DISPATCH OF THE SURVEY TEAMS

CHAPTER 2

2-1 THE PRELIMINARY SURVEY TEAM

In response to the Burmese request, JICA decided to send a preliminary survey team to Burma to examine the concept of the Burmese request and to carry out a necessary survey. The Burmese proposal was intended to establish an all-inclusive research and development center so that analytical, mineral processing, smelting and refining technologies could be adapted for already-developed mineral resources as well as those to be developed in the future. To realize this project, the Government of Burma requested the construction of buildings, provision of machinery and equipment, dispatch of Japanese experts and the reception of Burmese personnel for the establishment of the Center.

JICA organized the following Preliminary Survey Team, which visited the Socialist Republic of the Union of Burma for 13 days from October 12, 1978, to hold discussions with the Burmese Governmental Authorities concerned and to carry out the site survey.

- (Organization of the Preliminary Survey Team)

Hisashi OKI (Leader)	Executive Director, The Metal Mini Agency of Japan
Michio ICHIJO	Chief Research Engineer, National Research Institute for Pollution and Resources
Hidenori SASAKI	Senior Mining Engineer, Overseas Mineral Resources Development Co., Ltd.
Kenji SUZUKI	Mining and Industrial Development Cooperation Department, JICA

Toshio AI — Social Development Cooperation Department, JICA

● Itinerary of the Preliminary Survey Team

Day	Date	Details	Stay
1st	Oct 11 (Wed)	Tokyo to Bangkok.	Bangkok
2nd	12 (Thu)	Bangkok to Rangoon. Courtesy visit to Japanese Embassy.	Rangoon
3rd	13 (Fri)	Consultations with Foreign Economic Relations Department, Ministry of Planning and Finance, and No. 1 Mining Corp., Ministry of Mines.	do
4th	14 (Sat)	Consultation with No. 1 Mining Corp., Ministry of Mines.	do
5th	15 (Sun)	Consultation within the team	do
6th	16 (Mon)	do	do
7th	17 (Tue)	Rangoon through Pyinmana to Ela (by railway). Field survey of the site of construction at Ela.	Yeny
8th	18 (Wed)	Ela through Pyinmana to Rangoon (by railway).	Rangoon
9th	19 (Thu)	Consultation with No. 1 Mining Corp., Ministry of Mines.	do
10th	20 (Fri)	Visit to Rangoon Institute of Technology.	do
11th	21 (Sat)	Consultation with No. 1 Mining Corp., Ministry of Mines. visit to Geological Survey and Exploration Dept.	do
12th	22 (Sun)	Consultation within the team	do
13th	23 (Mon)	Visit Minister of Mines at Ministry of Mines. Report to Japanese Embassy. Consultation with Foreign Economic Relations Department, Ministry of Planning and Finance.	do

Day	Date	Details	Stay
14th	Oct 24 (Tue)	Rangoon to Bangkok.	Bangkok
15th	25 (Wed)	Bangkok to Tokyo.	—

The conclusions of the Preliminary Survey Team are summarized as follows:

(1) The concept of the proposal made by the No. 1 Mining Corporation, Ministry of Mines, Government of the Union of Burma is considered appropriate.

(2) In view of the high potentialities of underground mineral resources, high priority is given to the development of the mining sector in the National Industrial Development Plan, and the Government of Burma intends to carry out extensive exploitation and development of these resources using the processes of smelting and refining. In order to carry out the Burmese intentions, a Center such as the one planned in Ela is thought indispensable in advancing the basic technology needed.

(3) The development and promotion of the Burmese mining industry will make it possible to export a variety of mineral products, and, at the same time, will create new employment opportunities and contribute to the stability and improvement of social welfare.

(4) Judging from the results of the survey and other conditions, the project site selected by the Burmese Government is considered appropriate.

(5) It is considered that Japan's cooperation in this program would be made on the bases of both grant aid and technical cooperation.

2-2 THE BASIC DESIGN SURVEY TEAM

On the basis of the results of the preliminary survey, it was decided that the following basic design survey team be organized by JICA and dispatched to the Socialist Republic of the Union of Burma for 17 days from December 8, 1978, to discuss further the construction of the Center with the Burmese governmental authorities concerned and to carry out a site survey, including an approximate measurement of the site.

- Organization of the Basic Design Survey Team

Michio ICHIJO (Leader)	Chief Research Engineer, National Research Institute for Pollution and Resources
Minori SANO	Coordinator, Mining & Industrial Development Cooperation Department JICA
Keiji ITAKURA	Senior Metallurgical Engineer, Overseas Mineral Resources Development Co., Ltd.
Hidenori SASAKI	Senior Mining Engineer, Operation Department, Overseas Mineral Resources Development Co., Ltd.
Ichiro KANAGAWA	Architect, NAEC
Takashi MAKISHI	Structural Engineer, NAEC
Seiji MATSUMOTO	Mechanical Engineer, NAEC
Shimematsu NAKAYAMA	Quantity Surveyor, NAEC

● Itinerary of the Basic Design Survey Team

Day	Date	Details	Stay
1st	Dec 8 (Fri)	Tokyo to Bangkok.	Bangkok
2nd	9 (Sat)	Bangkok to Rangoon. Discussion with No. 1 Mining Corp. with respect to the schedule.	Rangoon
3rd	10 (Sun)	Consultation within the team	do
4th	11 (Mon)	Courtesy visit to Japanese Embassy. Discussion with Construction Corp., Mining of Planning and Finance.	do
5th	12 (Tue)	Discussion with Construction Corp. Discussion with No. 1 Mining Corp.	do
6th	13 (Wed)	Rangoon to Ela (5 members by railway and 3 members by car). Ela site survey.	Yeny
7th	14 (Thu)	Ela site survey.	do
8th	15 (Fri)	Ela vicinity survey. Pyinmana to Rangoon (by railway).	Rangoon
9th	16 (Sat)	Discussion with No. 1 Mining Corp.	do
10th	17 (Sun)	Consultation within the team.	do
11th	18 (Mon)	Discussion with Petrochemical Industry Corp. Discussion with Electric Power Corp.	do
12th	19 (Tue)	Discussion with No. 1 Mining Corp. Inspection of the construction site of Construction Corp.	do

Day	Date	Details	Stay
13th	Dec 20 (Wed)	Discussion with Burma Railways Corp. Inspection of the construction site of Boimedical Research Center. Discussion with Burma Five Star Shipping Corp.	do
14th	21 (Thu)	Discussion with Burma Ports Corp. Discussion with No. 1 Mining Corp. Dinner party held by Minister of Mines.	do
15th	22 (Fri)	Discussion with Ministry of Planning and Finance. Visit to Japanese Embassy.	do
16th	23 (Sat)	Rangoon to Bangkok.	Bangkok
17th	24 (Sun)	Bangkok to Tokyo.	—

The findings of the Basic Design Survey Team are reproduced briefly in the following.

(1) The survey team explained the scheme of free technical cooperation to the Burmese authorities concerned, and, at the same time, confirmed the way Burma would participate. Consequently, it was found, with respect to the present project, that:

a) It was the Foreign Economic Relations Department of the Ministry of Planning and Finance which would administer the procedures pertaining to E/N signature and finance, and

b) It was the No. 1 Mining Corporation of the Ministry of Mines which would administer signature of R/D and other contract documents, compiling the budget and all of the procedures pertaining to execution.

(2) All of the ministries concerned of Burma entertained great interests in the promotion of this project, and the cooperation and support extended to the survey team by the authorities concerned were very positive and considerate in every aspect of survey activities.

(3) The Burmese Government also showed a positive attitude toward budgetary appropriation for the expenditure, and execution of the work to be borne by the Burmese Government.

(4) Further, the Burmese Government showed its intention to accede to our request that it should bear the expenses required for domestic transport of machinery and materials, domestic travel of personnel sent from Japan, cargo loading and unloading, taxes and duties and safeguarding of personnel, machines and materials.

(5) The survey team investigated the intended site and its surroundings and collected necessary data. The Burmese Government and the survey team also confirmed the site for the Center and conducted a preliminary survey and, at the same time, asked the Burmese Government to conduct a detailed survey of the site, making test borings and geological tests as soon as practicable. The Burmese Government agreed to these requests and promised to send the data to Japan as soon as possible.

(6) Together with the representative of the No. 1 Mining Corporation, the survey team visited the Burma Corporations of Railways, Shipping, Ports, Electric Power, Construction and Petrochemical Industry, exchanged questions and answers and inspected construction sites. It also acquired data from the Ceramics Corporation and Road Transport Corporations. These survey activities were carried out satisfactorily through cooperation and support of the respective corporations, and apart from the data to be transmitted to Japan later, all necessary data were collected.

2-3 BASIC DESIGN DRAFT REPORTING TEAM

This Basic Design Draft Reporting Team was sent in order to explain to the Burmese Government the basic design drafted upon the results of the preceding two surveys, to obtain its agreement, and also to set forth clearly the details of the cooperation of Burma and Japan.

- Organization of the Basic Design Draft Reporting Team

Kenji TOMITA (Leader)	Deputy Director, National Institute for Research of Pollution and Resources, Agency of Industrial Science and Technology
Hidenori SASAKI	Overseas Mineral Resources Development Co., Ltd.
Ichiro KANAGAWA	Building Design Department, NAEC
Kenji SUZUKI	Mining and Industrial Development Cooperation Department, JICA

- Itinerary of the Basic Design Draft Reporting Team

Day	Date	Details	Stay
1st	Feb 19 (Mon)	Tokyo to Bangkok.	Bangkok
2nd	20 (Tue)	Bangkok to Rangoon. Courtesy call to the Japanese Embassy and No. 1 Mining Corp.	Rangoon
3rd	21 (Wed)	Explanation of Basic Design Draft, and consultation.	do
4th	22 (Thu)	Same as above.	Rangoon
5th	23 (Fri)	Same as above.	do
6th	24 (Sat)	Consultation with respect to Minutes of the Meetings.	do

Day	Date	Details	Stay
7th	Feb 25 (Sun)	Consultation within the team	Rangoon
8th	26 (Mon)	Signature to Minutes of the Meetings. Talks with No. 1 Mining Corp. and related corporations.	do
9th	27 (Tue)	Report to Japanese Embassy. Rangoon to Bangkok.	Bangkok
10th	28 (Wed)	Rangoon to Tokyo	—

The survey results of the Basic Design Draft Reporting Team are reproduced briefly in the following.

(1) The Team explained the draft in detail to the Burmese organizations concerned and ensured that it was acceptable to the Government of Burma.

(2) With respect to the Minutes, No. 1 Mining Corporation and the Team came to a substantial agreement on the content of the draft, including the project name, and on February 24, the Managing Director of No. 1 Mining Corporation and the Team Leader affixed their signatures to two copies of the Minutes. Prior to signing, some amendments were made, but these were minor changes of expression except for the addition of the work of planting trees in the compound of the institute at the expense of the Burmese Government, and do not at all change the basic framework.

(3) On February 23, the Burmese Government called a subcabinet meeting at which the Minutes and Basic Design Draft were reviewed and approved. The signatures mentioned above were made upon the approval at the subcabinet meeting.

(4) With the approval of the Minutes and the Basic Design Draft by the subcabinet as noted in the paragraph above, the budgetary appropriation for execution of the items stated in the Minutes and Draft was ensured.

(5) Further, the team conducted surveys which confirmed the results obtained from previous geological and other surveys, and studied questions of planting work, construction materials, electrical rules and regulations and sanitary equipment work.

DISCUSSION WITH No1 MINING CORP.

2-4 BURMESE PERSONS CONCERNED

The persons concerned with this project on the part of Burma are:

(1) Ministry of Mines

- Brig. Gen. Than Tiu, Minister,
- U Saw Hla Pru, Deputy Minister,
- U Ko Ko Than, Managing Director, No. 1 Mining Corporation, and
- U Bo, Project Controller, No. 1 Mining Corporation; and

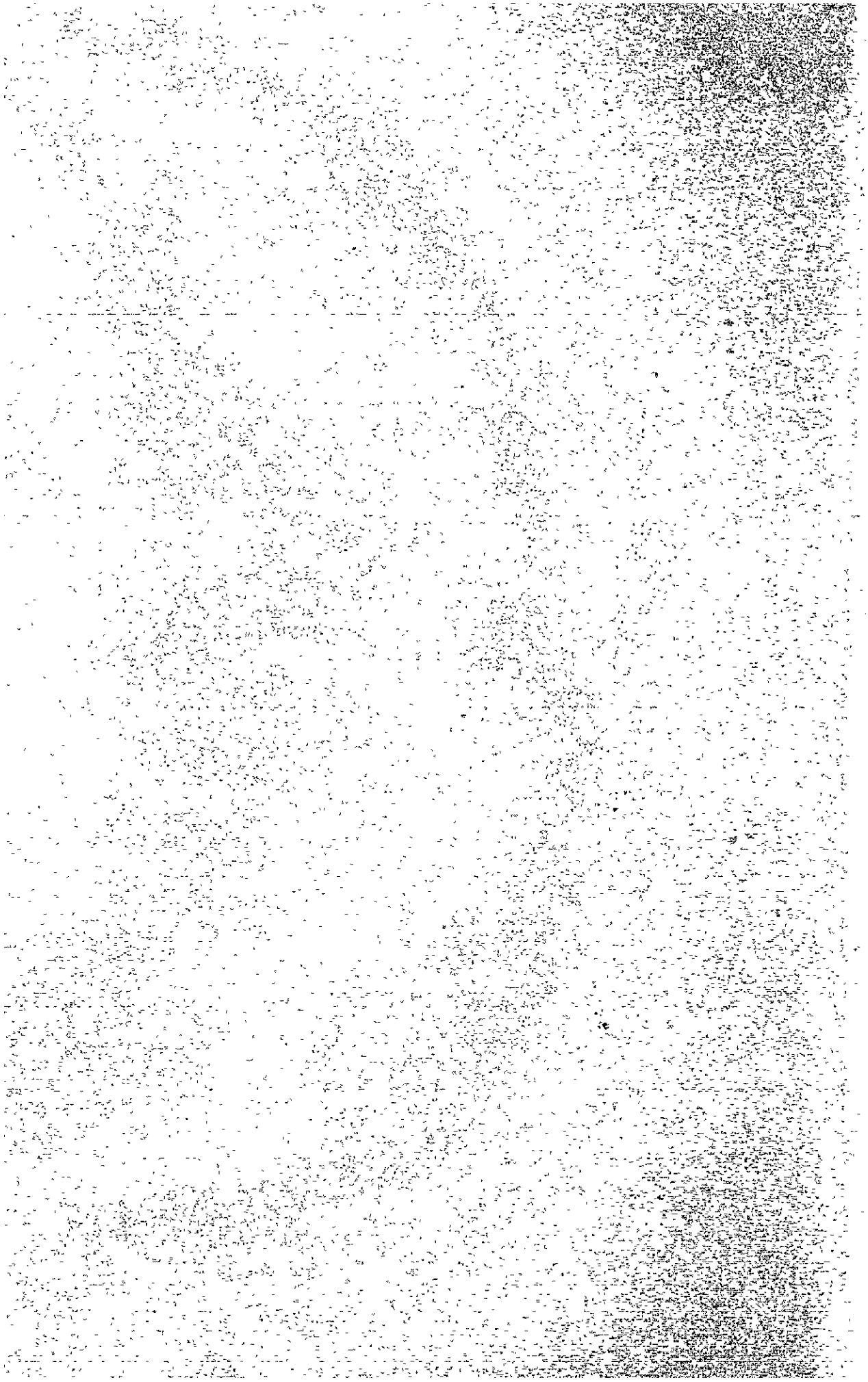
(2) Ministry of Planning and Finance

- U Tun Tin, Minister,
- U Myo Myint, Deputy Minister,
- Dr. Maung Shein, Deputy Minister, and
- U Thein Myint, Director General, Foreign Economic Relations Department (FERD).

DINNER PARTY

CONSTRUCTION SITE

CHAPTER 3

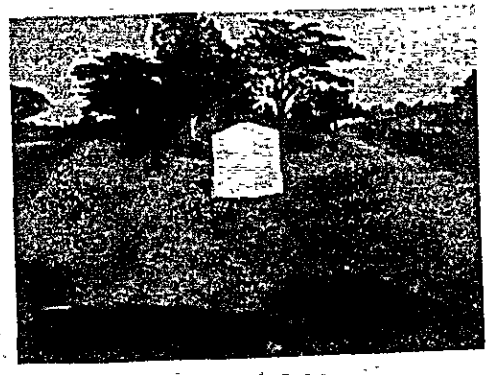


3-1 LOCATION OF THE CONSTRUCTION SITE

On travelling northwards along the major highway which runs towards Mandalay from Rangoon, one arrives at the city of Pynmana (north 19°43', east 96°13' and height above sea level 95.4 m) about 300 miles (480 km) from Rangoon.
The proposed site for this project is near Ela, a small town located at the division-border, and is reached by travelling 3 miles (4.8 km) along the regional highway which branches out eastwards from the abovementioned major highway at a point about 30 km before Pynmana City. This area is situated in the central inland more or less halfway along a straight line connecting Rangoon and Mandalay.

The Burmese Government has acquired a flat and spacious farm land extending to an area of about 350 acres (140 ha) located about 1 km southwest of Ela Town as a site for an industrial complex. The construction site in the present plan forwarded by the Burmese Government belongs to part of this industrial complex, and is a very quiet area facing the southern side of the abovementioned regional highway.

This site is about 80 - 90 m above sea level.



BRANCH ROAD TO EIA OFF FROM RANGOON - MANDALAY HIGHWAY

MARKET IN EIA

3-2 PRESENT CONDITION OF THE CONSTRUCTION SITE

The proposed site is an almost-level flat land extending to about 360 m from east to west and 300 north to south and is at a relatively high location for this area.

In the northeast part of the site there are four evergreen trees (Burmese name: Letpan-bin and Nyaung-bin) of a height of 10 m - 15 m, which make an ideal land mark. There are also plants belonging to the pulse family (Burmese name: Hnan-bin) and plants belonging to the eulalia family (Burmese name: Matsubei) thickly grown to a height of about 10 cm - 30 cm, but there are no obstacles on the ground.

Although the level survey of the site was planned to have been conducted by the Burmese Government, it was not complete at the time of the present survey. Therefore a rough level survey necessary for planning was conducted.

This site makes a gentle slope of about 1/100 both from north to south and from west to east. At the southern edge of the site about 200 m south of the front road the land forms a gap by about 1 - 2 m.

There is a depression in the ground, of a depth of about 0.5 - 1 m and about 5 m wide, lying between the shoulder of the front road and the site, and continuing along the road. This is a common feature seen along all roads in this region, and it is thought that these depressions are made to protect the roads from being flooded with rain water. The front road and the site adjoining the road are almost at the same level.

3-3 PRESENT CONDITION OF THE ENVIRONS OF THE SITE

The Rangoon-Mandalay line of the Burmese Government Railway runs about 800 m east of the proposed site, and after another 50 m beyond the railway line there is a natural lake with an area of about 20 ha.

After 1 km still further towards the east one reaches Yonbin Chaung River, a tributary of Paunglaung River. Yonbin Chaung River joins Paunglaung River after flowing for another 2 km eastwards from this point. A range of gentle hills is seen further away.

In the area sandwiched between the railway and Yonbin Chaung River is the township of Ela, and Ela Railway Station is located in the northwest part of the town.

Several years ago there was a plan to construct a paper factory in this proposed industrial complex, and several facilities for this factory have already been built in the zone on the north side of the front road of the present site. An outline of these facilities is given below.

- Accommodation facilities
  These are known as staff houses and there are now about 20 of these buildings. Although these facilities are not being used now, it is possible to make them habitable by providing them with water and a power supply.

- Elevated water tower
  There are elevated water towers, one of wood and one of reinforced concrete, in this site, both of them about 15 m high. However, the wooden tower has started to decay and we are unsure whether this could be used. The

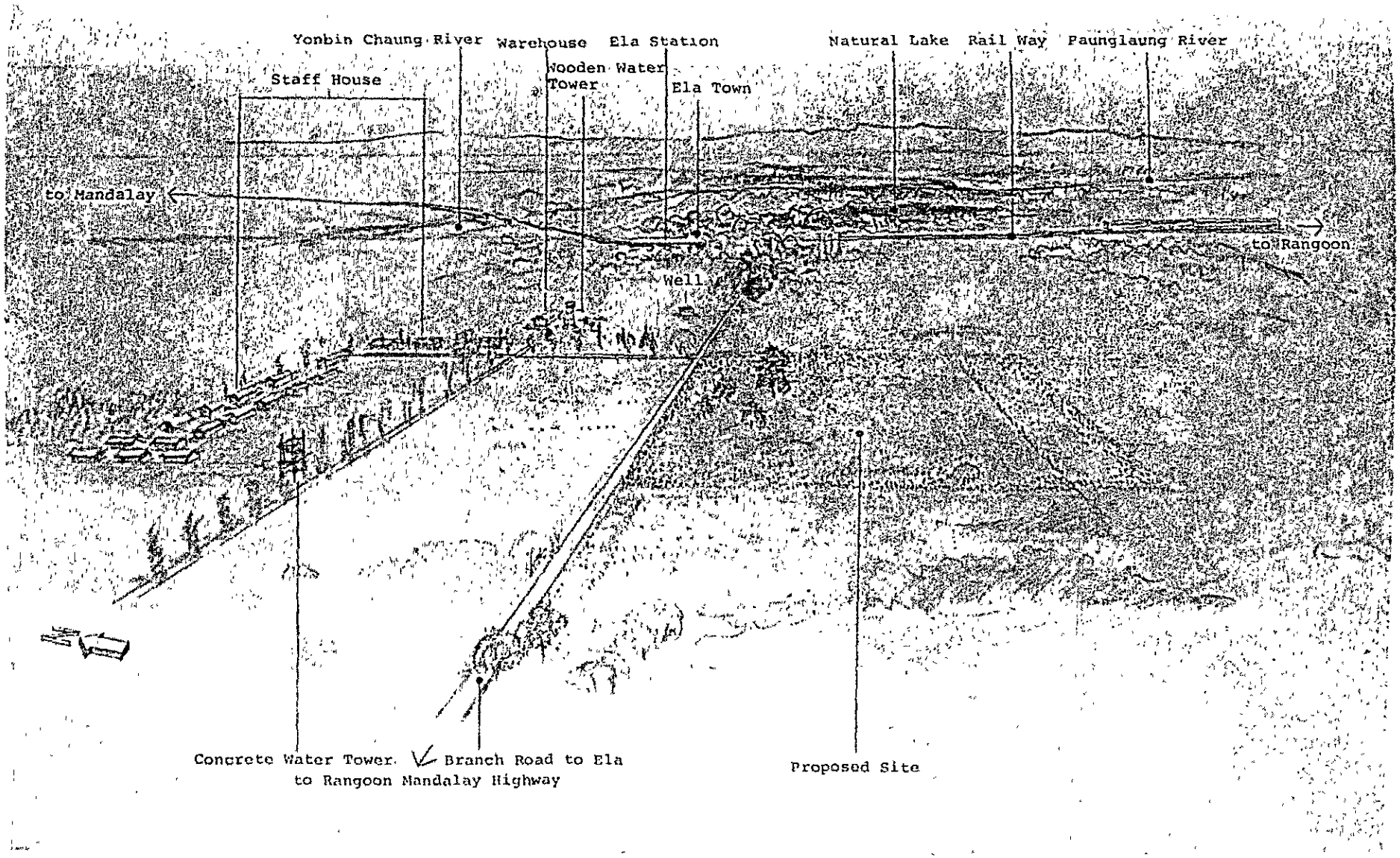
reinforced concrete structure is only a tower and a water tank is not yet fitted.

- Wells and pumps for the wells
  Although one well pump was installed near the wooden elevated water tank structure, it has been left unused for several years. Therefore it is thought impossible to use this pump again. In addition to this well, there is a shallow well with a diameter of about 1 m and a depth of about 5.5 m (18 ft). At the time of performing the Basic Design Survey, the measured water level in this well was about 1.8 m below ground.

- Stores
  To the east of the block of Staff Houses there is a store with an area of about 230 m^2 and of a reinforced concrete structure. This store is said to be managed by the Construction Corporation. However, it is not very clear how its space is being used.

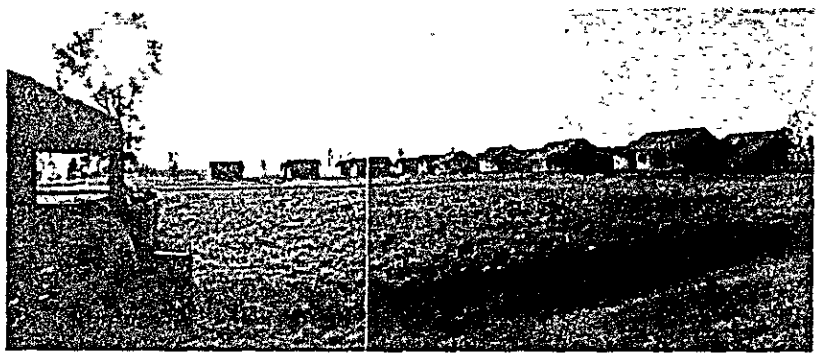
Fields with a gentle down slope continue for about 1 km from the southern side of the proposed site. Where this slope becomes steeper, there is a stream which flows into the natural lake mentioned above.

Along the roads around the site, there are tropical evergreen trees growing to heights of 10 m - 15 m scattered to make effective rows of trees. Beside the trees are herds of oxen eating grass, adding to the pastoral atmosphere.

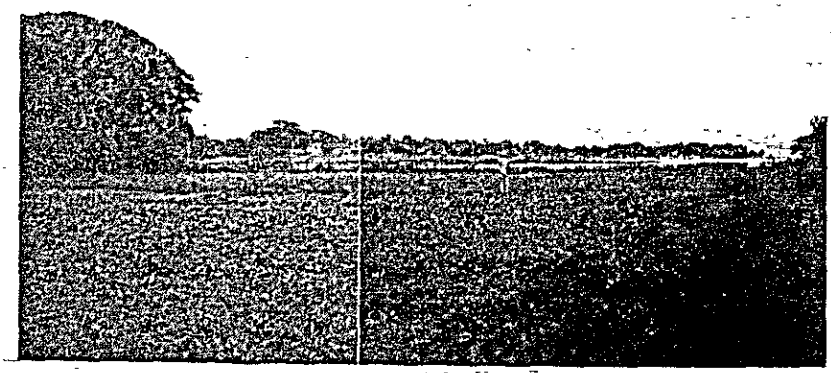


BARD'S EYE VIEW OF THE PROPOSED SITE

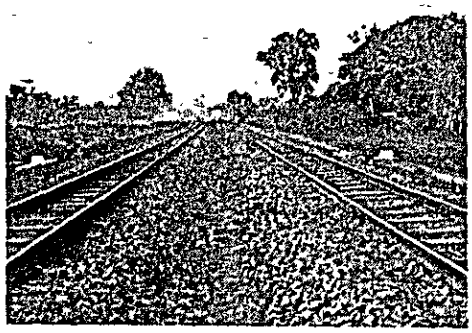
THE SITE FROM SOUTH-WEST



STAFF HOUSES

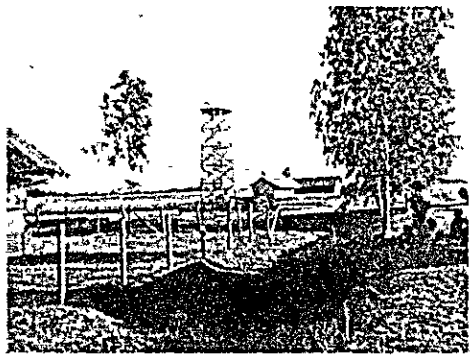


NATURAL LAKE IN ELA



RAILWAYS

YONBIN CHAUNG RIVER

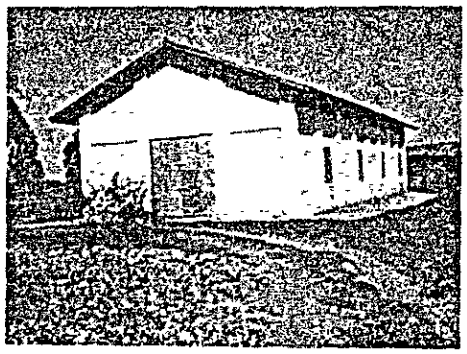


DITCH ALONG THE ROAD

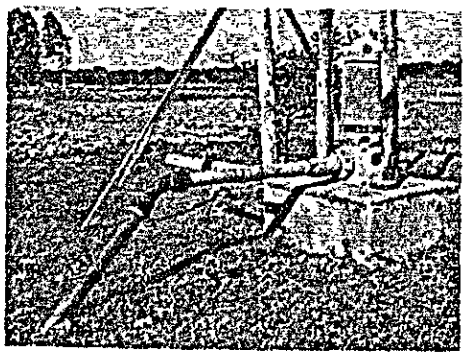
EUCALYPTUS

STAFF HOUSES

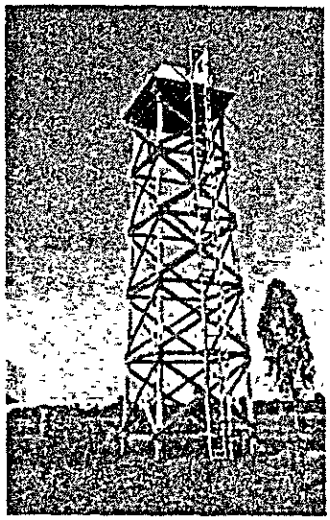
STAFF HOUSES



WAREHOUSE

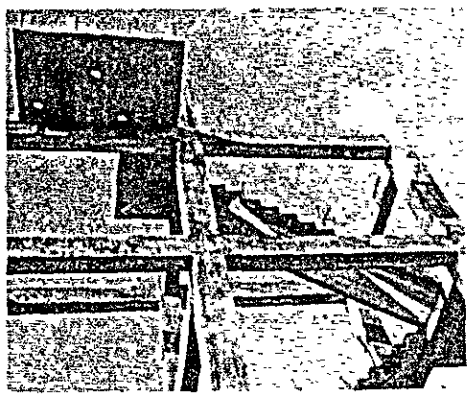


WELL AND PUMP



WOODEN WATER TOWER

CONCRETE WATER TOWER



DETAIL OF THE WATER TOWER

3-4 INFRASTRUCTURE

3-4-1 ELECTRICITY

Electricity can be obtained from a power line belonging to the Electric Power Corporation which passes above the natural lake on the east side of the site. Distance in a straight line from the site to the power line is about 2 km, and the power line has a voltage of 33 KV. At present electricity is not supplied to the site.

3-4-2 WATER SUPPLY

Public water supply facilities are not available. Wells around the site are discussed in Section 3-3, while the quality of water is discussed in Section 3-6.

3-4-3 DRAINAGE

Sewage facilities are also not available. The small waterway located at a distance of about 1 km from the site on its east side flows into the natural lake on the east of the railway line and this makes a natural drainage canal.

3-4-4 TELECOMMUNICATION

Telecommunication facilities are not available in the Ela area.

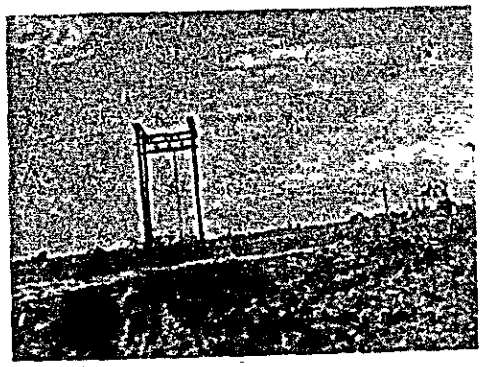
3-4-5 ROADS IN THE VICINITY

The regional highway which branches out from the Mandalay-Rangoon Highway is the main access road to Ela Area and the site faces this road. The road width varies from place to place, but is on average about 7.2 m out of which 4.8 m is covered by the central paved road surface. On

both sides of the road are open spaces varying in width from 2 to 5 m making a declivity.

The asphalt pavement of this road shows remarkable damage and the road has been left without maintenance for some time which has lead to irregularities all along it.

Although a motor vehicle passes only once in ten minutes or more, there is a relatively high number of bullock carts used for agricultural purposes.



POWER LINE (33KV)

3-5 THE GROUND CONDITIONS OF THE SITE

3-5-1 TEST PIT

In order to find out about topsoils in the construction site, a test pit was dug to a depth of 1.8 m during the Basic Design Survey.

The results with this test pit are shown in outline below.

OUTLINE OF THE CHARACTERISTICS OF TOPSOIL

Depth (cm)	Type of Soil	Consistency	Remarks
0 - 15	Sandy silt or Sandy clay	hard	Sand content small
15 - 40	as above	hard	Sand content slightly more. Thin fine sand layers are contained in lenses.
40 - 70	Silty fine sand or clayey fine sand	relatively hard	
70-180	Sand mixed clay or sand mixed silt	medium	Sand content is small.

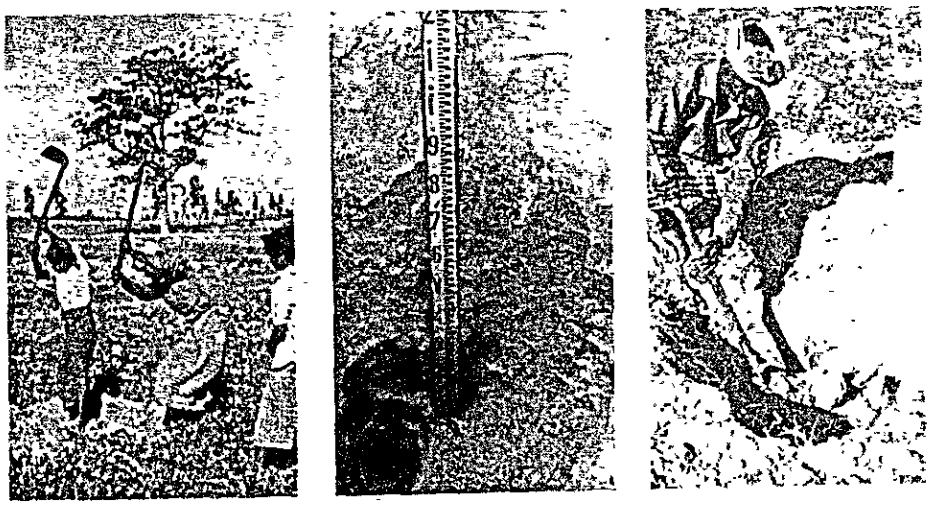
As clear from the above table, the top layers of the ground at this site have sand-mixed silt or sand-mixed clay as the major constituents while fine sand is found in thin layers here and there. Although ground water was not observed in the test pit, judging from the water level in the well in the vicinity of this site, it can be assumed that the water level is somewhere around 1.8 m - 2 m below ground. However, during the rainy season it can rise above this.

When the survey was conducted, approximately two months had elapsed since the dry season had started and therefore the hardness of soils

near the ground surface may be attributed largely to the effect of sunshine. Soil properties of the the top layers may be considered to be largely different from those during the six-month rainy season and it is necessary to take this into account in determining the bearing capacity of the soil.

According to the "Extract from the Report on Sub-surface Investigation of Sugar Factory Building Site, Ela" procured by the Preliminary Survey Team, the soil in the top layers shows a swelling tendency in both seasons and this swelling pressure is about 0.5 t/ft^2 (5.4 t/m^2). For various reasons, the sugar factory was not built in this area. Although the exact location where the soil survey for the sugar factory was made is not known, it is thought to have been somewhere close to the site selected for the present project, and therefore it may be necessary to pay attention to this swelling phenomenon.

Moreover, in the above data it is noted that the bearing capacity of ground in this area is about 1 ~ 1-1/4 t/ft^2 (10.8 ~ 13.4 t/m^2) at a depth of 5 ft.



TEST PIT

3-5-2 GROUND SURVEY

In order to find out about the ground conditions of the planned site of construction, a request was made to the Burmese side to conduct a ground survey at the time of the basic design survey. The requested items of the survey were:

(1) Boring (drilling);
(2) Standard penetration test; and
(3) Soil tests, including
    a) Specific gravity of soils,
    b) Natural water content test,
    c) Grain size analysis,
    d) Liquid limit test,
    e) Plastic limit test, and
    f) Unconfined compression test.

The survey was to be conducted at 5 places in the compound with 2 borings to a depth of 20 m (about 67 feet) and 3 borings to a depth of 15 m (about 50 feet). The results of survey so far obtained of the foregoing tests excepting the grain size analysis, liquid limit test and plastic limit test, are shown in brief. The survey was conducted by the Construction Corporation.

As the result of the survey, it was found that the soil formation varied considerably from point to point of the survey. While the survey result will be described in detail in the attached section on background information (Part III), it may be outlined as follows.

From the surface to a depth of 12 ∿ 14 feet (3.7 ∿ 4.3 m), the soil largely comprises a layer of sandy silt or silt with clay here and there.

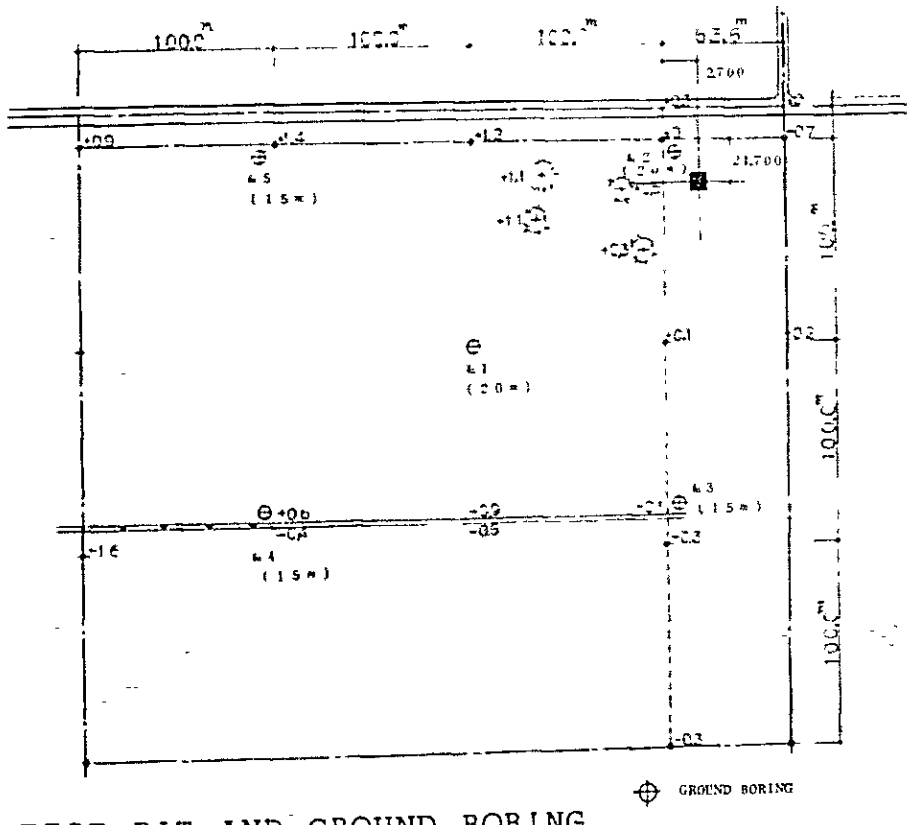
Further down, the soil largely comprises silty sand but includes sand, sandy silt and

clayey silt in a single or alternate layer respectively with clay interposed partly. But the condition varies considerably from test bore to bore, and it is difficult to find any regularity in the soil formation from the tested 5 bores.

The N values in the standard penetration tests vary from one test bore to another even at the same depth, due apparently to irregularity of the soil formation. But, in general, the N value seems to increase with increasing depth.

The boring and standard penetration tests were carried out from January to February. But, this is the period when the surface soil is at its driest so that it is advisable to regard the N values of the layers from the surface to a depth of 3 m (10 feet) as reference values.

It is noted in the Interim Report that the ground water level was observed to be at about 15 feet (4.6 m) below the surface. But in the wet season the water level will be considerably higher.



TEST PIT AND GROUND BORING

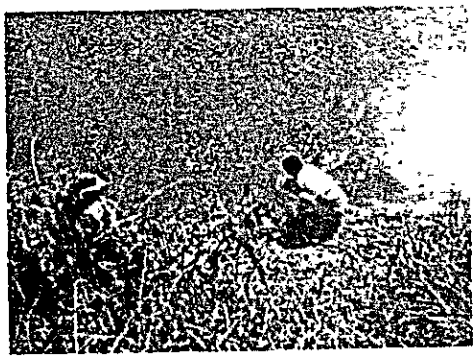
OUTLINE OF SOIL TEST

DEPTH (ft)	HOLE No. 1		HOLE No. 2		HOLE No. 3		HOLE No. 4		HOLE No. 5	
	VISUAL CLASSIFICATION	N	VISUAL CLASSIFICATION	N	VISUAL CLASSIFICATION	N	VISUAL CLASSIFICATION	N	VISUAL CLASSIFICATION	N
0 - 2	sand & silt (some clay)	18	sandy silt (some clay)	37	silt (some sand) (some clay)	46	silt (trace clay)	36	sandy silt (some clay)	—
2 - 4	ditto	21	ditto	26	ditto	59	ditto	38	ditto	24
4 - 6	ditto	28	ditto	31	ditto	42	sandy silt (some clay)	40	silt & clay (some sand)	23
6 - 8	ditto	36	ditto	26	sandy & clayey silt	36	ditto	32	ditto	17
8 - 10	ditto	51	clayey silt (some sand)	25	ditto	20	ditto	38	silt & clay (some sand)	22
10 - 12	ditto	47	ditto	15	ditto	21	ditto	22	clayey silt & sand	24
12 - 14	ditto	38	ditto	20	silty sand (some clay)	28	ditto	25	ditto	28
14 - 16	ditto	41	clayey sand & silt	20	ditto	22	sand & silt (some clay)	40	silty sand (some clay)	30
16 - 18	silty sand (some clay)	35	ditto	24	sandy & clayey silt	22	ditto	55	ditto	30
18 - 20	ditto	25	sand & silt (some clay)	24	ditto	14	ditto	57	ditto	28
20 - 22	ditto	26	ditto	54	silty & clay (some sand)	21	ditto	63	ditto	38
25 - 27	ditto	35	clayey sand & silt	47	clayey sand & silt	36	silty sand (trace clay)	63	clayey silt (some sand)	44
30 - 32	clayey silt (some sand)	57	ditto	41	silty coarse sand (some clay)	36	ditto	37	ditto	57
35 - 37	ditto	46	silty & clay (trace sand)	63	silty & clay (some sand)	25	ditto	45	silty coarse sand (some sand)	48
40 - 42	sand & silt (some clay)	42	ditto	95	ditto	85	silty sand (trace clay)	89	ditto	52
45 - 47	ditto	52	sandy silt (some clay)	67	sandy & clayey silt	109	ditto	109	silty & clay (some sand)	65
50 - 52	clayey silt (some sand)	78	silty sand (trace clay)	77	ditto	113	ditto	115	ditto	70
55 - 57	ditto	105	ditto	90						
60 - 62	coarse sand (some silt)	107	sand (some silt)	101						
65 - 67	ditto	128	ditto	86						

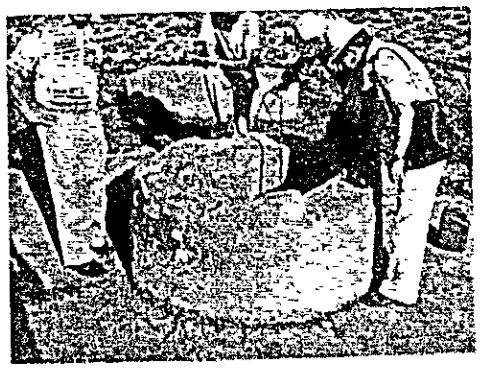
3-6 WATER QUALITY TESTING

Water samples from the shallow well, located near the construction site as described in paragraph 3-4, and from the Paunglaung River, running about 3 km from the construction site, were collected during the period of the survey for basic design in order to find if either or both could be used for the work during the construction period and for the research works after the completion. The samples were brought back to Japan and subjected to quality tests.

The test results are shown in the table below. As will be seen, the constituents are all of a level less than the standards set for service water in Japan ("Service and Waste Water Manual" (in Japanese), published by Maruzen, 1973). Tests for bacteria, or, more specifically, colon bacteria were not made. However, if the samples tested are representative, both well water and river water are usable for work and research.



DRAWING WATER FROM PAUNGLAUNG RIVER



DRAWING WATER FROM WELL

(unit : mg/ℓ)

Sample	pH	Evaporation residue	Suspended materials	Dissolved total organic carbon	Cl	PO_4	F	T-S	SO_3	SO_4
River water	7.5	248	11	9.0	1.0	<0.5	0.1	<0.5	<0.5	<0.5
Well water	6.2	244	6	16.5	6.9	<0.5	0.1	0.5	<0.5	1.3
Service water standards *	5.8∿8.6	<500	-	<10	<200	-	<0.8	-	-	-

Sample	Na	K	Ca	Mg	Cu	Zn	Fe	SiO_2	Al_2O_3	COD
River water	3.3	13	278	9.0	<0.01	<0.01	0.53	26.4	<2	2.2
Well water	18.0	29	135	4.2	<0.01	0.01	0.68	66.4	<2	3.5
Service water standards *	<300				<1.0	<1.0	<0.3	-	-	-

(Note) * Edited by Service and Waste Water Committee : "Service and Waste Water Manual" (in Japanese) (Maruzen, Oct. 1973)

CHAPTER 4

OUTLINE OF THE BASIC DESIGN

4-1 BASIC CONCEPT

Basic planning prior to this basic design for the Center was reviewed and conceived through discussions between the Japanese teams and Burmese Authorities concerned such as the No. 1 Mine Corporation of the Ministry of Mines and the Ministry of Planning and Finance of Burma.

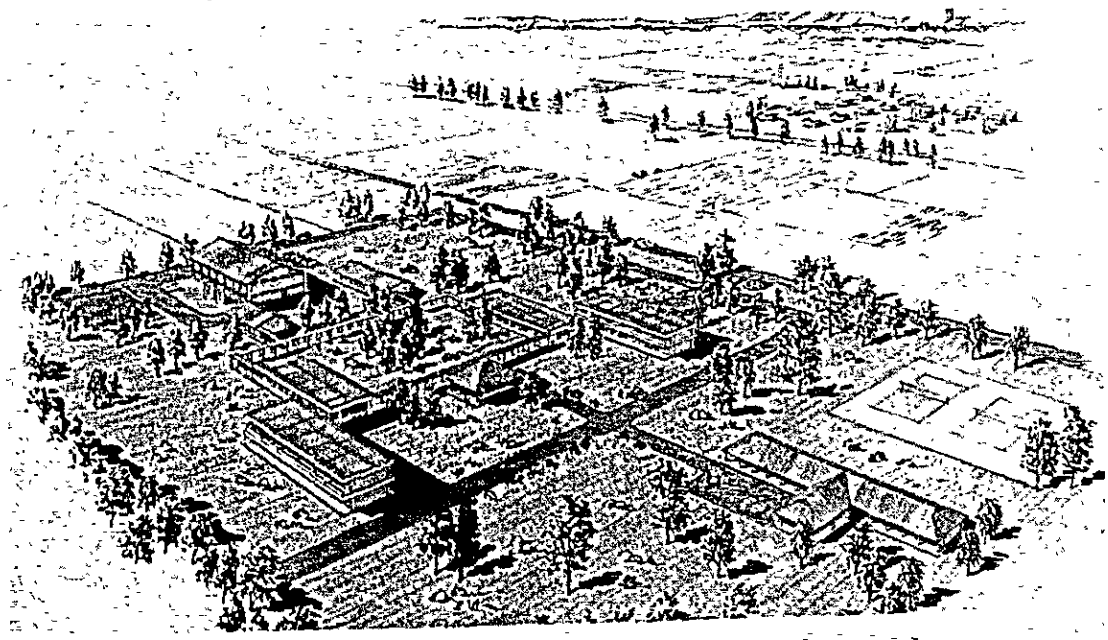
Ela, in the central area of Burma, was selected as suitable for this center by the Burmese Government in consultation with Japanese Basic Design Survey Team, since it is well decentralized and accessible to each mining district. The following guidelines for the basic design, have been worked out:

a) This center must be in harmony with the landscape of the surrounding area.

b) Land reclamation work should be kept to the minimum and as many existing trees should be conserved as possible in order to preserve a good environment.

c) As much local building materials are to be used in this project as possible.

d) Traditional building methods should be adopted in the design.



4-2 OUTLINE OF FACILITIES

The buildings and related facilities of the project are described briefly as follows.

4-2-1 BUILDINGS

(1) Administration building (approx. 750 m^2)

This will include the director's office, managers' offices, administration office, conference room, class room, a library and so on.

(2) Assay laboratory (approx. 850 m^2)

This research building will be used for emission spectrometer, gas chromatograph, fire assay, wet chemical analysis, etc., which are all related to the assay works.

(3) Mineral processing laboratory - 1 (approx. 400 m^2)

(4) Mineral processing laboratory - 2 (approx. 350 m^2)

This building will include the research rooms and sample preparation room for mineral processing related to ore dressing methods such as flotation, gravity concentration and leaching.

(5) Metallurgical laboratory (approx. 400 m^2)

(6) Metallurgical laboratory (approx. 200 m^2)

This building will include research rooms related to fundamental metallurgy by wet and dry process, electrolysis, etc.

(7) Pyrometallurgical laboratory (approx. 850 m^2)

This building will be equipped with fluidizing roaster, electric furnace and

other bench-scale smelting and refining apparatus for training.

(8) Dormitory (approx. 400 m^2)

This is a building for trainees (about 20 persons) and senior staff and will have ten lodging rooms, dining room, kitchen, shower rooms, toilets and so on.

(9) Power station (approx. 150 m^2)

A building for a 1,500 KVA transformer and

(10) other related facilities

(To be provided by the Burmese Government)

Attached building, guard house, etc.

4-2-2 RELATED FACILITIES

(1) Water supply facilities
- Pump, tanks, filtration and others

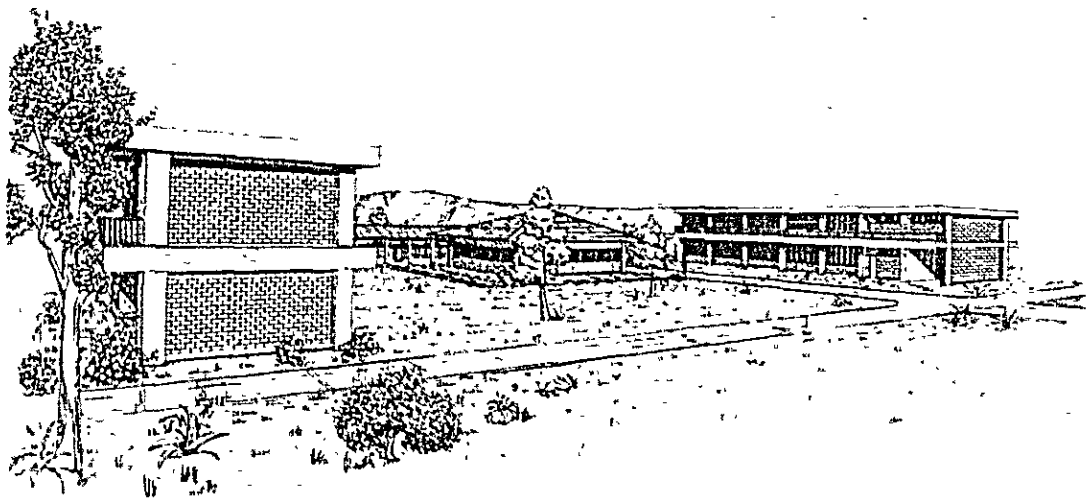
(2) Piping for water supply and drainage

(3) Septic tank

(4) Electrical installations for power station (1,500 KVA)

(5) Wiring within the site

(6) Generator (100 KVA)



4-3 FACILITIES LAYOUT PLAN

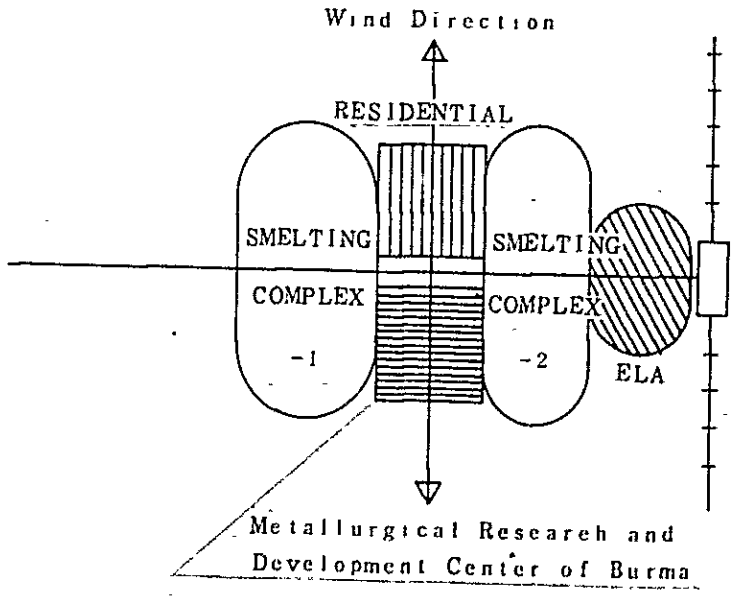
(1) Characteristics of the site

a) The site faces the main road leading from Ela Station to the Mandalay-Rangoon highway.

b) Prevailing wind direction is south-southwest and north-northeast. Since the residential area is to be located to the north, "a clean axis" can be planned. That is, the future smelting complex can be located off the axis connecting this research center to the residential district in order to reduce the effects of noise and air pollution which the smelting complex is expected to cause.

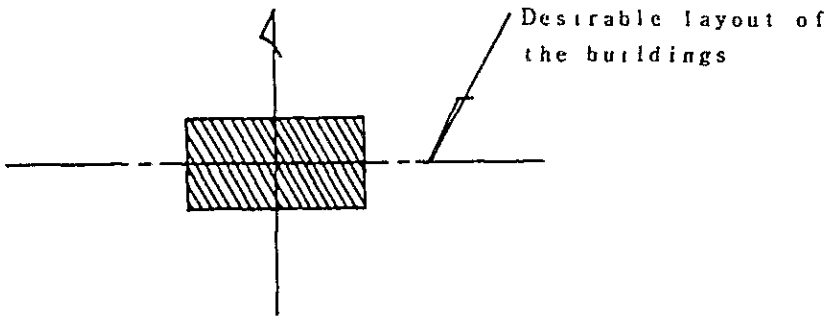
c) The proposed side is about 0.5 to 1.0 meter higher than the adjacent lot so that flooding during heavy rain may be prevented.

d) Existing trees at the site will be effectively used in planning.



(2) Characteristics of the climate

Ela is located in the inland tropical monsoon zone, and its rainy season continues from the end of May to the middle of October. Its cool season lasts from the end of October to the middle of February (it is dry but the temperature is still high in winter) and the hot season continues from the last part of February to the middle of May. Thus special attention should be payed to strong sunshine, heavy rain and winds, and so the buildings should be located along the east-west axis.



(3) Characteristics of the buildings

These are described in brief.

a) Administration building

This building includes offices, conference room and a classroom, and so general comfort is of great importance.

b) Assay laboratory

This is mainly for basic assay and research, and it is particularly important that vibration be eliminated for most of its

precision instruments. This building creates almost no vibration, noise or exhaust gases but a scrubber will be needed since there will be draft chambers in some rooms.

c) Mineral Processing Laboratory 1

Comprising general laboratory rooms, with little vibration or noise.

d) Mineral Processing Laboratory 2

Comprising special laboratory rooms, generating more or less vibration and noise.

e) Metallurgical Laboratory 1

Comprising general laboratory rooms, with little vibration or noise.

f) Metallurgical Laboratory 2

Comprising special laboratory rooms, generating noise, vibration and exhaust gas.

g) Pyrometallurgical Laboratory

Large building mainly containing experimental ovens and generating noise, vibration, heat and exhaust gases.

h) Dormitory

Residence for the researchers and trainees, requiring a quiet environment.

i) Attached Building

Tea room, utility room, storage and other facilities.

(4) Zoning and Layout Plan

The facilities making up the Center are classified roughly into the following zones according to their functions:

a) Administrative zone

Administration building;

b) Noiseless and vibration-free research and experimental zone

Assay laboratory,
Mineral Processing Laboratory 1, and
Metallurgical Laboratory 1;

c) Experimental and training zone, generating noise and vibration

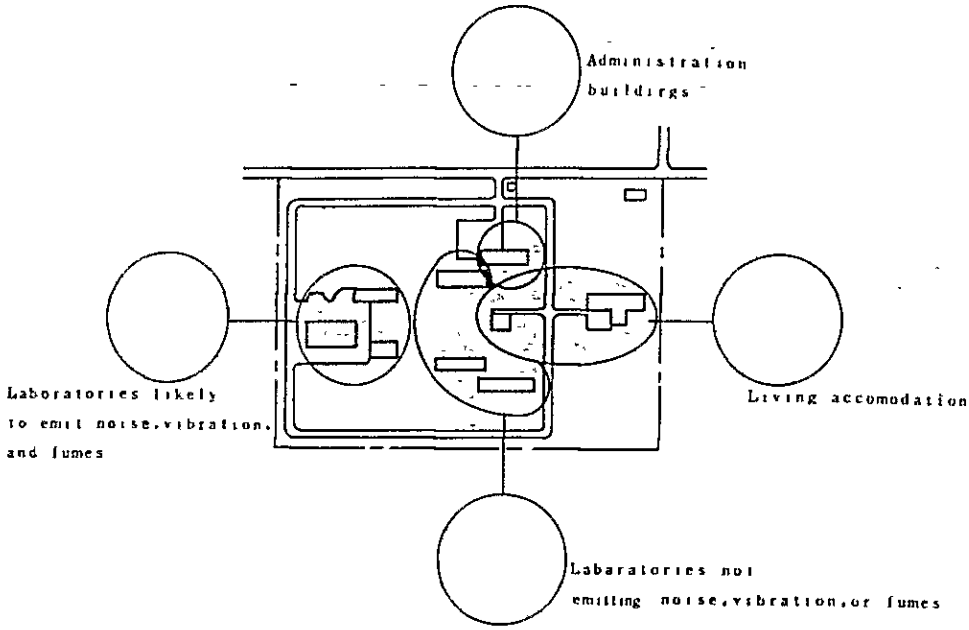
Mineral Processing Laboratory 2,
Metallurgical Laboratory 2, and
Pyrometallurgical Laboratory; and

d) Residential zone

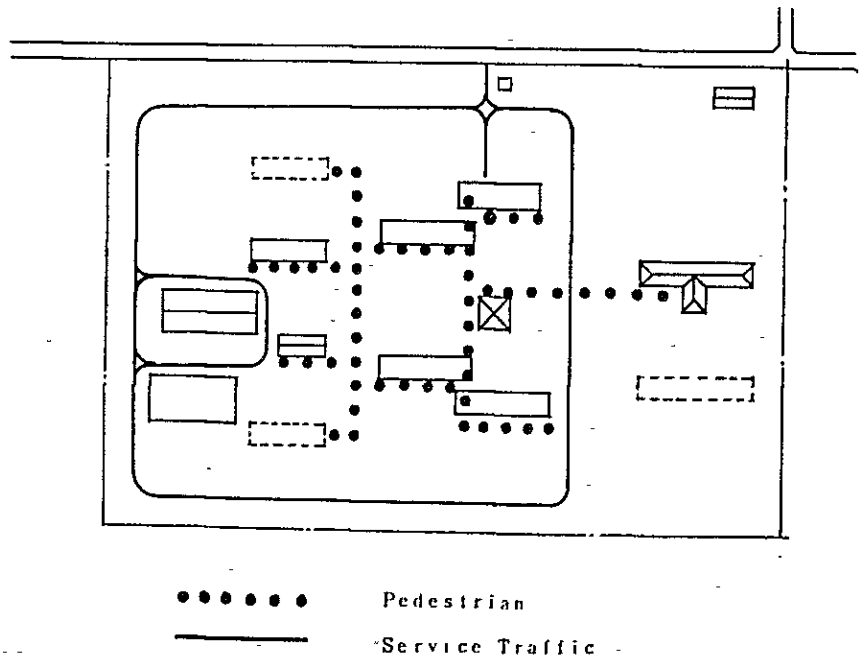
Dormitory, and
Attached Building.

As stated above, the buildings have different characteristics, and some of them might generate noise, vibration and exhaust gases liable to result in interference with others. Layout of the buildings will thus be made as described below. Viewed from the main approach, the Administrative Building will be placed nearest, then the three buildings in the noiseless and vibration-free research and experimental zone (b) will be arranged alongside, while the experimental and training zone generating noise and vibration (c) will be located at a remote place. Among the buildings in zone (b), it is particularly important that the Assay Laboratory be protected from vibration and noise; so that it will be furthest from zone (c), south of the Administrative Building. The dormitory in the residential zone (d) will be placed in a quiet area east of the Administration Building, while the Attached Building, a place of rest,

will be at the center of the courtyard surrounded by the Administration Building, Assay Laboratory, Mineral Processing Laboratory and Metallurgical Laboratory.



ZONING

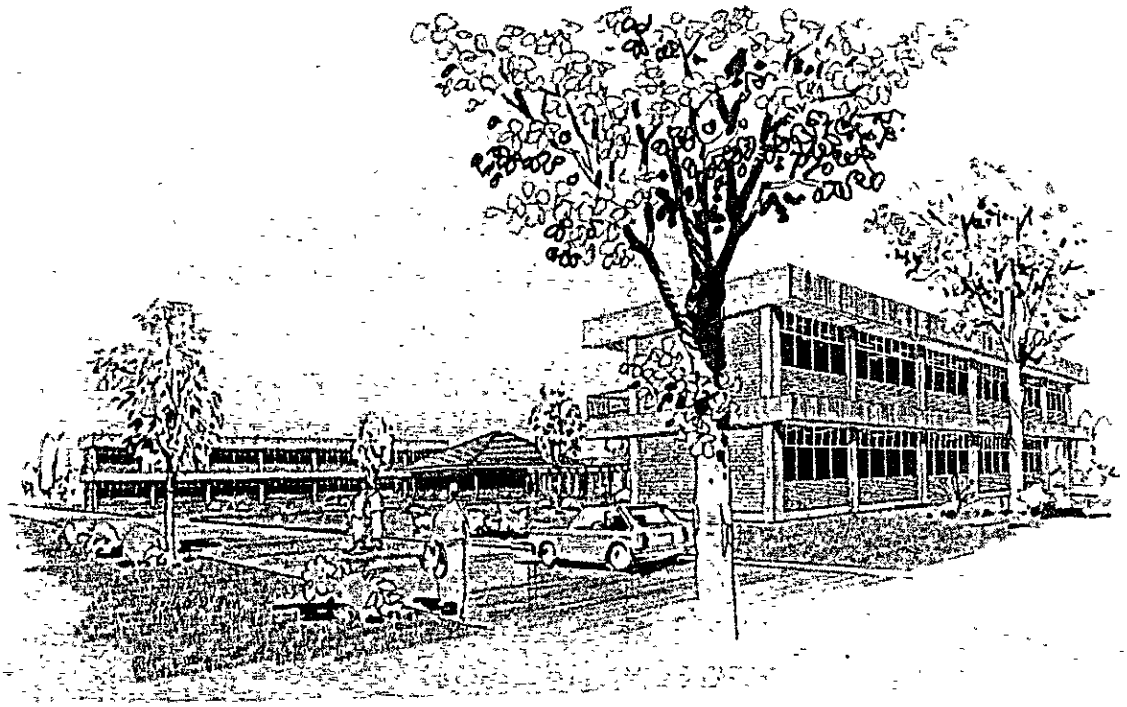


CIRCURATION DIAGRAM

(5) Circulation

A flow plan clearly separating people and vehicles will be employed. Vehicle services in the compound will be made entirely from the external loop road to the respective buildings, while the pedestrians will use a quiet and safe pathway facing the courtyard.

The pedestrains will have covered walks connecting the buildings to shelter them from rain and sunshine.



4-4 BUILDING PLAN

4-4-1 ARCHITECTURAL PLANNING

One of the biggest problems of the architectural plan is how to deal with strong sunlight in the dry season, and high temperature and humidity and heavy rain in the rainy season. In the architectural plan, it is vitally important to provide appropriate shape, structure and materials which will not cause any burden on the management and operation in the future.

The principal measures taken in the building parts plan are shown as follows.

a) Research laboratories requiring elaborate air conditioning will need some insulation and shutoff of the outside air. Thus the roof and main structure will be made of reinforced concrete and the exterior wall of brick. Particularly for roof surface, the top of the reinforced concrete roof slab will be water-proofed, and corrugated slate will be placed over the slab for insulating purposes.

b) For laboratories requiring only natural ventilation, steel frame structures with widely-corrugated slate roofing and finely-corrugated slate wall-covering will be employed.

c) Canopies will be sufficiently extended to prevent direct sunlight and rain from entering the room.

d) Windows on the exterior walls are expected to be large, and these windows should ensure easy opening and closing operation with watertightness.

- Also, plenty of natural light will be used to minimize the need for artificial lighting during the daytime.
- The window mechanism should allow for ventilation, hot air, high humidity, wind and rain, or cold air.

e) Floor finish will be smooth to prevent dust problems.

f) Partitions will be brick walls finished with plaster where fire-proofing and sound-proofing are required. Other walls needing less fire-proofing and sound-proofing will be made of wood or slate.

g) Unless special sound-proofing is required, the ceiling finish will be applied directly on the surface of the slab.

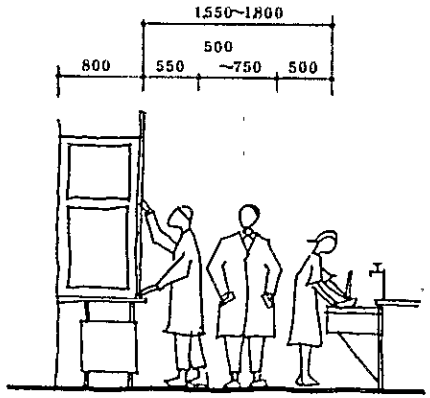
4-4-2 MODULAR COORDINATION

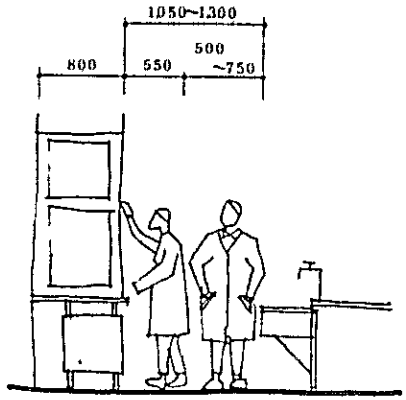
A base module, a multipliable basic unit of length, will be used in determining the fundamental modules of the project.

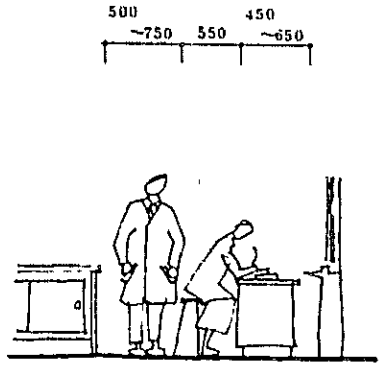
The base module was chosen by considering the modules of the human body, of units of movement and of the modules of machinery and furniture.

In the present project, the laboratories perform the main function of the facilities, so that from the fundamental modules of the laboratory a base module of 800 mm was settled on.

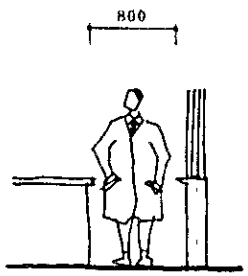
From this base module, a minimum length of 800 mm × 4 = 3.2 m will be used as the minimum room width.


1,550~1,800
500
800
550
~750
500


1050~1300
500
800
550
~750


500
~750
550
450
~650


1GR
1GR
1GR

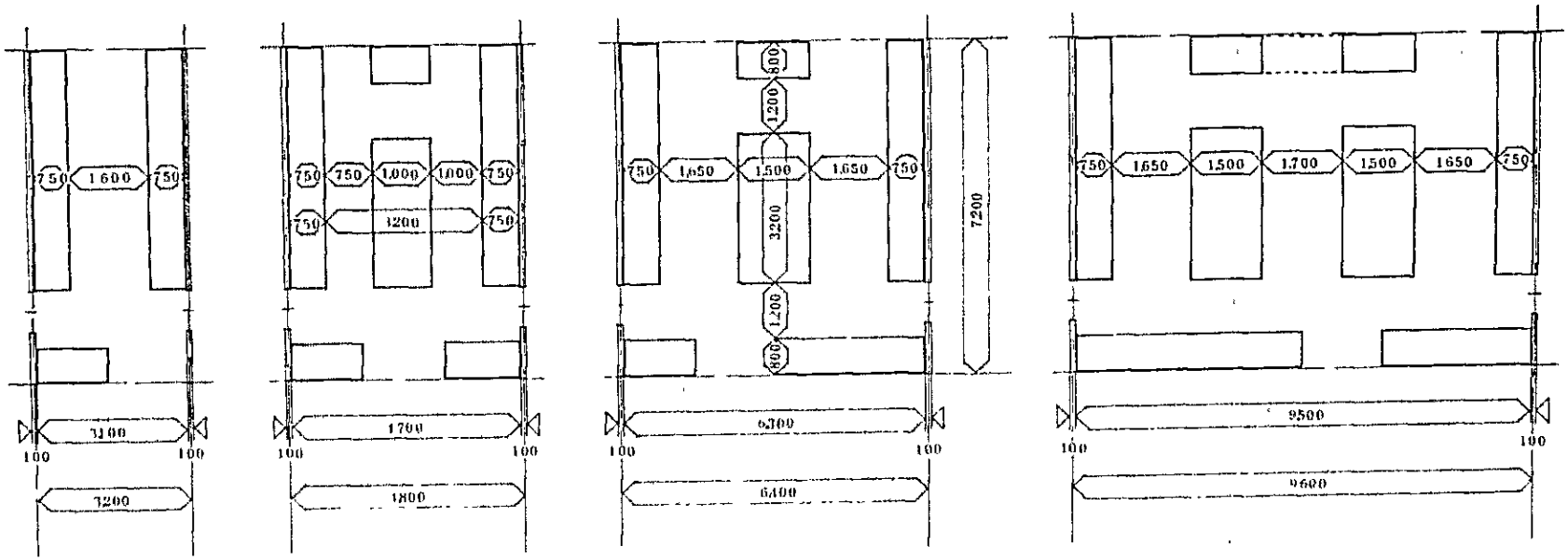

800


1GR
1GRID=800


1GR

SCALE-SPACE

WIDTH OF THE LABORATORY - 3,200 MODULE



MODULAR CORDINATION

4-5 STRUCTURAL PLANNING

Horizontal forces due to wind and earthquakes in Burma are less than those in Japan but cannot be neglected. As a horizontal resisting element, a reinforced concrete seismic wall might be considered but this method is generally not employed in Burma. In view of the construction time and the structure of single and two story buildings, a framing structure of columns and beams will be used except for special cases in the structural planning. Locally available bricks will be used for both interior and exterior walls.

There is no particular standard for structural design in Burma and, in many cases, structural calculations and other matters are made in conformity with British Standards. But it seems that these are not compulsory. Thus the structural design of this center will be made in conformity with the requirements of the Japanese Building Code and with the standards of the Architectural Institute of Japan as a rule, but local conditions will be also taken into consideration.

4-5-1 LOADS

(1) Dead Load

All of the weights of structural frames, finishing materials, etc. are to be calculated.

(2) Live Loads

The value of the respective live loads is to be determined from the applicable numerical value specified in the Enforcement Ordinance of the Building Standards Law of Japan.

LIVE LOAD (kg/m^2)

	slab	beam column foundation	earthquake
office room research room	300	180	80
laboratory	500	400	250
classroom	230	210	110
library	600	500	300
corridor stairs	300	180	80
lavatory and utility room	300	180	80

Special loads of machines, etc. will be specified separately.

(3) Seismic force

The maximum earthquake acceleration at the proposed site will be assumed to be 150 gal, and a static horizontal seismic factor of $k = 0.15$ will be used in design(See Paragraph I-4).

(4) Force due to wind pressure

The maximum wind velocity is 84 miles/hour (37.5 m/sec) but this will be increased by about 20% so that the building being planned may have a greater life expectancy.

By converting this into wind pressure, 124.9 kg/m^2 (100 miles/hour ≒ 45 m/sec) would be obtained but a wind pressure of 130 kg/m^2 will be actually employed.

4-5-2 PLANNING FOR STRUCTURAL FRAMING

(1) Administration building,
Assay laboratory

These will be two-story reinforced concrete structures, and vertical loads and horizontal loads (wind and seismic) will be taken by a frame consisting of columns and beams. Both exterior and interior walls will be made of brick. The wind pressure applied to the exterior wall will be transferred to the columns at both sides through the bonding strength of brick joints. Roof and first floor slabs will be made of reinforced concrete. Ground floor slabs will be made of reinforced concrete poured on grade, and lightweight equipment will be placed directly above these. However, extra-heavy equipment, equipment making considerable vibration and other equipment so specified will be supported by firm independent foundations.

(2) Mineral processing laboratory-1,
Metallurgical laboratory-1
Dormitory

These buildings will be single-story reinforced concrete structures and their frames, walls and floor construction will be the same as those of the administration building.

(3) Mineral processing laboratory-2,
Metallurgical laboratory-2,
Pyrometallurgical laboratory,
Power station

These buildings will be single-story steel structures with gabled roof frames and horizontal resisting elements in longitudinal direction will be made of steel braces. Roofs

and walls are to be covered with corrugated slate sheets and lightweight steel sections will be used for purlins and strips (wall purlins), members between columns. Floors will have the same configuration as those of the administration building.

4-5-3 FOUNDATION PLANNING

While there are no data available presently to determine whether or not the surface soil of the project site is the expansive soil seen here and there in the Ela area, it will be wise to take the possibility into consideration.

Further, the dynamic properties of the surface soil of the project site change considerably from the wet season to the dry season, and this should also be fully taken into consideration in planning the foundation.

To be free from such effects, the foundation base needs to be embedded more than 1 m below the ground surface.

In view of the foregoing and in consideration of the results of geological survey and test pit survey generally (see paragraph 3.5), the foundation of the project will be treated as a direct foundation with the G.L. 1.0 - 1.5 m sandy silt or sandy clay layer as a bearing ground, and for the bearing capacity of the sand ground, a design value of 10 t/m^2 (0.93 t/ft^2) for the long term or 20 t/m^2 (1.86 t/ft^2) for the short term will be employed.

4-5-4 STRUCTURAL MATERIALS AND CONSTRUCTION METHODS

(1) Concrete

Ordinary portland cement made in Burma will be used and a design standard strength of Fc = 180

kg/cm^2 will be employed. However, a construction deviation of σ = 60 kg/cm^2 will be taken into consideration by employing an actual required strength of F = 240 kg/cm^2 in structural design. Since the construction site is within the tropical climate zone, a slump of about 10 to 15 cm will be maintained for concrete to prevent cracks due to drying and contraction. The water pumped up from the wells at the job site can be used for mixing concrete.

(2) Reinforcing bars

Deformed steel bars made in Japan will be used. The type of steel will be mainly SD-30 (yield point: 3,000 kg/cm^2) of hot rolled steel (JIS G 3112). Since gas pressure welding is not commonly used in the area, the joints of the bars will be made for lap-splicing.

(3) Structural steel

Structural steel made in Japan will be used. The type of this material will be SS41 (yield point: 2,400 kg/cm^2) of rolled steel for general structural use (JIS G 3101). Cutting and welding will be done in Japan in advance as much as possible to provide a prefabricated structure for easier erection at the site.

Field connection for main frame should be made by friction joint method using high tension bolts made in Japan. Regular bolts may be used only for miscellaneous joints. As a rule, a minimum field welding connection will be used.

4-6 PLANNING FOR MECHANICAL AND ELECTRICAL FACILITIES

In planning mechanical and electrical equipment and systems, it must be borne in mind that most of equipment and materials are imported from abroad and that repairs and the obtaining of spare parts after completion of construction will not be easy. So reliability and durability of equipment and the availability of spare parts must be considered. Safety and ease of maintenance must be thoroughly studied, especially for operation and management of the equipment after completion of the building. British Standards are being used in Burma as design standards for electrical, plumbing, air-conditioning and ventilation facilities, so design meeting Japanese standards will fulfill the requirements.

4-6-1 PLANNING FOR ELECTRICAL FACILITIES

(1) Power supply plan

The existing 33 KV power line of Electric Power Corporation (E.P.C.) is located about 2 km away from the proposed site. E.P.C. will supply the electric power to the site through the overhead line. A power station (substation) must be built within the site, and 3-phase, 4-wire 400 V/230 V power will be supplied from the station to each building through underground cables for general lighting and power uses.

(2) Power equipment

Power equipment for air-conditioning, laboratory works and water supply will be required. A power panel board will be installed at each place of building where it is required, and power will be supplied through a switch for each equipment.

(3) Lighting fixtures

Fluorescent lighting fixtures will be mainly used but a few incandescent lamps will also be used.

(4) Outlets

Convenience outlets (1 ø, 230 V) will be installed where required in each building.

(5) Exterior lighting fixtures

Outdoor lights (with poles) will be installed at main areas in the lot for outdoor traffic and security during the night.

(6) Fire alarm and communication

a) Internal telephones

Internal telephones will be installed for communication between buildings in the lot.

b) Fire alarm system

Piezo-electric type spot fire alarm devices will be installed at main points of each building for fire monitoring and alarm.

c) Communication system

As a communication facility between the proposed Center and No. 1 Mining Corporation in Rangoon, short-wave radios will be installed at both places. The antenna will be equipped with a lightning arrester.

(7) Independent Power Generation Equipment

As emergency power equipment in the event of an outage, a diesel generator of a capacity of about 100 KVA will be installed using light oil to supply the minimum power required

during an emergency for operation, illumination and laboratory work. This generator will also be used for supply of power to erection machines during construction.

4-6-2 PLANNING FOR WATER SUPPLY AND DRAIN

(1) Water supply system

Water source will be provided by the government of Burma. Water will be pumped up from a deep well (about 100 m) and another stand-by shallow well to the elevated water tank in the lot, and supplied to each building by gravity method. Depending upon the quality of water, filtration may be used for water softening and removing ferrous materials.

(2) Domestic hot water supply

Domestic hot water should be supplied to required places from electric water heaters installed independently.

(3) Water drainage system

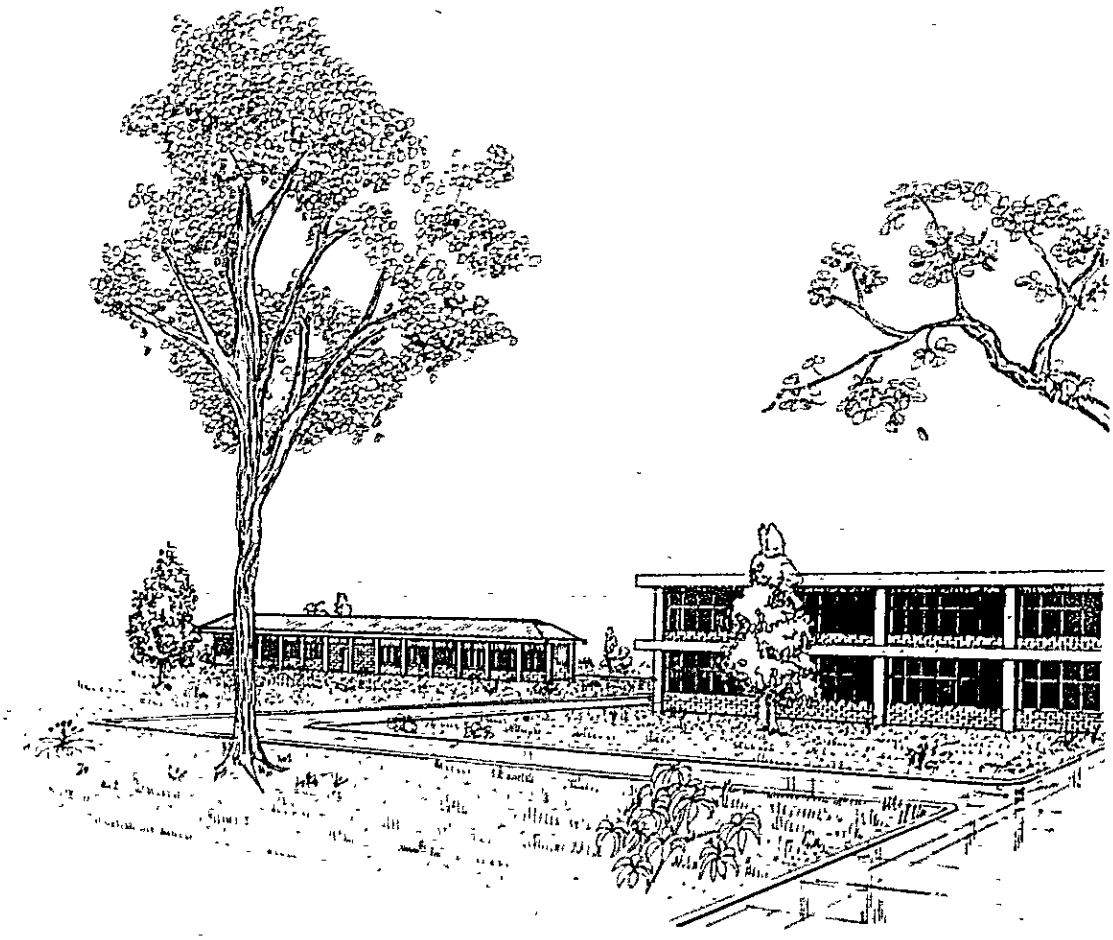
Water should be drained separately to a general sewer line, a laboratory sewer line and to a storm sewer line. Water will be drained through a septic tank for the building sewer line and through special water treatment equipment for the laboratory drain. Rain water will be drained through open channels, and drain water from each system should be discharged outside the site.

(4) Gas line for laboratory

Gas for experimental use wherever required will be supplied from gas cylinders installed outside the building.

4-6-3 PLANNING FOR AIR-CONDITIONING AND VENTILATION

Only cooling facilities will be required for people's comfort. And some air conditioning will be required for experimental apparatus in laboratories. For air conditioning and cooling both separate air conditioners and window type coolers will be installed where required.



4-7 PLANNING FOR EQUIPMENT

Research and training necessary for the Project are as listed below.

(1) SAMPLE PREPARATION EQUIPMENT

Jaw Crusher (83 x 114 mm)	1
Sample Grinder (Gyratory Type, 150 mm)	1
Roll Crusher (Laboratory Type, 250 mmø x 150 mmø)	1
Disc Type Vibration Mill	2
Ball Mill (Laboratory Type, 300 & 150 mmø)	4 sets
Vibrating Screen (Gyrer Type, 600 mmø)	2
Sample Blending, Splitting & Preparation Apparatus	1 set
Dust Collecting Equipment	1 set
Other Machinery & Instruments (Sieve Shaker, Scullery, etc.)	1 set

(2) ASSAY LABORATORY

Atomic Absorption Spectrometer (AA640-12) with Cathode Lamp	3 sets
Emission Spectrometer and Accessories (GE-170)	1 set
X-Ray Fluorescence Spectrometer (VF-310)	1 set
X-Ray Diffractometer (3K-2038)	1 set
Double Beam Spectrophotometer (UV-810)	1 set
Gas Chromatograph (GC-7AP7F)	1 set
Microphotosizer	1 set
Fire Assay Equipment	1 set

Destilled Water Unit (WAR-560)	2	
Analytical Balance	3	
Draught Chamber	4	sets
Gas Cylinder (7 m^3)	40	
Other Machinery & Instruments (Oven, Water Deionizer, Hot Plate, Water Bath, Magnetic Stirrer, Centrifuge, Compressor, Scullery, etc.)	1	set

(3) MINERAL PROCESSING LABORATORY

Flotation Cell (MS & FW Type, 0.15 - 2 kg)	7	
Cyclosizer	1	
Magnetic Separator (Dry & Wet Type)	3	
High Tension Separator (Carpco Type)	1	
Darkroom Equipment & Accessories	1	set
Microscope & Accessories	1	set
Point Counter (Swift CD-Type)	1	
Bench Type Rock Cutter	1	
Thin Section Polishing Machine	2	
Isodynamic Magnetic Separator (Frantz Type)	1	
Tube Type Electric Furnace	1	set
Heavy Liquid Separation Apparatus	1	set
Bench Type Pulverizer (AQA Type)	1	
Draught Chamber	1	
Other Machinery & Instruments (Agitator, Water Bath, Meters, Super Panner, Balance, Mineralite, Magnetic Stirrer, Deionizer, Vacuum Pump, Scullery, etc.)	1	set

(4) FLOTATION LABORATORY INCLUDING WORKSHOP

Belt Feeder (Variable Speed)	1
Jaw Crusher (5" x 6")	1
Vibrating Screen (1-1/2" x 3")	1
Cone Crusher (8"ø)	1
Drum Washer (3'ø x 4')	1
Wet Vibrating Screen (1-1/2" x 3")	1
Constant Auto-Feeder (Variable Speed)	1
Ball Mill (16"ø x 48")	1
Spiral Classifier (9"ø x 6')	2
Conditioner (18"ø x 24")	3
Flotation Cell (14 & 10", 4 Cells each)	6 sets
Filter (Drum & Disc Type)	2
Slurry Pump & Diaphragm Pump (1"ø)	9
Thickener (48"ø)	2
Portable Belt Conveyor (16" x 18')	8
Water Tank (5 m^3, Automatic Level Control)	1
Reagent Preparation Apparatus	1 set
Vibrating Feeder (10" x 24")	1
Hoist Crane (2 ton)	1
Miscellaneous Meters (pH Meter, Flow Meter)	1 set
Dust Collecting Equipment	1 set
Other Ore Processing Equipment (Cyclone, Reagent Feeder, Balance, Scale, etc.)	1 set
Lathe	1
Drilling Machine (Upright Type)	1
Grinding Machine	1
Welder	6

Other Machinery for the Workshop (Bench Drilling Machine, Bending Roll, Hoist, Electric Carpenter Tool, etc.)	1 set
Crude Ore Hopper (2 ton)	1
Fine Ore Bin (2 ton)	1

(5) GRAVITY CONCENTRATION AND OTHER EQUIPMENT

Mineral Jig (No. 1-M)	1
Plunger Jig (No. 1 Harz Type)	1
Concentrating Table (Wilfley, Jauces and Deister Type, 50" x 25")	3
Spiral Concentrator (Humphley Type, 24A)	1 set
Vertical Dryer (with Burner)	1 set
Other Machinery & Instruments (Pressure Filter, Vacuum Filter, Compressor, etc.)	1 set

(6) METALLURGICAL LABORATORY

Fluosolid Furnace (60 mmø x 2,000 Hmm)	1
Electric Arc Furnace (60 KVA)	1
Induction Furnace	1
Muffle Furnace	2
Combustion Furnace	2
Crucible Furnace	2
Sintering Machine (500 x 500 mm)	1
Disc Pelletizer (1,000 mmø)	1
Drum Pelletizer (500 mmø x 4,000 mm)	1
Optical Pyrometer	3
High Temperature Thermocouple	12
Automatic Temperature Control Unit	6
High Temperature, High Pressure Autoclave (300 °C x 200 kg)	1

Ordinary Leaching Autoclave (150 °C x 10 kg)	1
Continuous Leaching Apparatus	1
Electrolytic Cell	1 set
Solvent Extraction Equipment	1 set
Degassing Equipment	1 set
Baghouse (20 m^2)	1
Scrubber (for Sintering Machine)	1
Fume Hoods with Exhaust Scrubber	1 set
Gas Cylinder (H_2, N_2, Cl_2, He, Ar Gas)	1 set
Metallurgical Microscope (with Camera)	1 set
Differential Thermal Balance	1
Potentio-Galvano Stat	1
Other Machinery & Instruments (Ball Mill, Sieve, V-Type Blender, Electrostatic Precipitator, Cyclone, Sample Preparation Equipment, etc.)	1 set

(7) PYROMETALLURGICAL LABORATORY

Fluosolid Furnace & Accessories (Feeding Equipment, Blower, Instrument & Control Room, Gas Cooler, Cyclone, Electric Precipitator, Exhaust Fan & Duct)	1 set
Wind Furnace & Accessories (Molds, Trolley & Hoist, Fuel Tank, Blower)	1 set
Tank House & Accessories (Electrolitic Cell, Rectifier, Circulating & Purifying Facilities, Machine Tools, etc.)	1 set

Electric Furnace & Accessories (Transformer, Instrument & Control Room, Transportation Facilities, Gas Cooler, Cyclone, Exhaust Fan)	1 set
Desulfurization Apparatus (Cooling Tower, Absorption Tower, Slaked Lime Storage, Thickner, Clarifier, Oxidizer, Centrifuge, Stack & Duct)	1 set

4-8 ARCHITECTURAL DRAWINGS OF THE BASIC DESIGN

01 Map of Ela Site

02 Ela Site Survey

03 Layout Plan of the Center

04 Administration Building

05 Administration Building

06 Assay Laboratory

07 Assay Laboratory

08 Mineral Processing Laboratory - 1

09 Mineral Processing Laboratory - 2

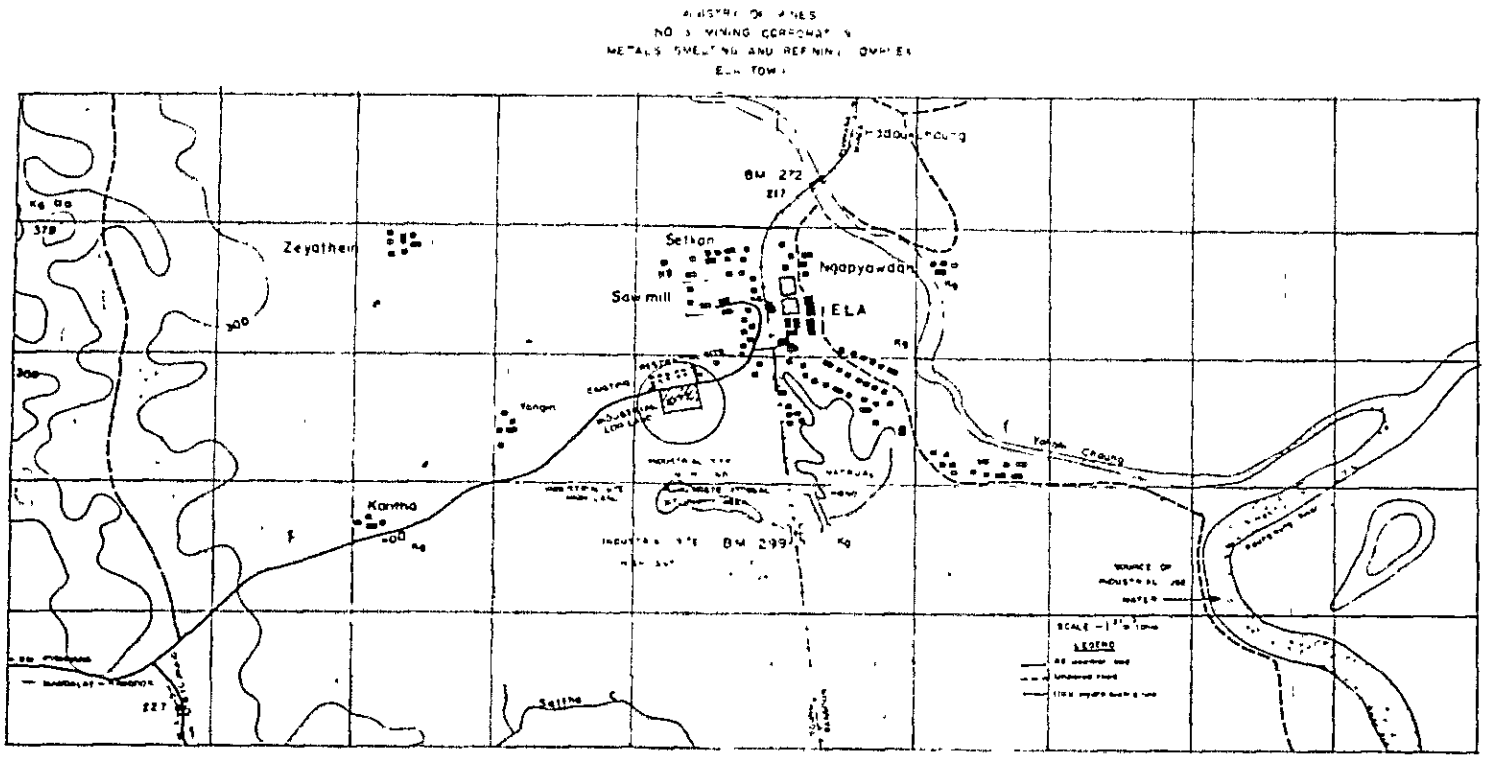
10 Metallurgical Laboratory - 1

11 Metallurgical Laboratory - 2

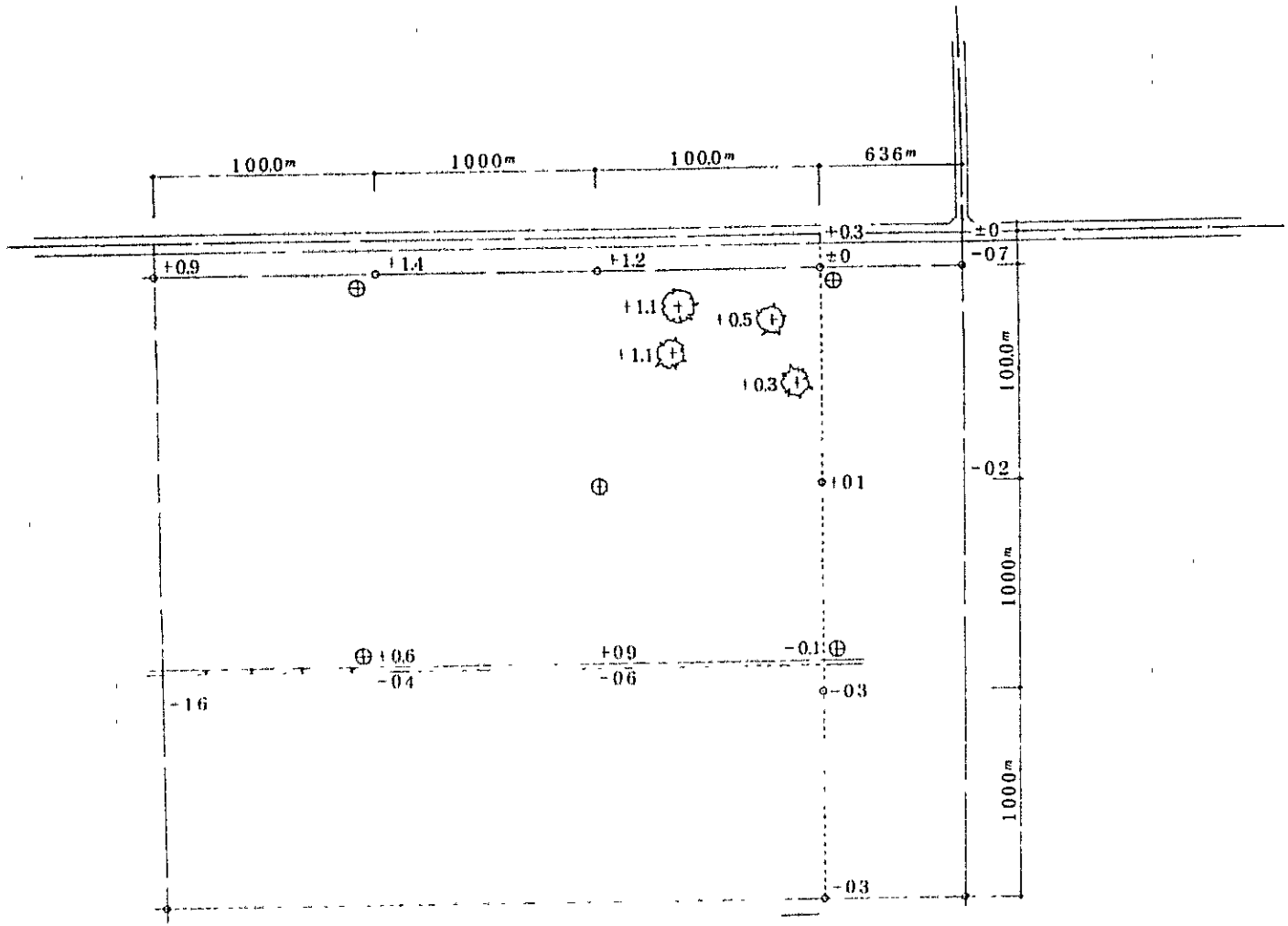
12 Pyrometallurgical Laboratory

13 Dormitory

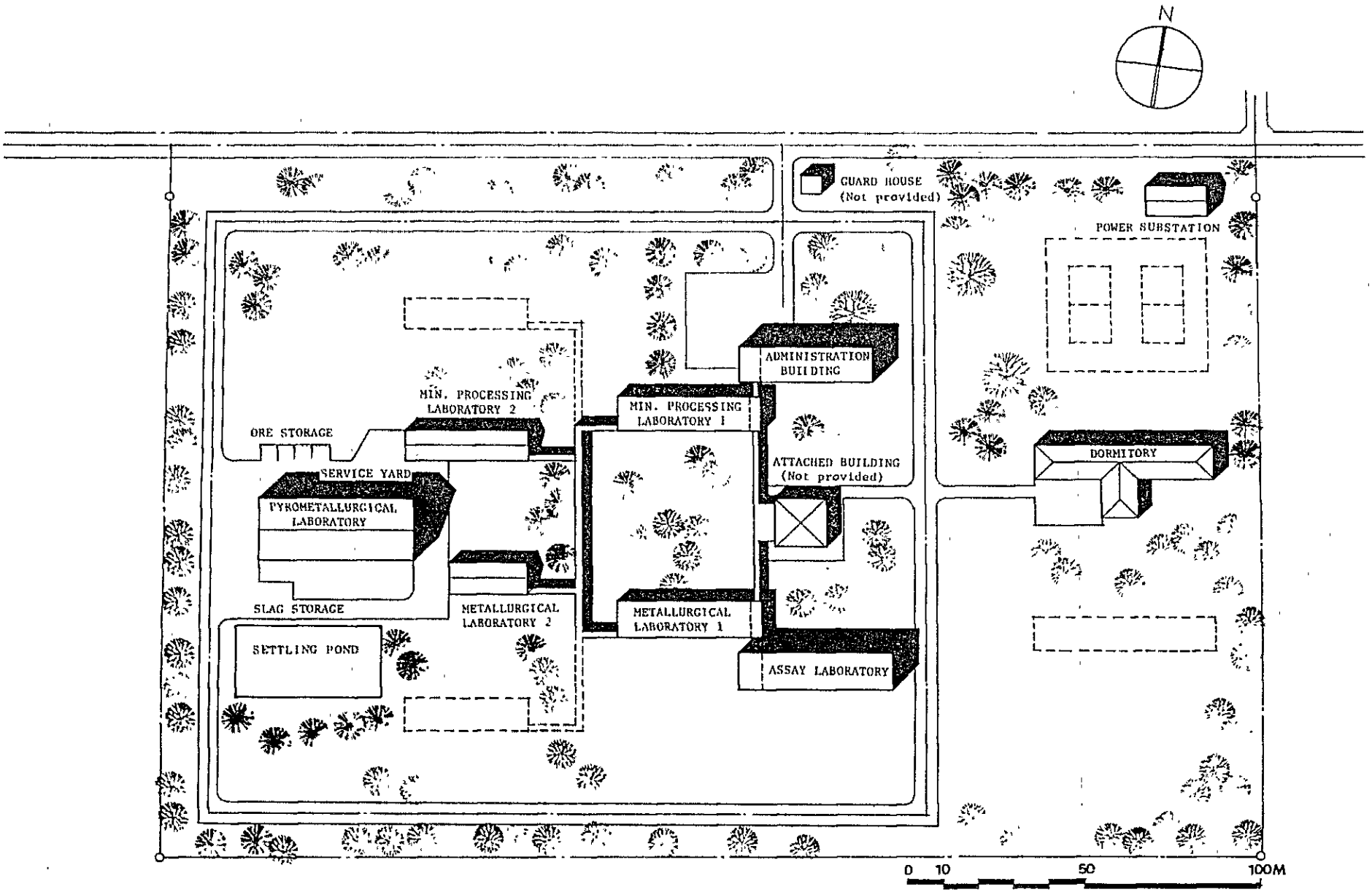
14 Power Subatation



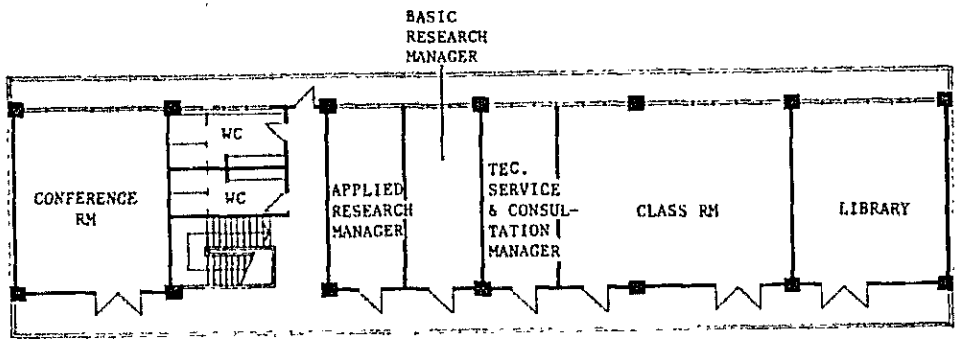
MAP OF ELA SITE 01



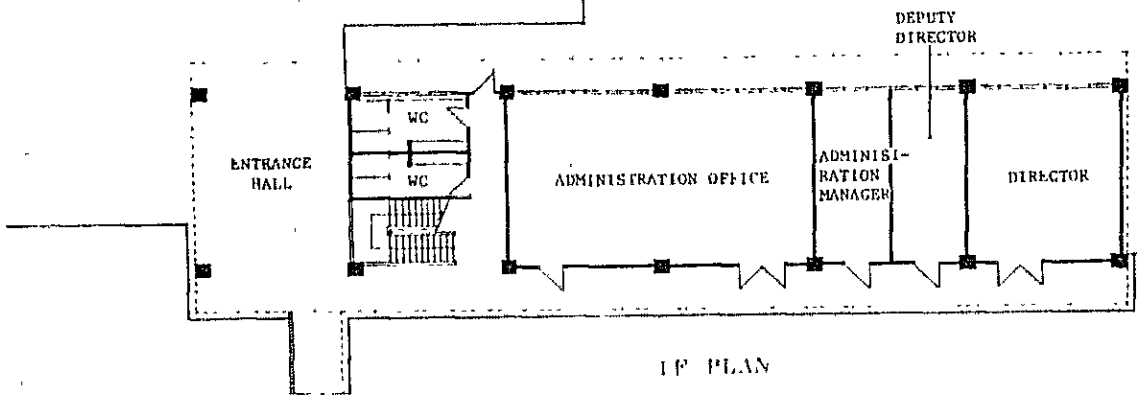
ELA SITE SURVEY 02



LAYOUT PLAN OF THE CENTER 03



2F PLAN



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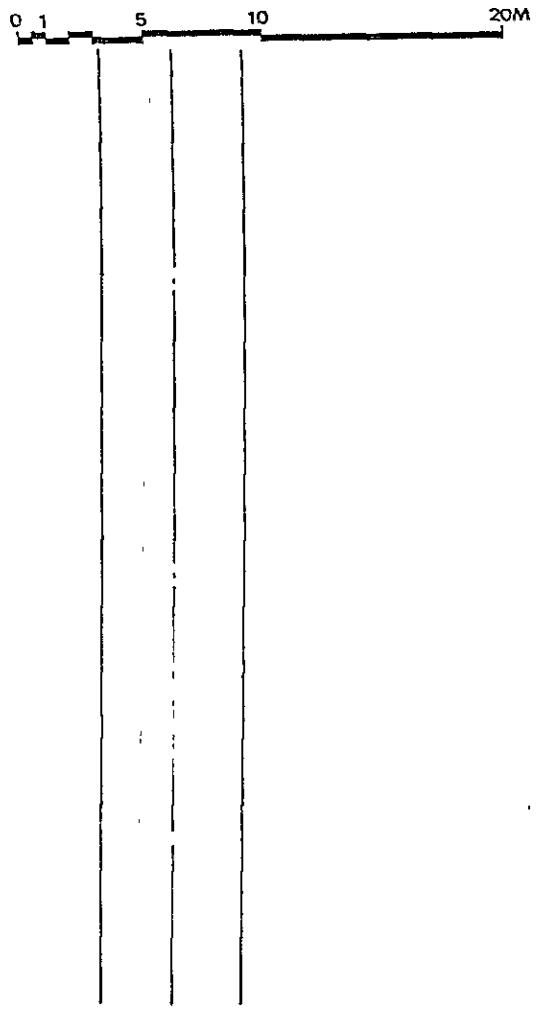

ADMINISTRATION BUILDING 04

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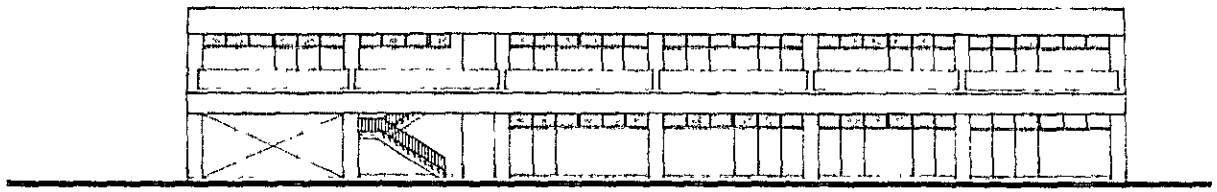
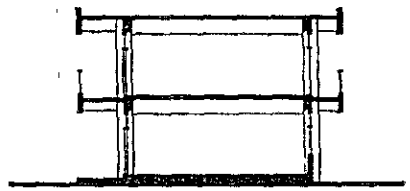


SOUTH ELEVATION



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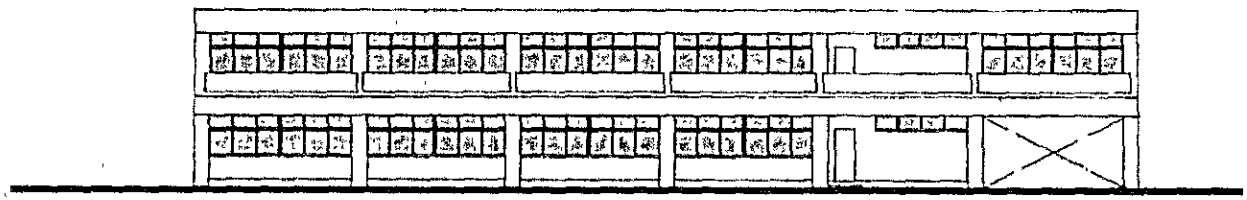
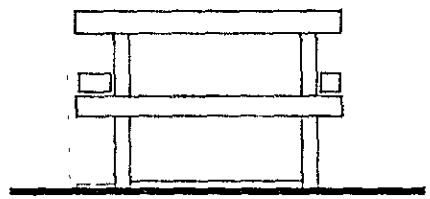


NORTH ELEVATION



EAST ELEVATION

ADMINISTRATION BUILDING 05

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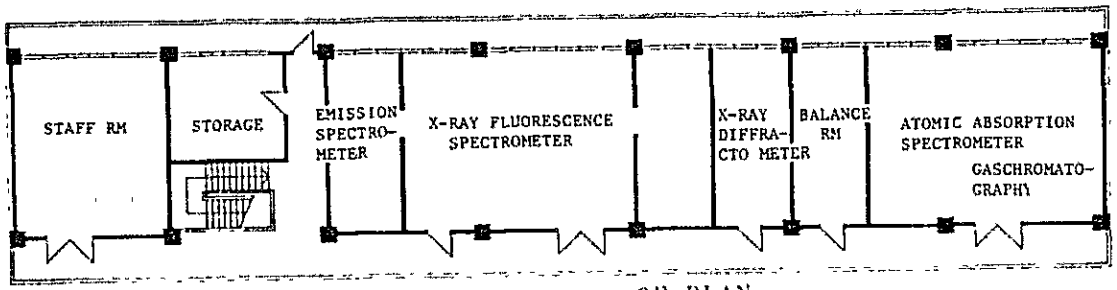

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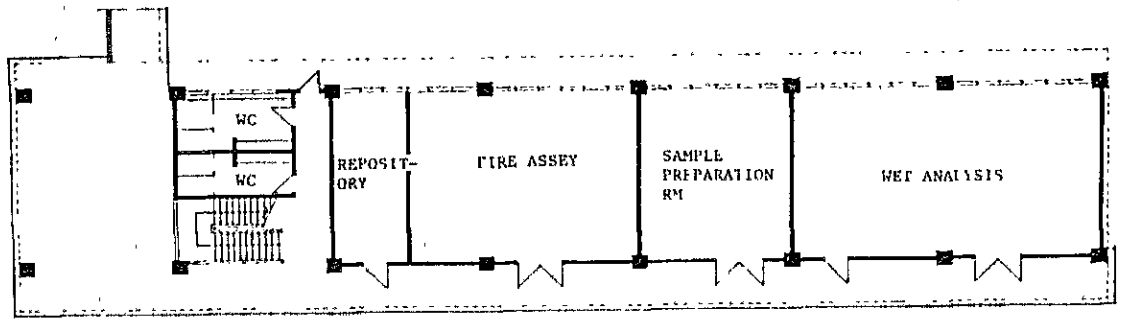

1F PLAN

ASSAY LABORATORY 06

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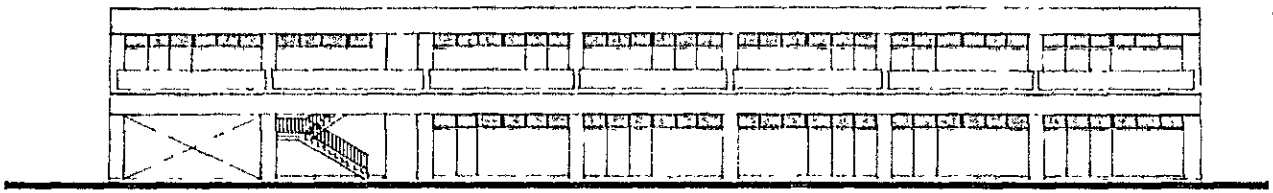

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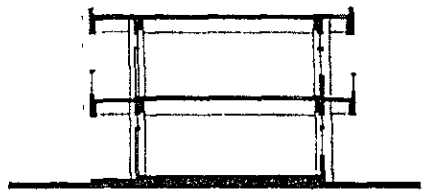

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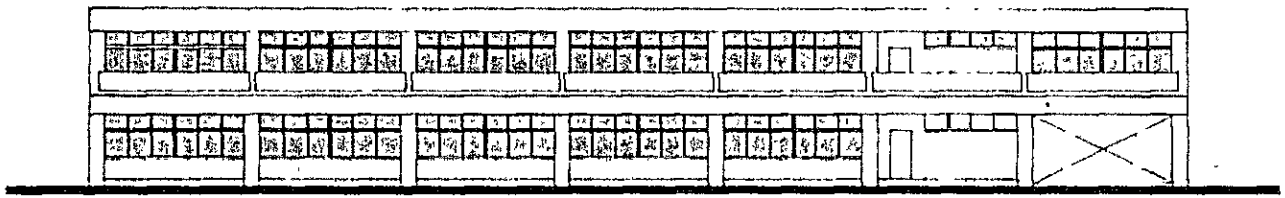

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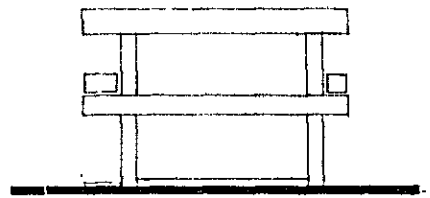
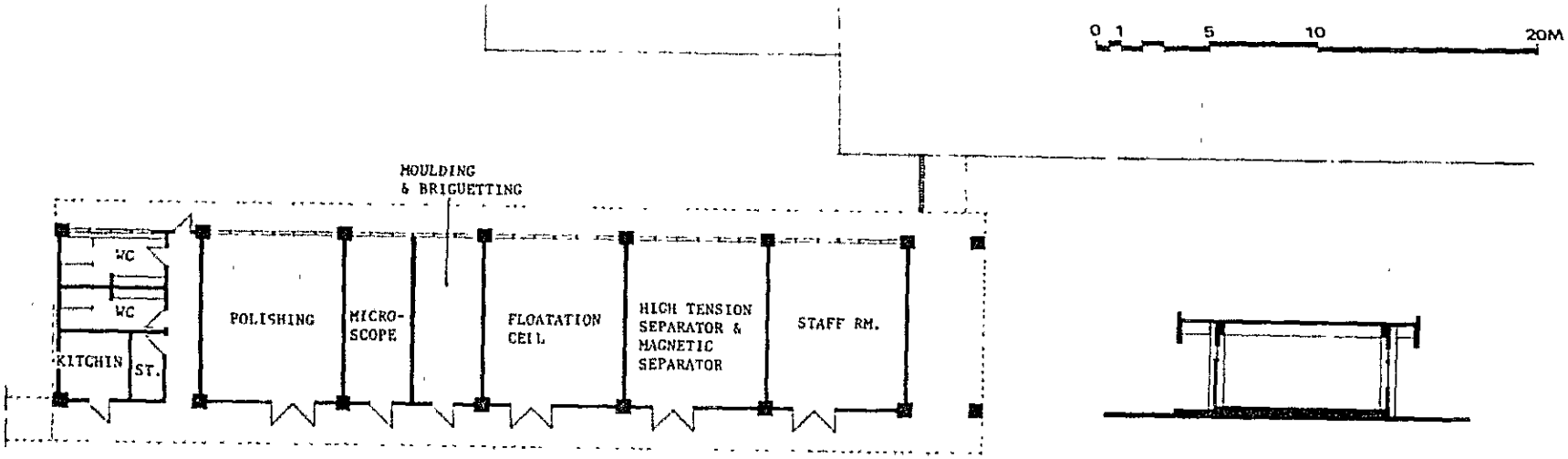


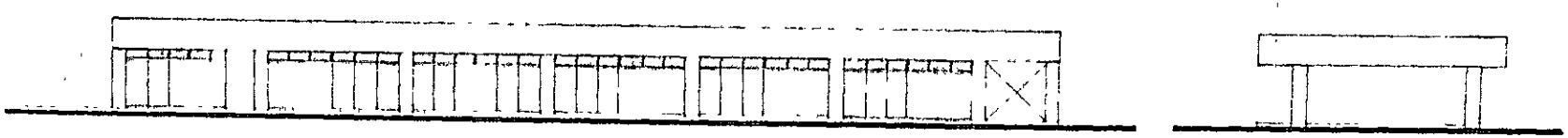
EAST ELEVATION

ASSAY LABORATORY 07



PLAN

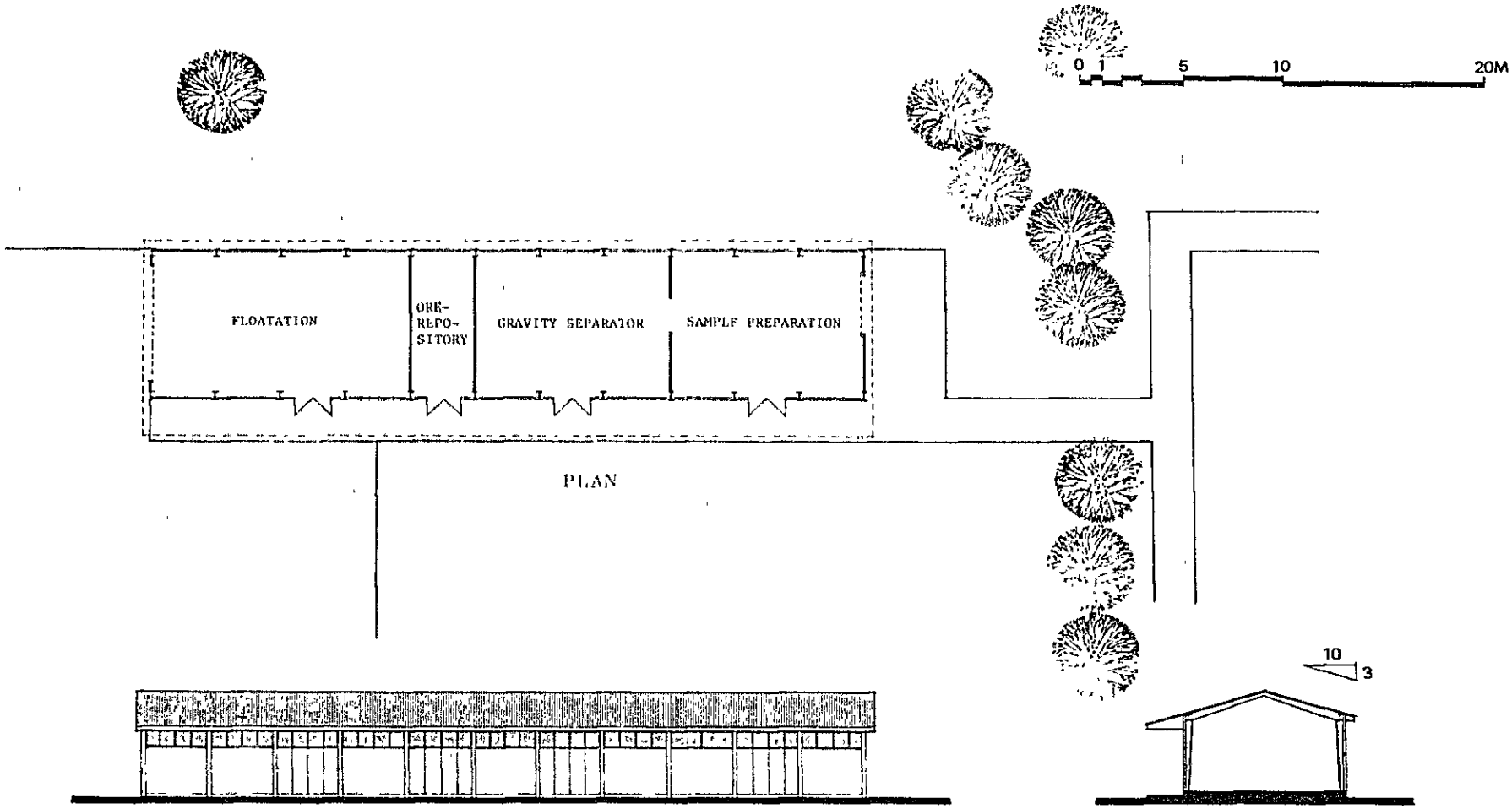
SECTION



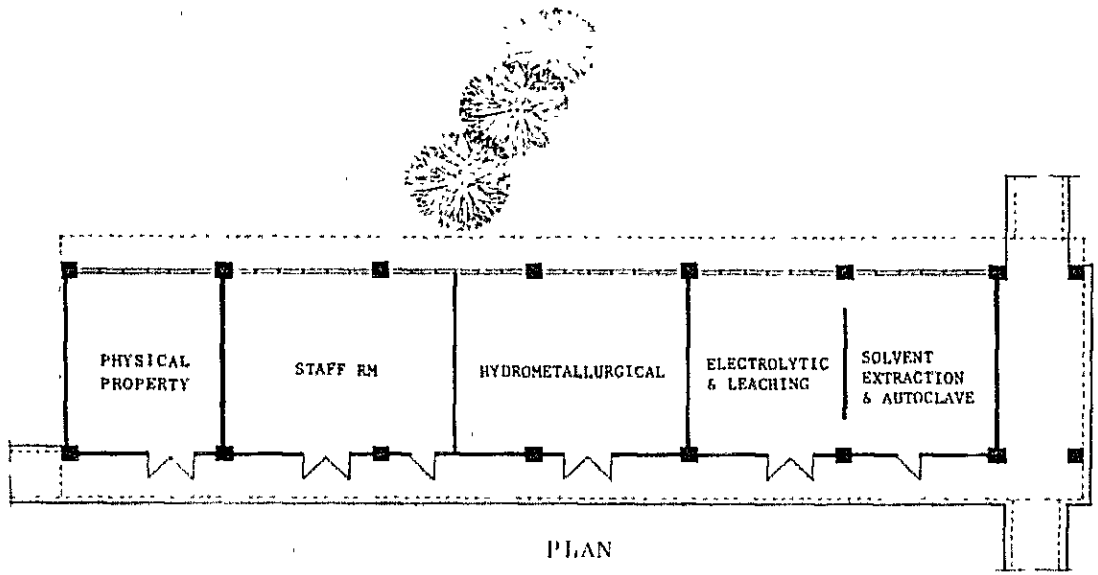
SOUTH ELEVATION

EAST ELEVATION

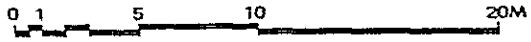
MINERAL PROCESSING LABORATORY-1 08

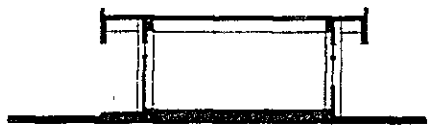


MINERAL PROCESSING LABORATORY-2 09



PLAN





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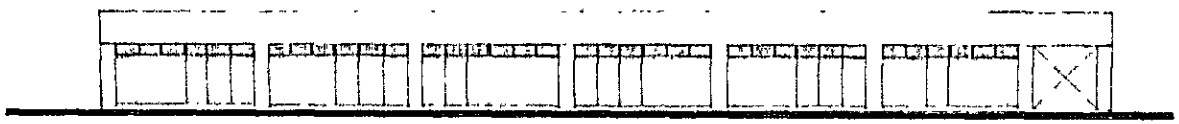

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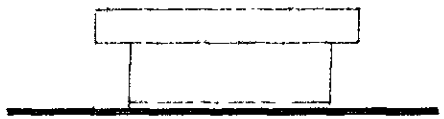
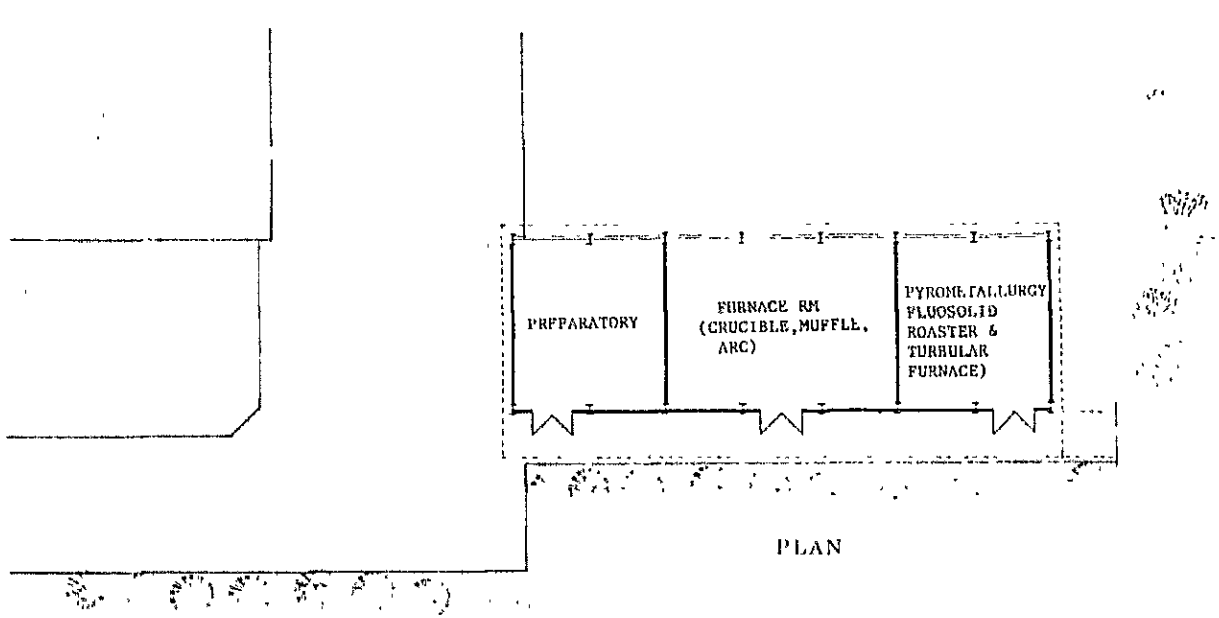
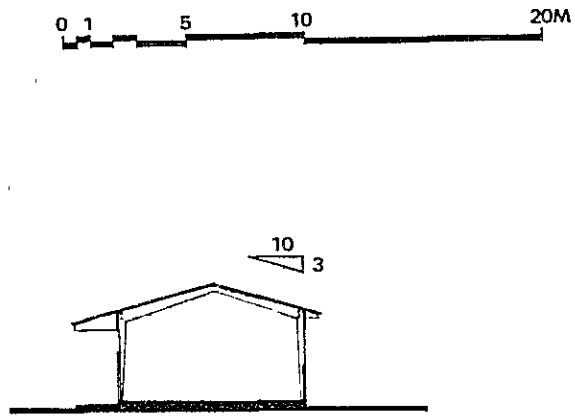


EAST ELEVATION

METALLURGICAL LABORATORY-1 10



PLAN



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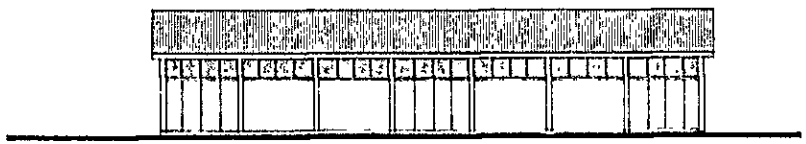

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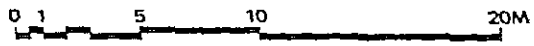
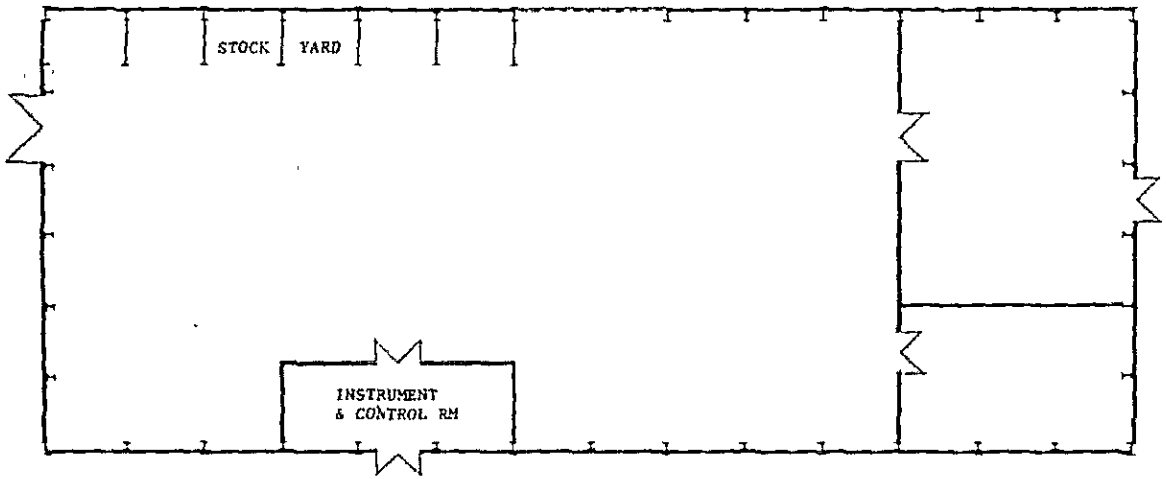
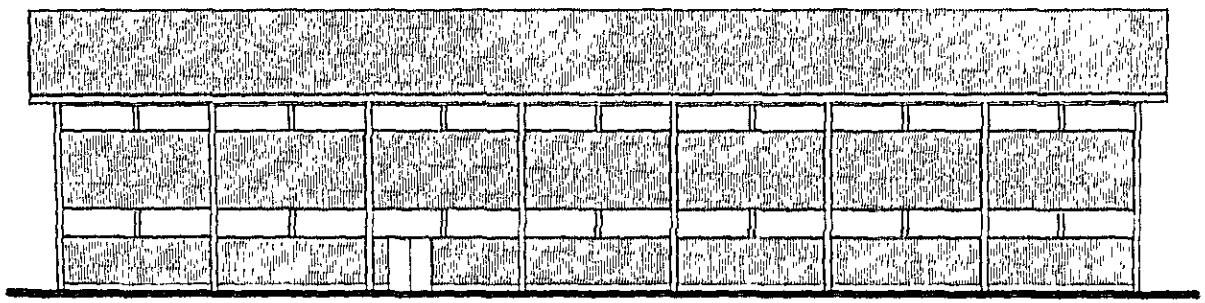




PLAN



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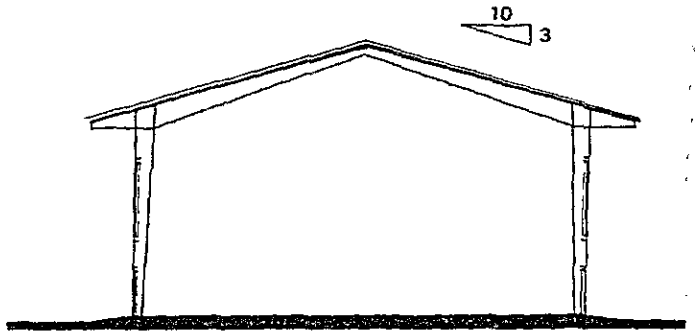
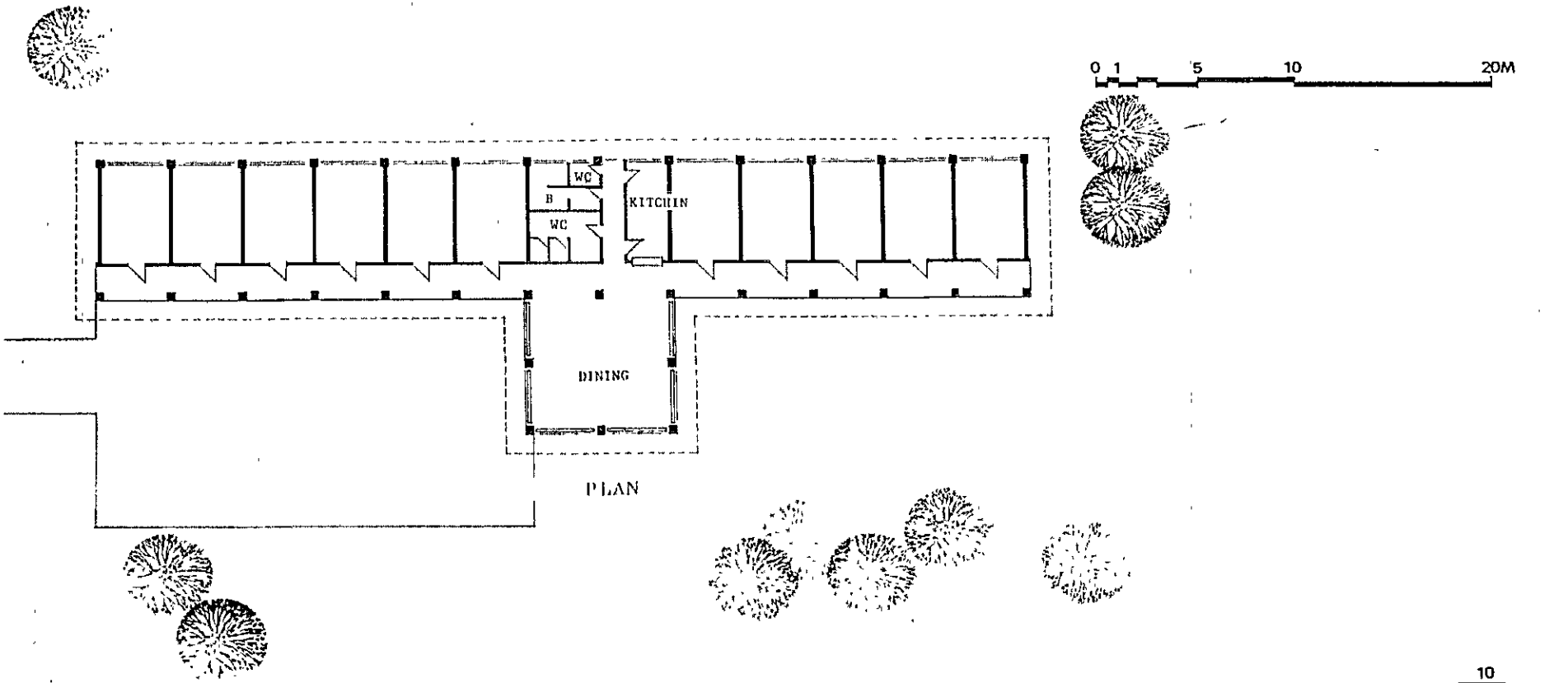
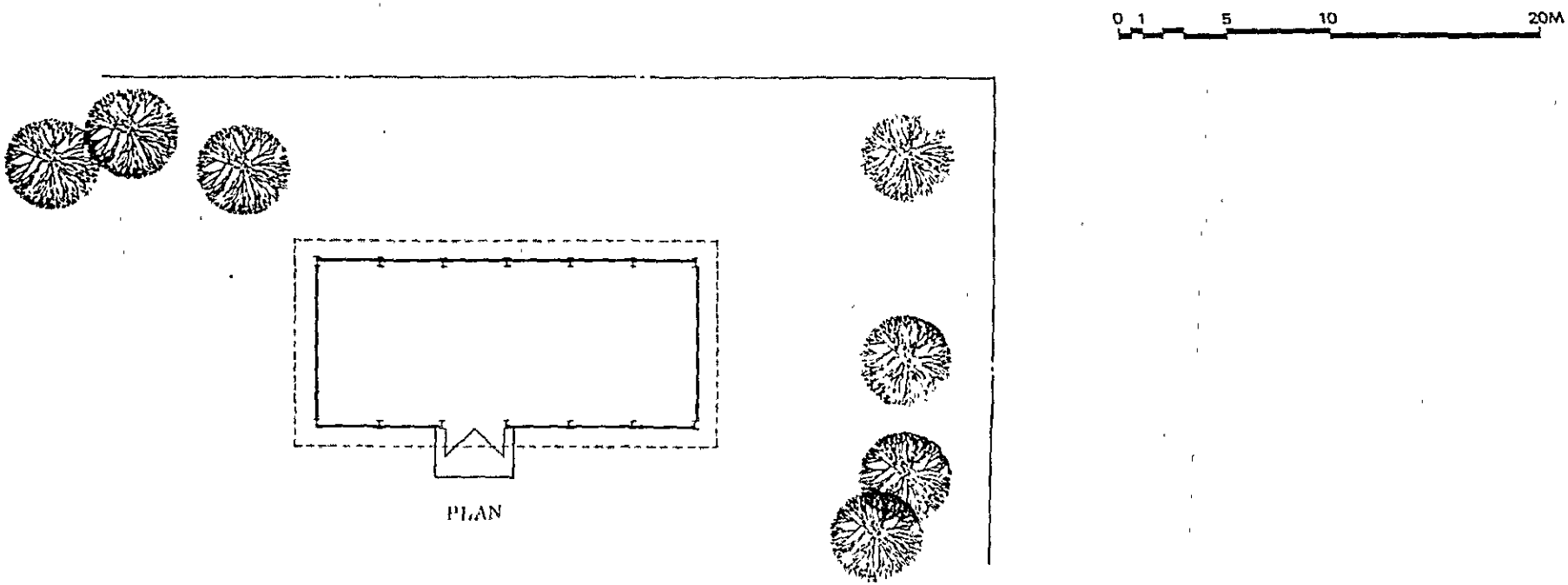


SECTION

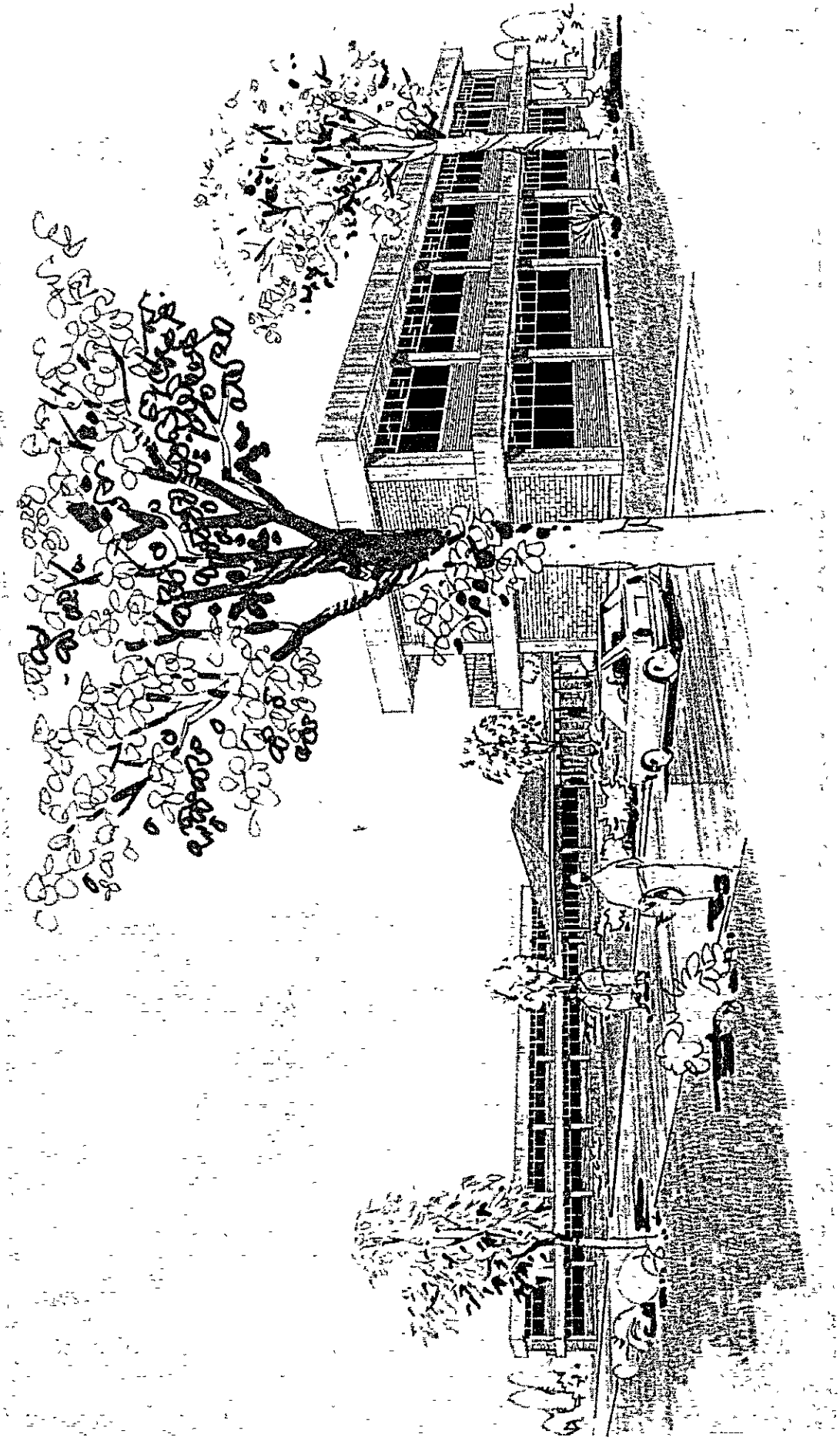
PYROMETALLURGICAL LABORATORY 12

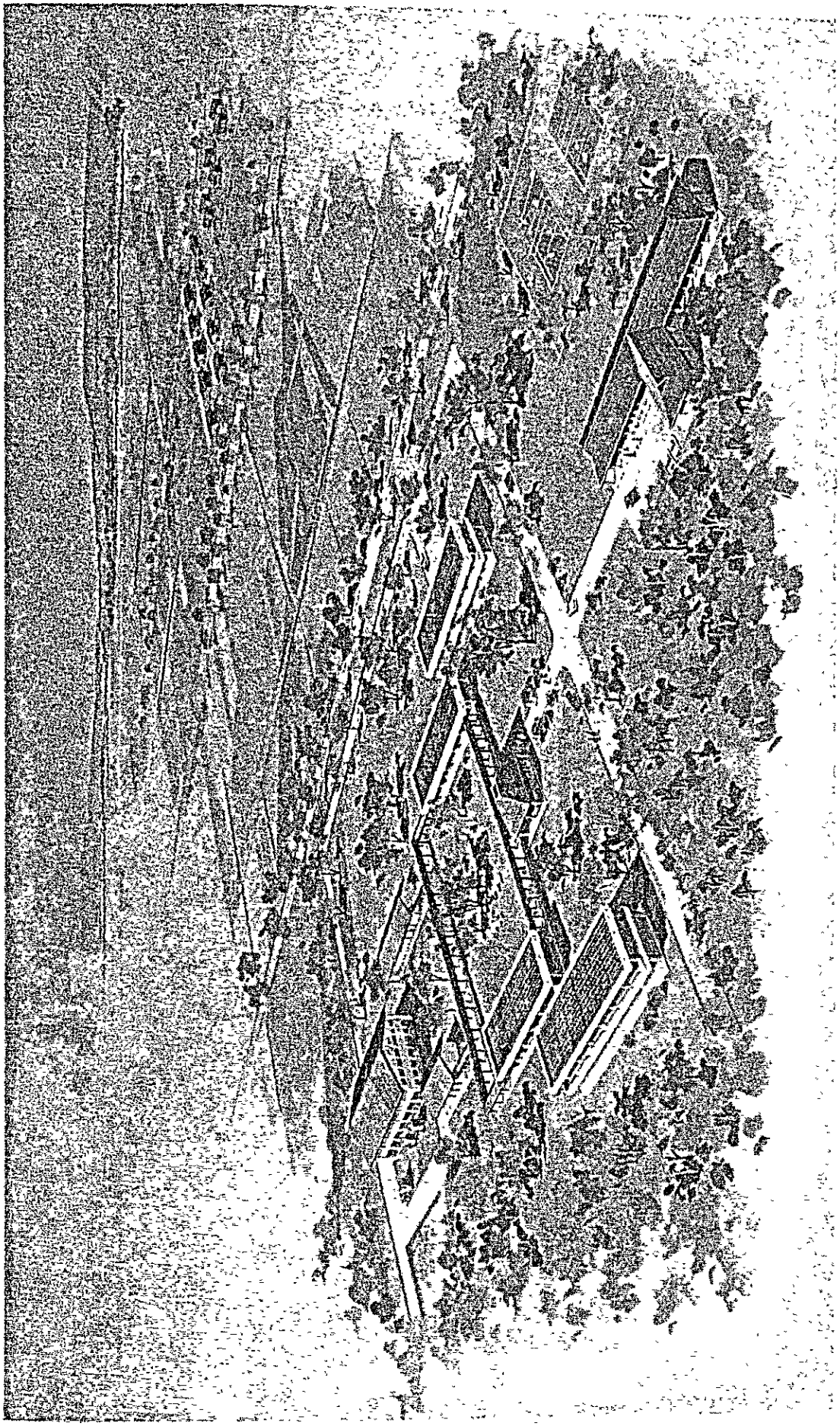


DORMITORY 13



POWER SUBSTATION 14





4-9 CONSTRUCTION PLAN

4-9-1 ESTIMATION OF THE CONSTRUCTION COST

The construction cost was estimated from the scope of the work shown in the "Outline of the Project."
The estimate was calculated upon the data which the Basic Design Survey Team surveyed as of December 1978.

(1,000 yen)

I.	Building Construction Work	886,400
II.	Related Facilities	324,800
III.	Equipment	600,600
IV.	Design and Supervision Fee	181,200
V.	Total	1,993,000

4-9-2 CONSTRUCTION SCHEDULE