CHAPTER 3
OUTLINE OF THE PROJECT

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3-1 Objectives

The objective of the Project is the establishment of ITC in the proposed 30 hectare construction site owned by ID in the suburbs of Pegu city 77km northeast of Rangoon.

In order to cope with the diversification of irrigation projects, ITC will hold following functions; consolidation of various standards in connection with irrigation technology, conducting of testing service, training of engineers, collection and dissemination of Irrigation Technology Data/Information.

This will contribute to the development of agricultural irrigation technology, an increase in agricultural production, and the development of economy of Burma whose fundamental industry is agriculture.

3-2 Review of Contents of Request

As mentioned in Chapter 2, there is a great need for the implementation of this project in view of the urgent tasks of training irrigation engineers and determining design standards. Consequently the contents of request made by Government of Burma side were almost appropriate.

However, the modifications on the following items were made in the contents of request after the discussion with the Burmese side during the preliminary survey and basic design study.

(1) Training Plan

The training will not be conducted solely during the rainy season. Instead, multiple short training courses will be carried out throughout the year, including the dry season in order to make use of the facilities more effectively.

(2) Facilities

The workshop for heavy construction machinery will not be included in the project because it is more efficient to be constructed in the other existing facilities.

3-3 Outline of the Project

3-3-1 Implementation, Maintenance and Administration Organization

The implementation body of the project is the Irrigation Department(ID) of the Ministry of Agriculture and Forests. ID is responsible for implementation of the project and for negotiations on procedures concerned with execution of the project along with other ministries. The Planning Branch of ID will carry out the respective practical tasks. ITC will rank equal to the existing 5 sections and 2 project offices under the Planning Branch of ID after it is opened.

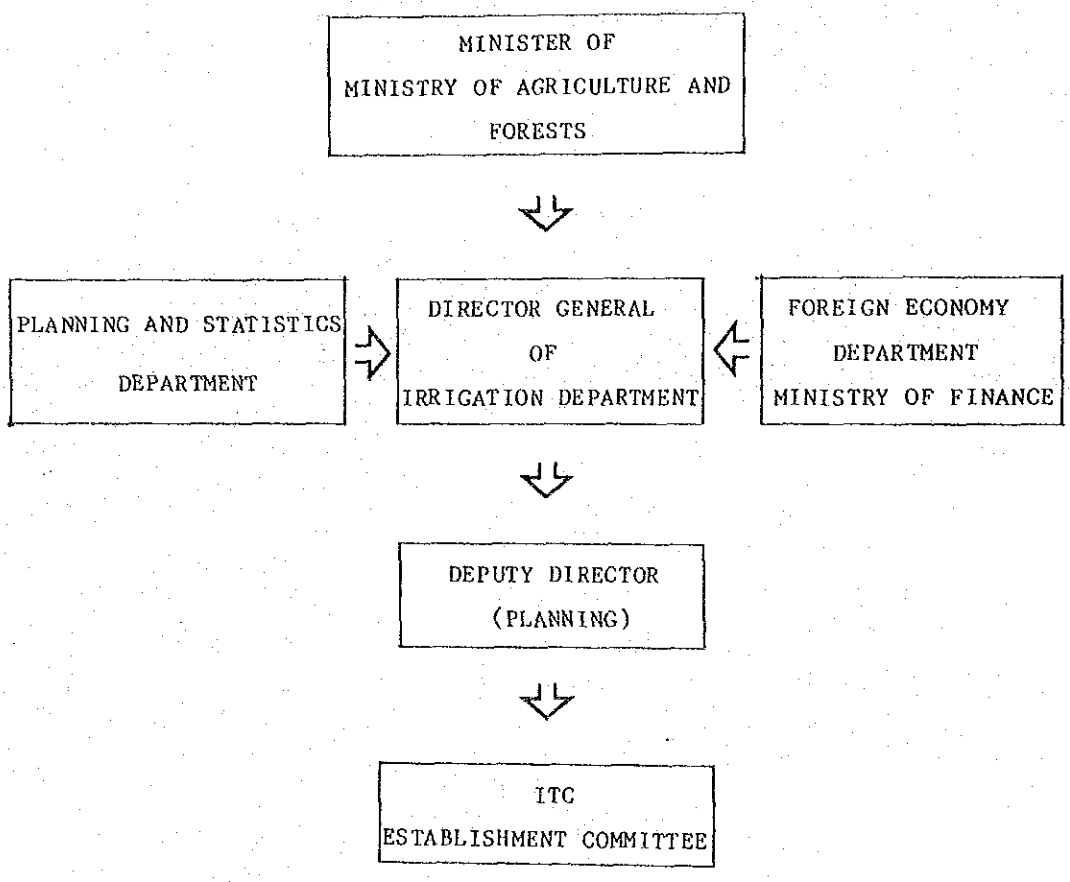


Fig. 3-1 Organization Chart of Implementating the Project

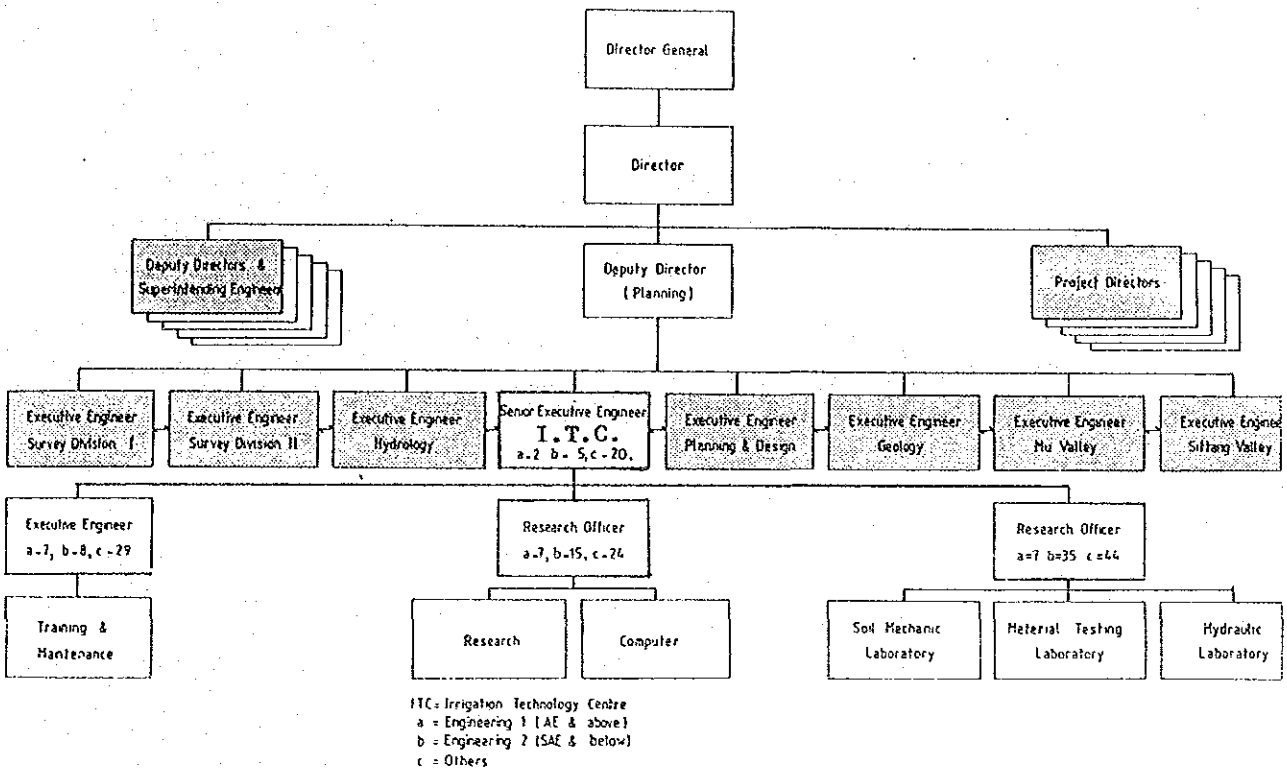


Fig. 3-2 Organization of ID

The administration and management in ITC is as follows.

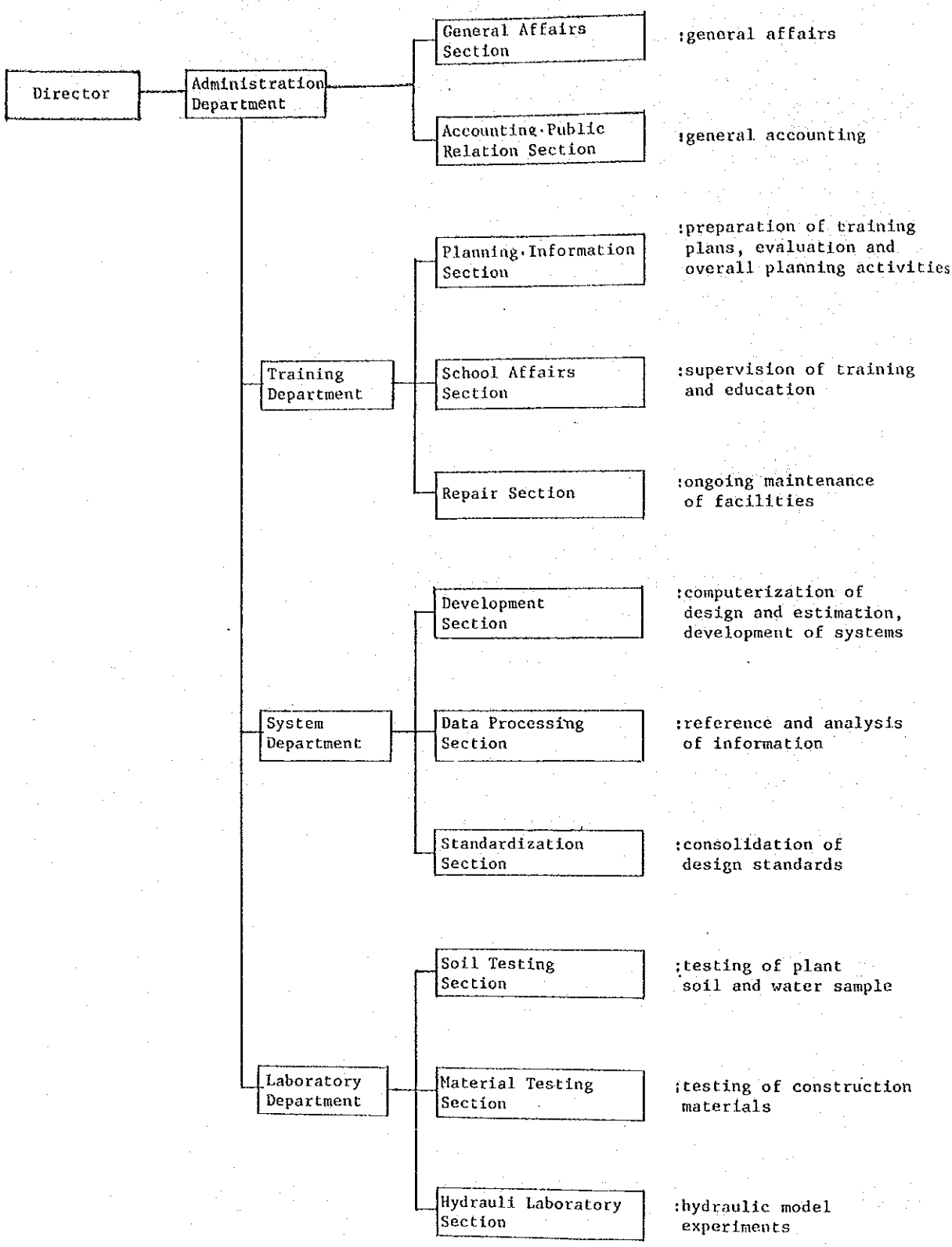


Fig. 3-3 Organization of ITC

3-3-2 Function of ITC

(1) Collection and Processing of Irrigation Technology Data/Information

All data/information obtained in the course of the current projects will be collected and categorized for the benefit of future irrigation projects. The categorized technological data/information will be processed by computer processing system and the results will be made available to contribute to the technological development and planning by ID engineers.

(2) Development of Irrigation Technology and Determining Design Criteria/Standards

Design criteria/standards will be determined taking the Burmese construction materials, construction and irrigation methods into account. In addition, planning standards, estimation, construction supervision and management should be standardized to promote irrigation technology and increase the efficiency of irrigation procedures.

(3) Soil/Construction Material Tests

Physical and mechanical tests of structure foundation and construction materials such as soil, concrete, cement, and water are to be performed. In order to enhance the efficiency of the construction works, the result of the test should be used to give advice to designers and on-site engineers.

(4) Hydraulic Model Test

The hydraulic phenomena caused by the planned hydraulic construction will be inspected in a hydraulic model test. A scale model should be used in the test and a simulated hydraulic model should be tested by computer.

(5) Training of Irrigation Engineers

ITC will provide three different types of training. New employees will be given Pre-Service Training, those who have been employed for more than 7 years will be given In-Service Training and candidates for executives will be given Re-Orientation Course.

3-3-3 Data/Information Processing and Design Criteria/Standards

(1) Data/Information Processing

Since the existing PRESTO System has no extra capacity to spare for additional data processing and numerous volume of hydro-meteorological data are not processed due to restricted utilization of the UCC computer, it is inevitably necessary to introduce a new computer system into the proposed ITC.

The activities and functions of ITC involving collection and analysis of data and information concerning irrigation in Burma, preparation of design criteria/standards for irrigation facilities suitable for the condition in Burma and development of new irrigation technology aided by computer, will enable the existing available data to be effectively utilized and analyzed, and will largely contribute towards strengthening and intensifying the irrigation technology in the whole Burma.

1) Future Computer Requirement

In addition to the present achievement in computer processing, the proposed computer application will involve the following subjects;

1. Data base management system for hydro-meteorological data storage, processing and retrieval
2. Publishing quarterly and annual hydro-meteorological reports
3. Analytical study on irrigation problems
4. Hydrologic mathematical models (stochastic and conceptual models)
5. Storing the detailed and updated informations of existing irrigation facilities such as dam, weir, embankment, drainage system and etc. for prompt retrieval
6. Storing the technical standards and criteria for irrigation systems
7. Periodical revision of the existing reservoir operating system aiming at updating floods and droughts operation rules
8. Numerical simulation of large-scale hydraulic phenomena
9. Linear programming model for irrigation system optimization as the combined effects of soil type, land availability, water resources,

cropping pattern, draft animals and others

10. Computer aided design by use of digitizer and plotter systems
11. Developing the inventory control system in irrigation stores including heavy equipment and spares.
12. Recording financial allotment, balance, etc. and budget controlling system
13. Training of ID staff

2) Data Processing Network

The materialized contribution expected from the data processing network is summarized as follows;

1. On-line Service
   - Data processing
   - Retrieval and offer of processed data/information

2. Other Services
   - Collection, perusal, lending and copying services of technical data/information
   - Publication service
   - Development of computer programs
   - Technical supporting service concerning computer utilization
   - Training

To cope with the above mentioned requirements, it is necessary to plan the most effective utilization of the computer system, especially in consideration of the following viewpoints;

1. To construct data base systems
2. To develop and to provide software properties
3. To install computer network

The computer network is to be designed on the basis of the projected organization and system for computer utilization as well as volume of data/information to be processed. Taking the present and proposed status of computerization into consideration, a vertically structured computer network system with a mini-computer as the host and personal computers as the work station terminal is proposed. As for the

peripheral devices to be equipped with the computer network system, a digitizer and X-Y plotter will be effectively used for computer aided design or standardized design of relatively simple structures such as canal, culvert and others. With regard to the technical data/information services, introduction of the full-scale image information processing and retrieval system is still early.

3) Operation and Maintenance

UCC has been taking charge of the installation and utilization of computer systems in entire Burma and has been executing supporting services inclusive of installation, adjustment, maintenance and system design at the request of the users. Regarding maintenance works of the computer system, UCC has accumulated many experiences especially for mini-computer as well as for personal computer systems, and no serious problem has been reported. In connection with this, the PRESTO system in the Head Office of ID was installed, and has been maintained by UCC.

It is thus recognized that the proposed computer system in ITC will be fully maintained by UCC when the following conditions are satisfied.

1. Staff training for hardware engineers, system engineers and application programmers
2. Stock of necessary spare parts
3. Provision of all manuals for hardware

It should be emphasized, however, that the maintenance contract be closed under the tight cooperation among ID, UCC and the computer manufacturer.

4) Basic Design of Computer System

Taking into account the volume and grade of data processing, making use of the existing available data stored on magnetic tapes and facility of system maintenance, a super mini-computer system with required minimum peripheral devices is proposed. Also taking risk dispersion into consideration, personal computers which are operative self-supported are installed as the work station terminals.

. Central Processing Unit (super Mini-Computer)

. Work Station (Personal computer)
. Magnetic Disk Unit
. Magnetic Tape Unit
. Console display
. Line Printer
. X-Y Plotter
. Digitizer and Graphic Sub-system
. Serial Printer

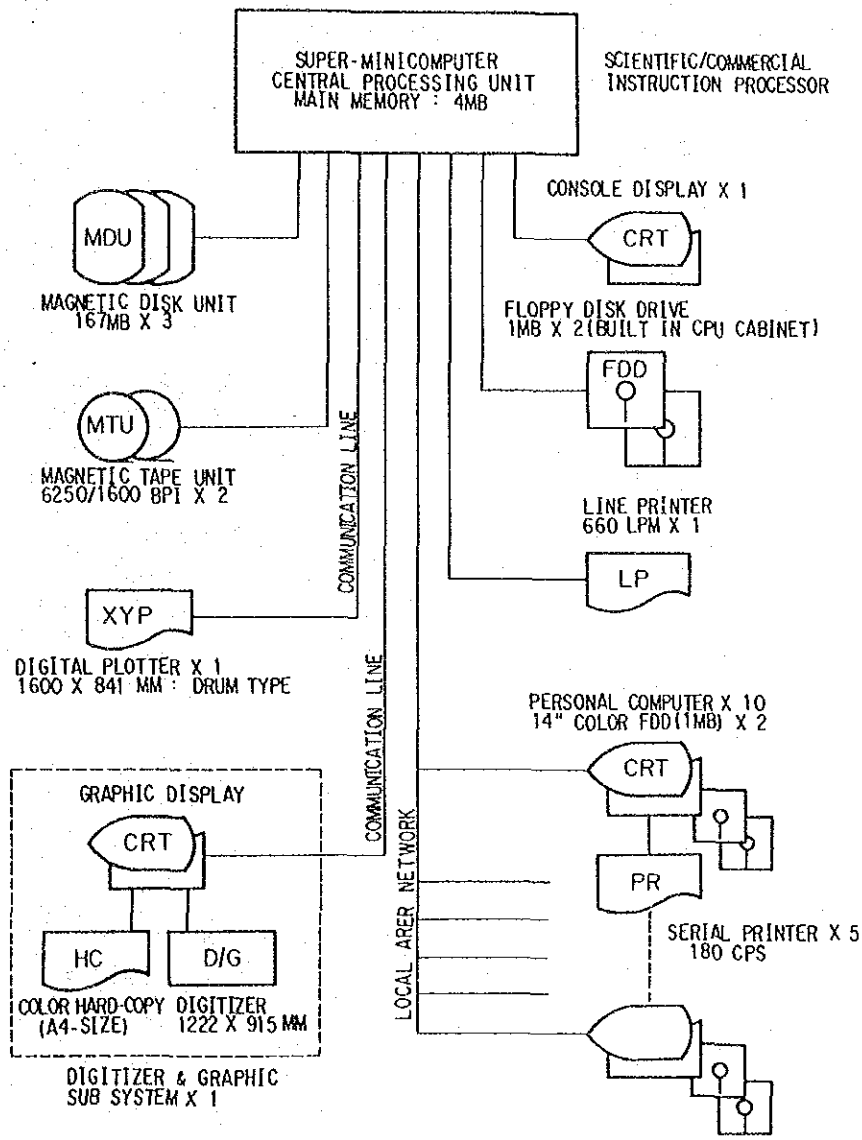


Fig. 3-4 Proposed Computer System Configuration

To determine the capacity and number of each device, the following items were carefully studied as a basis for system selection:

- Capacity of direct access storage device to store the estimated volume of data
- Reliability, availability and serviceability
- Marginal utility and expansibility
- Treatment for corrective maintenance
- Risk separation
- Supporting system for software development and staff training
- Test program function
- Security of data
- Programming language

(2) Technology Development and Design Criteria/Standards

Computer application for the development of irrigation technology comprises management and efficient application of available data and information, standardization and computerization of planning and designing procedures.
The following diagram presents the outline of flows and procedures which are executed by ID.

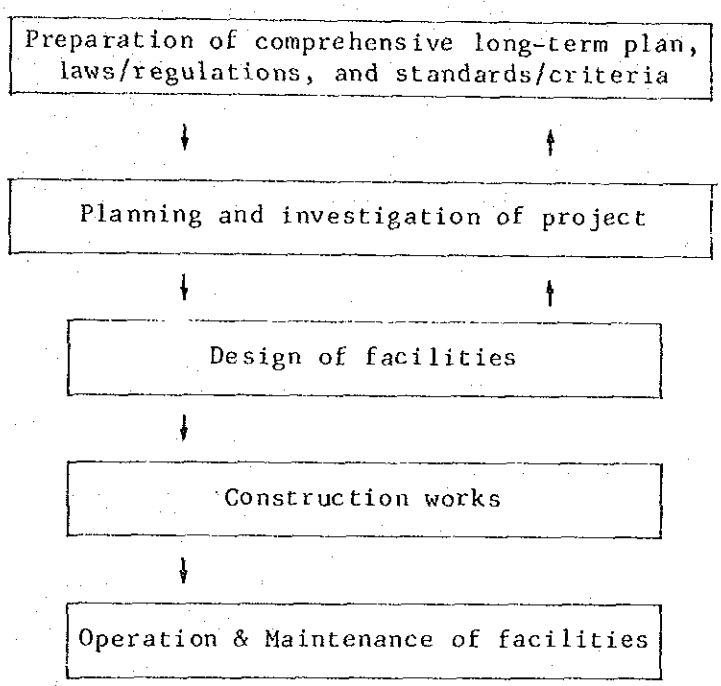


Fig. 3-5 Flows and Procedures

Note: An upward arrow means the feedback comprising evaluation and adjustment works.

By means of computer application, rapid utilization and updating of available data/information, standardization and simplification of planning and designing procedures, centralization of cost estimation and management of construction machinery and materials are expected, resulting in the overall simplification and unified accuracy. In addition, as is seen in the Fig. 3-5, since the feedback procedure is usually included in a series of implementation works, to accumulate,

arrange and evaluate the existing completed project dimensions directly mean the comprehensive upgrading of the irrigation technology.

1) Development of Irrigation Technology

As previously stated, development of computer application technique will extensively contribute to improving and upgrading irrigation technology as a whole.

2) Design Standards and Criteria

At present, no unified standards and criteria for investigation, planning and design have been prepared by ID, but various criteria/standards of various countries have been mixed. It would be useful to introduce such criteria/standards adopted in Japan after modified for the specific local conditions of Burma.

However as the first step, it is essential to collect and analyze the existing data/information obtainable from the completed projects.

Information relevant to the project concerned will be given in various forms such as words, numerical values, letters and figures, tables and maps. While a priority may be given to the numerical data or information, appropriate study should be started with selecting suitable criteria/standards to meet local conditions of Burma.

3-3-4 Soil/Construction Material Test and Hydraulic Model Test

(1) Soil Testing

In principle, the soil testing equipment to be provided in the laboratory shall be procured along with the following guide.

1. Samplers, particularly for undisturbed samples, shall be procured, and it will be necessary to take into account transportation measures for sample materials.
2. The quantity of the equipment to be provided shall be decided in taking into consideration the annual programs of the project execution and training of the staffs.
3. The procurement of large-scale soil test equipment shall be planned.

1) Procurement of Samplers and Transportation Measures of Sample Materials

As a matter of course, more sample tests should be made in order to expect more precise design. Hand-auger boring and the like are deemed effictive to meet such requirements.

Specifically, soil tests have two kinds; while one is to test with disturbed samples for embankment materials, the other with undisturbed samples for clarifying specific features and strength of foundation of structures.

The national land of Burma is roughly divided into two; i.e. the Upper Burma and the Lower Burma. In the Lower Burma, the irrigation projects will be developed in the Irrawaddy Delta.

Thus, the thorough understanding and knowledge on specific features of the alluvial deposits will be essentially required for successful development of the Irrawaddy Delta. The Thin-Wall Sampler or the like will be indispensably provided to take undisturbed samples from the layers below the groundwater.

In other respect, the engineers assigned on soil testing for fill-type dams in particular should have sufficient knowledge of the project site conditions. Therefore the engineers themselves shall be engaged in sampling in the fields.
Consequently, some transportation measures should be provided within the laboratory facility for soil sampling.

2) Determination of Quantity of Testing Equipment

As described in the Fifth Four-Year Development Plan, most of the irrigation development projects have been proposed as those with fill-type dams. Thus, the necessary quantity of the equipment shall be determined on the annual basis in consideration of the number of the projects proposed in the aforesaid Four-Year Plan and the preparatory study of the projects expected in the following year. As a result, the number of the objective projects per year has been estimated to be 15 including five of the implementation stage of the expected projects. Based on the said number, the total quantity of the required equipment

is to be determined.

Training shall be given to 4 groups on the basic matters, each of which consists of 5 trainees. Such a training plan also should be taken into consideration for determining the definite quantity of the equipment to be provided.

3) Procurement of Large-scale Testing Equipment

Large-scale testing equipment are necessary for analyzing specific features of those test materials of gravelly soils and rock. In other view, since Burma has been attacked by earthquakes frequently, such earthquake-proof type dams are required for large-scale fill-type dam construction, e.g. rock-fill type or zone type dam, and the design of these types of dams indispensably requires large-scale soil testing.

In Burma, most of the national land, excepting the alluvial plains, it is rare to find the ground surface covered with thick clayey soil layers or heavily weathered soil layers because of its meteorological conditions, that is to say, the heavy rainfall and its erosive action. Under the above circumstances in Burma, the fill-type dam construction have to use a great deal gravelly sand and weathered rock materials instead of using earth. Consequently, the large-scale machines are to be provided for necessary testing.

(2) Concrete Testing

The necessary equipment shall be introduced in accordance with the following policy.

1. The basic equipment shall be served as one of the functions of ITC to make a technical study for preparing design criteria/standards applicable to the practical work in Burma.

2. As for concrete test equipment, only the basic equipment shall be introduced so as to help the trainees have essential knowledge of general features of concrete for practical use.

3. Special attention should be paid to specific problems found in Burma after introducing the equipment.

1) Basic Testing Equipment

The concrete tests may be generally classified as follows; tests for cement, aggregates and concrete before and after hardening. The basic equipment necessary for these tests shall be introduced.

2) Equipment and Training

The following test items shall be the training objectives; they are slump test, test for amount of air, mixing test, and strength. The training shall be given to 4 groups, each of which consists of 5 trainees.

3) Specific Problems found in Burma

The alkali reaction of the aggregates has been recently taken up as a serious problem in Burma. A polarization microscope shall be introduced so as to detect the composition of stone for aggregates and solve the problem.

(3) Water Quality Test

The necessary equipment shall be introduced in accordance with the following basic policy.

1. The water quality tests shall not be taken up as objectives of the training.
2. The quantity of the equipment to be provided shall be determined in taking into consideration the projection of the annual number of the tests.
3. The specific problems in Burma shall be taken into account when the equipment are introduced.

1) Water Quality Test

The water quality test, while requiring enough experience for detail analysis, may be done in a simple manner by using reagents so that there seems to be no need of training for this testing practice.

2) Quantity of Water Quality Tests

Sampling of water for the tests shall be made for two samples per 100 acres. And about 200 to 300 samples should be taken for one project in

general. Consequently, about 4,000 samples will be taken per year on the premise so that approximately 15 projects will be implemented in a year.

3) Specific Problems found in Burma

As mentioned already, the development of the Lower Burma will be carried out by the project of the Irrawaddy Delta as a core. The saline water will be one of the major problems in the Irrawaddy Delta projects for agricultural development.

Under the circumstances the water quality test will play an important role in the projects in the Lower Burma and the program for introducing the equipment should be worked out in taking into consideration this fact.

(4) Hydraulic Model Test

To solve the technical problems which ID faces at present and also to implement the projects under the Fifth Four Year Plan, ITC is expected to assume the following activities;

1. To simulate hydraulic reaction due to construction of the designed structure and to verify hydraulic phenomena by providing various model dimensions.

2. To simulate hydraulic phenomena of dam seepage and to reflect the experimental values on planning and designing new projects.

3. To conduct river model tests intending the basic research for river flow, embankment erosion and sediment deposit, and to take necessary measures for them.

4. To develop computer simulation techniques in terms of mathematical model analyses.

5. To construct a basic experimental channel outdoors, and to conduct calibration of flow-velocity meters by operating the self-propelling trolley.

6. To conduct training for engineers concerning the mentioned subjects.

Taking into account the required extent for simultaneous test of two different types of models, and also considering necessary space for model manufacturing depending upon the scale and dimension of the model to be prepared, the floor area of the hydraulic laboratory is figured as 20mx51m. Since the experiments are conducted mainly during the rainy season, elevated tanks and pumps are to be installed indoors to prevent themselves from being aged. It is also required to construct a reservoir which is filled with water on a day or so before the commencement of the test. Regarding the outdoor model tests, sufficient open space for the outdoor testing works is provided.

Required equipment are as follows;

1. Model channel for the basic test and staff training
2. Measuring devices such as velocity meter, level gauge and etc.
3. Model materials that are not procurable in Burma
4. Small-scale workshop machinery and tools for model manufacturing and removing

3-3-5 Training Program

(1) General

In order to carry the training program efficiently, it is necessary to establish a well organized system and program. Training program to be conducted in ITC consists of Pre-Service training for newly employed staff, In-Service training for staff with more than 7-years experience and Re-Orientation course for executives. Each training course will be conducted in accordance with trainees' education background, i.e., university graduate level, diploma level, technical high school level and matriculation. Each training period ranges four to eight weeks and number of trainees per one class is ten to twenty.

(2) Prospect Trainees

Staff eligible for training in ITC are limited to technical high school level or above. Personnel below that school career are excluded from a training program due to the reason that those staff can be sufficiently trained through on-the-job training. ID's 4 Branch offices with their own workshops provide training for mechanical staff. Therefore, ITC would not offer any training courses for them. The total number of trainees in ITC amounts to 2,290 which is obtained by subtracting 149 of mechanical staff from total 2,439 with technical high school level or above.

(3) Number of Trainees

The total number of trainees a year would be 340, out of which 170 in Pre-Service training, 140 in In-Service training and 30 in Re-Orientation course are allocated. ID will employ 160 to 200 of staff with basic education of technical high school level or above. In Pre-Service training course, those newly employed staff are subject to be trained. In In-Service training course, the total 1,400 staff with more than seven years experience excluding mechanical staff are subject to be trained and the regular trainees number per year is determined as 140 under conditions that 50% of the staff will be trained within five years. In Re-Orientation course, 10 with university graduate level which is equivalent to 1.5% of the total 682 staff of the level, and 20 with diploma level equivalent to 2% of the total 990 staff of the level are subject to be trained.

(4) Aim of Training

Main aim of Pre-Service training is to offer trainees basic engineering knowledge for execution of their duties. Trainees in In-Service training are to be equipped with the capability of introducing and spreading new technologies. Trainees in Re-Orientation course are to learn the latest technologies mainly focusing on computer operation.

(5) Training Schedule

The training schedule and subjects discussed in each course are shown in the following table.

Training is conducted throughout the year and maximum number of trainees is 80 which would be divided to 4 classes during the rainy season from May to October.

Table 3-1 Pre-Service Training

Particulars	No. of Trainees	Duration (Weeks)	No. of Session/Year (Frequency and Time)
1. Assistant Engineers (Graduate)	20	8	2/(May to June and Sept. to Oct. Yearly) Total 40 Trainees
2. Sub-Assistant Engineers (Diploma)	20	8	2/(May to June and Sept. to Oct. Yearly) Total 40 Trainees
3. Engineering Surveyors (T.H.S)	20	8	1/(July to Oct.) Total 20 Trainees
4. Assistant Engineering Surveyors (T.H.S)	20	8	1/(July to Oct.) Total 20 Trainees
5. Draftsmen (Diploma and T.H.S)	10	8	1/(Jan. to Feb.) Total 10 Trainees
6. Assistant Draftsmen (Diploma and T.H.S)	10	8	1/(Jan. to Feb.) Total 10 Trainees
7. Tracers (T.H.S)	20	8	1/(Nov. to Dec.) Total 20 Trainees
8. Lab. Assistants (Matriculation, Graduate)	10	8	1/(Nov. to Dec.) Total 10 Trainees
			G. Total 170 Trainees

Table 3-2 In-Service Training

Particulars	No. of Trainees	Duration (Weeks)	No. of Seesion/Year (Frequency and Time)
1. Assistant Engineers (Graduate)	20	8	1/(July to Aug. Yearly) Total 20 Trainees
2. Sub-Assistant Engineers (Diploma)	20	8	1/(July to Aug. Yearly) Total 20 Trainees
3. Engineering Surveyors (T.H.S)	20	8	1/(May to June) Total 20 Trainees
4. Assistant Engineering Surveyors (T.H.S)	20	8	1/(May to June) Total 20 Trainees
5. Draftsmen (Diploma and T.H.S)	10	8	1/(May to June) Total 10 Trainees
6. Assistant Draftsmen (Diploma and T.H.S)	10	8	1/(Mar. to Apr.) Total 10 Trainees
7. Tracers (T.H.S)	10	8	1/(Mar. to Apr.) Total 10 Trainees
8. Lab. Assistants (Matriculation)	10	8	1/(Mar. to Apr.) Total 10 Trainees
9. Account Staff (Matriculation)	20	6	1/(Dec. to Apr.) Total 20 Trainees
			G. Total 140 Trainees

Table 3-3 Re-Orientation Course

Particulars	No. of Trainees	Duration (Weeks)	No. of Session/Year (Frequency and Time)
1. Executive Engineers (Graduate)	10	4	1/(Oct. Yearly) Total 10 Trainees
2. Assistant Engineers (Diploma)	20	4	1/(Nov. Yearly) Total 20 Trainees
			G. Total 30 Trainees

340 Trainees Yearly

. Engineering Level and Subject

Training subjects depends upon trainee's education background

1. Graduate	Executive Engineer, Assistant Engineer
2. Diploma Level	Sub-Assistant Engineer, Draftsman Assistant, Draftsman
3. Technical High School Level	Engineering Surveyor, Assistant Engineering Surveyor, Tracer
4. Matriculation Level	Laboratory Assistant

Table 3-4 Training Subjects

Subject	Graduate Level	Diploma Level	T.H.S* Level	Matriculation Level
1. Hydrology & Hydraulics	○			
2. Water Resource Planning	○			
3. Hydraulic Structure	○	○		
4. Irrigation Engineering	○			
5. Soil Mechanics & Foundation	○			
6. Concrete Structure	○			
7. Irrigation Practice	○			
8. Water Resource Project Formulation	○			
9. Engineering Economy	○			
10. Departmental Instructions & Codes	○	○		
11. Quantity Estimates & Costing		○	○	
12. Engi. Drawing & Graphics		○	○	
13. Surveying & Geodesy			○	
14. Laboratory Practice & Theory				○
15. Special Subject				
i) Computer Technology & Programming	○			○
ii) Theory of Hydraulic Modeling	○			○

* T.H.S: Technical High School

Table 3-5 Training Program

Trainee	Dry Season				Rainy Season						Dry Season		Basic Education
	1	2	3	4	5	6	7	8	9	10	11	12	
Executive Engineer													Graduate Level
Assistant Engineer													- ditto -
Sub Assistant Engineer													Diploma Level
Engineering Surveyor													Technical High School Level
Assistant Engineering Surveyor													- ditto -
Draftsman													Diploma Level
Assistant Draftsman													- ditto -
Tracer													Technical High School Level
Laboratory Assistant													Matriculation Level
Account Staff													
Total	30	30	30	30	80	80	80	80	40	50	60	60	

Notes: Pre-Service Training In-Service Training Re-Orientation

3-3-6 Proposed Construction Site

(1) Proposed Construction Site

Being situated at 77km northeast from Rangoon, the construction site of ITC is in Kyauk Taing Gan, Quarter of Pegu Division, southwest of Pegu city. It is approximately 1km west of the Mandalay road in the direction of the old airport.

Since the construction site is in the sparsely populated outskirts of Pegu city, there is almost no legal constraints.

(2) Nature Conditions

1) Topographical Features

The construction site is a 30 hactares area of flat grassy plain and shrubbery which was formerly used to grow vegetables and fruit and the lower part of the area was used for paddy field.

During the rainy season part of the land becomes submerged, but it doesn't stay under water for long. However, consideration must be paid to the discharge of rain water and in determining the floor height of new buildings.

2) Soil Condition

Soil investigation done during the Basic Design Study of the construction site shows that the ground to a depth of 0.5m is of silty clay layer containing some sand. Below this a laterite clay layer of N value 20 - 25 extends down to a depth of 3.0 m. Deeper than 3.0m there is a consolidated laterite clay layer of N value 30 or more. As the ground water level is 6m from the ground level, no disturbance for the earth and foundation works are assumed.

The results of the soil investigation data are attached in the ANNEX.

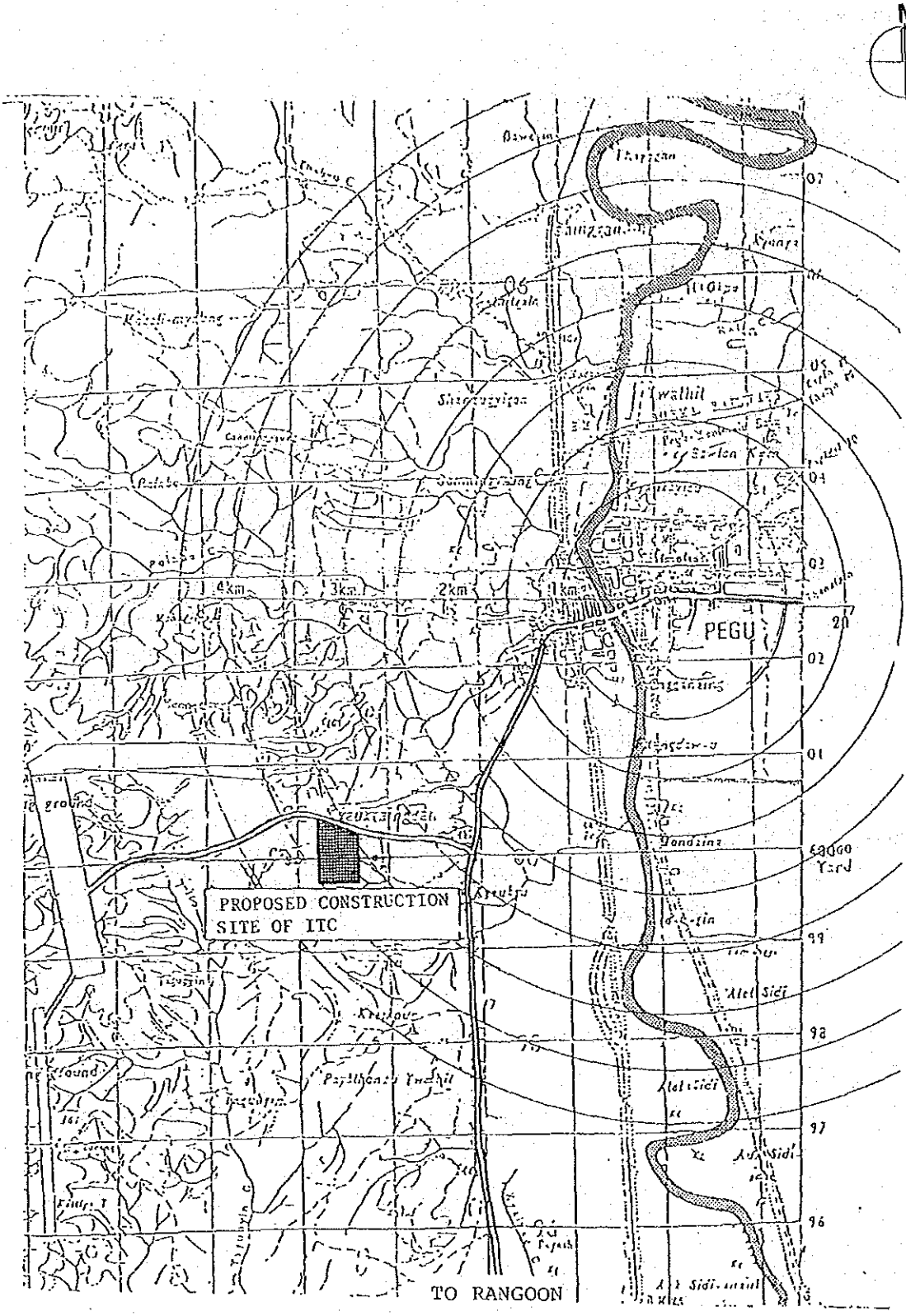


Fig. 3-6 Vicinity Map

(3) Infrastructure

1) Electricity

Nearby the site along the Mandalay road there is a 33kV aerial power line. The power line to the site shall be constructed from this 33kV aerial power line to the boundary of the site by the Burmese side(see Fig. 3-7).

Power supply failure in the area is frequent and sometimes lasts as long as 4 days. The voltage regulation also is as much as ±12.5%. Therefore, countermeasure for power failure and voltage regulation variation are required.

2) Telephone

Although there is a telephone cable along the Mandalay road, this does not have enough capacity to accommodate more lines. It is required that the new telephone line to the building for the project is installed by the Burmese side.

Necessary COL (central office line) circuits will be 4 for telephone use and other circuits for future computer on-line system.

3) Water Supply

Since there is no city water available to the site, it is necessary to use well water. There are two old wells in the construction site which have a water level of 5m under the ground surface.

According to the reliable data on 6 existing wells around the construction site, it has been confirmed that sufficient water for the building facilities can be obtained by deep tube wells in the site. It will be necessary to use 2 new deep tube wells, namely, an 8 inch diameter well in the west part of the site to supply the main complex and the laboratory and a 4 inch diameter well in the east part of the site to supply the dormitories. The drilling work for deep tube wells shall be executed by the Burmese side.

4) Waste Water Disposal

The area has no waste water disposal system. It is necessry to sterilize waste water if pollutants included and let it soak into the ground.

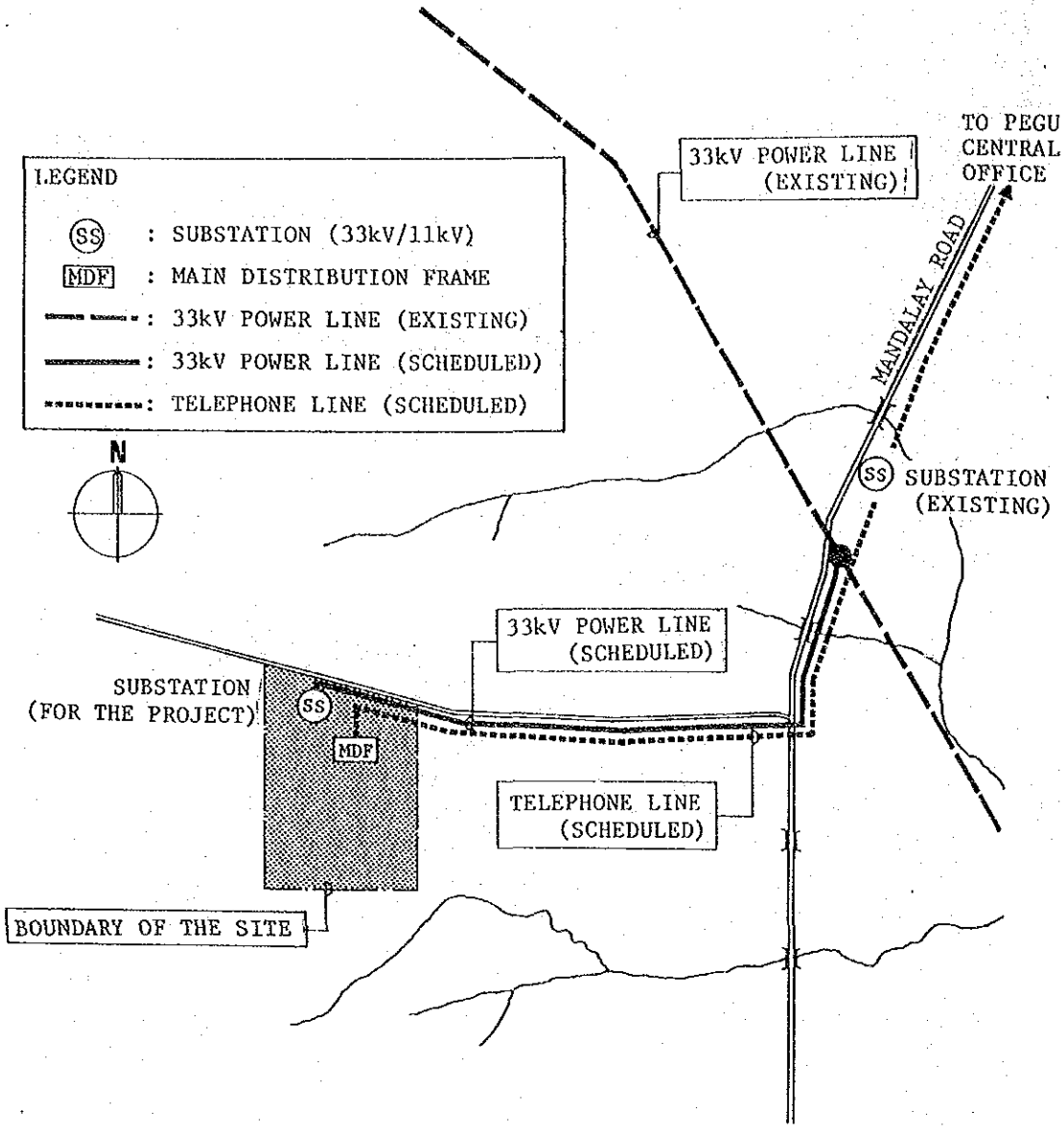


Fig. 3-7 Power and Telephone Line for the Proposed Construction Site

3-3-7 Outline of Facilities and Equipment

Analyzing the required functions of ITC, as stated in 3-3-2 ITC Functions, the Administration & Training building, the Laboratory building and the Dormitory building complexes are to be conceived with organic relationship. The outline of proposed facilities and equipment is as follows.

(1) Facilities

1) Administration & Training Building

1. Training ..... Classrooms, drafting room, audio-visual room, computer room, library, text preparation room, teaching and administration staff room, multi-purpose hall
2. Administration... Project director's room, department chief offices, reception rooms, meeting rooms, offices

2) Laboratory Building

1. Soil testing ..... Testing rooms, preparation offices
2. Construction Material testing .. Testing rooms, workshop
3. Hydraulic model laboratory ..... Hydraulic laboratory, hydraulic training room, electrical room

3) Dormitory

1. Dormitory ... Male dormitory and female dormitory, guest rooms, superintendent's room
2. Cafeteria

4) Others

. Garage, covered walkway

(2) Equipment

1. For testing and training .... Equipment and fittings for soil/construction materials testing room, soil testing room hydraulic models, laboratory and workshop

2. For training ..... Equipment and fittings for library, audio-visual room, classrooms, drafting room and text preparation room

3. Computers

3-3-8 Staff Recruitment Plan

The ITC recruitment plan is shown in Table 3-6.

The ITC project received the Burmese Cabinet's approval last year and final appropriation is expected to be given shortly by the highest authority. If the project is going to be implemented in the 1988 fiscal year, ID staff will immediately be increased 1.5 times. The required personnel will be posted according to the ID plan for new organization. ID staff positions are extremely popular. 350 candidates applied for 21 positions (16.5 times) at the last enlistment six months ago. Since 700 students graduate from engineering departments, including 250 civil engineering students at Rangoon University every year and still there are qualified engineers who are out of work, it is not difficult to recruit qualified personnel. In addition it will be possible to provide the required job training for engineering department graduates who studied subjects other than civil engineering when the ITC facility is completed. Graduates from the engineering department which is said to be next difficult to the medical department to enter are of a very high standard.

Therefore, there will not be any personnel problems for ITC recruitment.

The majority of the current executive engineers at ITC are graduates from Rangoon University and have studied at least one or two years at universities in England, Holland and the Soviet Union after their graduation. Their theoretical level is enough high and their professional knowledge seems sufficient to manage the facility and machinery to be provided.

Table 3-6 ITC Recruitment Plan

Post \ Rank	Senior Executive Engineer	Executive Engineer	Technical Work			Office Work			Other	Total
			Assistant Engineer	Sub-Assistant Engineer	Technician	Assistant Engineer	Sub-Assistant Engineer	Technician		
Director	1									1
										(1)
1. Administration Department										
(1) Department Chief		1								1
(2) General Affairs					3		2	5	2	12
(3) Accounting Public Relations					5		3	3	2	13
										(26)
2. Training Department										
(1) Department Chief		1								1
(2) Planning			2	1	1		3	1	2	10
(3) School Affairs			2		3		2	3	2	12
(4) Repairing			2	1	7		1	8	2	21
										(44)
3. System Department										
(1) Department Chief		1								1
(2) Development			2	2	3		3	2	2	14
(3) Data Processing			2	3	3		5	2	2	17
(4) Standardization			2	2	3		3	2	2	14
										(46)
4. Laboratory Department										
(1) Department Chief		1								1
(2) Hydrology			2	5	8		1	3	2	21
(3) Material Testing			2	9	8		2	3	2	26
(4) Soil Testing			2	13	15		2	4	2	38
Total	1	4	18	36	59		27	36	22	(86) (203)

3-4 Technical Cooperation

The Government of Burma eagerly requested the Government of Japan for Project-type Technical Cooperation in order to effectively perform the functions of the new organization.

In response to the request the Government of Japan made a decision to conduct the Preliminary Survey for the project. In October 1985 the Japan International Cooperation Agency (JICA) dispatched the Preliminary Survey Team to evaluate and confirm the contents of the request and to clarify the formal procedures.

The following is the specific outline of the Project-type Technical Cooperation.

(1) Objectives of Technical Cooperation

- Collection and analysis of data/information of irrigation technology in Burma
- Establishment of design criteria/standards for irrigation facility which are suitable to Burma's condition
- Testing and analysis of soil, construction materials and water quality
- Hydraulic model test and simulation experiment for verification of hydraulic phenomena of designed structures.
- Training of irrigation technology for irrigation engineers.

(2) Period of Technical Cooperation

4 years after the first dispatch of experts.

(3) Contents of Technical Cooperation

1) 5 to 6 long-term experts including a team leader and a coordinator to be dispatched.

- Irrigation technology
- Data analysis
- Standardization
- Construction materials test
- Hydraulic model test

. Training plan

. Project coordination

2) Training Burmese counterparts in Japan

If necessary, Burmese counterparts may undergo training in Japan during the Technical Cooperation period.

3) Supply of equipment

Additional equipment will be provided if necessary.

CHAPTER 4
BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4-1 Basic Design Policy

(1) To design facility suited to Burmese climatic conditions and the natural features of the land.

The natural climatic conditions in the Pegu Division are very harsh, with a half year of sultry wet season during which there are often heavy downpours of rain and another half year of dry season during which there are enormous temperature change in the course of one day. It will be necessary to design a facility capable of withstanding these conditions.

(2) To undertake architectural planning which allows for multiple functions and future expansion.

Since ITC will undertake a multitude of activities and functions such as irrigation technological data processing, standardization, soil and construction materials test, hydraulic model test and training of irrigation engineers, it will be necessary to consider efficient circulation planning, the individual and communal use of different parts of the total facility in the architectural plan, also to consider the possiblity of future expansion in the whole site layout plan.

(3) To establish suitable standards in terms of grade, scale, type of equipment and facility based on the local condition in Burma.

The result of a survey investigating the current condition of existing ID facilities and grant aid facilities should be utilized for establishing the standards of this design regarding grade, scale and nature of the facility which is well-suited to the local conditions in Burma. On the other hand, it will also be necessary to keep in mind the fact that this facility will be housing contemporary large-scale experimental machinery and equipment.

(4) To reduce the maintenance and running costs of the facility.

It is mandatory to implement an architectural plan so as to provide sufficient allowance for natural ventilation and natural lighting and to make effective use of local construction methods and materials. This type of planning, while economizing the construction, generally facilitates maintenance of the facility once completed. Furthermore, it also helps encouragement of the local participation.

4-2 Site and Layout Planning

(1) Site

The total area of entire ITC site is approximately 30 hectares, and one third of which has been allocated for the construction of the Project. The northern half of the total site area is a predominantly flat grassy plain, while the area of the southern side, because it was formerly an orchard, is shrubbery, including some large fruit trees.
The only access road to the site is an unpaved farming track of about 6 meters in width which diverges off the Mandalay road and runs along the northern boundary of the site.

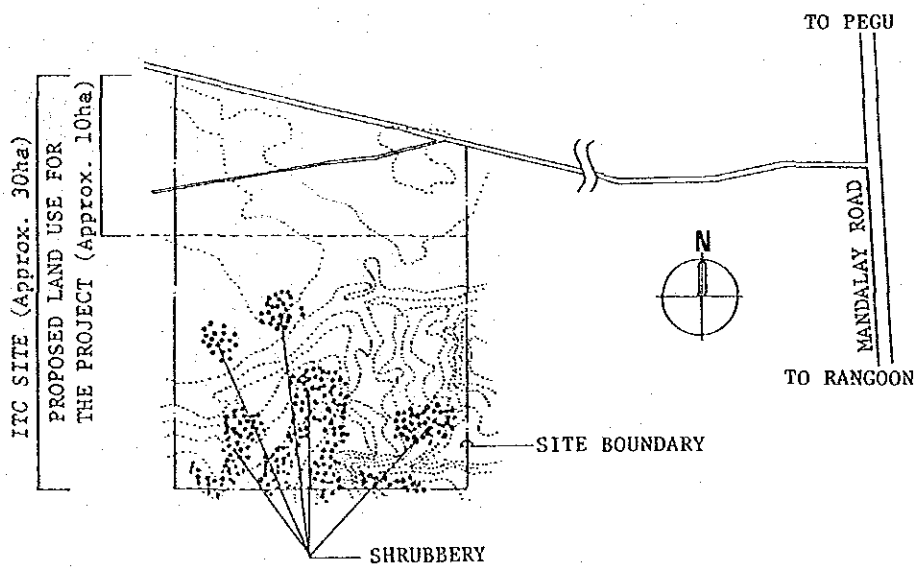


Fig. 4-1 Location of the Site

(2) Layout planning

1) The principle of the total ITC layout plan

The total site area is utilized most effectively by dividing it into three blocks in accordance with each of the functions listed below. In other words, the main block area through which most of the incoming and outgoing traffic flow is benefited by a large flat area and closeness to access road is to be located accordingly on the grassy plain to the north near the front road; likewise, the residential block which needs to be situated in quiet surroundings is located in the shrubby area on the southeast side.

Similarly, the outdoor training block, which requires a topography full of variation for the diverse forms of outdoor training such as surveying practice to be undertaken is located accordingly on the southwest side.

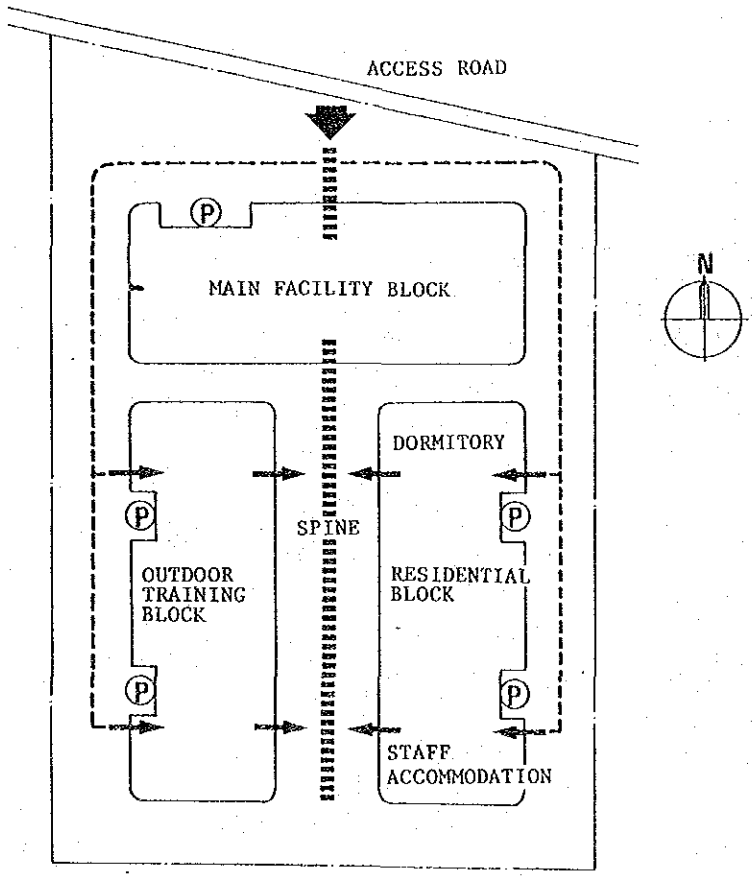
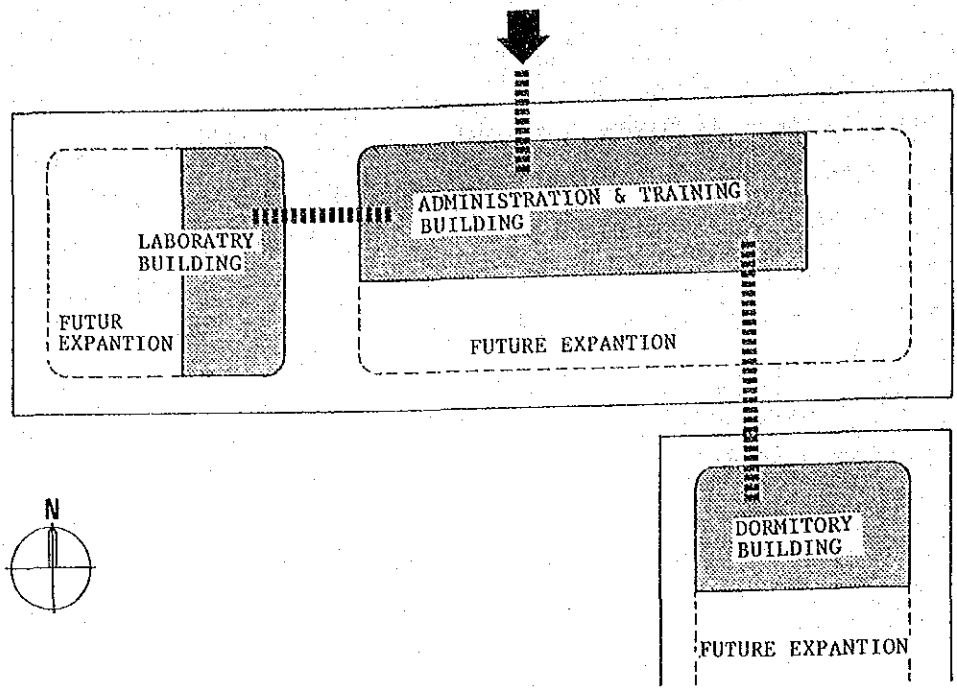


Fig. 4-2 Block Layout

In order to separate the traffic flow of pedestrians and vehicles within the compound, roads for vehicles will be extended from those planned to run along the inner perimeter of the site boundaries to the public car parks attached to each block. From there ordinary connection between the individual buildings will be on foot and pedestrians will be easily guided to the central focus of the compound which provides all directional paths of walkways and piloti, etc.
Furthermore, with respect to the layout of the buildings, a quiet environment is desirable functionally for classrooms, library, administration offices and other facilities from which a relatively low level of noise is emitted. Therefore, these facilities are situated near pedestrian paths, and other facilities such as laboratories, testing rooms, cafeteria, etc. which generate a relatively high level of noise are located along the roads designated for use by vehicles.

2) Layout Plan

Since the wind constantly blows south-north direction in the Pegu region, in most cases the rooms have been situated along an east-west axis in order to provide natural form of ventilation.
There are some administration, computer and testing rooms which functionally require air-conditioning, and if the light from the sun in the west is intercepted in these rooms, it is not always necessary to locate them along an east-west axis. These buildings have therefore been designed around a central courtyard, and the external appearance of the building will blend with general Burmese architectural styles and the sense of the originality of ITC.
The dimensions of the courtyard are 36m x 65m, and because all four corners are left open there is an ample level of natural ventilation.
Because the laboratory buildings may generate a level of noise they are situated at the western end of buildings. The dormitories are located at the northern end of the residential block which is in fact the south-eastern area of the site in terms of overall layout planning. The cafeteria is located between the dormitories and the administration & training buildings for convenient access from both blocks.
An electrical substation will be constructed by Japanese side to supply 11 kV electric power in the site. In addition, a guardhouse to monitor incoming traffic to the ITC premises is required for administration and management purposes (to be constructed by Burmese side).



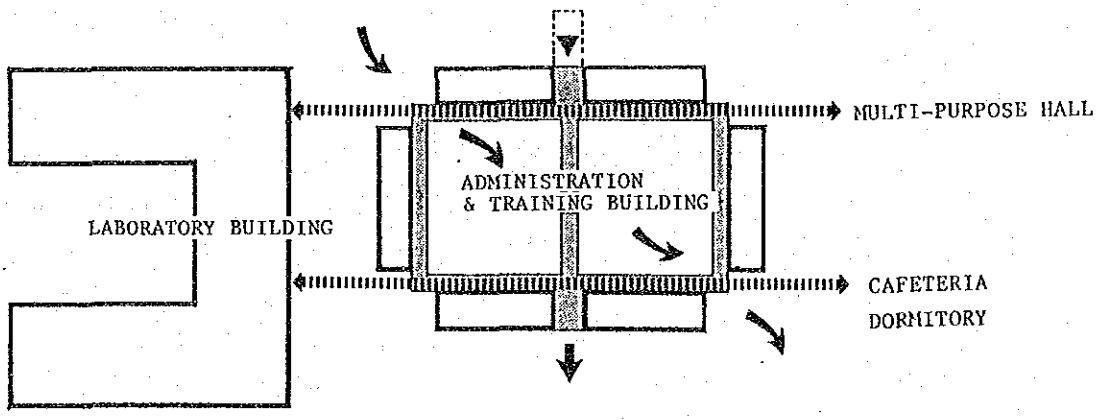


Fig. 4-3 Building Block Layout Composition

4-3 Architectural Planning

4-3-1 Floor Plan

(1) Floor Plan of Buildings

The facilities are divided into administration & training building, laboratory buildings and dormitories as set out in the layout plan, and the architectural plans for each are detailed as follows.

1) Administration & Training Building

The floor plan for the classrooms and offices is basically designed with a corridor running along one side of the rooms receiving the trade wind for the purposes of providing natural ventilation and natural lighting for the rooms.

The computer room, audio-visual room and other rooms which are installed with air-conditioning are located on the east and west wing of the building with a corridor running along one side, and the large inner courtyard is surrounded by rooms used for a variety of academic and administrative functions. These corridors and covered walkways connecting all buildings will act as the main pedestrian mall for circulation.

The library and audio-visual room are located in the east wing of the building to make them easily accessible from the classrooms, staff rooms, and administration offices as well as from the dormitories.

The teaching staff rooms are located on the first floor, and the allocation of the staff to either individual offices, offices accommodating 10-12 people or offices accommodating 20-25 people determined by overall staff numbers, level of seniority and mutual functional relationship.

The north wing houses the administrative staff rooms and has the entrance hall facing a circular drive way by which the cars of staff members and visitors approach. The entrance hall leads to a reception desk, adjacent to which the general office is located to deal with any general affairs. The computer room is located on the first floor of the west wing connecting administration rooms to the training rooms and also to provide easy access from the laboratory building.

The local custom is to leave the floors of toilets in a perpetually wet

condition, which may generate a smell, hence the toilets have been located at the far end of both the north and south wings where there is good natural ventilation.
Staircases are suitably located to serve as emergency exits besides still maintaining a practical day-to-day function, and both the toilets and staircases have been designed so that it is not always necessary to rely on artificial light sources when using them during daylight hours.

2) Laboratory Building
Large-scale heavy equipment is installed and operated in the laboratory buildings, hence their layout design aims to facilitate the handling of testing materials for operation, maintenance and administration efficiency.
The layout is a U-shape surrounding a courtyard with the construction materials testing rooms which house many equipment to be shared in the center wing and the soil testing, hydraulic laboratories on either side. An external open corridor 3 meters wide running around the building facing the inner courtyard, can be used either as an outside working area for unpacking materials in the rainy season or as a temporary storage area.
As outlined in Chapter 3, the hydraulic laboratory enables simultaneous pursuit of a couple different types of hydraulic model testing and the column layout span for this laboratory is large enough to meet the special characteristics of exprimental models and equipment.

3) Dormitory
The dormitory buildings which are comprised of male and female dormitories, accommodation for visitors and a cafeteria are designed in a similar fashion to the administration & training building on an east-west axis receiving the trade wind with a corridor running along one side. In order to make each of the rooms more comfortable and to provide the inhabitants some degree of privacy, all the bed rooms are arranged on a single row.

(2) The number of principal rooms and the basis for calculating their floor area

The number of principal rooms contained in each building and their

calculated floor area are as follows.

1) Administration & Training Building

. Classrooms

The maximum training capacity of ITC is 4 classes of 20 people, that is, a total of 80 people, and according to the training schedule, time spent in the classrooms occupied 65% while the rest is engaged with experimental and field training. Therefore, 3 classrooms of 20 people are necessary on an average(4 x 0.65 = 2.6). However, the timetable is such that there might be some subjects for which it is more suitable to conduct one combined class. Accordingly, a movable partition divides two out of three classrooms, thus enabling to provide one single classroom accommodating 40 people.

The audio-visual room can also be used as a classroom during the most occupied period by Pre-Service training and In-Service training when necessary. Working on the assumption that usage ratio of the classrooms is on an average for approximately 70% (in Japan this figure is approximately 60%), then 4 classrooms are required (2.6/0.7 =3.7). This means in effect using the three ordinary classrooms as mentioned above(designed to hold a class of 20 people) plus the audio-visual room.

The floor area of the classrooms is figured to allow a unit area of 1.8 square meters per person. This is roughly equivalent to the criterion used in other similar buildings in Burma.

This figure is roughly 1.2 times the average floor area per person in ordinary classrooms in Japanese high schools and universities, however, considering the hot and sultry nature of the climate, it would be more appropriate to meet the local condition in this instance.

. Staff rooms

In Burma all staff members occupying senior positions above the rank of department chief should have private offices while the rest of the offices are shared. Staff members are allocated in offices usually according to one of two systems; i.e. either by seniority(separate offices for senior and junior staff) or according to the department in which they are teaching or the nature of their

duties.

In ITC, because staff members within the same department need to confer closely with one another, the latter method has been adopted in producing the plan for the staff rooms.

Table 4-1 Proposed Number and Floor Area of Staff Rooms

ROOM NAME	PERSONNEL, ORGANIZATION	REQUIRED AREA m^2	PLANNED AREA m^2
1. Administration Dept.	Total 27		99
Director Rm	1 -Director	30	27
Dept. Chief Rm	1 -Chief	20	18
Office(General Affairs)	1 -Assistant Engineer 1 -Sub Assistant Engineer 10-Technician	46.1 12(Reception)	45
Office(Acounting, Public Relation)	1 -Sub Assistant Engineer 3 -Sub Assistant Engineer	56.6 18(Communication)	54
2. Training Dept.	Total 44		129
Dept. Chief	1 -Chief	20	18
Office(Planning)	2 -Assistant Engineer 4 -Sub Assistant Engineer 4 -Technician	36.2	36
Office(Repairing)	2 -Assistant Engineer 2 -Sub Assistant Engineer 8 -Technician	35.2	36
Office(School Affairs)	2 -Assistant Engineer 2 -Sub Assistant Engineer 17-Technician	53.2	54
3. System Dept.	33+(13)* Total 46		144
Dept. Chief	1 -Chief	20	18
Office(Development)	2 -Assistant Engineer 5 -Sub Assistant Engineer 2 -Technician	36.7	36
Office(Data Processing)	2 -Assistant Engineer 8 -Sub Assistant Engineer 4 -Technician	54.2	54
Office(Standardization)	2 -Assistant Engineer 5 -Sub Assistant Engineer 2 -Technician	36.7	36
4. Laboratory Dept.	39+(47)* Total 86		162
Dept. Chief	1 -Chief	20	18
Office(Const.Materials)	2 -Assistant Engineer 11-Sub Assistant Engineer	59.7	54
Office(Soil)	2 -Assistant Engineer 15-Sub Assistant Engineer	77.7	72
Office(Hydrology)	2 -Assistant Engineer 6 -Sub Assistant Engineer	37.2	36

Note: ( )* Number shown in Parenthesis are technicians whose offices are located at Laboratory Building.

As far as the floor area per person is concerned, the architectural plan provides for 18 square meters for department chief(private offices), 5.1 square meters for each senior staff members, 4.5 square meters for junior staff members and 2 square meters for assistants (based on the average floor areas of existing ID facilities)

. Multi-Purpose Hall

In Burma, it often requires the staff members of each local governmental agency to assemble as one body, and since there is no suitable meeting facility close to ITC, it will be necessary to construct a hall within ITC compound. This hall can also be used as a venue for lecture meeting, film shows and other activities aiming at publicity of knowledge and information on irrigation technology. The hall will accommodate a total of 210 people; the 203 ITC employees plus some visiting lecturers. The floor area per person is 1.2 square meters, which is roughly equivalent to to the floor area per person of lecture halls at standard public junior and senior high school in Japan.

2) Laboratory Building

. Testing Department for Soil & Construction Materials

By classifying the various tests set down in Chapter 3 into groups of items which categories depending on either individually or commonly used, the rooms required for type of test are provided respectively.

Because the design of the testing rooms aims to follow the priority on the smooth flow of procedures, materials for testing and the interaction with instructors, the spaces are assigned along the central corridor running through the building.

Though this may not be particularly advantageous for natural lighting, since a mean for natural ventilation is taken into consideration in the overall design, it is possible to use the building comfortably.

In order to calculate the floor area of each room, projection of the volume of testing materials and the relative positioning of machinery and equipment have been studied, while the size and layout

of other similar existing facilities have also been investigated.

The test rooms required for each type of testing are listed below:

- Consolidation test room
- Direct shear test room
- Water permeability test room
- Triaxial compression test room
- Moisture content test room
- Sample preparation room
- Large-scale test room
- Physical soil test and water quality test room
- Cement physical property test room
- Aggregate physical property test room
- Test piece curing room
- Concrete test room

. Hydraulic Laboratory Department

Taking into account the required extent for simultaneously conducted two different types of model test, and also considering the space for model manufacturing depending upon the scale and dimension of the model to be prepared, the floor area of the hydraulic laboratory is planned as 20mx51m.

3) Dormitory

. Dormitory Building

It is compulsory for all trainees involved in this training program to live in the dormitories. Consequently, the number of people accommodated in the dormitories is 80 people in total, the same as the maximum number of people on the training program. Allowing for the expected rise in the number of female trainees, a male-female ratio of 85:15 has been used as a criterion for the architectural planning.

There are a total of 40 rooms in the dormitories, each accommodating 2 people. The floor area of each room is 13.5 square meters, which is 6.7 square meters per person.

This is the same size as standard dormitory rooms for students in Burma, and does not present any functional problems. Since the local people generally follow the practice of hanging washing out on the balcony when the weather is fine, each room has a door leading out onto a balcony. The toilets and shower rooms conform to the general pattern of corresponding facilities in ordinary local dormitories for students. They have been designed in a similar manner to the toilets in the administration & training building to ensure a good supply of natural light and ventilation.

. Guest Rooms

There are three guest rooms each accommodating 2 persons to be designed to serve as temporary accommodation for visiting lecturers and experts.

. Cafeteria

The cafeteria is designed for 50 people to seat, on the basis of lunch to be served in three shifts to the 80 trainees and one-third of the staff who will use the cafeteria at lunch time.

Since the menu is to be simple dishes only, such as white rice and soup with some meat and vegetables, the kitchen area may not require much space.

4-3-2 Outline of Building Construction

As outlined in item 4-1 Basic Design Concept, it is necessary to consider following three points to determine the building construction details to suit for the Pegu region. They are; to prevent water from penetrating into the building during periods of heavy rain, and to make provision for both prolonged periods of direct exposure to the sun and high water level.

The floor to floor heights of the respective buildings are as follows: administration & training building; 4.0 meters, dormitories; 3.0 meters, soil and materials testing laboratory; 4.5 meters and hydraulic laboratory; 7 meters. The ground floor of the laboratories which must be accessible to vehicles delivering heavy machinery and materials will be raised 25cm above ground level as a precaution against flood damage

and the ground floor of the other buildings in which emphasis is placed on comfortable working conditions will be raised 75cm above ground level.

Asphalt shingles were chosen as the roofing material for their durability and insulating properties, and the roof has a standard pitch of 3.5 in 10 in order to prevent water seepage from heavy rains. When a wooden roof truss is used, there is a possible risk of being attacked by termites, and so in this case a concrete ceiling slab will be laid above the top floor, and further on the ceiling slab reinforced concrete posts supporting a steel frame will be erected. The layer of air trapped in attic therefore has an insulating effect, alleviating the heat in the rooms on the top floor.

(1) Administration & Training Building

The ceiling height is 3.0 meters in all of the classrooms, administration offices, rooms used for training, etc., the balconies are 1.5 meters deep and sunblinds are provided to block out the sun. The balconies are designed to protect rooms from getting wet by rain and are used for maintenance. Due to the heavy traffic in the corridors and the fact that many people tend to congregate in the corridors between classes, special measures have been taken to the corridors to be protected from becoming wet due to rain.
Sashes opening outwards form the balcony side of the rooms and the panel section at the transom light on the corridor side is made of glass louver in order to allow the air to pass through.
Because the computer room, audio-visual room and executive offices are air-conditioned, while sashes opening outwards are installed on the balcony side, the wall adjacent to the corridor will have sliding glass windows which can be opened to let fresh air in whenever necessary.

(2) Laboratory Building

The central corridor design of the soil and materials testing laboratory does not provide very good ventilation but the building has been rendered more functional by leaving the top of corridor open with no ceiling to allow fresh air in through an opening in the roof

designed to improve natural ventilation (see Fig. 4-4).
In the case of the sample preparation room, concrete testing room workshop and other rooms requiring high ceilings, it is possible to increase the height of the ceiling without altering the height of each floor by utilizing the space of the attic.

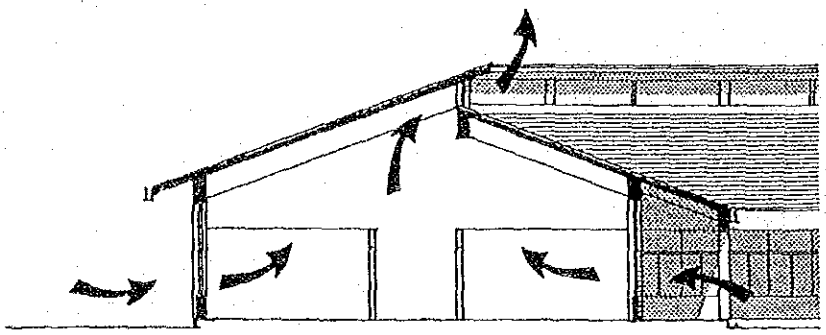


Fig. 4-4 Natural Ventilation System

The height of the hydraulic testing laboratory has been set at minimum 7 meters to enable large-scale model experiments to be conducted. Photographs of the model experiments may be taken from the observation gallery and hydraulic training rooms located on the mezzanine. Windows on the upper floors will also be openable when necessary for ventilation purposes.

In providing a vehicle entry bay for trucks delivering large materials and equipment, the floor of the building has been raised 25cm above ground level and a loading bay opening for materials and equipment 3 meters high and 3 meters wide will be provided, thereby making operations more efficient during the rainy season.

(3) Dormitory

Because the floor to floor height is 3 meters, which is lower than the 4 meter height of the administration & training building, the eaves over the balconies and the corridors are to be 1.2m and 1.5m deep respectively.

Openable louvers are installed above the windows on the balcony side and along the transome section on the corridor side in order to enhance the air flow which acts as a source of natural ventilation. Screens are installed on the inside of the louver to keep insects out.

As is also the case for the administration & training building, the balconies are not protected from the rain, but the construction detail is so made as to ensure that the floors of the corridors remain dry during periods of heavy rain.

4-3-3 Building Materials

A comprehensive investigation of all of the primary factors relating to the building components of each building, their functional requirements, local conditions for construction, the construction period, and the reduction of both technical aspects including maintenance and administration costs has been undertaken.
In case of the project it is necessary to pay particular attention to climatic conditions associated with rainfall, solar radiation and ventilation because of the significant effect they have on the material selection.

(1) Structural materials

A combination of reinforced concrete and bricks which is commonly used for local construction projects is the basis of the structural materials to be used in this project.
There are no significant problems with the quality or production output of local cement, aggregate materials or bricks.

(2) Finishing Materials

The fundamental objective of the finishing material scheme for the ITC facilities is the effective and appropriate utilization of materials to enhance durability and minimize maintenance work.
The primary finishing materials have the important role upon the lifespan of the roof and external walls, hence these materials which have already been proved in Japan to be both economical and durable are

selected. Other finishing materials are to be selected on the basis of the results of investigation of local materials which have been used in existing facilities without presenting any major functional or maintenance problems.

1) Roof

A reinforced concrete slab is to be placed at the top ceiling level of the building on which reinforced concrete posts are erected to support the roof construction.

As outlined previously, asphalt shingles with insulation are then placed over. The air space in attic actually serves as an insulation for the rooms on the top floor.

2) External walls

The gable walls of the buildings, toilets, staircases and all other external walls exposed to rain will be constructed of reinforced concrete in order to make them waterproof, while the remainder of the external walls is to be brick walls.

External walls exposed to the rain will be finished with spray tiles over a coating of cement mortar, and the remainder of the external walls will be painted.

Most of the walls of existing facilities in the area are painted. With this type of finish, however, it is necessary to repaint the walls once every a few years in order to extend the life of the building.

A limited number of colors of paint can be easily obtained locally, but provisional equipment costs for scaffolding, etc. are also incurred and further this type of finish increases maintenance costs too.

On the other hand, spray tiles, while material cost of it is more expensive than paint, is superior in terms of their ability to withstand sun exposure for long periods without requiring refinishing.

Since there is a constant trade wind blowing south-north direction, if sufficient attention is given to the positioning of the exterior openings to secure natural ventilation, there should be no necessity to install air-conditioning in any of the rooms except for the rooms used for special purpose.

3) Floors

In similar fashion to other existing local facilities, cast-in-situ terrazzo finish and concrete trowel finish are to be employed as the basic finish for the floors of rooms and corridors. These are the most common materials used locally, moreover they are inexpensive, extremely durable and easy to maintain.

In the case of the computer room, because the floor will be thicker due to the many electric wiring underneath, it is essential to use light materials, hence plastic tile will be laid over the floor. The same material will also be used in the multi-purpose hall in order to minimize the sound of footsteps, etc.

Cast-in-situ terrazzo finish is used for the floor of the entrance hall and surrounding area. It is more expensive than concrete trowel finish but it is more attractive. This finish is also very durable and easy to maintain, and as long as it is protected from direct exposure to rain.

4) Interior walls

The reinforced concrete walls and brick walls are applied first with a coating of cement mortar and then painted.

Wooden partitions will be used partially in order to reduce construction costs by using lighter materials and to shorten the construction time. The panels for the wooden partitions are plywood with two coats of painting. The skirting are finished either with terrazzo, or painted cement mortar depending on the finish of the floor and walls, taking considerations of water-proof qualities and durability into account.

5) Ceilings

The ceilings will be basically constructed in a similar fashion to those of existing local facilities, with attention given to preserving the atmosphere of the rooms and concealing the electrical wires and water pipes in the toilet, etc.

6) Doors and windows

The windows of local buildings are fitted with wooden sashes. However, since wood materials from the local area which, due to climatic conditions, still has a relatively high moisture content, there is a

strong possibility of subsequent warping and distortion. Furthermore, there are also problems relating to the airtightness of rooms to be fitted with air-conditioning. It is therefore decided that aluminum sashes should be used throughout the buildings.

Since flies and mosquitoes are inactive during the daylight hours in Pegu, no screen will be provided to the administration & training building and the laboratory building, but since students want to study in the dormitory building at night, fixed screens will be fitted to the transom in each room.

As a security measure to prevent robberies and protect materials and equipment, steel grill will be fitted to the windows of the ground floor of the administration & training building, laboratory building, other principal rooms and the female dormitory.

4-3-4 Structural Design

Since Burma is located in the Eurasian seismic zone, there have been many disasters caused by earthquakes in the past. Due consideration must be given to this fact in the formulation of a structural design. Nevertheless there are no standards relating to aseismatic (earthquake-resistant) construction methods; rather such decisions are left to the engineer's experience and judgement. As a rule, given considerations of the importance of the building, etc. a seismicity of K=0.12 is usually adopted in the design. This practice is followed in the structural design for the facilities.

The design of foundations is carried on the basis of results of an investigation of the properties of the soil at the construction site. Keeping in mind the fact all of the buildings in this complex have maximum two stories, directly foundations are supported by the stratum of good quality clay which extends for almost 1.5 meter below the surface (GL-1.5m).

The bearing capacity of the soil at 1.5 meter below the surface has been estimated as $13t/m^2$ according to the results of boring and laboratory soil tests.

The external forces and loads on the building shall be taken as follows:

(1) External forces and loads

1. Seismic force	Standard seismicity	k=0.12
2. Wind pressure	$q=150\ kg/m^2$	
3. Soil bearing capacity of construction site.	Supporting soil	GL-1.5m, $13t/m^2$
4. Dead load	The combined weight of the structural materials and other finishing materials.	
5. Live load	Will conform to the provisions set down by the Japanese Building Standards.	

(2) The main structural materials

1. Concrete	$Fc=180kg/cm^2$ (compressive strength at 28 days age)
2. Reinforcing bars	SD 35 (above D19) SD 30 (below D16)
3. Structural Steel	SS 41

4-3-5 Building Services

(1) Electrical Facilities

1) Power supply system

(a) Substation

Receiving electric system is 33kV, 3 phase, 3 wire, 50Hz. The work from existing 33kV power line to the power receiving point(close to the northern boundary of the site) will be executed by the Burmese side. From the 33kV power receiving point, power supply system work for the project should be included in the scope of Japanese side work.

Two substations are to be constructed in the site. One is outdoor type substation, having approximately 750 kVA transformer, located near the power receiving point which transforms from 33kV to 11kV. Another is indoor type substation, having approximately 500kVA transformer, located in the laboratory building which transforms from 11kV to 400V/230V. Low voltage power to each building is distributed from the substation of the laboratory building.

An induction-type automatic voltage regulator(IVR) will be provided at the secondary side of the transformer in the substation as countermeasure of voltage regulation.

(b) Generator

For countermeasures of city power breakdown, a generator system is installed for the minimum number of equipment necessary for running and operation of the facilities and training. The capacity of the generator will be approximately 150kVA.

The power supply system and construction demarcation are shown in Fig. 4-5.

2) Motor control system

The motor control system is to handle power to the air-conditioning and plumbing equipment controlling the operation of such equipment.
The office(general affairs) will be provided with an alarm panel that indicates equipment failure and water level.

3) Lighting system

Fluorescent lighting fixture will be mainly used for the project. However, for those rooms with high ceiling (such as the hydraulic laboratory), mercury lamps will be employed.

Illumination level will be in accordance with the following table.

Table 4-2 Illumination Level of Rooms

Room	Average Illumination level
. Office, Meeting room,Library	300 - 400 Lux
. Text preparation room	200 - 300 Lux
. Classrooms, Audio-visual and Computer rooms	250 - 350 Lux
. Laboratories	250 - 350 Lux
. Multi-purpose hall	150 - 250 Lux
. Storage	100 - 150 Lux

4) Socket outlet system

Socket outlets will be provided to supply power to small electric appliances.

The socket outlet type is of 15A, 2 pins + 1 earthing pin, BS standard.

5) Power source for laboratory equipment

A distribution board will be installed in each laboratory room to supply power to laboratory equipment.

Especially, the computers and audio-visual equipment are to be supplied power from a quick response static type AVR (automatic voltage regulator) to avoid the possibility of malfunction and damage caused by momentary voltage regulation.

6) Telephone system

The main unit (telephone exchange equipment) and reception telephone (direct station selector) will be installed in the general affairs office, and extension telephones will be installed in the offices (such as director, department chief, expert), computer room, etc.

The telephone exchange equipment will have a capacity of 5 central office lines and 40 extension lines, with electronic key-telephone system furnished.

7) Electric clocks

Electric clocks will be installed in the following rooms:

- Entrance hall
- Multi-purpose hall
- Laboratories
- Meeting room

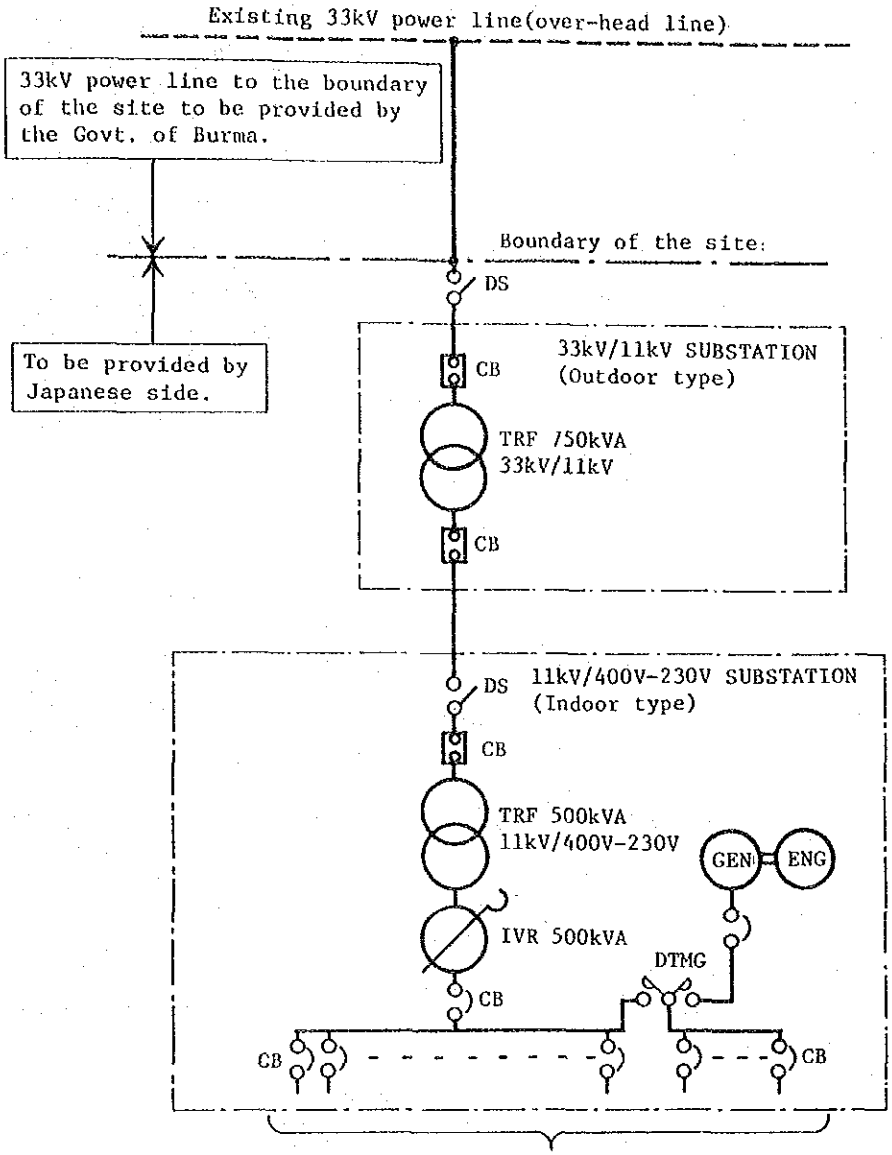
In addition, a carillon will be placed on top of the water tower instead of a clock. The carillon will be operated by a time switch so that it will automatically chime at a certain hour, and control panel will be located in the general affairs office.

8) Fire alarm system

Fire alarm bell and indication lamp will be provided at upper part of fire hydrant boxes, and starting switch for fire hydrant pump will be installed in the inside of fire hydrant box. No fire-detecting sensors will be installed.

9) Lightning protection system

Lightning protection system will be installed to each building to prevent damage caused by lightning.



Note. DS : Disconnecting switch
CB : Circuit breaker
TRF : Transformer
IVR : Induction type automatic voltage regulator
GEN : Generator
ENG : Engine
DTMG : Double throw magnetic contactor

Fig. 4-5 Outline of Power Supply System

(2) Air Conditioning Facilities

The outdoor design air temperature and humidity for the project are set up as follows.

- Temperature: 38 deg. C (D.B.)
- Humidity : 28 deg. C (W.B.)

Indoor design temperature will be approximately 25 deg. C (D.B.)

Rooms to be air conditioned will be the director's office, department chief's offices, meeting rooms, computer room, audio-visual room, reception room and dark room. Natural ventilation system will be provided by architectural design to maintain the comfortable environment in no air conditioned rooms.

1) Air-conditioning equipment system

Air-conditioning equipment system will employ air-cooled separate type air conditioners.

2) Piping system

Piping system will be provided to drain the condensate from air-conditioners.

Piping material will be polyvinyl chloride pipe.

3) Ventilating system

Ventilation fans will be installed to toilets, pantries, kitchen, etc., and ceiling mounted fans will be installed to classrooms, offices, etc.

(3) Plumbing and Sanitary Facilities

1) Potable water supply system

Since there is no city water available in the site, water source will be from wells.

Two deep tube wells will be installed by Japanese side except the drilling works to be prepared by Burmese side.

Well water to be lifted from deep tube well by submerged pump will be stored in the underground reservoir.

After the treatment of removing sand and iron, water is pumped up to

the elevated tank and will be supplied to the necessary area by gravity.

Two main water supply facilities in the site are necessary. One is for Administration & Training building and Laboratory building, and another for the Dormitory building.

The material used for the water supply system will be galvanized steel pipes.

2) Drainage and air vent system

The drainage system will employ a separate system for the soil water and waste water in both outside and inside buildings.

Sewage will be treated by oxidized bed system to be constructed in the site. Treated water will be disposed into atmosphere and underground by means of evaporation and percolation.

Considering the rainy season, overflow pipe will be provided between the percolation area and the lower part of site to discharge the filtered surface water after percolation. Waste water will be disposed by means of evaporation and percolation with installation of overflow pipe.

Gutter to catch the rain water of buildings will be constructed around the building by architectural work, and by culvert, this collected rain water will be drained from gutters to the lower part of site.

Vinyl chloride pipe will be used for all of the internal and external drainage facilities.

3) Fire extinguishing system

Interior and exterior fire hydrant system will be provided.

Interior and exterior common fire pump will be installed in the pump room.

Japanese Fire Prevention Law will be adopted for installation of fire extinguishing system, since there are no such legal regulations in Burma.

Piping material for fire extinguishing system will be galvanized steel pipes.

4) Sanitary fixture installation

Sanitary fixtures suitable for Burmese living custom will be securely installed.

5) Kitchen equipment installation

Considering Burmese practice and meal custom, most food will be cooked by wood fire.

Electric cooking heaters and a refrigerator will be furnished.

6) Incinerator installation

Natural draft type incinerator will be installed.

7) Water supply system for hydraulic laboratory

Water from main elevated tank will be lead to an elevated tank in the hydraulic laboratory via underground resovoir by lift pumps. From there water is to be supplied to both outside and inside hydraulic experimental models by gravity with keeping constant water level in the elevated tank.

Water used in hydraulic experiments will be returned to outside pond through both inside and outside channels.

Water in the pond is to be flowed into underground reservoir and then be reused.

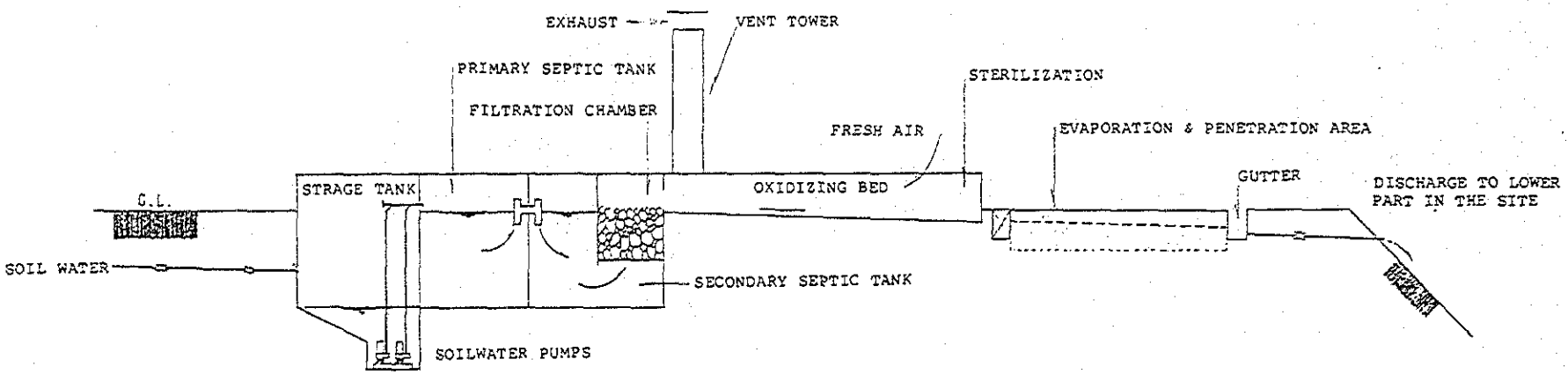


Fig. 4-6 Soil Water Treatment System

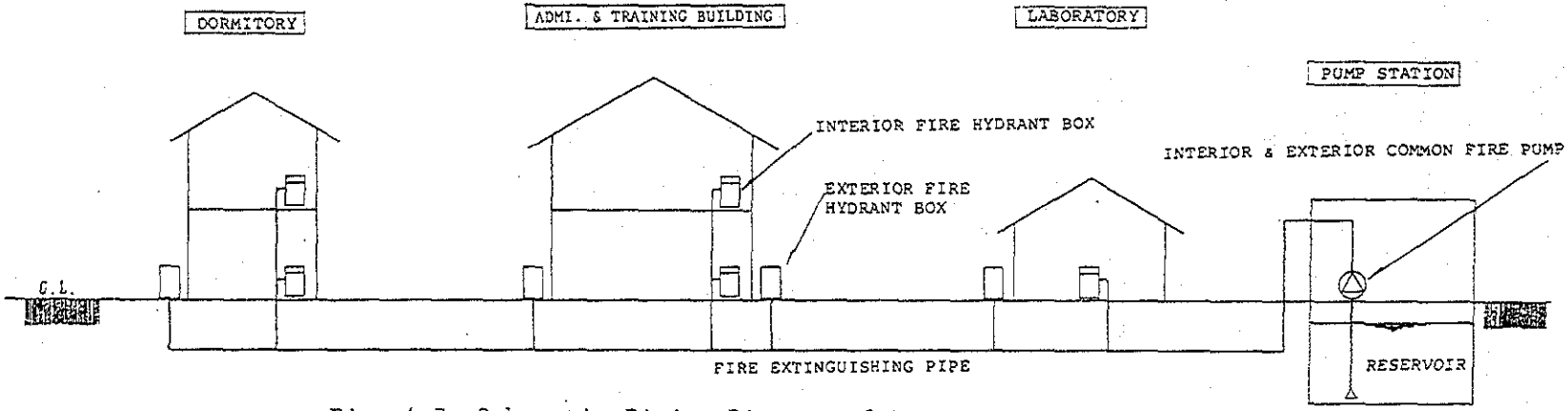


Fig. 4-7 Schematic Piping Diagram of Interior & Exterior Fire Extinguishing System

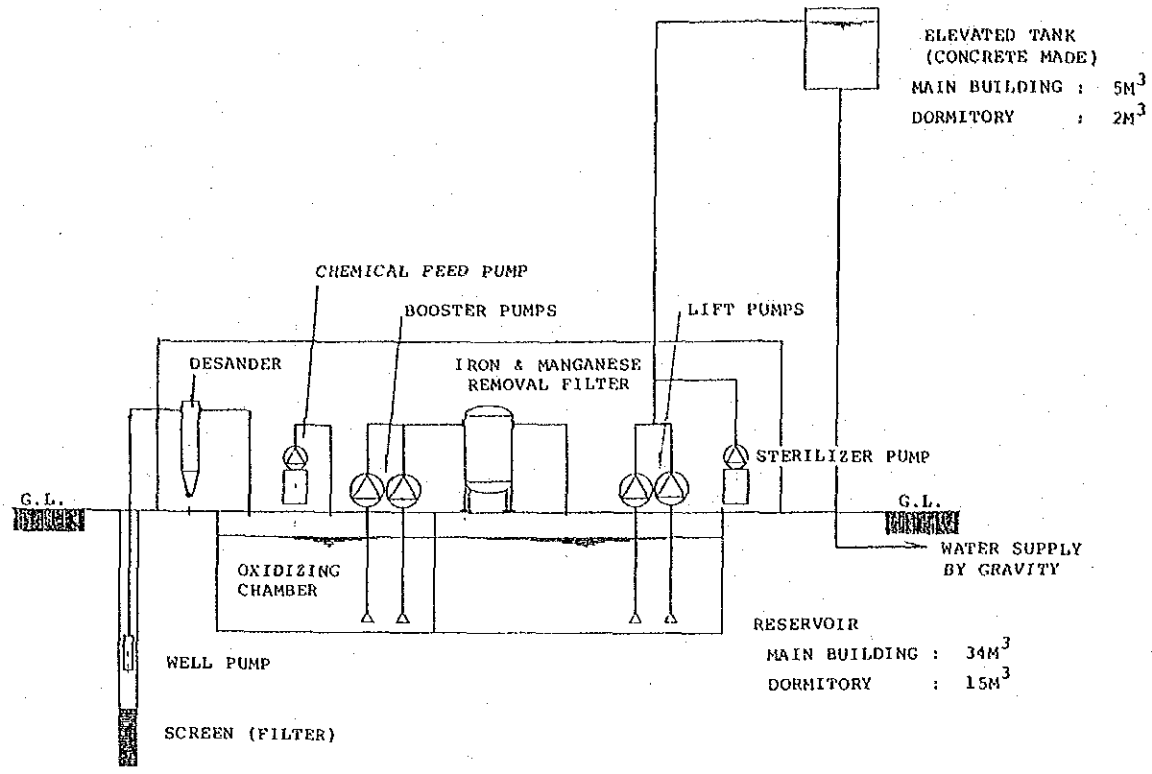


Fig. 4-8 Schematic Piping Diagram of Potable Water Supply

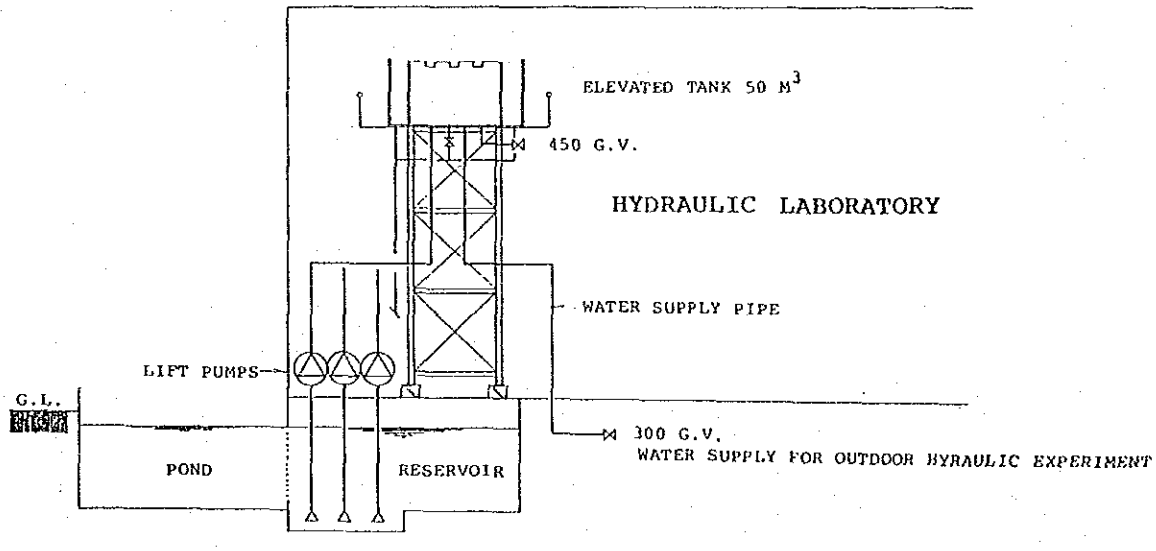


Fig. 4-9 Schematic Water Supply Piping Diagram for Hydraulic Laboratory

4-3-6 Floor Areas

The planned floor area for each building and room is shown below.

(1) Administration and Training Building..... 3,600.0 m^2

1) Administration		936.0 m^2
Director		31.5 m^2
Department Chief (1 x 4rooms)		72.0
Administration Office	(2-Assistant Engineers, 5-Sub Assistant Engineers, 20-Technicians x 2rooms)	99.0
Training Office	(6-Assistant Engineers, 8-Sub Assistant Engineers, 29-Technicians x 3 rooms)	126.0
System Office	(6-Assistant Engineers, 18-Sub Assistant Engineers, 8-Technicians x 3 rooms)	144.0
Laboratory Office	(7-Assistant Engineers, 32-Sub Assistant Engineers)	162.0
Japanese Expert's Room (3 x 1 room)		27.0
Lecturer's Waiting Room		27.0
Reception Room (7 persons x 1 room, 5 persons x 5 rooms)		117.0
Meeting Room (30 person x 1 room, 10 person x 1 room)		108.0
Secretary		22.5

2) Training	904.0 m^2
Computer	162.0 m^2
Classroom (20 persons x 3 rooms)	108.0
Preparation Room	54.0
Audio-Visual (including projection room)	72.0
Library (including book storage)	90.0
Text preparation room(Book-binding, Copying, Printing)	108.0
Drafting Room	54.0
Multi-purpose Hall	256.0

3) Common Use (Entrance Hall, Toilets, Stairs, Corridors, Storage, etc.)	1,760.0 m^2
(2) Laboratory Building	2,685.0 m^2
1) Soil Test Department	540.0 m^2
Consolidation Test Room	36.0 m^2
Direct Shear Test Room	36.0
Water Permeability Test Room	36.0
Triaxial Compression Test Room	36.0
Moisture Content Test Room	18.0
Sample Preparation Room	252.0
Physical, Water Analysis Room	72.0
Large Scale Test Room	54.0
2) Construction Material Test Department	3,780.0 m^2
Cement Physical Property Test Room	36.0 m^2
Aggregate Physical Property Test Room	36.0
Test Piece Curing Room	36.0
Concrete Laboratory	270.0
3) Hydraulic Laboratory Department	1,020.0 m^2
Hydraulic Laboratory	1,020.0 m^2
4) Training Department	135.0 m^2
Hydraulic Training Room (20 persons x 1 room)	63.0 m^2
Assistants Room (36 persons x 2 rooms)	72.0

5) Workshop	180.0 m^2
6) Common Area (Entrance Hall, Toilets, Stairs, Corridors Storages)	432.0 m^2
(3) Dormitory	1,395.0 m^2
1) Bedroom (2 bed x 40 rooms)	540.0 m^2
2) Guest Room (2 bed x 3 rooms)	90.0
3) Superintendent Room	30.0
4) Cafeteria (include Kitchen)	135.0
5) Common Use (entrance Hall, Toilets, Stairs, Corridors Storages, etc.)	600.0
Total	7,680.0 m^2
(4) Other	855.0 m^2
1) Connecting corridor	504.0 m^2
2) Garage	126.0
3) Laboratory Covered Way	225.0
Grand total	8,535.0 m^2

4-4 Equipment

Equipment to be supplied for the project are classified as follows:

1. Computer equipment
2. Equipment for soil, construction material and hydraulic model testing.
3. Audio-visual and training equipment for training and technical information service
4. Vehicles for field observation tour and working machinery for preparation of outdoor hydraulic model testing
5. Workshop equipment

Selection on type of equipment and quantity has been made under the following consideration.

1. Basic types of equipment are so selected as to cope with the future variation of testing and training items although primarily selection of equipment is made considering irrigation project plans to be implemented and research, testing and training program.
2. On the basis of the field survey in respect to the supply of spare parts and operation and maintenance, selected equipment are easily maintained in good condition by the responsible person in charge of the project even after the Technical Cooperation is over.
3. Considering the number of projects to be implemented yearly and of investigation works, required quantity of equipment for training is determined with the frequency of specific experiment carried by two to four groups per one class assigning five persons per one group.

Taking into consideration the operation scope due to capable engineers who manage this center and Technical Cooperation by the Japanese Government, the grade of equipment should be appropriate to conduct testing, research and training. The lists of training equipment is shown as follows:

List of Major Training & Testing Equipment

A. Computer Equipment

No.	Item	Unit	Q'ty
1	Mini-computer System	set	1
2	Digitizer Sub-system		1
3	Digital Plotter		1
4	Graphic Display		1
5	Personal Computer		10
6	Serial Printer		5
7	Data Cabinet		21
8	Blackboard		3
9	Move Rack		1
10	Working Desk		1
11	Maintenance Tools	lot	1
12	Spareparts	lot	1

B. Soil, Construction Material, Hydraulic Model-Testing Equipment

No.	Item	Unit	Q'ty
B1 Soil Test			
1	For survey and sampling of embankment materials		
1-1	Auger drilling apparatus (Post.Hole type)	set	10
1-2	A series of different types of augers		1
2	For survey and sampling to the foundation composed of soil layers		
2-1	Thin wall sampler set	set	1
2-2	DENISON sampler set		1
2-3	Standard penetration test apparatus		1
2-4	Double tube cone penetrometer		1
2-5	DUTCH cone penetrometer		1
2-6	Torque wrench vane shear apparatus		1
2-7	Plate bearing test apparatus		1
2-8	CBR testing set for field use		1
2-9	Soil hardness tester		2
3	For sample preparation		
3-1	Sample preparation set for physical soil test	set	1
3-2	Sample preparation set for mechanical soil test		1
3-3	Tools/devices for shaping undisturbed samples		1
4	For physical soil test		
4-1	Specific gravity test set	set	1
4-2	Moisture content test set		1
4-3	Density test set by paraffin method		1

No.	Item	Unit	Q'ty
4-4	Grain size analysis test apparatus		1
4-5	Liquid limit test set		6
4-6	Plastic limit test set		6
4-7	Shrinkage limit test set		6
4-8	Soil pH measuring apparatus		1
4-9	Soil aggregation analyzer		1
4-10	pH meter (glass pole type)		1
4-11	Organic compounds content test (heating method)		1
4-12	Organic compounds content test set (Dichromic acid method)		1
4-13	Centrifuge moisture equivalent set		1
5	For mechanical soil test		
5-1	Compaction test apparatus (100mm ϕ, 150mm ϕ)		1
5-2	Large-scle compaction test apparatus (200mm ϕ, 300mm ϕ)		1
5-3	Laboratory cone penetration apparatus		1
5-4	Unconfined compression test apparatus		1
5-5	Direct shear apparatus		1
5-6	Triaxial compression test apparatus (100mm)		1
5-7	Large-scale triaxial compression test apparatus (200mm, 300mm)		1
5-8	Unit-type falling-head permeameter (100mm)		1
5-9	Large-scale falling-head permeameter (200mm)		1
5-10	Large-scale constant-head permeameter (300mm)		1
5-11	Six gang consolidation test apparatus		1
5-12	CBR laboratory set		1
6	For quality control test to embankments		
6-1	Field density apparatus		4
6-2	Field density core-cutter (drive-in type)		4
B2	Construction Material Test		
1	For sampling and shaping		1
1-1	Core drilling machine (portable type)	unit	1
1-2	Core drilling machine		1
1-3	Specimen cutting machine		1
1-4	Drilling machine		1
2	Tests to cement		
2-1	Appratus for specific gravity test of cement	set	1
2-2	Appratus for finess degree test of cement		1
2-3	Appratus for coagulation test of cement (VICATA apparatus)		1
2-4	Appratus for swelling test of cement		1
2-5	Appratus for strength test of cement		1
2-6	Appratus for judging the suitableness of sand and water from the compressive strength of mortar		1

No.	Item	Unit	Q'ty
3	Tests to aggregate		
3-1	Sieving analysis apparatus to aggregate		1
3-2	Specific gravity and absorption test apparatus to fine aggregate		1
3-3	Specific gravity and absorption test apparatuss to coarse aggregate		1
3-4	Apparatus for density and real mass percentage of aggregate		1
3-5	LOS ANGELS testing machine	unit	1
3-6	Sodium-sulfate soundness test set	set	1
3-7	Washing analysis sieves set		1
3-8	Harmful object, organic compound, test set to sand		1
3-9	Harmful object, salt, test set to sand		1
3-10	Apparatus for observing rock formation		1
3-11	Soft pieces percentage test set to coarse aggregate by scratching hardness method		1
3-12	Surface moisture test set to sand		1
4	Test to fresh concrete		
4-1	Concrete mixer and shovels		1
4-2	Calorimeter	unit	1
4-3	Dial gage type comparator for length change test		1
4-4	Slump test apparatus		1
4-5	WASHINTON type air meter		1
4-6	Unit weight and air content test set		1
4-7	Bleeding test set		1
5	Tests to hardening concrete		
5-1	Cylinder molds set	set	1
5-2	Compression testing machine (universal type)	unit	1
5-3	Compression testing machine		1
5-4	POISSON's ratio measurement apparatus	set	1
5-5	Spring type creep test apparatus		1
5-6	SCHMIT test hammer	unit	2
5-7	Concrete distribution test apparatus	set	1

B3 Water Quality Test

1	EC meter	unit	1
2	pH meter (glass pole type)		1
3	Water quality apparatus	set	1

B4 Hydraulic Model Testing Equipment

1	Measuring equipment and material		
1-1	Point gauge	unit	25
1-2	Pitot tube, manometer		20
1-3	Inclined type manometer		10
1-4	Flow meter (electric type)		2
1-5	Stepladder		1
1-6	Camera (35mm)		1
1-7	Blackboard		2

No.	Item	Unit	Q'ty
1-8	Drafting instrument		1
1-9	Lighting apparatus	set	10
1-10	Portable concrete mixer		1
1-11	Acrylic plastics		30
2	Open channel model and flume accessories		
2-1	Tilting open channel flume	set	1
2-2	Measuring equipment		2
2-3	Gates		9
3	Automatic carriage for field type flow measuring instruments calibration	lot	1

C. Audio-visual Equipment, Training Equipment for Training and Technical Information Service

No.	Item	Unit	Q'ty
C1	Multipurpose Hall		
1	Audio mixer	unit	1
2	System amplifier		1
3	Audio cassette deck		2
4	Microphone	pcs	2
5	Table top type microphone stand		1
6	Floor type microphone stand		1
7	Monitor speaker		2
8	Main speaker		2
9	Side speaker		2
10	Microphone plate		2
11	Speaker plate		2
12	16 m/m film projector	set	1
13	35 m/m slide film projector with pedestal		1
14	Screen		1
15	Connecting cables		1
16	Component rack		1
17	Light shutter curtain		1
C2	Audio & Visual Room System		
1	1/2" Video casette recorder (VHS)	unit	1
2	Monitor television		1
3	Ceiling-mount color TV set		4
4	Ceiling-mount bracket		4
5	Audio cassette deck		1
6	Microphone	pcs	2
7	Table top type microphone stand		1
8	Floor type microphone stand		1
9	35m/m Slide film projector remote control		1
10	System amplifier	unite	1
11	Lecture table		1
12	Main speaker	pcs	2

No.	Item	Unit	Q'ty
13	Monitor speaker		1
14	Connecting cables	set	1
15	16m/m Film projector		1
16	35m/m Slide film projector w/ pedestal		1
17	Screen		1
18	Light shutter curtain		1
C3	Vidio Editing System		
1	Video mixer	unit	1
2	Telep system		1
3	VHS editing video recorder		2
4	Automatic editing control unit	pcs	1
5	Monitor television	unit	3
6	Audio cassette deck		1
7	Microphone	pcs	1
8	Audio mixer	unit	1
9	Monitor speaker	pcs	1
10	Component rack	unit	1
11	Connecting cables	set	1
C4	Video Picture Taking System		
1	Colour video camera	unit	1
2	Tripod		1
3	Tripod with rolly		1
4	Portable 1/2" video cassette		1
5	Locating lighting kit	set	1
6	Trunk case		4
C5	Video Set for Training & Hydraulic Model Testing		
1	Color TV	unit	2
2	VHS video recorder		2
3	Wagon		2
C6	Text Preparation		
6-1	Processing & plate-making machine	set	1
6-2	Offset printing press		1
6-3	Guillotine paper cutter		1
6-4	Book binder		1
6-5	Stencil cutter		1
6-6	Electronic copier		1
6-7	- do -		1
6-8	Diazo duplicator		1
6-9	Drawing cutter	unit	1
6-10	Perforating tool	set	1
6-11	Electric stapler		1

No.	Item	Unit	Q'ty
C7 Darkroom			
1	Darkroom Set	set	1

D Vehicles for Field Observation Tour and Working Machinery for Preparation of Outdoor Hydraulic Model Testing

No.	Item	Unit	Q'ty
1	Micro bus	unit	2
2	Cargo truck (2 ton)		1
3	Cargo truck (5 ton)		1
4	4-whell drive van		1
5	Fork lift truck		1
6	Vibration roller		1
7	Buldozer w/back hoe		1

E Manufacturing, Repairing, On Training Equipment

No.	Item	Unit	Q'ty
E1 Workshop Equipment			
1	Precision lathe	set	1
2	Foot shearing machine		1
3	Hand lever shear		1
4	Bendch drilling machine		1
5	Electric drouble head grinder		1
6	Electric drill		1
7	AC arc welder		1
8	Hotjet welder		1
9	Oxy-acetylene gas welding		1
10	Parts washing stand		1
11	Portable crane		1
12	Pipe threading machine		1
13	Portable grinder		1
14	Air compressor		1
15	Jig saw		1
16	Circular saw		1
17	Saber saw		1
18	Electric planer		1
19	Universal saw		1
20	Tools and measuring instrument	lot	1
E2 Training and office equipment			
1	Level	set	5
2	Levelling staff		10
3	Hand level		5

No.	Item	Unit	Q'ty
4	Theodolite		5
5	Pole	pcs	20
6	Surveying flag		20
7	Pin Pole		20
8	Measuring tape (stenless steel 100m)		3
9	Measuring tape (stenless steel 50m)		3
10	Measuring tape (s-lon 50m)		5
11	Simple transit	set	3
12	Plane survey set		5
13	Telescopic alidate		5
14	Stadia table	pcs	5
15	Planimeter	set	10
16	Curvimeter		10
17	Stereoscope		5
18	Pocket type stereoscope		5
19	Drafting instrument		10
20	Drafter		10
21	Electronic copier		2
22	Typewriter		10
23	Blackboard		1