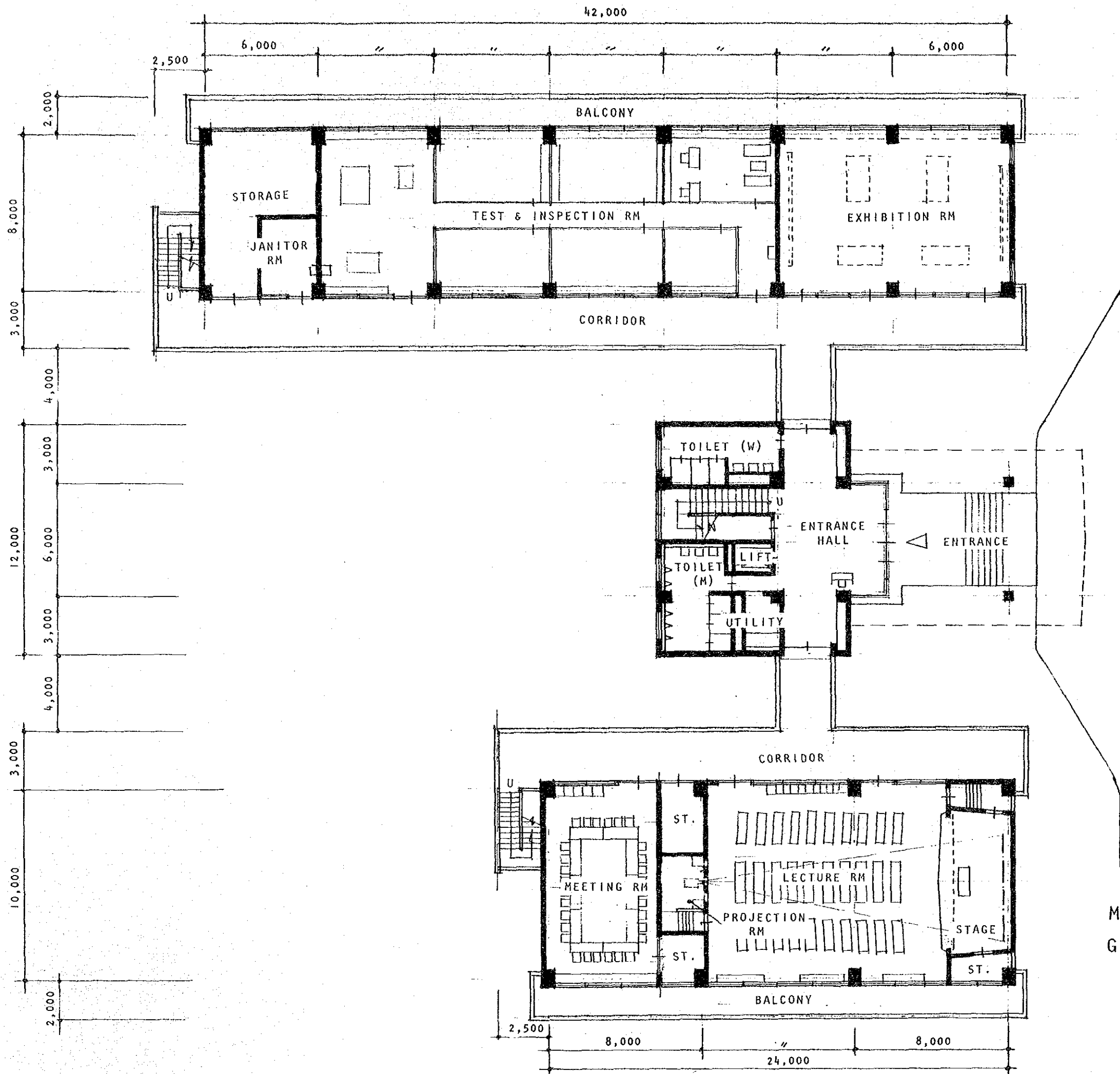
TEXTILE INSTITUTE



SITE AREA 7,500 m²

MIDI PROJECT
SITE PLAN (SITE B)

S= 1: 600

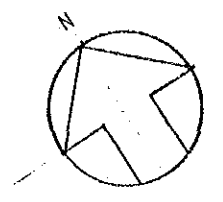
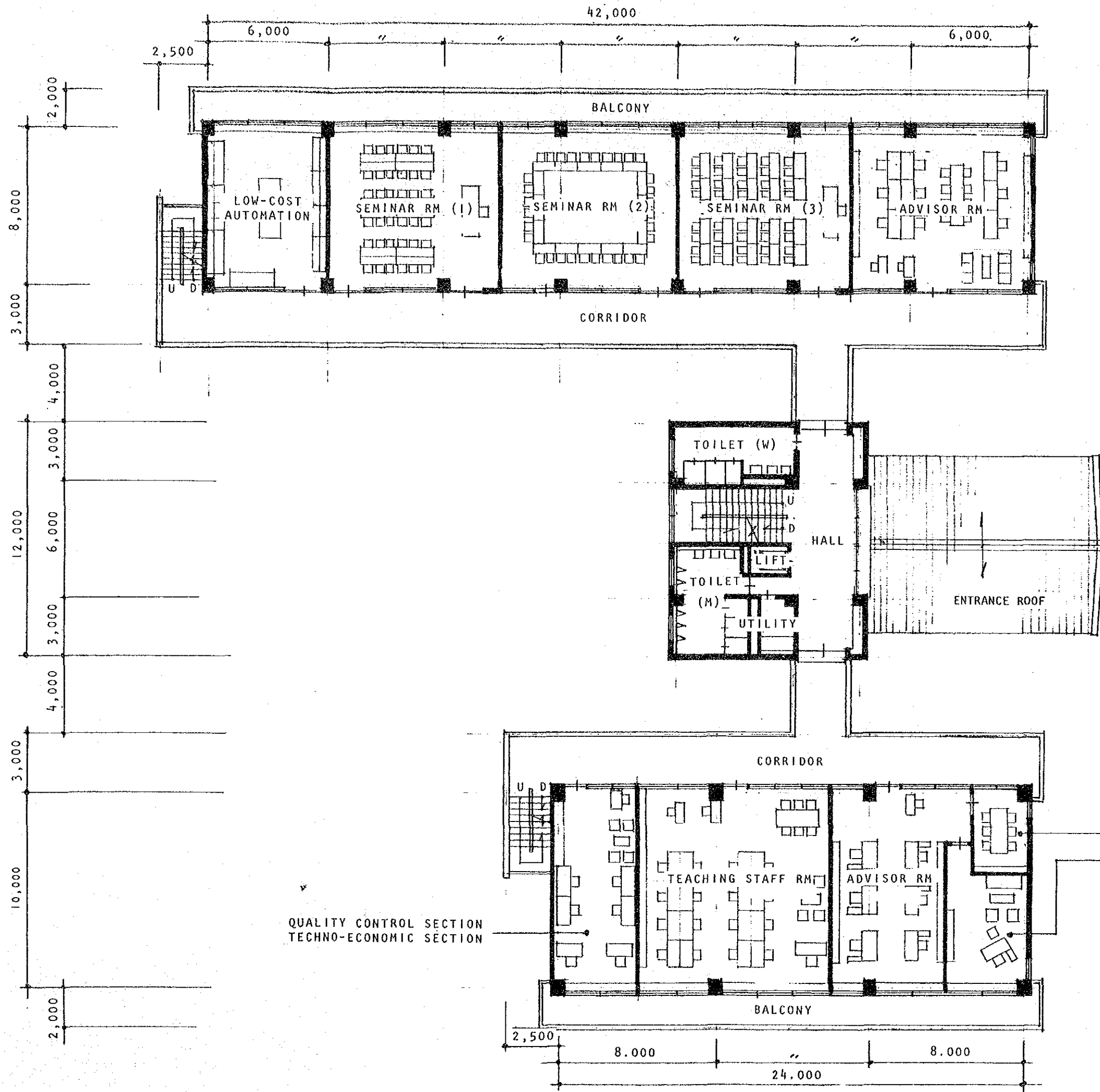


FLOOR AREA

P F.	45.0 m ²
3 F.	963.6 m ²
2 F.	963.6 m ²
G F.	972.2 m ²
TOTAL	2944.4 m²

MAIN BUILDING
GROUND FLOOR PLAN

S= 1:200

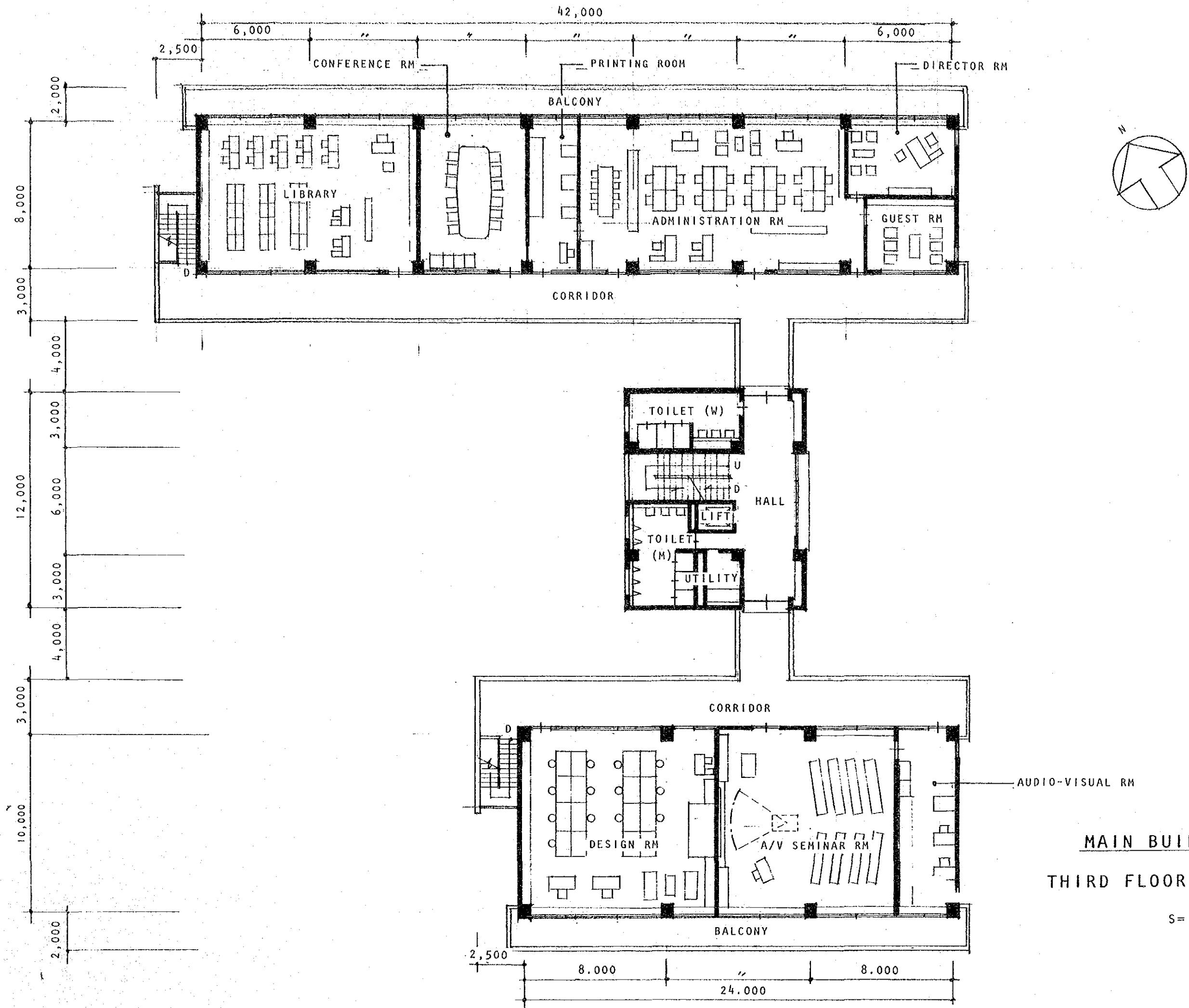


QUALITY CONTROL SECTION
TECHNO-ECONOMIC SECTION

MEETING RM
CHIEF ADVISOR RM

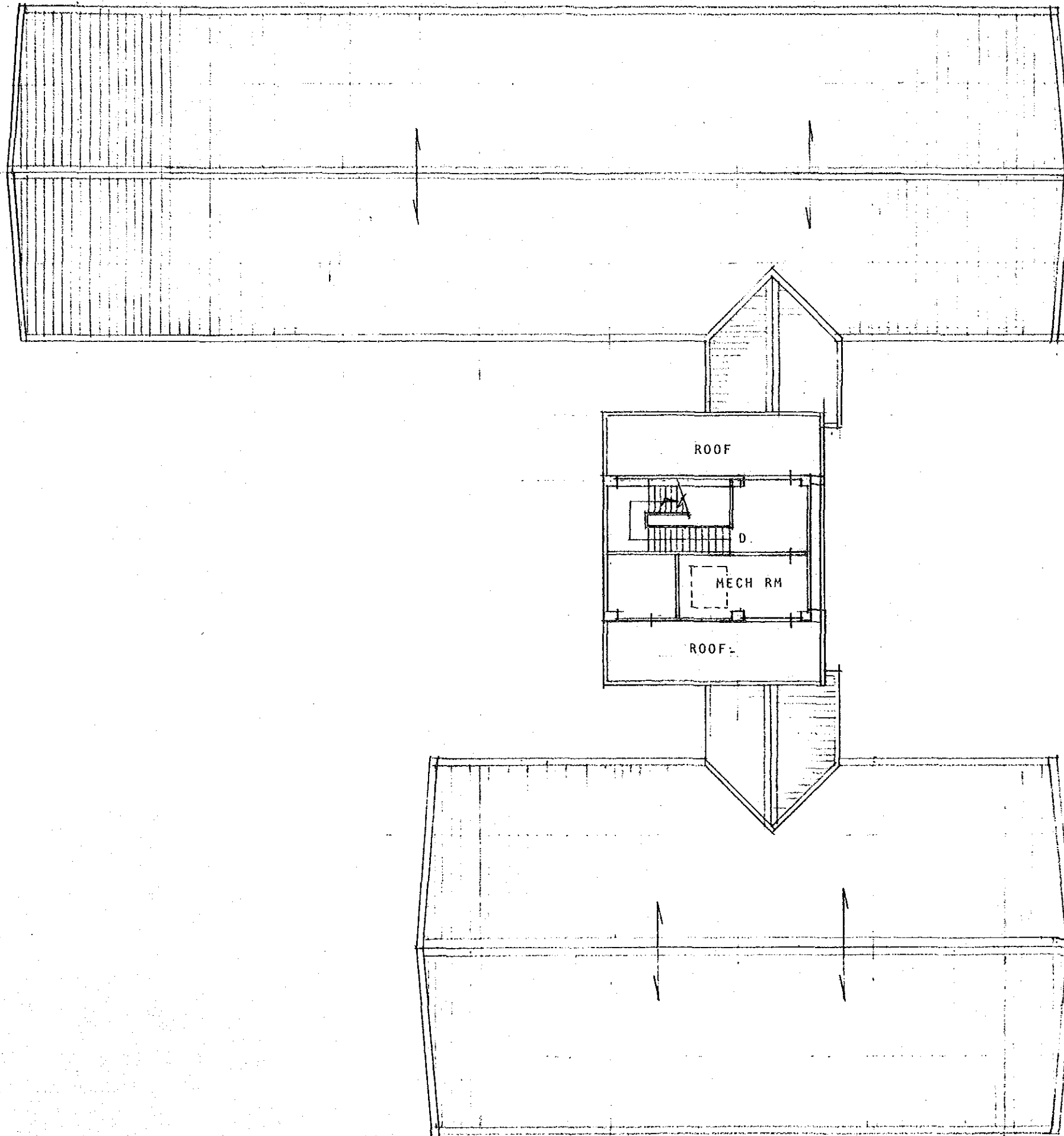
MAIN BUILDING
SECOND FLOOR PLAN

S = 1: 200



MAIN BUILDING
THIRD FLOOR PLAN

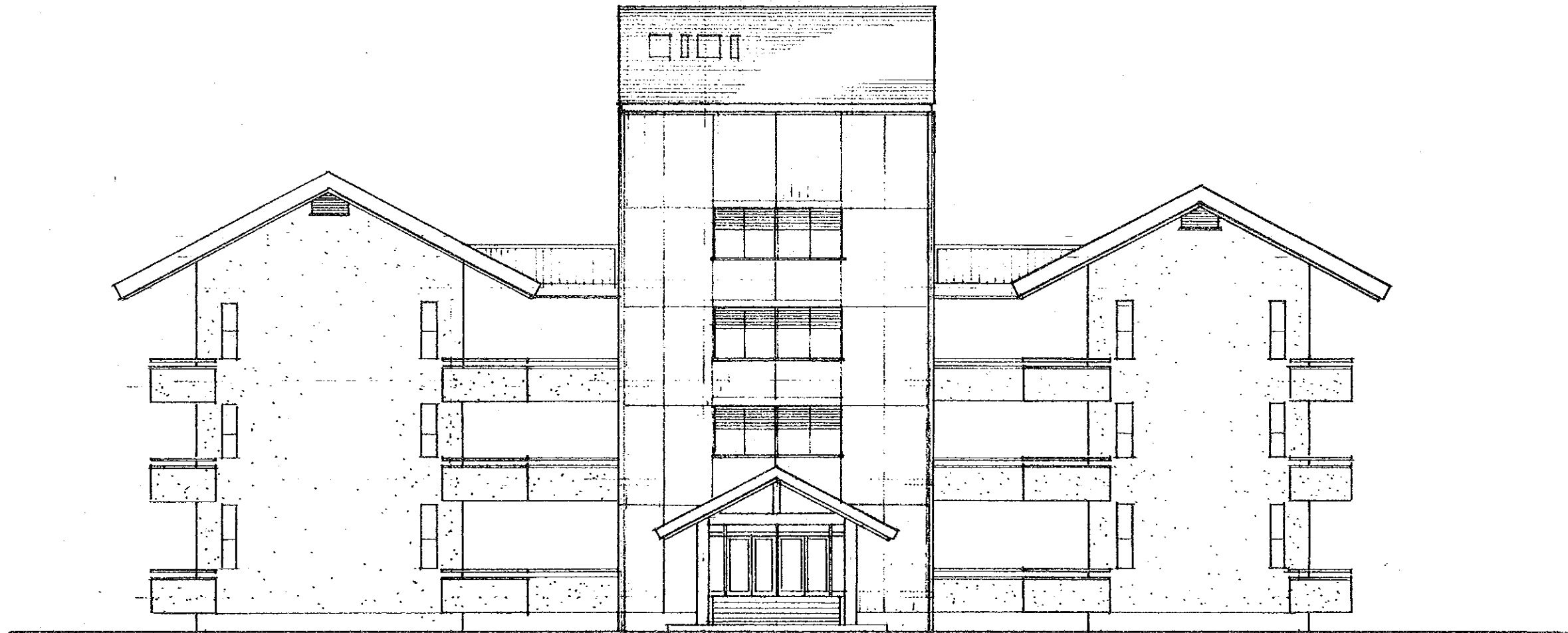
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MAIN BUILDING

ROOF PLAN

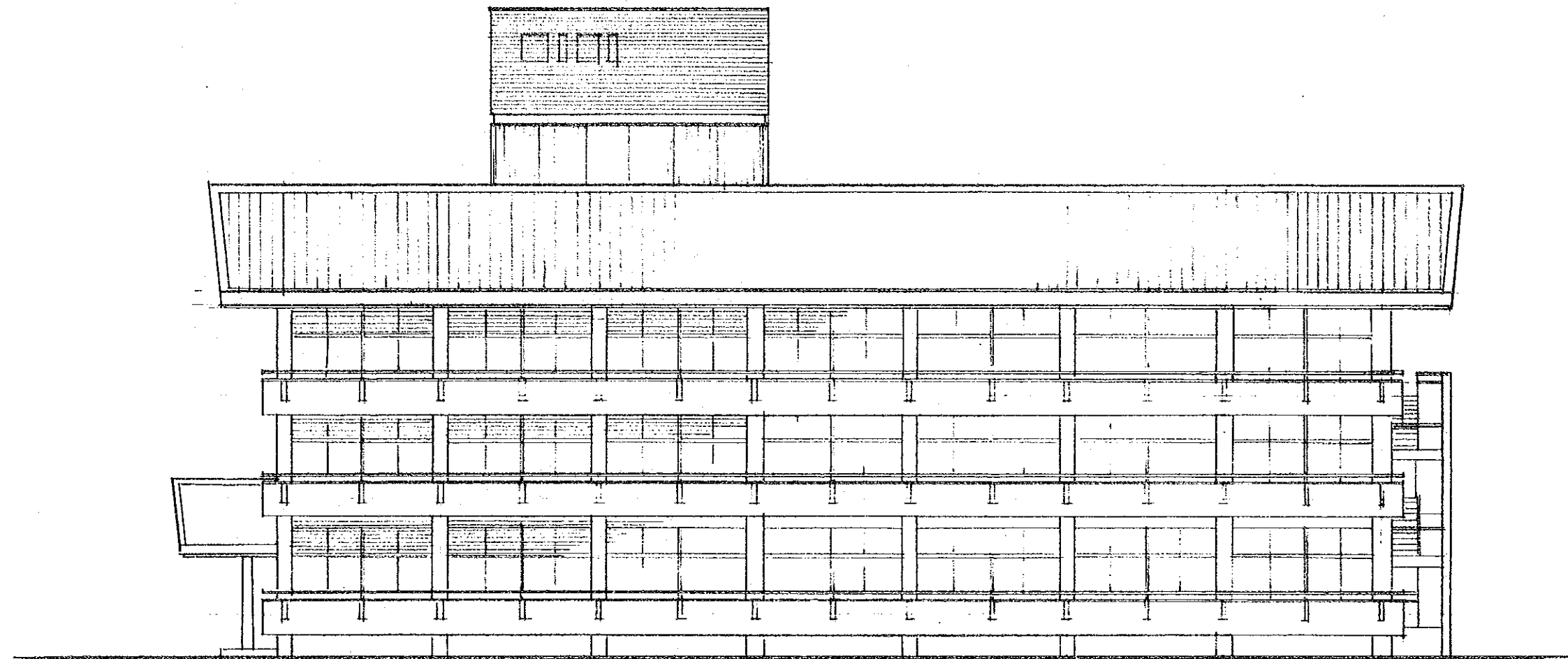
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MAIN BUILDING

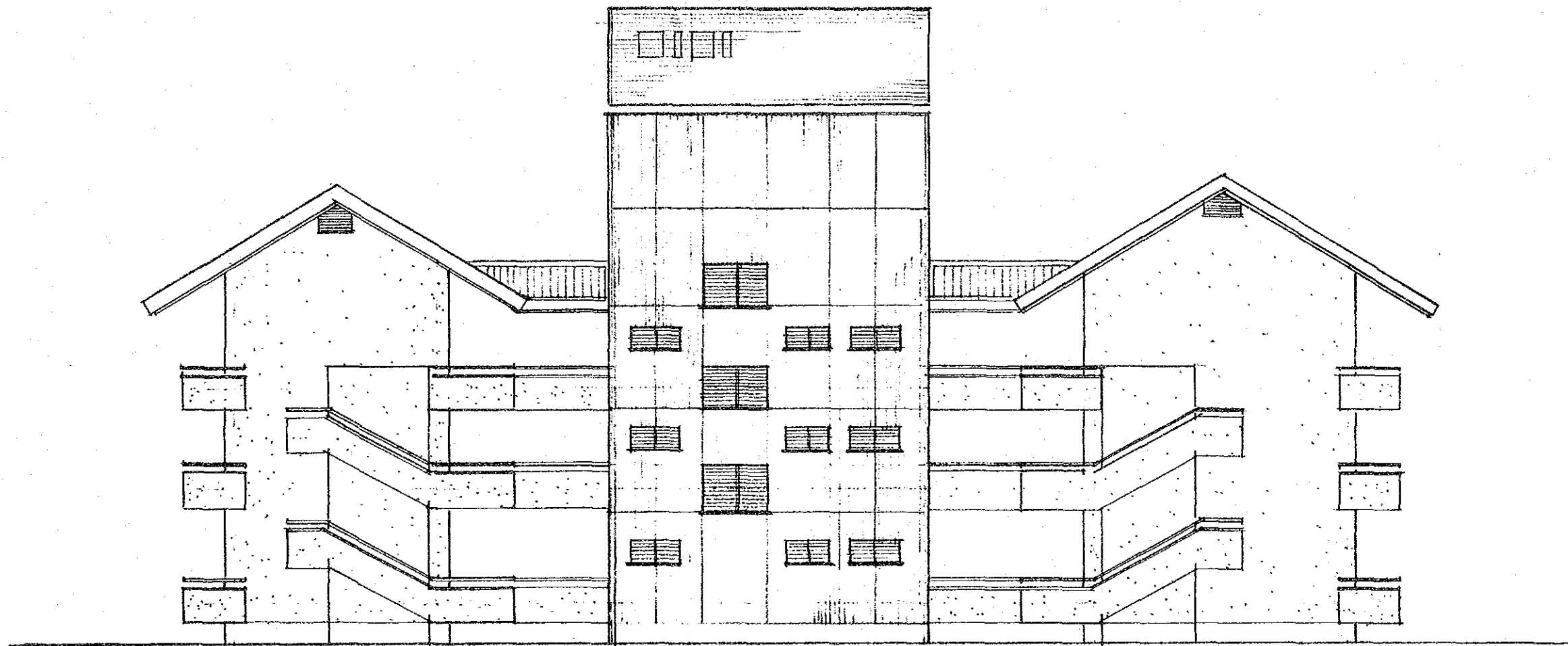
EAST ELEVATION

S= 1: 200



MAIN BUILDING
NORTH ELEVATION

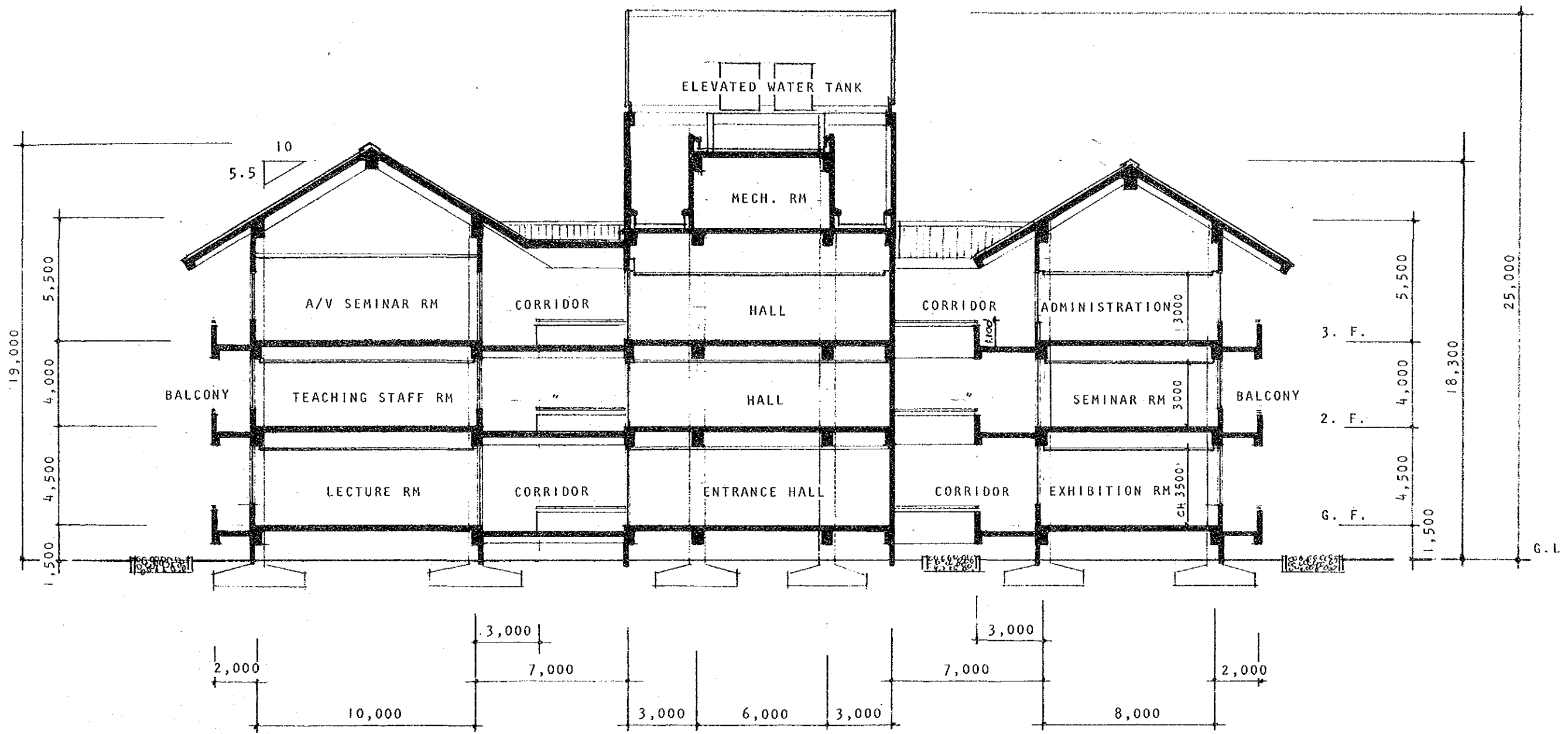
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MAIN BUILDING

WEST ELEVATION

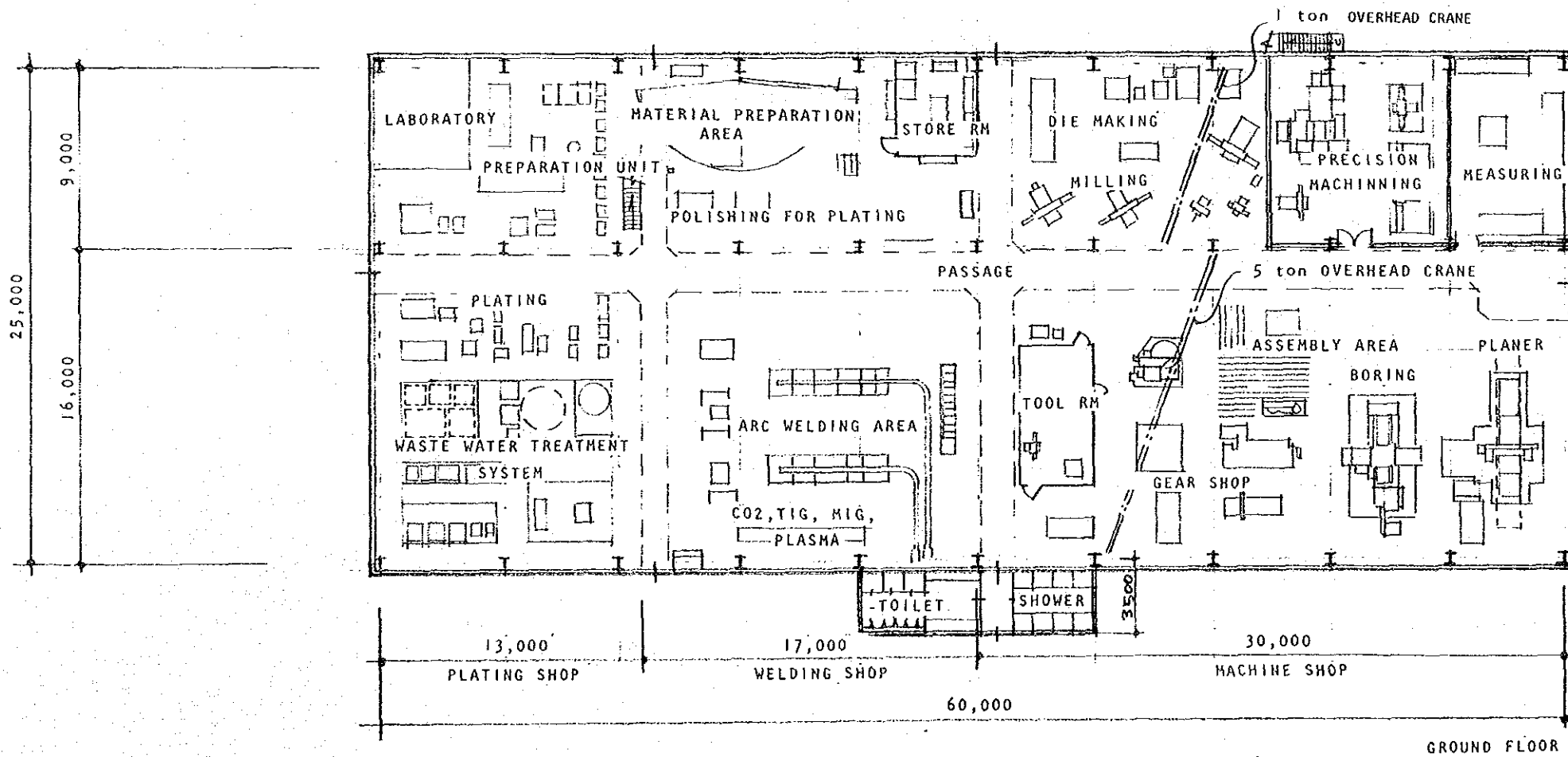
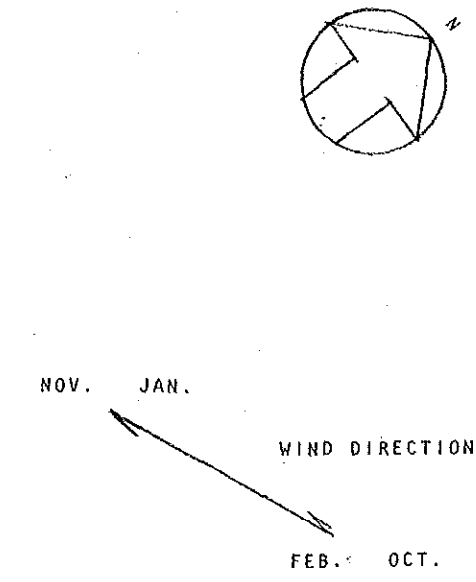
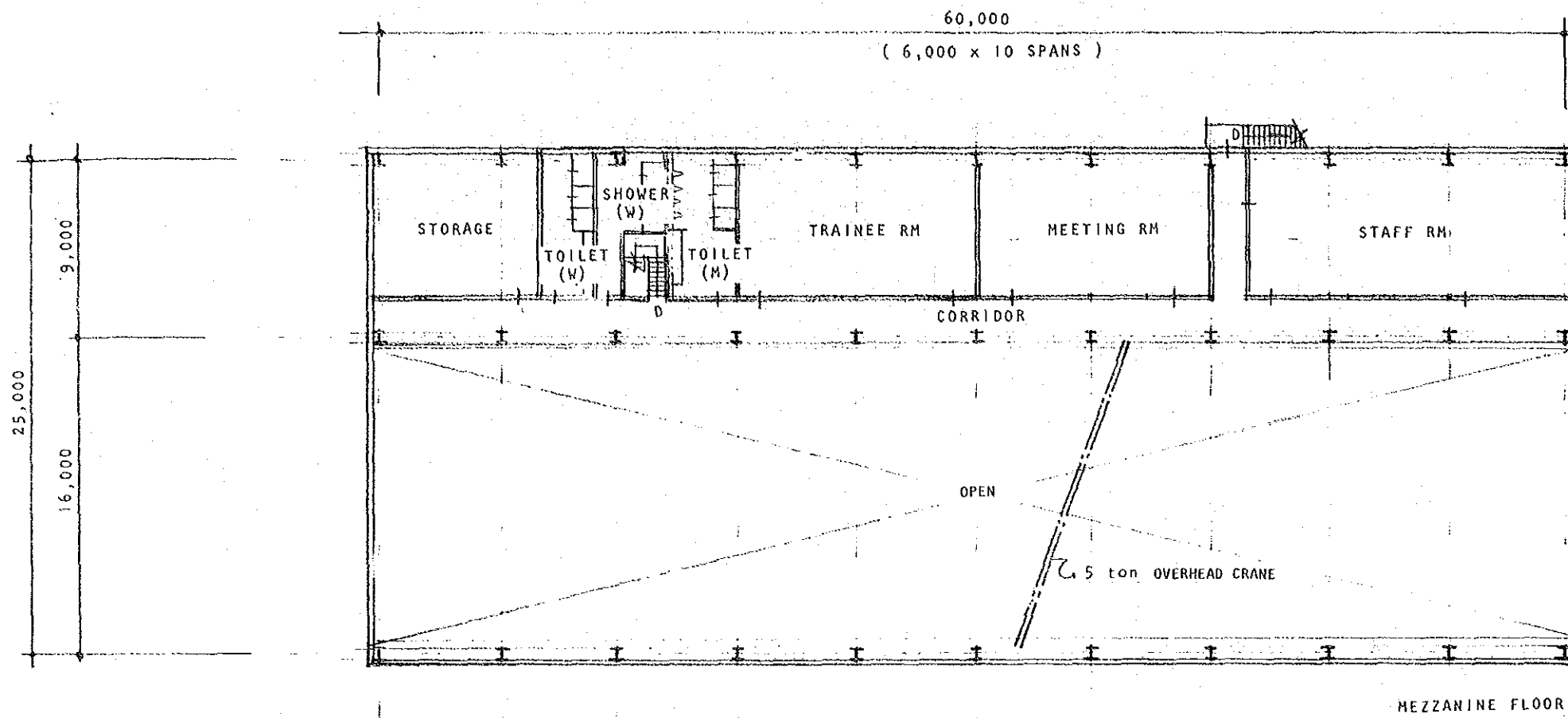
S= 1: 200



MAIN BUILDING

SECTION

S= 1: 200



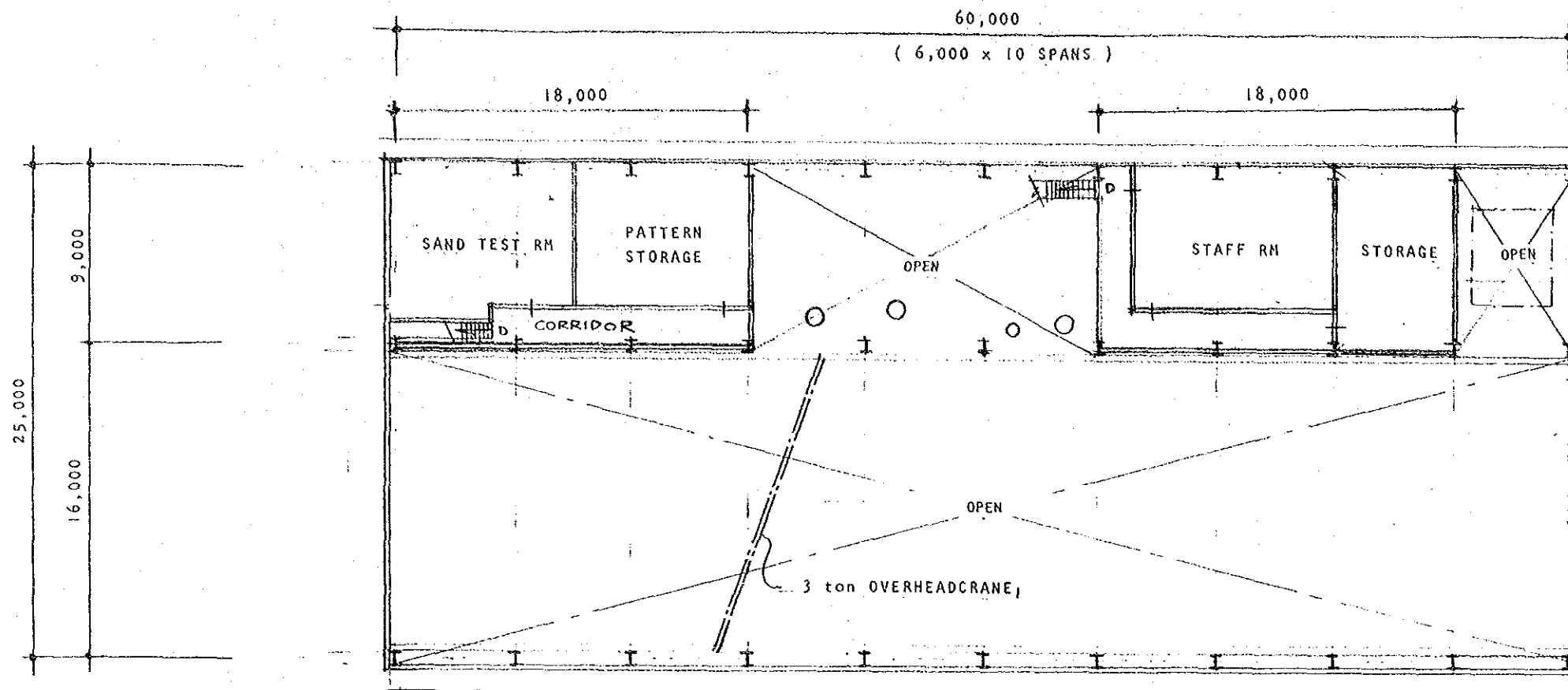
FLOOR AREA 2,076 m²

(G F. 1,536 m²)
(M2F. 540 m²)

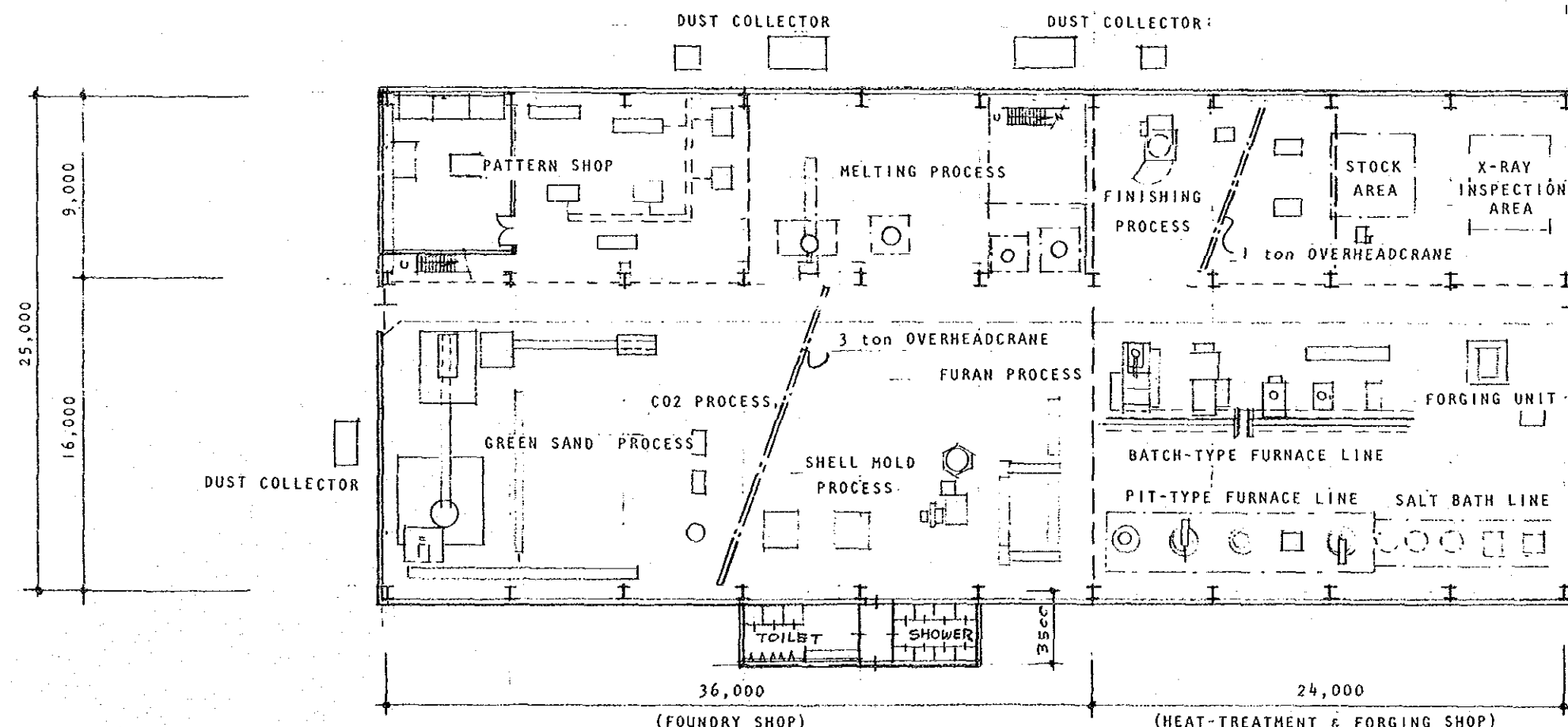
WORKSHOP (A)

FLOOR PLAN

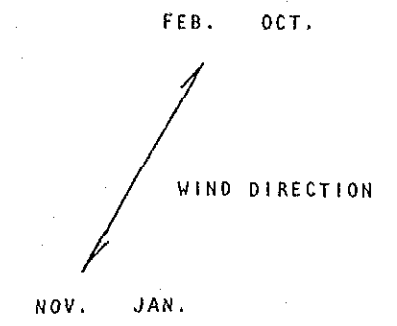
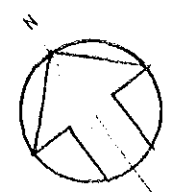
S=1: 300



MEZZANINE FLOOR



GROUND FLOOR

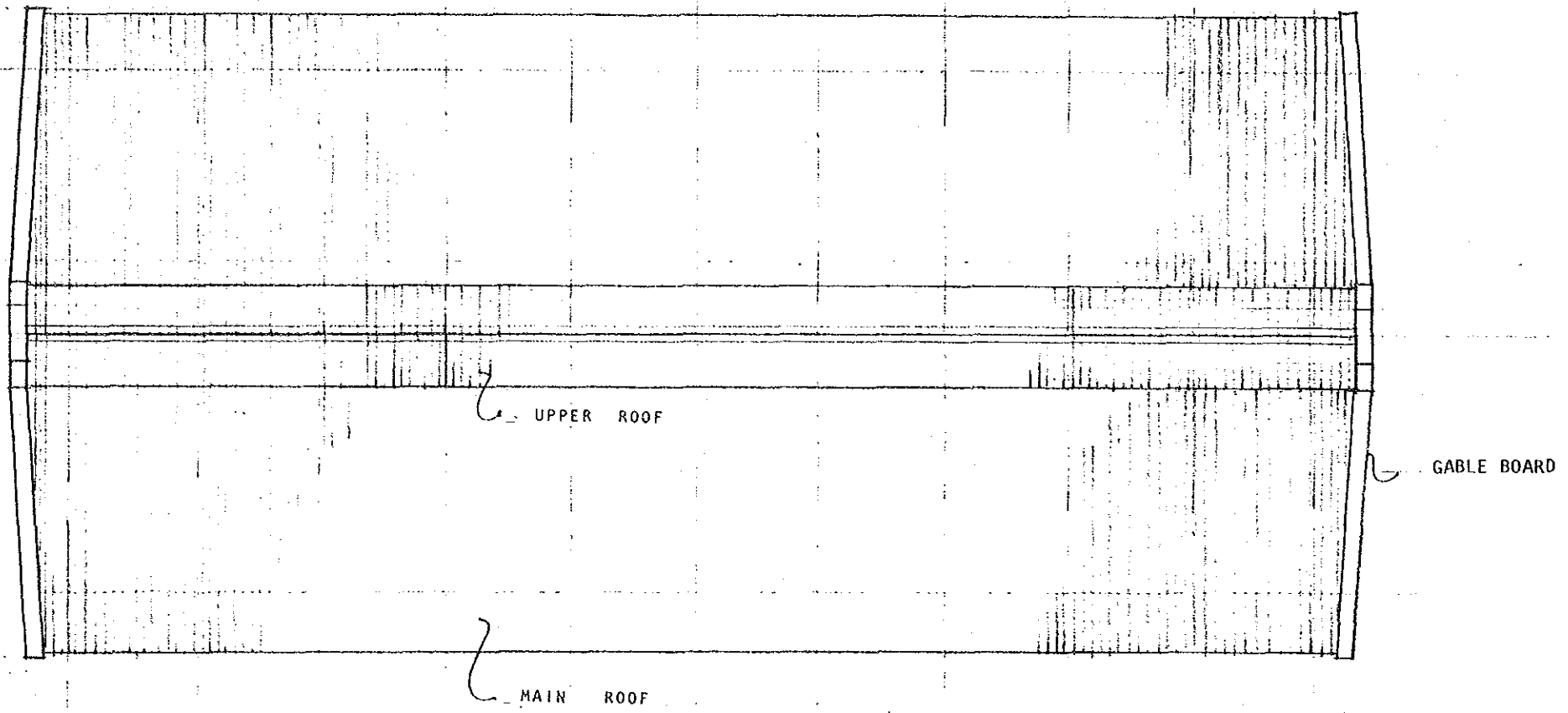


FLOOR AREA 1,861 m²
 (G.F. 1,536 m²
 M2F. 325 m²)

WORKSHOP (B)

FLOOR PLAN

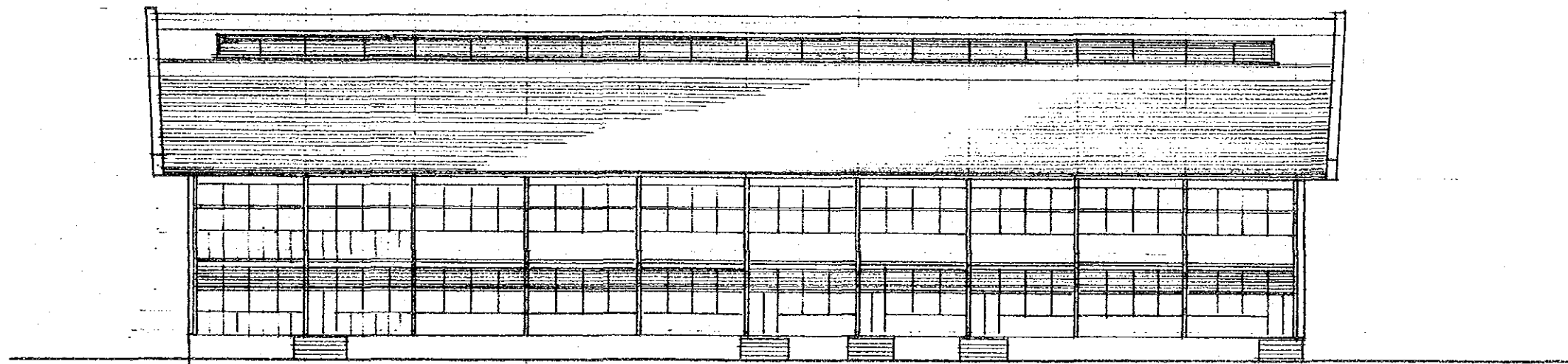
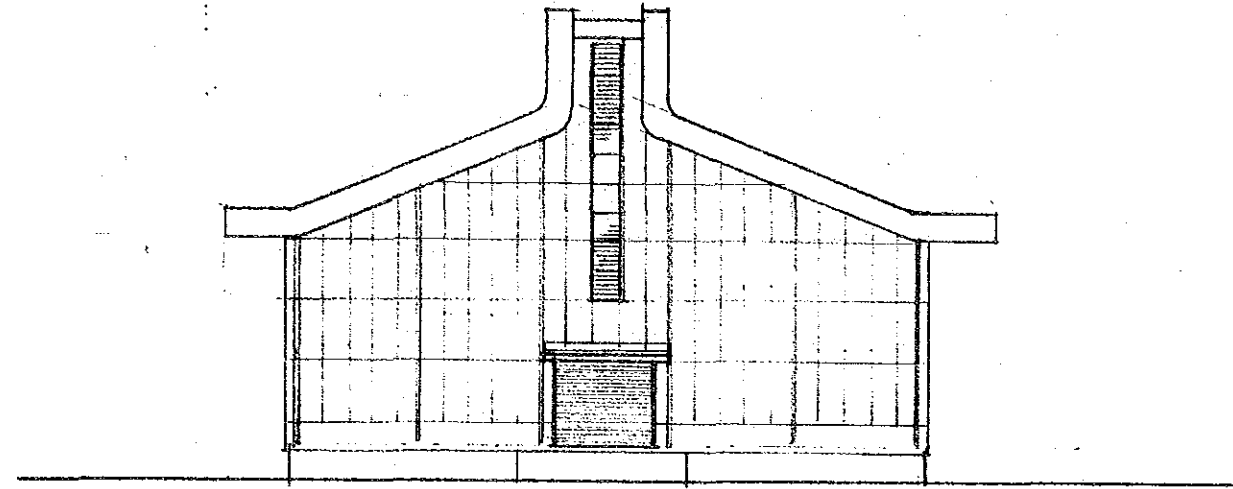
S= 1: 300



WORKSHOP

ROOF PLAN

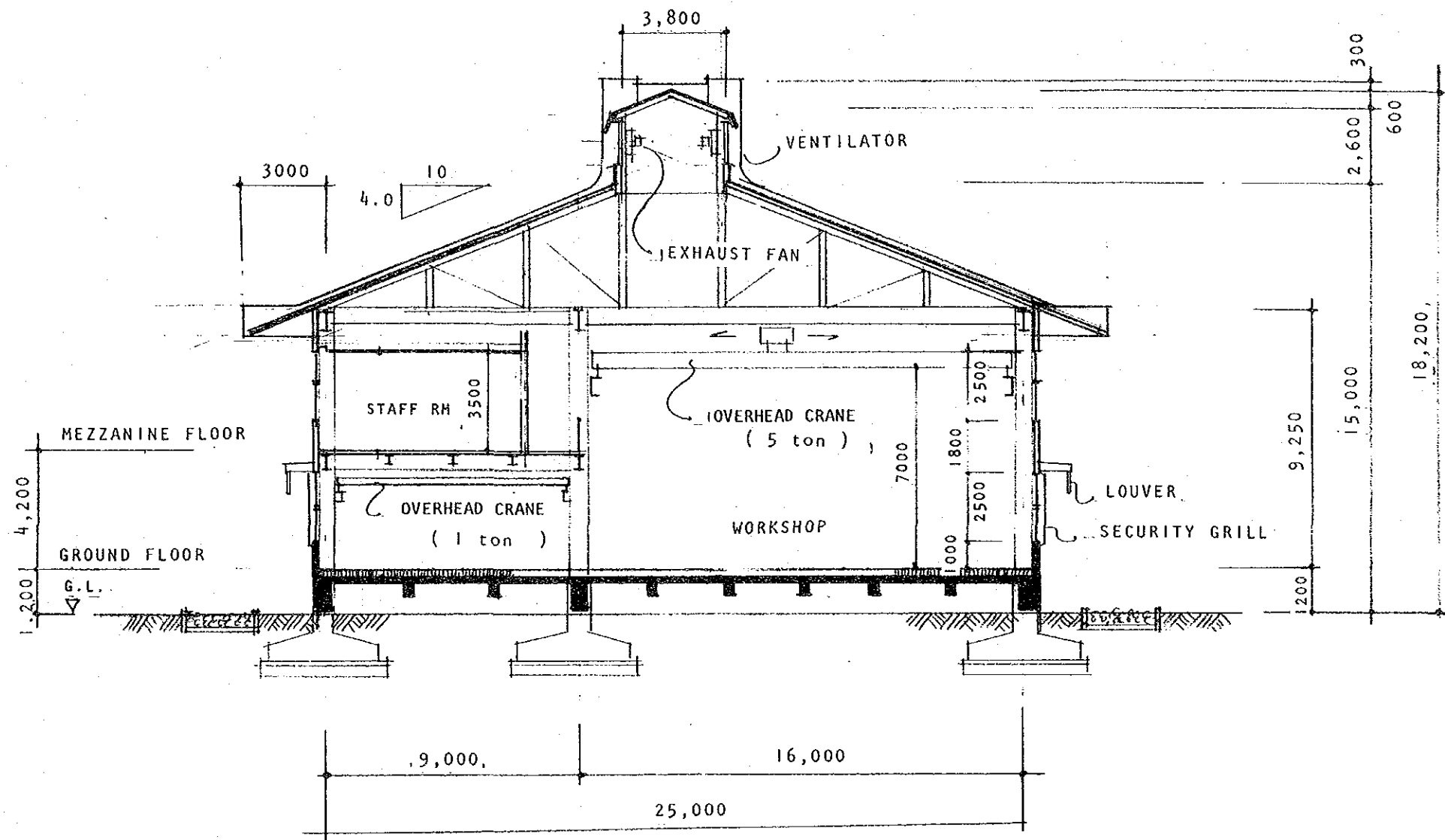
S= 1: 300



WORKSHOP

ELEVATIONS

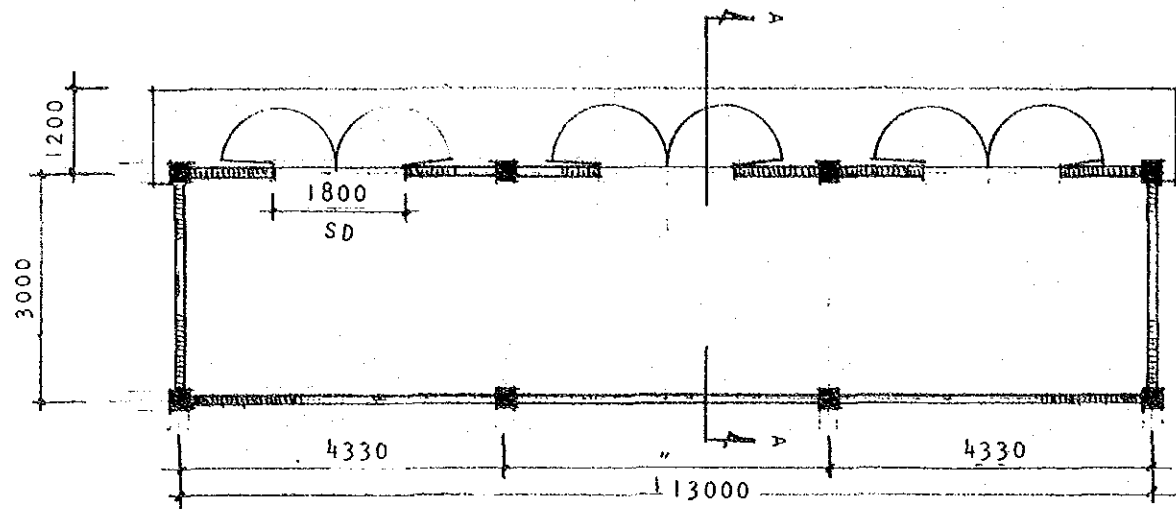
S= 1: 300



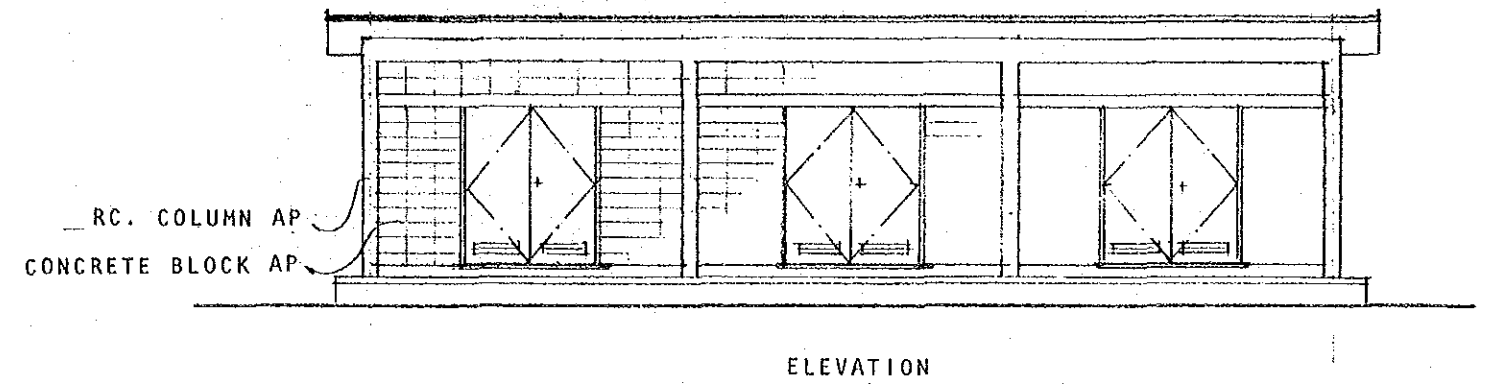
WORKSHOP (A, B)

SECTION

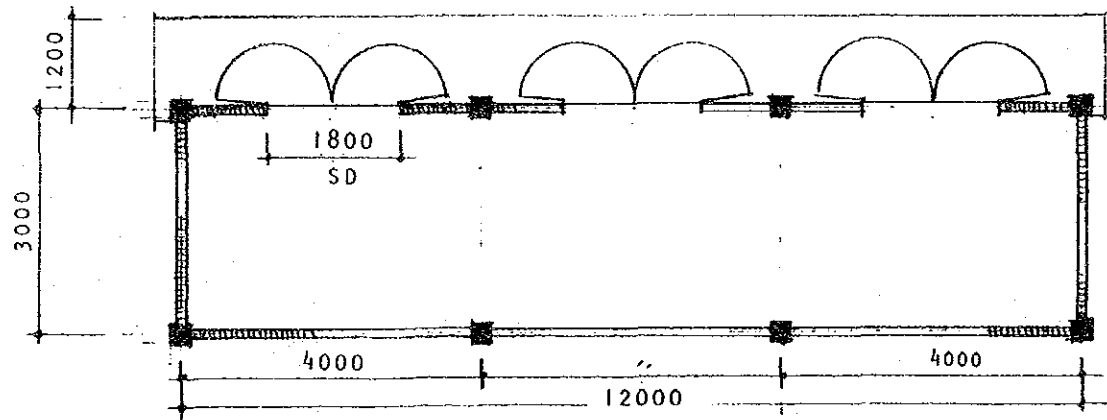
S=1: 200



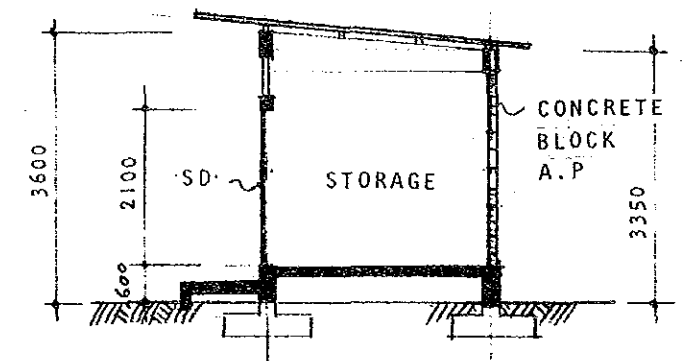
A. FOUNDRY MATERIAL STORAGE 39.0 m²



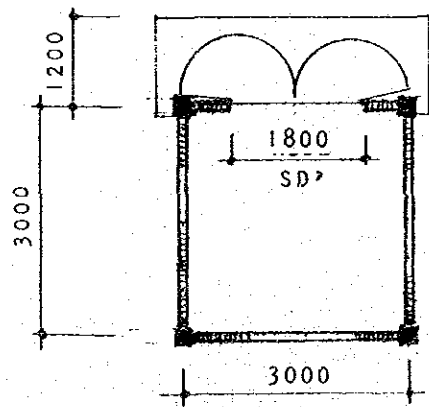
ELEVATION



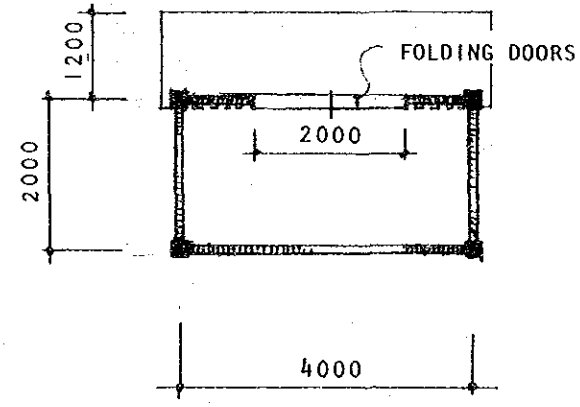
B. GENERAL MATERIAL & COMPRESSOR STORAGE 36.0 m²



A-A SECTION



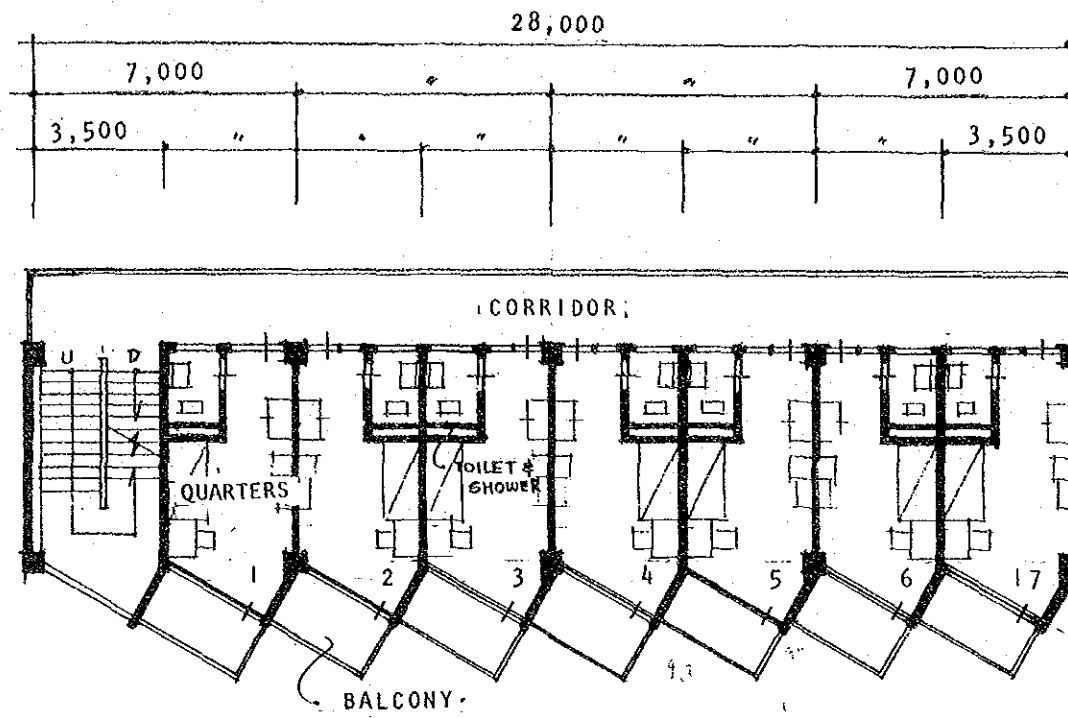
C. DANGEROUS MATERIAL STORAGE 9.0 m²



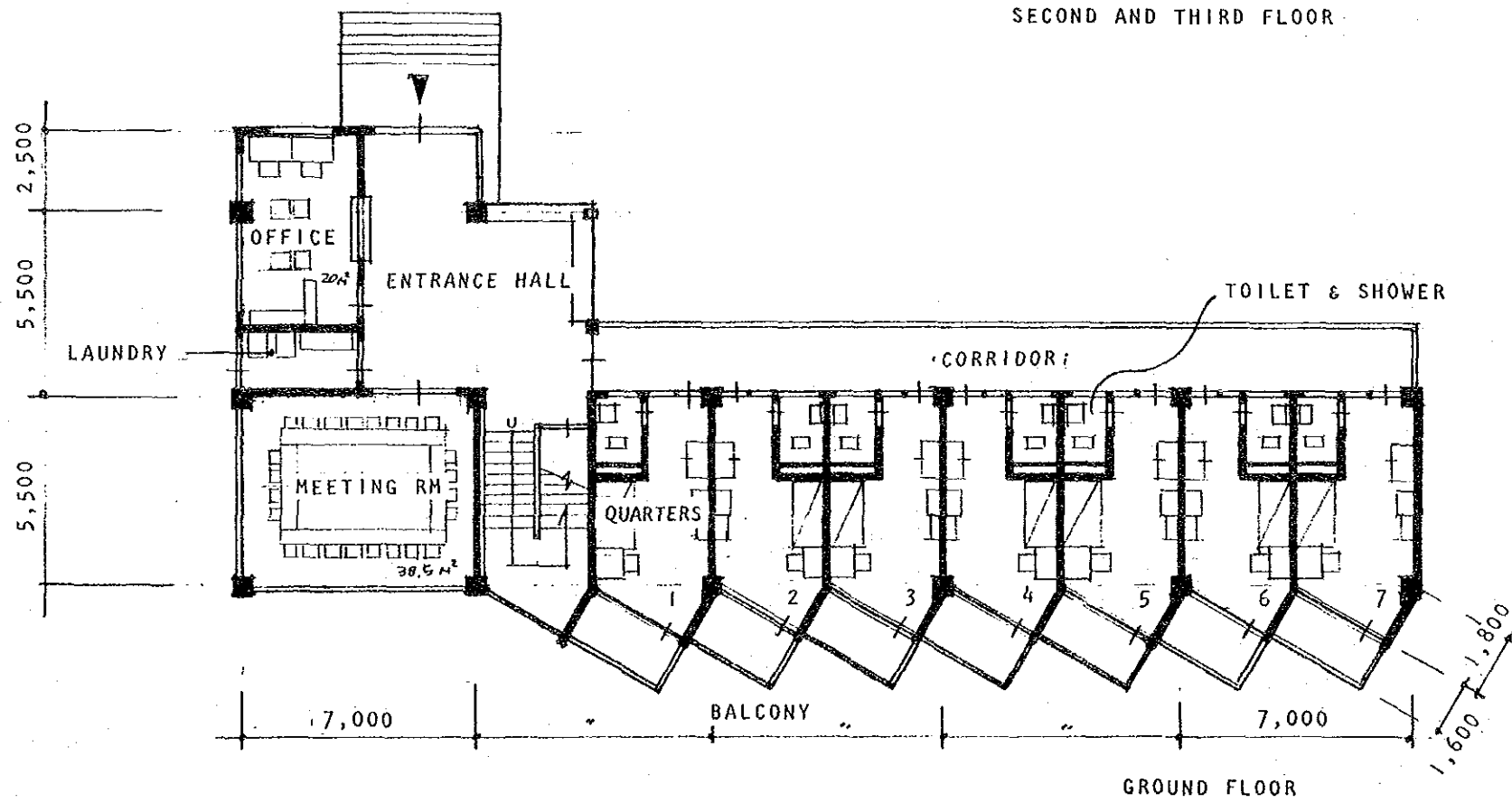
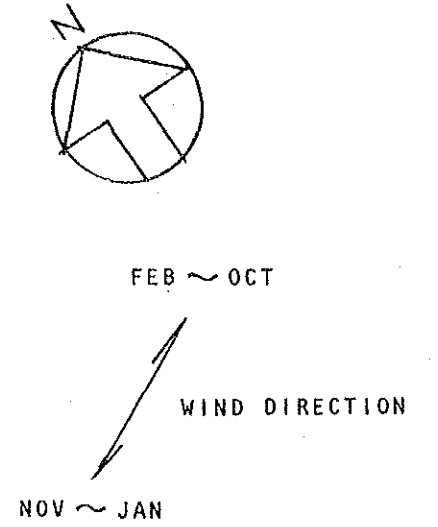
D. SAND & DUST DUMP YARD 8.0 m²

WORKSHOP UTILITY BUILDING

S = 1 : 100



SECOND AND THIRD FLOOR

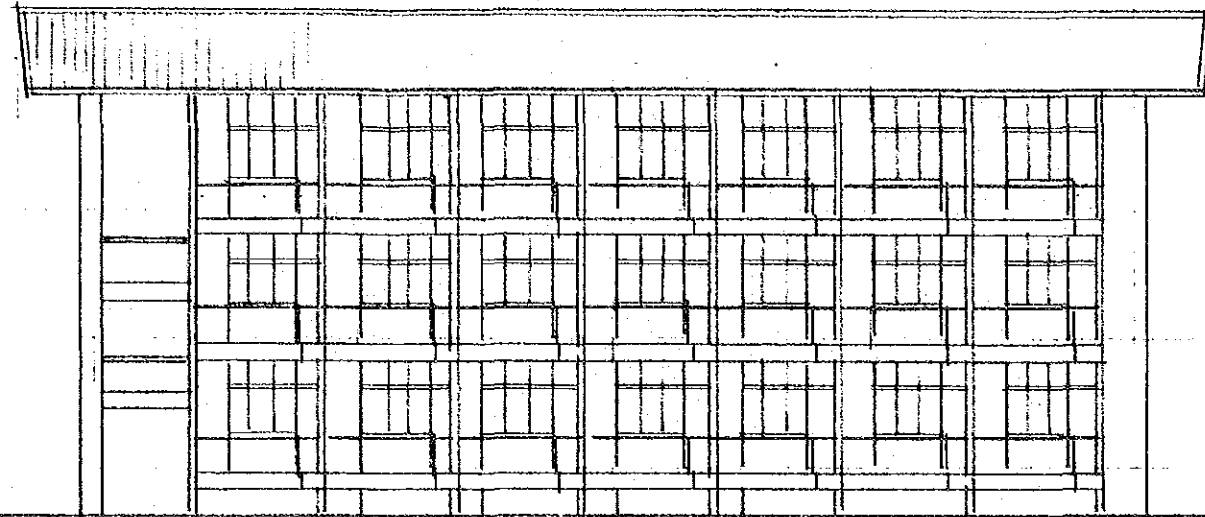


GROUND FLOOR

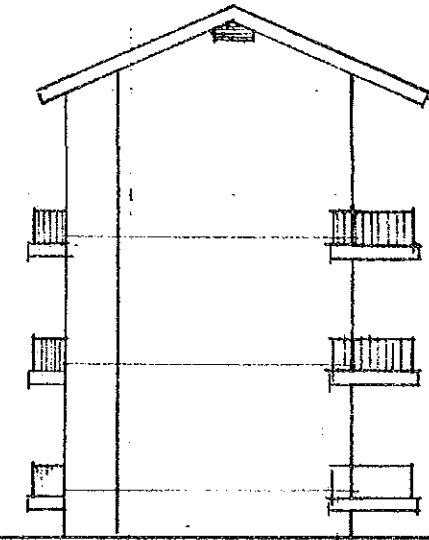
FLOOR AREA	815.0 m ²
(3 F	235.2 m ²)
(2 F	235.2 m ²)
(G F	344.6 m ²)

DORMITORY
FLOOR PLAN

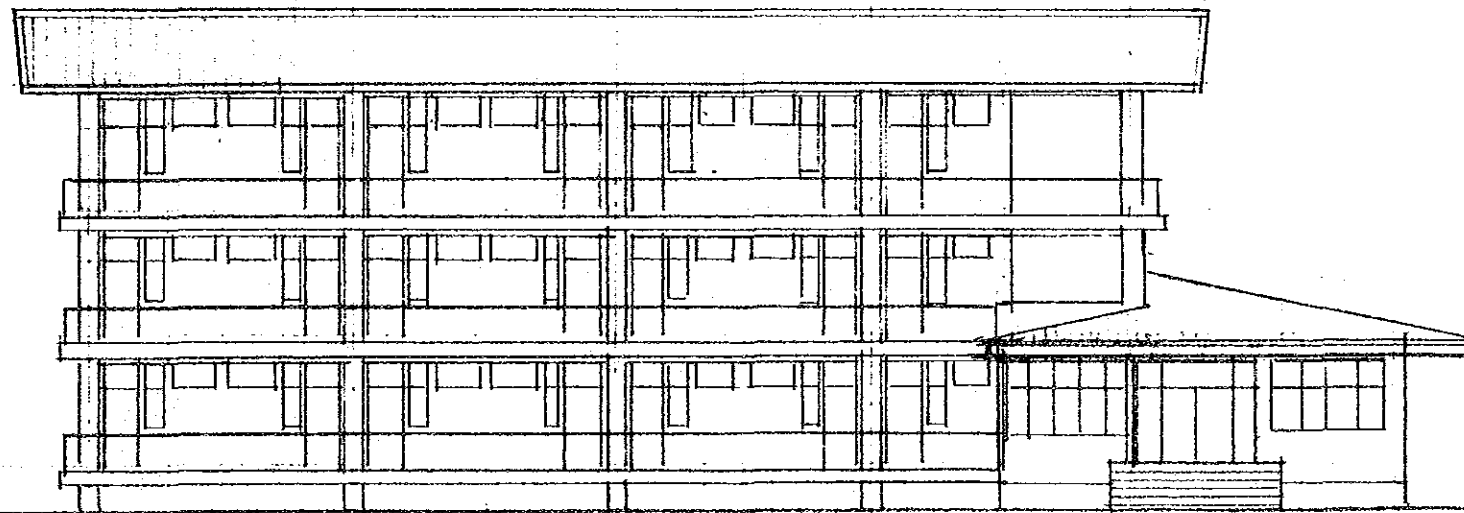
S = 1 : 200



SOUTH



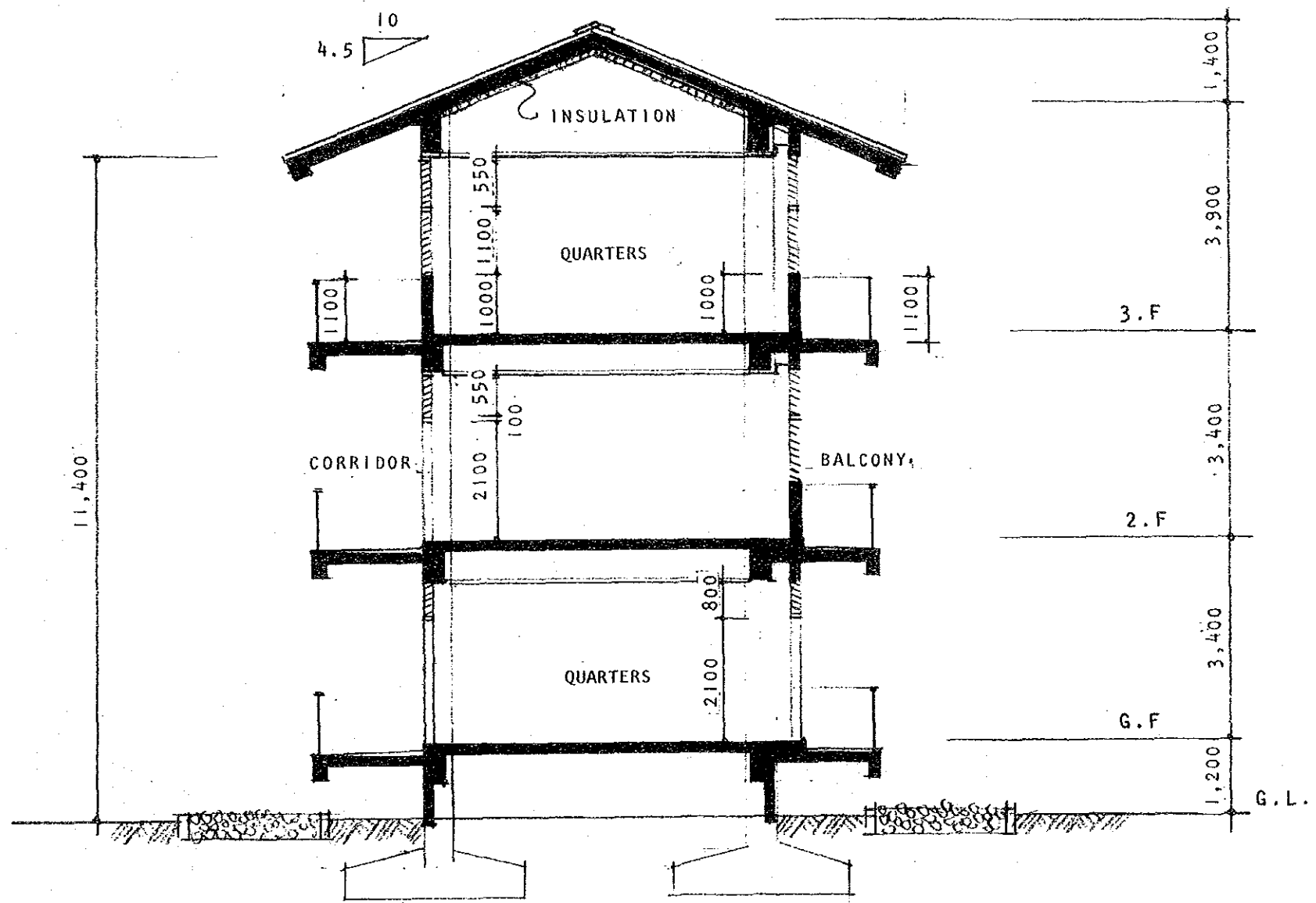
WEST



NORTH

DORMITORY
ELEVATIONS

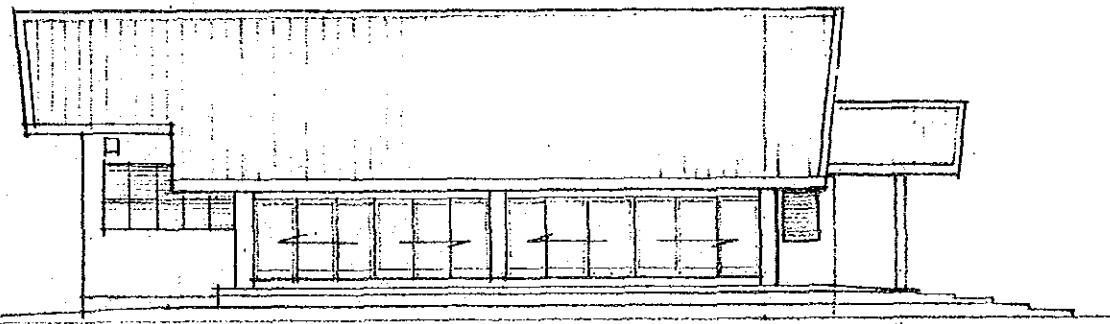
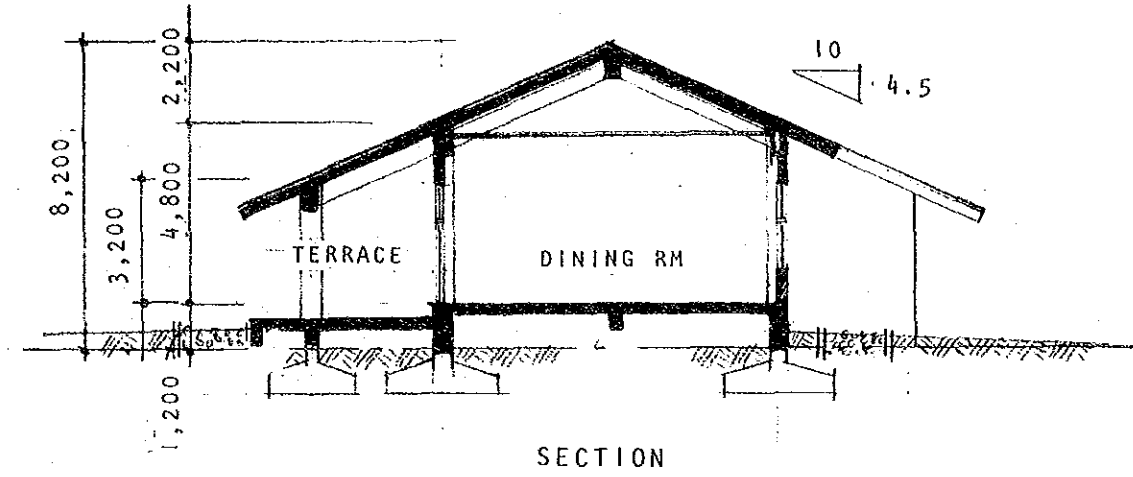
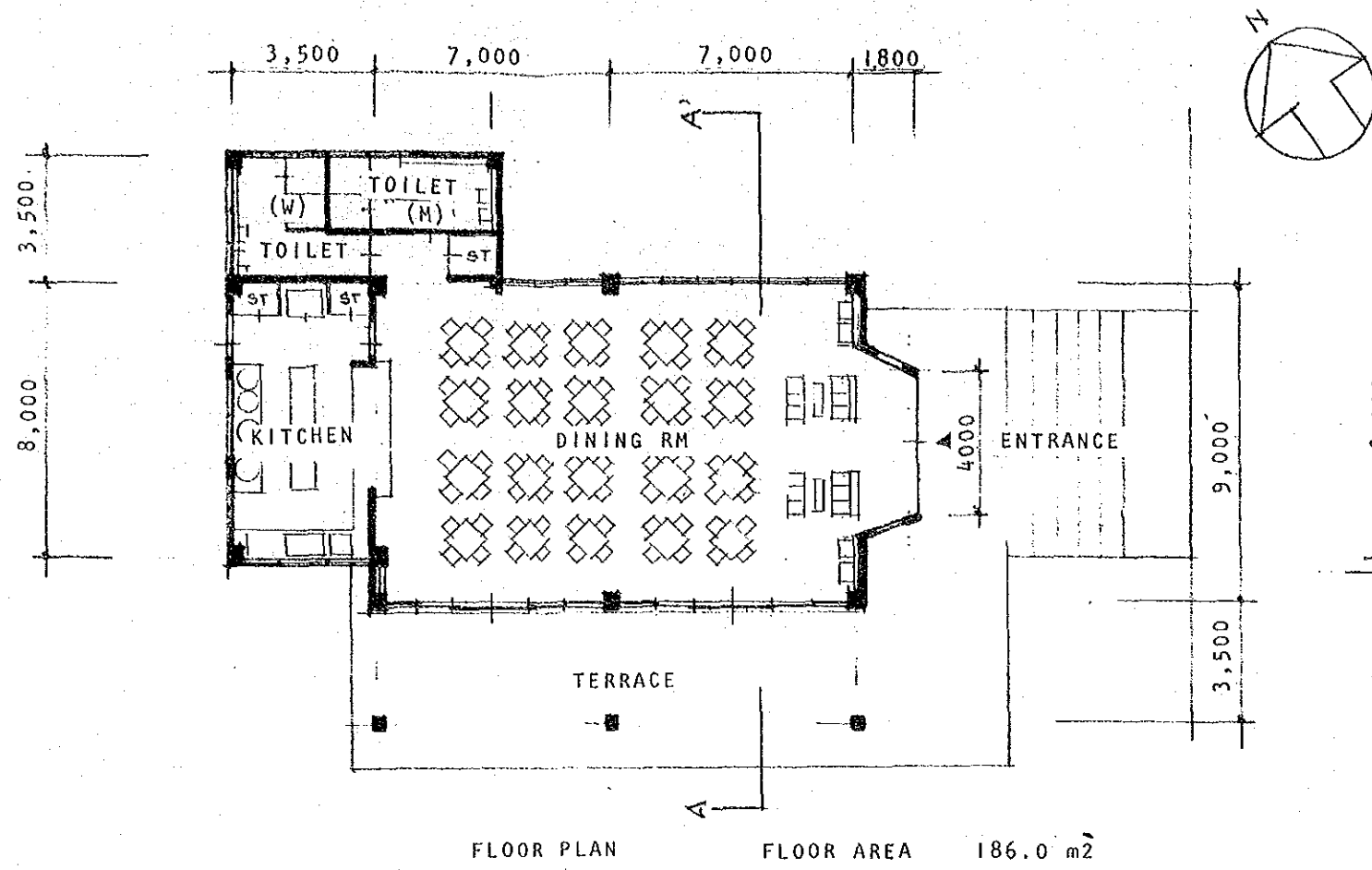
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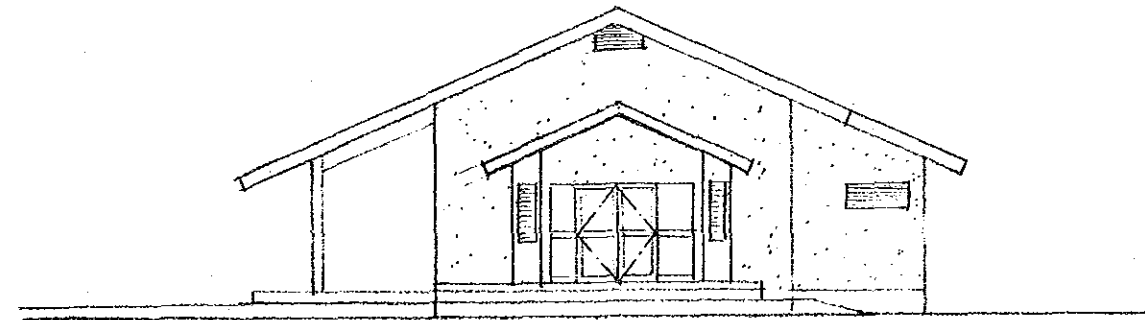
DORMITORY

SECTION

S= 1: 100



SOUTH ELEVATION



WEST ELEVATION

CANTEEN

S= 1:200

