BASIC DESIGN STUDY
ON
THE CONSTRUCTION PROJECT
OF
THE ELECTRONIC ENGINEERING POLYTECHNIC INSTITUTE
IN
SURABAYA
IN
THE REPUBLIC OF INDONESIA

APRIL, 1986

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to the request of the Government of the Republic of Indonesia, the Government of Japan has decided to conduct a basic design study on the Construction Project of the Electronic Engineering Polytechnic Institute and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Indonesia a study team headed by Dr. Yoshiyuki NAITO, Professor, Faculty of Engineering, Tokyo Institute of Technology, from December 1 to December 22, 1985.

The team had discussions on the Project with the officials concerned of the Government of Indonesia and conducted a field survey in Surabaya area. After the team returned to Japan, further studies were made, a draft report was prepared and a mission to explain and discuss it was dispatched to Indonesia. As a result, the present report has been prepared.

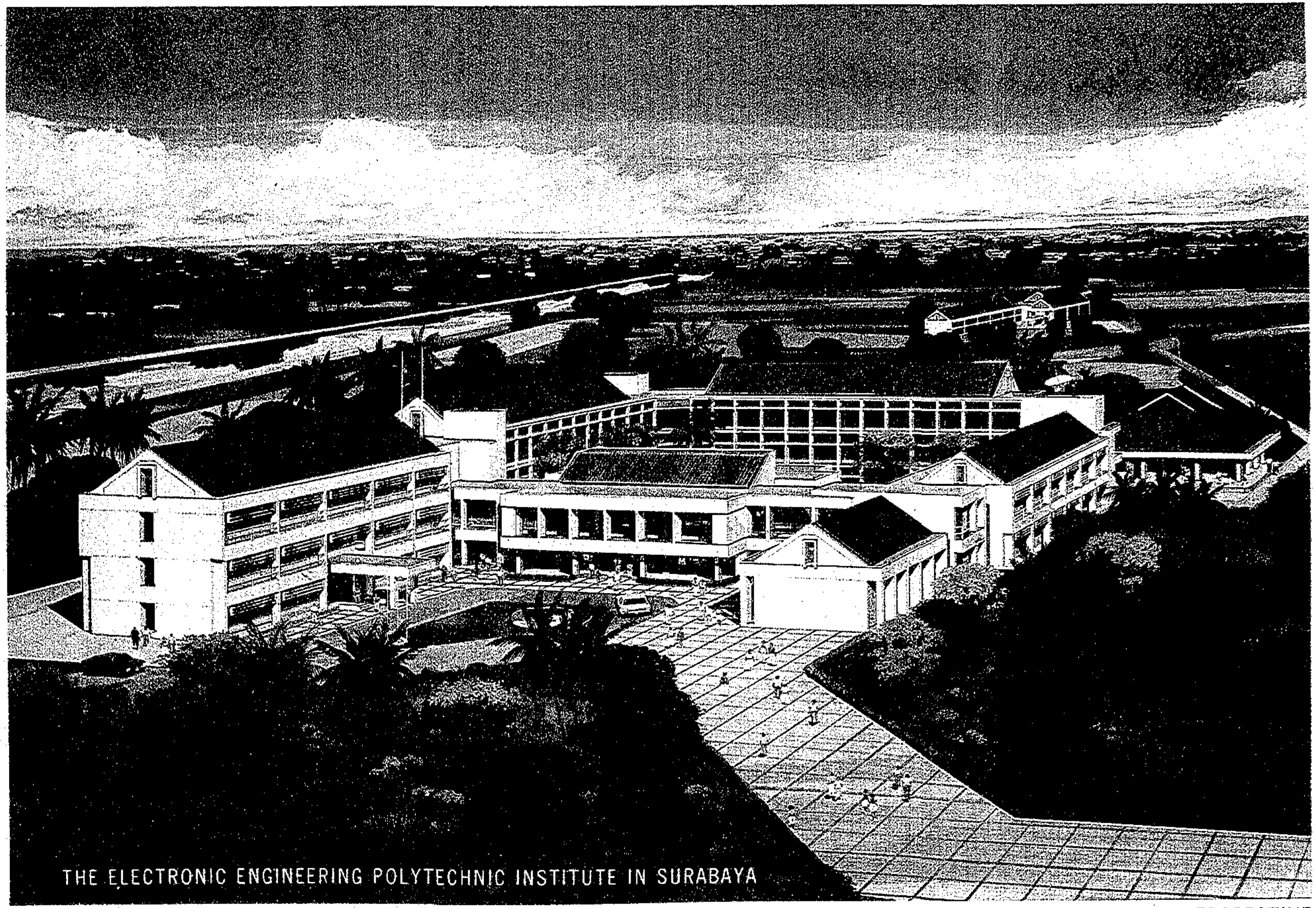
I hope that this report will serve for the development of the project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the team.

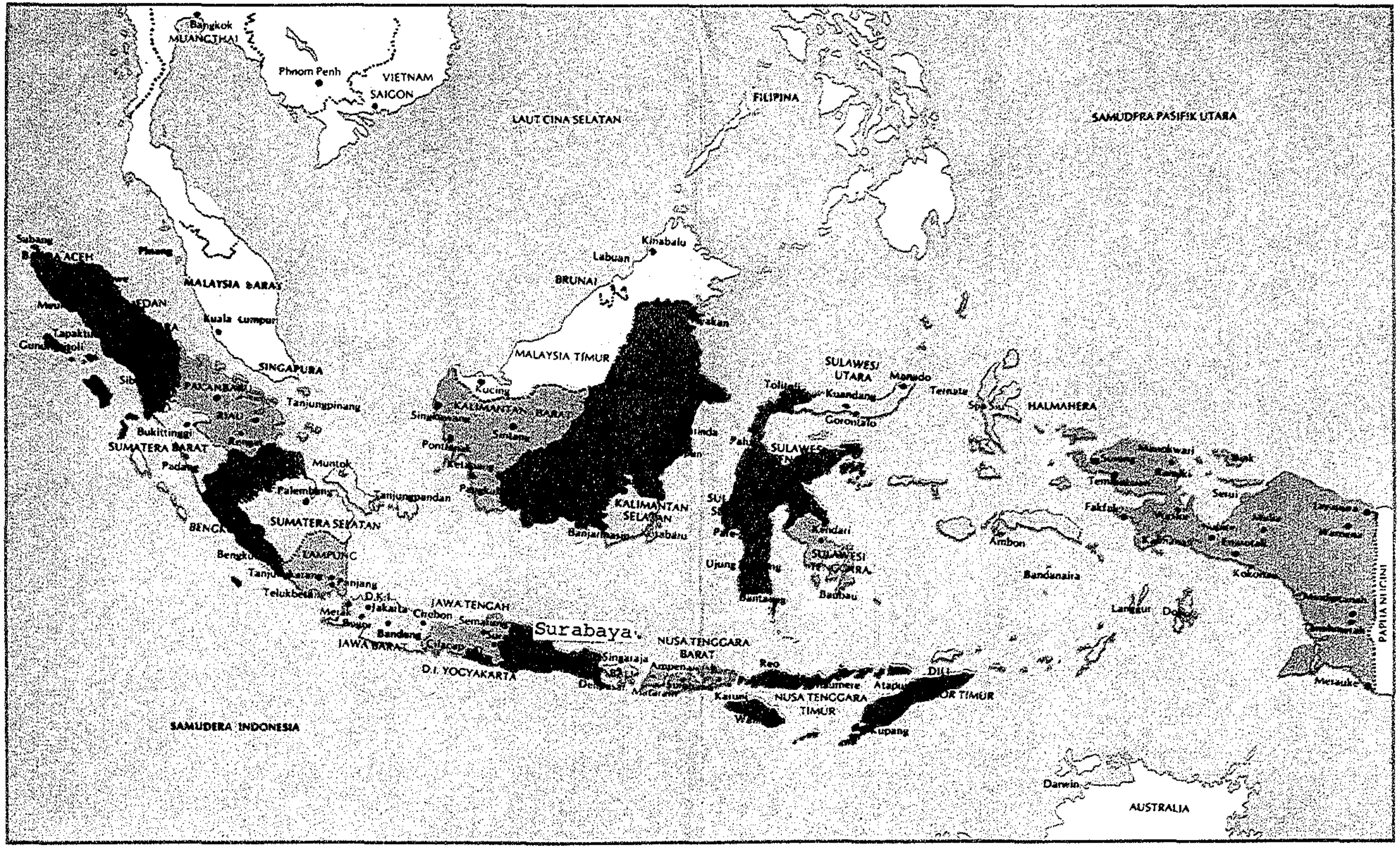
April, 1986.

Keisuke Arita
President
Japan International Cooperation Agency

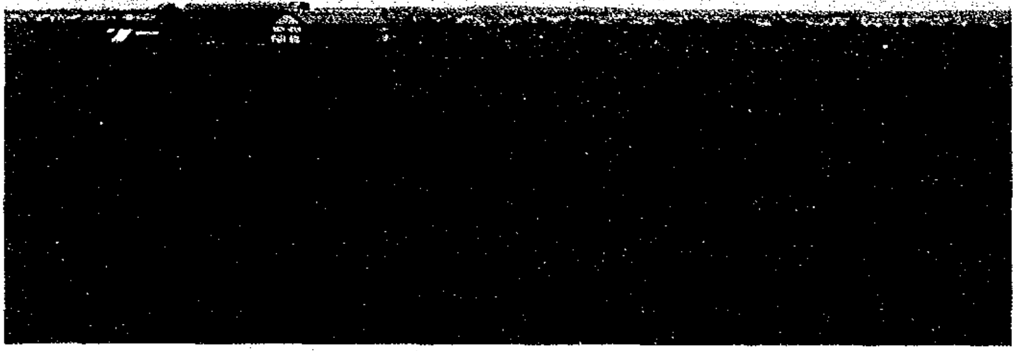
CHAPTER 1
INTRODUCTION



PERSPECTIVE



MAP OF INDONESIA



PROPOSED CONSTRUCTION SITE

SUMMARY

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The Government of the Republic of Indonesia has planned to establish the Electronic Engineering Polytechnic Institute in Surabaya (EEPIS) for the purpose of providing middle-level skilled manpower in the electronic engineering field, as a constituent of the polytechnic education plan, and requested the Government of Japan to extend grant aid for the Project.

In response to the request of the Government of the Republic of Indonesia, the Government of Japan decided to conduct the Basic Design Study for the Project, and the Japan International Cooperation Agency (JICA) dispatched the Basic Design Study Team headed by Dr. Yoshiyuki Naito, Professor, Tokyo Institute of Technology to Indonesia from December 1, 1985 to December 22, 1985 to confirm the contents of the request and study the background of the Project, the appropriateness of the grant aid, the proposed construction site, the Project implementation system, the administration and maintenance organization, and construction situation.

The Government of the Republic of Indonesia has been carrying out the forth five-year development plan since 1984, and the plan places emphasis on industrial development as well as on the promotion of agriculture.
In particular, the maintenance of the growth rate in the industrial sector requires to promote high-level and high-value added productivity of industry to advance one step ahead from the conventional policy of replacing imported products with domestic products. For this reason, qualified engineers and technicians are urgently needed.

Presently Indonesia especially requires more highly skilled technicians engaged in the operation, adjustment, maintenance, and control of technics and equipment introduced from industrialized countries and in the domestic production of these items.

Higher technicians have been educated in faculties of non-degree of universities or academies. However, the education system can not meet the increased social demand for such qualified technicians because of the

shortage of facilities, equipment, and sufficiently experienced teaching staff, and because on-the-job training after employment which is seen in manufacturing firm in Japan is not common in Indonesia.

In consideration of the above conditions, the Government of the Republic of Indonesia has planned to strengthen technical/vocational education in the fourth five-year plan and to adopt this as an important project, that is, the expansion of polytechnic education system for educating higher technicians from graduates of secondary senior high schools and senior secondary vocational schools.

In 1982 six polytechnic institutes were established, through financing by World Bank. Additional eleven polytechnic institutes financed by World Bank and six agricultural polytechnic institutes financed by Asian Development Bank are scheduled to be opened under the present five-year plan.

The Government of the Republic of Indonesia has planned to establish the Electronic Engineering Polytechnic Institute in Surabaya, and has requested the Government of Japan to extend grant aid for the construction of EEPIS as well as technical cooperation based on Japan's advanced technology. EEPIS is scheduled to have two Departments, Electronic Engineering and Electronic Communication Engineering. EEPIS will be included in the above-mentioned polytechnic education system and is to be established in Surabaya, in East Java, where industry has been remarkably developing recently.

The implementation body of the Project is the Ministry of Education and Culture, and EEPIS will be managed under the control of Rector of the Institute of Technology Sepuluh Nopember in Surabaya (ITS). EEPIS will be ranked equal to Faculty of degree program and Faculty of Non-degree of diploma program. Proposed curricula have been developed by the technical cooperation sector of JICA jointly with the EEPIS establishment committee and was tentatively approved by both countries. These curricula will be applied to EEPIS.

The proposed construction site occupies a part of the ITS Sukolilo Campus, and the master plan for the whole campus including facilities of the Project has been established.

The local environmental conditions, the proposed construction site, existing related facilities, and the present construction conditions have been surveyed, considering the curricula noted above and the request from Indonesia. Subsequent to an analysis in Japan, the content and floor area of the facilities and equipment optimal to the Project have been planned as enumerated below.

* Content of facilities

- Lecture, Laboratory & Administration Building
  Consisting of classrooms, laboratories, offices for teaching and administration staff (number of teaching staff: 85; number of administration staff: 24), etc. necessary for education of three years for 120 students per year (two Departments, Electronic Engineering and Electronic Communication Engineering, two classes each).

- Student Dormitory
  Accommodating 72 students.

* Floor area of facilities

- Lecture, Laboratory & Administration Building:
  3-story reinforced concrete building with floor area of 9,083.6m^2
- Student Dormitory:
  2-story reinforced concrete building with floor area of 1,108.7m^2
- Others (including electric building)
  1-story reinforced concrete buildings with total floor area of 89.3m^2

* Content of Equipment

- Education equipment for experiment and practice in the fields of electricity, electronics, and electronic communications.

Local construction methods will be adopted and materials will be procured locally as much as possible to extend local portion. And equipment as well as buildings were planned taking account easy maintenance and cost efficiency. The construction period will be fifteen months.

The maintenance and administration budget of EEPIS will be allocated to ITS by the Ministry of Education and Culture. The estimated annual maintenance and administration budget of 260,000,000 Rp of EEPIS is within the proper range, compared to the converted ITS budget per student.

The establishment of the proposed EEPIS is highly needed and if EEPIS is established as scheduled and managed smoothly, EEPIS is expected to play an important role in continuously upgrading the education level of higher technicians in the electronic and electronic communication industry and, as a result, contribute to the high growth of the industrial sector in Indonesia, and to stabilize economic development of the country.

The construction project of EEPIS as described above is considered sufficiently appropriate. Therefore, it is expected that the grant aid to the Project will be extended by the Government of Japan.

Further efforts, for example, the recruitment of qualified teaching staff to meet the personnel plan, effective utilization of electronics industries in and around Surabaya, study of measures to encourage students to learn on their own initiative such as government licencing system and realization of Japanese Technical Cooperation will be necessary to enhance the educational effect of EEPIS.

CONTENTS

CHAPTER 1 INTRODUCTION

In response to the request of the Government of the Republic of Indonesia to the Government of Japan, the Japan International Cooperation Agency dispatched to Indonesia in July, 1985,a Preliminary Survey Team in connection with project type technical cooperation and grant aid. The objectives of the Survey Team were to study the establishment of the Electronic Engineering Polytechnic Institute in Surabaya (EPPIS) and to confirm and assess the content of the request and determine the outline of related plans. In October, 1985, Japanese Technical Cooperation Long-Term Experts were dispatched to discuss the basic policy of the project with their Indonesian counterparts and made surveys. In December, 1985, the Japan International Cooperation Agency dispatched the Basic Design Study Team after reviewing the results of the above surveys. The Team conducted the following survey to explore the possibility of grant aid for the Project.

(1) Analysis of the background and appropriateness of the project

(2) Survey of education conditions in Indonesia, especially relating to vocational/professional education.

(3) Discussion on content and scale of the project

(4) Confirmation of the project implementation organization, operation and administration system, scope of work, and budget allocation for works undertaken by the Indonesian side.

(5) Survey and evaluation of the proposed construction site.

(6) Survey of existing facilities similar to EEPIS.

(7) Data collecting of the construction situation

This report is based on the above survey in Indonesia and the subsequent analysis in Japan.

CHAPTER 2
BACKGROUND OF THE PROJECT

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2-1 Outline of Relevant Plan

2-1-1 Fourth Five-Year Development Plan

The Government of the Republic of Indonesia published the following eight items in the basic policy of the Forth Five-Year Plan (1984/1985 - 1988/1989)

The basic policy virtually follows the policy of the Third Plan, although there are slight differences in expression.

1) Assurance of food, clothing, and housing

2) Equal opportunity for education and medical care

3) Fair income distribution

4) Equal employment opportunity

5) Equal opportunity for economic and enterprise activities

6) Equal opportunity for youth and women in participating in national development

7) Rectification of imbalance in regional development between Java and other islands

8) Equal opportunity in law

The basic policy states that: "We, the Indonesians, must progress aiming at an impartial and prosperous society by our own efforts through the nation-wide participation of nations in every field and the utilization of manpower and natural resources to a great extent. The present development plan requires further arrangement of plans that have been developed since the First Five-Year Plan together with an enhanced rate of implementation. Emphasis is placed on agriculture for autarky, while heavy and light industries are also to be developed. Other fields such as politics, social culture, and public security are to be further developed, with a balanced development in agriculture and industry." This clearly indicates that the Government places emphasis on development of industry as well as the promotion of agriculture.

2-1-2 Guidelines of Industrial Development

The Fourth Five-Year Plan sets an annual GDP growth rate at 5%, which is rather low compared with than 6.5% in the Third Plan.
However, the target rate of industry is 9.5%, far higher than those of other sectors, indicating that the development of industry has a high priority, as shown in the following table

Sector	Third Five-Year Plan			Forth Five-Year Plan		
	1979 Ratio	1983 Ratio	Average Rate of Growth	1984 Ratio	1988 Ratio	Average Rate of Growth
Agriculture	31.4	27.2	3.5	29.3	26.5	3.0
Mining	17.9	15.9	4.0	7.0	6.1	2.5
Industry	10.2	12.6	11.0	15.8	19.4	9.5
Construction Industry	4.9	5.5	9.0	6.7	6.7	5.0
Transport/ Communications	4.6	5.4	10.0	6.0	6.1	5.2
Others	31.0	33.4	8.1	35.2	35.2	5.0
Total	100.0	100.0	6.5	100.0	100.0	5.0

(Source; Fourth Five-Year Plan)

Table 2-1 Guidelines for Rate of Growth by Sector

The rate of growth in the industrial sector registered results exceeding assigned guidelines; 13.0% in the First Plan, 13.7% in the Second Plan, and 11.4% in the Third Plan. This is attributable to the government policy which substitutes imports with domestic products. This policy allowed entrepreneurs to extend their production nearly to market demand from zero by means of newly invested production equipment and facilities.

Maintenance of a high rate of growth is a target of the Fourth Five-Year Development Plan. This involves the sophistication and high value-added productivity of industry, which in turn demands many technicians with sufficient knowledge and skill provided by higher education.

2-1-3 Current Status of the Electronics Industry

At present the electronics industry is centered on the home electrical appliance manufacturing industry in Indonesia. Few communications instruments appear on the market with the exception of transceivers.

Home electrical appliances being manufactured include radio sets, radio cassette players, B & W TV sets, color TV sets, fluorescent lamps, dry cells, air conditioners, refrigerators, and fans. These electrical appliances are expected to grow further, supported by huge market demand. In the course of growth, models and types will be diversified while the ratio of parts in domestic production will rise gradually.

		1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1.	Radio set	1,000	1,071	1,100	1,090	1,280	1,006	990	1,243	971	662
2.	Radio cassette	160	227	325	547	488	444	836	836	746	729
3.	Black & white TV set	135	165	210	502	573	846	472	475	437	347
4.	Colored TV set	-	-	2.7	24	38	53	135	168	167	170
5.	Electric bulb	18,900	20,980	24,800	24,872	29,000	32,533	-	-	-	-
6.	Decorative lights	67	466	1,200	2,182	1,240	2,829	2,584	1,216	4,330	2,410
7.	Dry cell	144,000	288,000	420,000	478,000	420,000	515,000	549,347	582,375	649,783	692,427
8.	Air conditioner	24	27	30	32	22	35	37	43	55	57
9.	Refrigerator	25	40	50	71	75	76	82	95	96	115
10.	Electrical fan	128	143	166	177	190	173	245	332	324	273
11.	Rice cooker	11	12	19	19	1.2	7	32	32	55	30
12.	Loud speaker	-	-	637	600	700	700	1,415	1,994	1,285	1,712
13.	Variable resistor	-	-	269	852	800	900	1,828	2,654	1,675	2,192

(Source: Technical Cooperation Long-Term Experts Survey Report)

Table 2-2 Transition of Home Electrical Appliances Production by Type (unit : 1,000 pieces)

On the other hand, communication equipment such as telephones and car telephones was not manufactured domestically until 1983. Statistics suggests that the communication equipment industry entered the take-off stage in 1984.

The communication equipment industry is supported by the huge potential demand of the Government industrial sector and of local government authorities. Three companies have been established in anticipation of future market size.

Communication Equipment	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
Telephone set (1,000 subscribers)	0	40.3	120	120	175	230
Car telephone (base/car)	0	3/600	6/1,200	7/1,400	8/1,600	9/1,800
Rural telephone (base/subscribers)	0	15/750	28/1,000	28/1,400	28/1,400	28/1,400
Urban telephone (line unit)	0	25,000	105,000	105,000	157,000	210,000
Small earth station	0	8	10	20	20	20
HF - SSB (unit)	0	2,500	2,700	3,000	3,500	3,500
VHF/UHF single channel (unit)	0	1,400	2,250	2,700	4,000	5,000
TV relay station (station)	0	50	120	130	140	140
Radio Broadcast (station)	0	20	20	21	22	23
Radio Transmitter (unit)	0	0	10	35	40	45
Multiplex (unit)	0	0	6,500	6,500	9,500	12,500
Radio & Wind sound (unit)	0	4,000	5,000	6,000	7,000	9,000
PABX (line)	0	20,000	22,000	22,000	22,000	22,000

(Source: Technical Cooperation Long-Term Experts Survey Report)

Table 2-3 Predicted Production Trend of Communication Equipment by Type

The description of the current status of the electronics industry in Indonesia is based on the Technical Cooperation Long-Term Experts Survey Report written in November, 1985.

In conclusion, in light of the world trend in both industrialized and developing countries, electronics industry in Indonesia will definitely find a wide range of applications in all industry fields, not limited to directly related industries, although the electronics industry still remains at level of the home electrical appliance manufacture at present.

2-1-4 Higher Education System

The general features of the higher education system in Indonesia followed the pattern of the Dutch higher education system. However, a new higher education system was introduced in 1979, and the conventional system was switched to the credit system.

Based on the new system, the higher education system in Indonesia is divided into two main streams: one is the academic stream and the other is the vocational/professional stream.

Students in Stratum I (SI) of the academic stream obtain 140-160 credits within a minimum of four years and a maximum of seven years after entrance. Graduates from SI are given the degree of Sarjana and are allowed to enter Stratum II (SII)/Pasca - Sarjana Level and Stratum III (SIII)/Doctor Level successively.

The vocational/professional stream consists of several diploma programs, and graduates from this stream are given Diplomas, DI, DII, or DIII, according to the type and term of program they complete.

The educational institutes for the vocational/professional stream consist of three types of schools; (1) Non-Degree Faculty (3-year course) situated as a department of a university, (2) academies (most are private) set up for the needs for technicians in various field and which are under the control of Ministries other than the Ministry of Education and Culture, and (3) special institutes such as nursing schools with 2-year or 1-year course.

Graduates from Non-Degree Faculties (3-year course) can enter the fourth year of SI, on the condition that they pass the entrance

examination with professional experience for a specified term. However, as a matter of fact, it is extremely difficult to pass the examination.
Even though they are allowed to enter SI, they have to start in courses for the first or second year because the placement test is also difficult. To add to this, the prolonged period of study causes heavy expenses, which makes the system almost impractical.

Higher education system has been administered under the above described system. This, however, has not necessarily contributed to rapid national development. In particular, the following problems are pointed out in the academic stream.

1) The high repeater rate prolongs the normal period of study and inflates the total number of students, adversely affecting educational efficiency.

   In particular, there are many students who work besides studying to pay their school expenses. And insufficient study time under such condition delay their graduation for as long as 7-10 years.

2) Enrollment in higher education institutions is expanding needs while facilities and teaching staff for applicants are completely insufficient.

3) The operation budget is not adequate.

4) The insufficient budget for personnel expenses and low salaries for official personnel degrade the quality of teaching and administration staff.

5) The traditional tendency of esteeming theory fails to meet demands which require practical ability.

In the vocational/professional stream, which is expected to be the source of middle-level skilled manpower, the Non-Degree Faculty adopts the SI curriculum from the first year to the third year only mechanically. This causes students to be graduated with both theory and practice left incomplete.

The number of Academies is 350 (including 300 private academies). Although there are some excellent academies and students, academies generally suffer from insufficient facilities, equipment, and teaching staff for experiment and practice. The academies therefore adopt a theory-oriented curriculum. The large number of academies proves that the vocational/professional stream is in high social demand.

The necessity of universities is recognized by the Government of the Republic of Indonesia, as a matter of course, where manpower is educated to take charge of research and development. However, the Government has come to place greater value in the middle-level skilled manpower rather than university graduates. Such manpower is ranked between senior vocational school graduates and university graduates, and is expected to engage in the operation, adjustment, maintenance, and domestic production of technology and equipment introduced from foreign countries.

In fact, the higher education system was not well established to the extent that the education of middle-level skilled personnel meets the increased social demand for such manpower, though such manpower was trained in Non-Degree Faculties or academics as shown above.
This is because (1) insufficient facilities, equipment, and teaching staff did not allow sufficient performance of practice subjects and, as a result, there is a considerable difference between the actual capability of graduates and the capability expected by industry and, (2) the social structure of Indonesia makes it difficult to perform on-the-job training after employment as prevalent in Japan.

For these reasons, the Polytechnic Establishment Plan was drawn up to bring up ready-to-work middle-level skilled manpower after graduation by implementing higher education for graduates from secondary senior high schools and senior vocational schools for two or three years, using job-oriented curricula with emphasis on experimentation and practice.

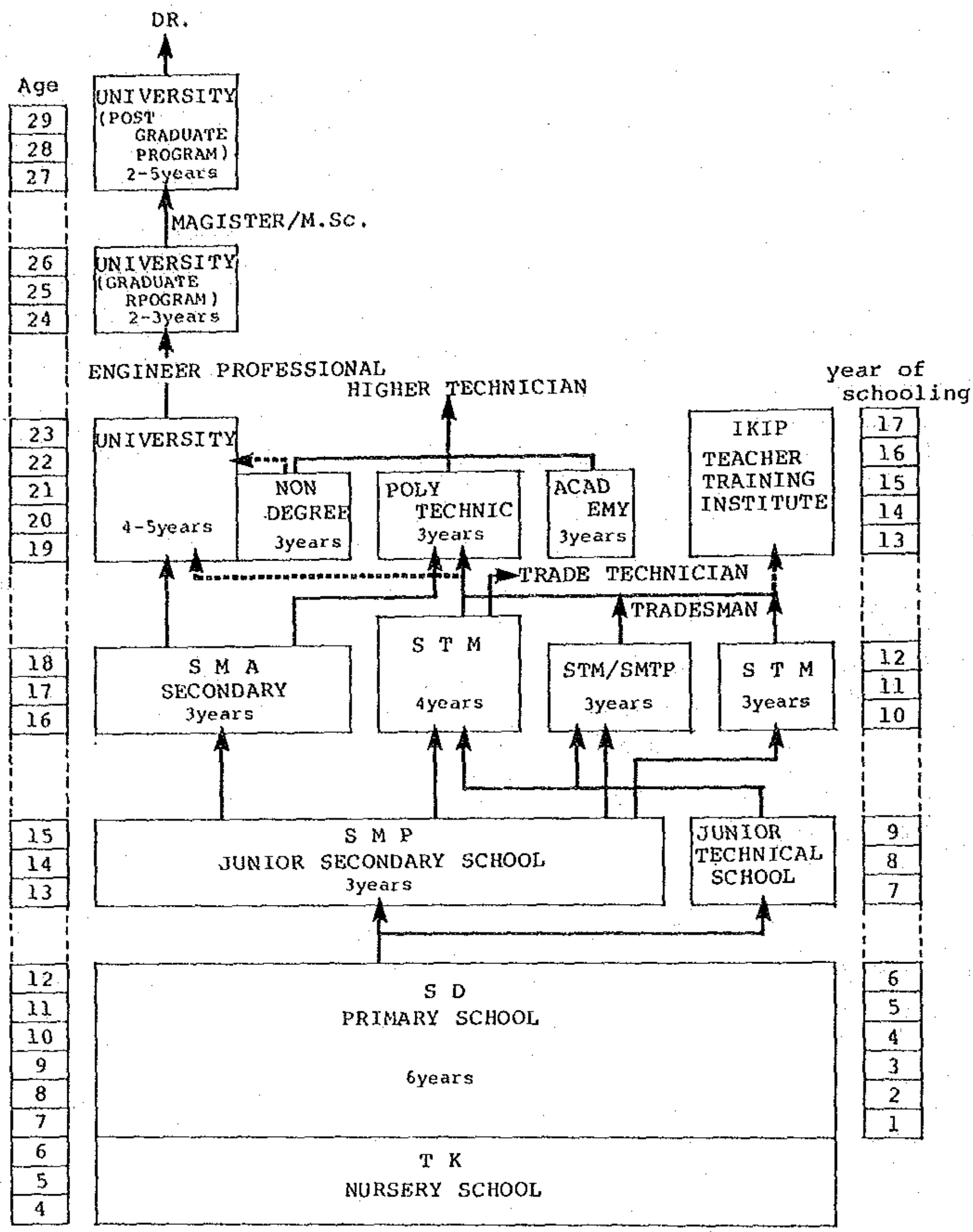

Fig. 2-1 Diagram of Indonesian Education System

2-1-5 Polytechnic Plan

(1) First polytechnic plan

Considering the necessity of the above mentioned middle-level skilled manpower, the Government of the Republic of Indonesia has started to establish polytechnics, financed by World Bank.

The purpose of the polytechnic is to educate graduates of secondary senior high schools and senior secondary vocational schools for two or three years and to bring up middle level-skilled manpower through practice-oriented curricula. Practice and experiment amount to 55% while theory and lecture amount to 45%. The graduates from the polytechnic are given Diploma, DIII of vocational/professional stream.

Six polytechnics were established based on the First polytechnic plan in 1982. These polytechnics are placed as the diploma program 3-year course attached to national universities or institutes in Bundung, Medan, Palembang, Jakarta, Semarang, and Malang. Electrical/Electronic, mechanical, and civil engineering departments are provided in these polytechnics which have a total enrolling capacity of 1,488 students per year in total.

Department/ Polytechnic	Electric/ Electronic	Mechanical	Civil	Total
Bandung	48 (2)	48 (2)	48 (2)	144 (6)
Medan	96 (4)	96 (4)	96 (4)	288 (12)
Palembang	-	96 (4)	96 (4)	192 (8)
Jakarta	96 (4)	96 (4)	96 (4)	288 (12)
Semarang	96 (4)	96 (4)	96 (4)	288 (12)
Malang	96 (4)	96 (4)	96 (4)	288 (12)
	432 (18)	528 (22)	528 (22)	1488 (62)

(Source: PEDC)

Table 2-4 Number of Students per Year by Polytechnic and by Department in the First Polytechnic Plan
Figures in parenthesis show number of classes

(2) Second Polytechnic Plan

In succession to the first Polytechnic Plan, the Second polytechnic Plan is about to start. The Establishment of 11 new polytechnics and the expansion of existing polytechnics are planned with finance amounting to 104.7 million U.S. dollars from the World Bank.

4 Polytechnics out of the 11 new polytechnics will offer 3-year courses and the other 7 will have 2-year course. Various departments will be provided, according to the circumstances of each polytechnic. (Table 2-5)

In addition, six existing polytechnics will have additional classes in each department and several newly organized departments, such as Chemical Processes, Aeromechanics, Casting, Secretary, Accounting, and Banking.

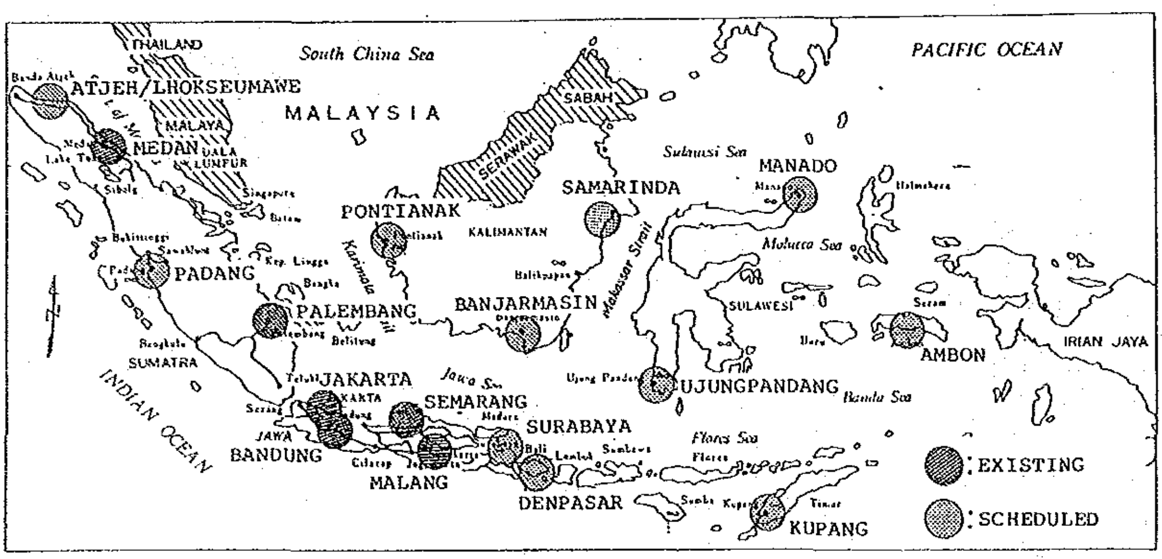

Fig. 2-2 Placement Plan of Polytechnics

Polytechnic	Department	Electric/ Electronic	Mecha- nical	Civil	Chemis- try	Ship- building	Secre- tary	Accoun- ting	Tour- ism	Total
3-year course	Ache/Lhok-seumawe	96 (4)	96 (4)	96 (4)	96 (4)	-	-	-	-	384 (16)
	Padang	96 (4)	96 (4)	96 (4)	-	-	-	-	-	288 (12)
	Ujung Pandang	96 (4)	96 (4)	96 (4)	96 (4)	-	-	-	-	384 (16)
	Surabaya	-	-	-	-	192 (8)	-	-	-	192 (8)
	3-year course total	288 (12)	288 (12)	288 (12)	192 (8)	192 (8)	-	-	-	1,248 (52)
2-year course	Denpasar	48 (2)	48 (2)	72 (3)	-	-	72 (3)	72 (3)	96 (4)	408 (17)
	Kupang	48 (2)	48 (2)	72 (3)	-	-	-	-	-	168 (7)
	Samarinda	48 (2)	48 (2)	72 (3)	-	-	72 (3)	72 (3)	-	312 (13)
	Banjar masin	48 (2)	48 (2)	72 (3)	-	-	-	-	-	168 (7)
	Ambon	48 (2)	48 (2)	72 (3)	-	-	-	-	-	168 (7)
	Manado	48 (2)	48 (2)	72 (3)	-	-	72 (3)	72 (3)	-	312 (13)
	Pontianak	48 (2)	48 (2)	72 (3)	-	-	-	-	-	168 (7)
	2-year course total	336 (14)	336 (14)	504 (21)	-	-	216 (9)	216 (9)	96 (4)	1,704 (71)
	Total	624 (26)	624 (26)	792 (33)	192 (8)	192 (8)	216 (9)	216 (9)	96 (4)	2,952 (123)

(Source: PEDC)

Table 2-5 Number of Students per Year by Polytechnic and by Department in the Second Polytechnic Plan (Newly Established Polytechnics)
Figures in parenthesis show number of classes

Polytechnic	Department	Electric/ Electronic	Mecha- nical	Civil	Chemis- try	Aero- mechanics	Cast- ing	Secre- tary	Accoun- ting	Bank	Total
3-year course	Bandung	48(2)	96(4)	-	48(2)	120(5)	-	48(2)	48(2)	48(2)	456(19)
	Medan	48(2)	48(2)	-	-	-	-	96(4)	96(4)	96(4)	384(16)
	Palembang	144(6)	-	-	96(4)	-	-	72(3)	72(3)	-	384(16)
	Jakarta	48(2)	48(2)	96(4)	-	-	-	96(4)	96(4)	96(4)	480(20)
	Semarang	48(2)	48(2)	96(4)	-	-	-	120(5)	120(5)	96(4)	528(22)
	Malang	48(2)	-	96(4)	96(4)	-	-	120(5)	120(5)	-	480(20)
	Total	384(16)	240(10)	288(12)	240(10)	120(5)	-	552(23)	552(23)	336(14)	2,712(113)

(Source: PEDC)

Table 2-6 Number of Students per Year by Polytechnic and by Department in the Second Polytechnic Plan (Expansion of the First Plan)
Figures in parenthesis show number of classes

(3) Establishment of agricultural polytechnics

Apart from the first and second polytechnic plans, the Government plans to newly establish six agricultural polytechnics in 1987, financed by the Asian Development Bank. These agricultural polytechnics will have departments such as food crops, agricultural engineering, animal husbandry, dry farming, fishery, and forestry.

(4) Position of polytechnics in the vocational/professional stream

Six existing polytechnics belong to the diploma program of universities and are not institutes independent of universities.

Some universities have Non-Degree Faculties as diploma program. Some polytechnics are provided as Faculties in the diploma program separated from the Non-Degree Faculty, while the other polytechnics are ranked under the umbrella of the Non-Degree Faculty. Thus, polytechnics are ranked at the discretion of universities according to the particular situation to each university.

The integration of Non-Degree faculties, academies, and newly established polytechnics coexisting at the DIII level of the vocational/professional stream should be considered in terms of educational efficiency.

Some argue that both Non-Degree faculties and academies have problems in educational programs, while polytechnics are better suited to social needs. This argument has led to the following concept. The Non-Degree faculties of the university should be absorbed in the polytechnics in the university while academies should be incorporated into the polytechnic education system in the form of independent polytechnics. Academies including private academies should be awarded subsidies in the future and guided to the PEDC standard in curriculum, personnel, facilities, and equipment.

However, integration of these three education institutions has not yet been budgeted or stipulated partially because academies are under the control of Ministries other than the Ministry of Education and Culture. As a result, coexistence of the Non-Degree faculty, academy, and polytechnic will continue for the time being.

(5) Target of technical level

The rank of the technical labor force is classified in response to academic careers as below.

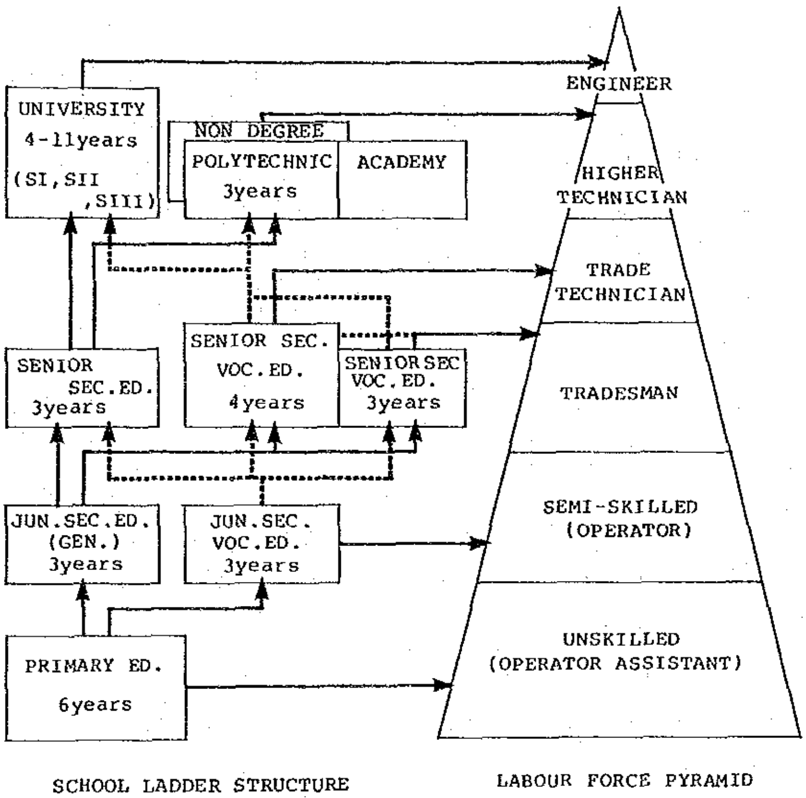

Fig. 2-3 Structure of School Type and Labor Force

Graduates from polytechnics are supposed to reach the technical level of higher technician. the higher technician should have the following abilities.

1) To assist, in a manufacturing firm, engineers graduated from universities.
2) To establish and manage his or her own company after practical experience for a certain period.
3) To take charge of a project from planning, designing to

implementing at his or her own initiative.

4) To serve as a teacher in the technical education or vocational training institutions.

It is difficult to predict the future job rank of polytechnics graduates in private companies because no information is available at present. Because the first graduates from the six existing polytechnics entered business in 1985. However, current research for graduates from the academies at the DIII level shows that the graduates are posted to supervisory jobs such as section chief and factory manager in home electrical appliances manufacturing firms, which are typical employers of the academy graduates. Some manufacturers utilize the ability of the academy graduate in the research and development department.

The current research suggests that polytechnic graduates will be posted to similar jobs.

(6) Teacher education and training plan

The serious constraint on the higher education institutions in Indonesia is how to ensure teaching staff to cope with increasing students.

1) The population rate of students for the higher education institutions is likely to increase from 5.1% in 1984 to 8.2% in 1988.

2) The institutions have a capacity of accepting only 20 - 30% of applicants at present.

3) A key to responding to the increasing number of students is to ensure teaching and administration manpower.
   Generally, the ratio of the teacher to the student is as low as 1:18 in average of engineering faculties. Teachers with a degree of SII or SIII are only 14% of total teachers.

4) The quality and quantity of teachers must be improved or increased to expand higher education.

Few SI graduates who wish to be teachers in technical education because of the low salary standard.
Insufficiency of qualified engineers has rapidly raised the salary standard in modern industry in Indonesia (up to 4 -5 times as much as the salary of the education sector). At the same time, engineers in the industrial sector will not transfer to the education sector.

Polytechnic Education and Development Center (PEDC) was established on the premise of the Polytechnic attached to Institute of Technology, Bandung in order to organize and supervise the Polytechnics in the country. As a part of is activities, PEDC educates and trains graduate engineers and technicians to fit their abilities to the needs of the industrial sector.

The activities of PEDC are listed below.

1) Education and training of polytechnic teachers.

2) Development and research of curriculum and teaching materials.

3) Coordination of education programs in existing polytechnics.

4) Re-training of polytechnic teachers

In addition, PEDC is responsible for coordinating the construction plans of all polytechnics to be newly established.

The types of the polytechnic teachers are roughly divided into lecturer, instructor, and assistant technician. The teachers are to be trained in PEDC for 1 - 3 years before being assigned to each polytechnic.

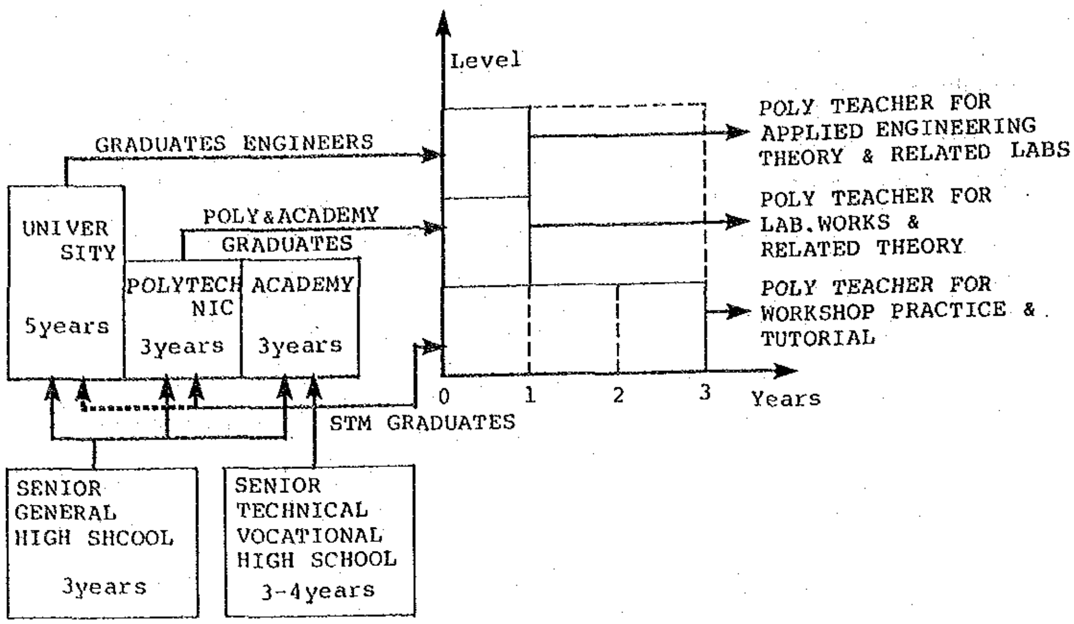

Fig 2-4 Polytechnic Teacher Education and Training in PEDC

At least 700 teachers are required in the Second Polytechnic Plan, but PEDC does not have the capacity to accept so many teachers. Therefore, the Ministry of Education and Culture is planning to dispatch 275 teachers to Switzerland, France, Australia, etc. for 8-20 months for overseas training in and after 1987.

The Ministry of Education and Culture has expanded the scope of recruitment to cover graduates from teacher training center of vocational training facilities and existing six Polytechnics, retired engineers from public sector, retired technical officers etc.
And part-time condition of teachers of the degree program can be accepted. Thus, recruitment of qualified and dedicated teachers is given priority among problems in a series of Polytechnic programs.

2-2 Background and Content of Request

The outline of relevant plan (2-1) has shown that the polytechnic establishment plan is urgently needed, especially the improvement of the electronic engineering department to keep pace with the growing electronics industry.

Careful consideration was given to selecting Surabaya for establishing Electronic Engineering Polytechnic Institute in Surabaya (EEPIS) to be attached to the Institute of Technology Sepuluh Nopember in Surabaya (ITS). Attention was drawn to the fact that only the Surabaya Polytechnic has no program to have an electric/electronic department amount the ten 3-year course polytechnics and that Surabaya is a strategic point of East Java where electronics manufacturers are present and the population is rapidly increasing with the development of the industrial estates in recent years. EEPIS is not included in the Second Polytechnic Plan financed by the World Bank, but will be opened on the condition that it becomes one of the constituents of the Polytechnic Education System established by the Ministry of Education and Culture. The Government of the Republic of Indonesia has requested the Government of Japan to extend grant aid and technical cooperation for the project since Japan has advanced technology in this field.

The outline of the original request is as shown below.

(1) Objectives

To establish the Electronic Engineering Polytechnic Institute for educating middle-level skilled manpower needed by the electronics industry.

(2) Requesting authority

Directorate General of Higher Education, Ministry of Education and Culture.

(3) Management and Administration Organization

Institute of Technology Sepeluh Nopember in Surabaya (ITS)

(4) Proposed construction site

Sukolilo Campus, ITS, Surabaya

(5) Education plan

1) Department and number of students

- Electronic Engineering Department: 75 students/year
- Electronic Communication Engineering Department: 75 students/year

2) Education term : 3 years

3) Number of teaching staff : 94

4) Number of administration staff : 24

5) Curriculum : Curriculum drafted by ITS on the basis of the PEDC standard curriculum

(6) Facilities

- Classrooms, laboratories, staff rooms, etc.
- Meeting rooms, library, etc.
- Student Dormitory, re-training facilities for employed technicians

(7) Equipment

- Educational equipment for experiment and practice
- Furniture
- Books and teaching materials

CHAPTER 3
OUTLINE OF THE PROJECT

CHAPTER 3 OUTLINE OF THE PROJECT

3-1 Objectives

The objective of this project is to establish the Electronic Engineering Polytechnic Institute in Surabaya (EEPIS), as a part of the Polytechnic Education System, in Sukolilo Campus of the Institute of Technology Sepeluh Nopember in Surabaya (ITS), and to educate middle-level skilled manpower involved in the electronics industry. Consequently it is expected that EEPIS will contributes to the upgrading of the level of industry in Indonesia.

3-2 Review of Content of Request

Education of middle-level skilled manpower in the electronics engineering field in Indonesia is urgently needed as stated in Chapter 2, and this project is significantly appreciated.

The contents of the request are regarded as most appropriate. However, the following items in the request have been modified through discussion with the Indonesian side in the preliminary survey and basic design study stage.

(1) Number of students

The number of students has been reduced from 75 per department per year to 60 per department per year (2 classes, 30 students per class) in consideration of education effect and the efficient utilization of educational equipment.

(2) Number of teaching and administration staff

With a decrease in the number of students, the number of teachers has been reduced from 94 to 85.

(3) Facilities

The re-training facilities for employed technicians have been excluded from the scope of the Project in the light of management and administration since vocational training facilities should not be mixed with educational facilities.

(4) Equipment

Educational equipment and technical books are included in this project, but general furniture, general books, and education materials are excluded.

3-3 Outline of the Project

3-3-1 Implementation, Maintenance and Administration Organization

The implementation Body of the Project is the Ministry of Education and Culture. The Ministry is responsible for the implementation of the Project and for negotiations on procedures concerned with execution of the Project along with other ministries.

Actually, the Directrate General of Higher Education and the EEPIS Establishment Committee under the control of the Rector of ITS will fulfill their respective works in the Project.

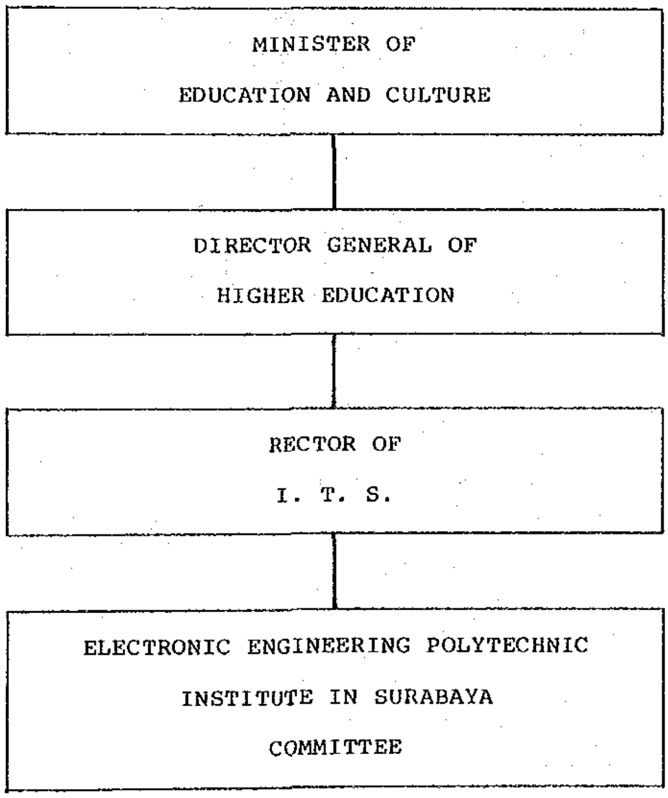

Fig. 3-1 Organization Chart for Implementing the Project

ITS takes charge of education, maintenance, and administration of EEPIS after EEPIS is opened. EEPIS will be situated along with each Faculty of Stratum I and Faculty of Non-Degree of Diploma III (Fig. 3-2).

As stated in 2-1-5 (4), Position of Polytechnics, each of the existing Polytechnics belongs to the vocational/professional stream of each university, but relationship of Polytechnic to Faculty of Non-Degree in the same DIII level differs from one university to another. In this Project, it is regarded as appropriate that EEPIS should be managed and operated as a Faculty independent of Faculty of Non-Degree in consideration of number of experiment hours and difference of academic staff organization between Faculty of Non-Degree.

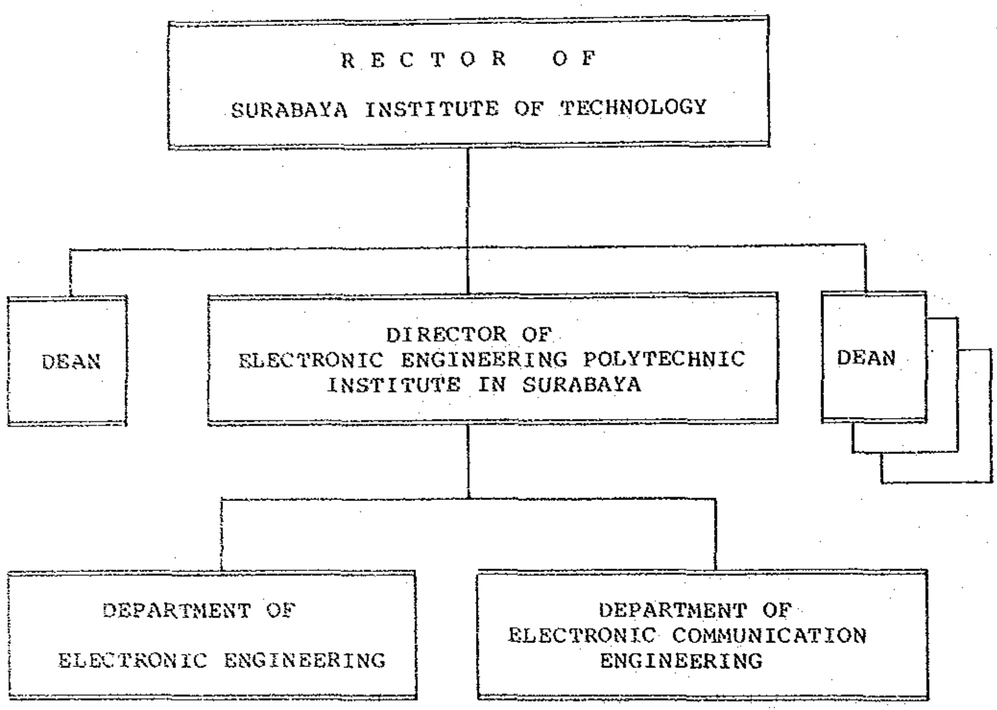

Fig. 3-2 Education, and Administration Systems of EEPIS

Originally, ITS was established as a private higher technical institution in 1957, and became a public institution in 1960. Since 1983, the conventional faculties have been re-organized into the present five faculties.

. Sarjana Program (160 credits)	1. Faculty of Mathematics and Sciences (Physics, Mathematics, Statistics, and Chemistry)
	2. Faculty of Industrial Technology (Mechanical Engineering, Electrical Engineering, Chemical Engineering, and Engineering Physics)
	3. Faculty of Civil Engineering and Planning (Civil Engineering, Architectural Engineering, and Sanitary Engineering)
	4. Faculty of Marine Technology (Shipbuilding, Marine Engineering, and Ocean Engineering)
. Diploma Program (110 credits)	5. Faculty of Non-degree (Civil Engineering, Mechanical Engineering, Electrical Engineering, Shipbuilding, and Chemical Engineering)

(Source : ITS)

Table 3-1 Faculties and Study Programs of ITS

The number of students and staff of ITS are as follows;

Number of Students	Sarjana Program	5098
	Faculty of Mathematics and Science	547
	Faculty of Industrial Technology	2476
	Faculty of Civil Engineering and Planning	1510
	Faculty of Marine Technology	565
	Diploma Program	1811
Total		6909
Number of Teachers	Full-time	397
	Part-time	203
Number of Administration Staff		511
Full-time Teachers/Students		1 : 17.4
Administration Staff/Students		1 : 13.5

(Source : ITS)

Table 3-2 The Number of Students and Staff of ITS 1985/1986

ITS had its faculties scattered to three Campuses (Manyar, Cokroaminoto, and Baliwerti), with management efficiency reduced. Since 1973, ITS has progressed a plan to integrate all the faculties in the Sukolilo area on the east of Surabaya financed by Asian Development Bank.

Facilities of the Faculty of the Industrial Technology, Faculty of the Civil Engineering, etc. of Sarjana Program have been removed to the Sukolilo Campus, where education was started since March 27, 1982.

The subsidy on the research project from the Ministry of Education and Culture increased in 1985 by 260% compared with that in 1984 as described later. This indicates a rapid rise in the education level of ITS as well as satisfactory management. There is no problem with the ability of ITS, the management and administration body of EEPIS.

3-3-2 Education Plan

Electronic engineering shares a lot of common basic regions with communications engineering. They should play an important roll in industrial development in Indonesia. It is considered appropriate that EEPIS has two Departments, Electronic Engineering and Electronic Communication Engineering. The target level to be reached by EEPIS students is that of "higher technician", as is the case with other polytechnics.

Predictively, most graduates from polytechnics will become supervisors in production department of electronic and communication engineering in government sectors and private enterprises.

Industry needs technicians ready to work at site. Therefore, education in polytechnics should be performed so that students acquire practical capabilities more precisely. And emphasis should be placed on experiment and practice that conform to job and service in the actual production field of electronic industry.

In addition, there is a probability that the content of services after employment is subject to change, because electronic engineering and electronic communication engineering are in a field where technological innovation is in rapid progress. This requires students to acquire adaptability.

For this purpose, polytechnics have to exercise basic experiment as well as basic theory and general subjects to support the experiment.

On the other hand, it is appropriate that the curriculum which will be applied to EEPIS should be based on the standard curriculum of PEDC. Consequently, EEPIS can utilize teaching materials prepared by PEDC. And PEDC can perform effective training for teachers dispatched from EEPIS.

In 1983 the Ministry of Education and Culture stipulated a regulation of higher education, which is not applied to the standard curriculum of PEDC, because it was established before 1983.

However, the EEPIS curriculum needs to follow the regulation which, for example, stipulates the allocation of about 10% education hours to general subjects, 20 - 25% to basic special subjects, and the rest 65 - 70% to special subjects.

The Japanese Technical Cooperation Long-term experts who were dispatched in October, 1985, proposed on the basis of status quo research on electronic industry in Indonesia to develop new curriculum for EEPIS, that the curriculum be reviewed on the following points.

1. Subject on industrial management is required.
2. In-plant-training is recommended.
3. Subjects on electrical and mechanical engineering are required.
4. Curricula should not be too specific. Computer education is recommended as a general course.
5. Further study on radio operator license is required.

The subjects necessary for EEPIS to perform the above content of education were proposed by the Japanese Technical Cooperation Long-term Experts in collaboration with EEPIS Establishment Committee of ITS. The subjects and their characteristics are as follows.

(1) General subjects (Common to both departments)........Pancasila, Indonesian, English, Industrial Management*1, Kewiraan, Religion, Technology Concept.

*1 : Management Techniques on production, stock-keeping, personnel, finance, etc. which are required for supervisors in addition to their specialized techniques.

(2) Basic special subjects (Common to both departments)....Mathematics, Physics, Chemistry, Drawing, Electrical Materials, Electric Circuit, Electric Measurement, Workshop, Computer Language*2, Quality Control*3.

*2 : Computer languages as a basic knowledge for application.

*3 : Basic knowledge and skill on quality control to develop production control capability necessary for field supervisors.

(3) Special subjects (Common to both departments).........Electricity & Magnetism, Electronic Device, Electronic Circuit, Signal Processing*4, Digital Electric/Micro-processor, Electric Power Engineering, Automatic Control, Maintenance Control, Computer Aided Problem Solving*5

*4 : Signal theory and processing, as a basis of telecommunication, with combined demonstration by the spectrum analyzer, computer display, etc. for improvement of education effect.

*5 : Numerical analysis and simulation of electric circuits, electronic circuits, transmission lines, etc. to cultivate the capability of problem solution and programming.

(4) Special subjects (Electronic Engineering)........Applied Electronic Circuit*6, Industrial Electronics*7, Computer Interface*8, Opto-Elecronics*9, *Project (graduation thesis)*

*6 : Principle, system, and circuit technique of television, radio, etc.

*7 : Process control in plant including application of automatic control.

*8 : Connection and adjustment of computer hardware is emphasized, with associated software included.

*9 : Primary course of photoelectronic engineering such as laser, optical fiber, etc.

(5) Special subjects (Electronic Communication Engineering)....Communication Circuit & System, Transmission Lines, Wave-Prop & Antenna*10, Network & Switching*11, Microwave, Applied Communication Systems*12, Optical Communication*13, Radio Wave Measurement & Instrumentation*14,

Project (graduation thesis)

*10 : Transmission lines, radio wave transmission, antennas, etc.

*11 : Hardware, etc., using telephone exchange equipment and telephone circuits.

*12 : Applied communication systems to television, radio, radar, ocean communication, facsimile, satellite communications, etc.

*13 : Primary course, such as optical communication system, optical communication devices, optical transmission system, etc. including regulation and communication method to train radio operators.

*14 : Measurement and experiment of transmitting and receiving radio wave, including field measurement practice outside the campus.

The Table 3-3 and 4-3 are the tentative curricula proposed through discussions between Japanese Technical Cooperation Long-term Experts and EEPIS Establishment Committee of ITS; the discussions were also made on lecture hour and practice hour necessary for the above subjects as well as hour allotted to each semester. The curricula specify the allocation of total education hour for each department; the lecture hour occupies 42% in Electronic Engineering Department and 45% in Electronic Communication Engineering Department while practice hour is 58% and 55% respectively.
The proposed curriculum details the allotment of the total education hour over three years. The total education term consists of 5,016 hours and is divided into six semesters. Each semester consists of 22 weeks, and each week consists of 38 hours (Monday - Thursday: 5 hours in the morning and 2 hours in the afternoon, Friday and Saturday: 5 hours in the morning).

The tentative curriculum has been further reviewed subsequently in Japan and has been concluded to be basically appropriate for the education plan of EEPIS. As a result, the tentative curriculum will be carried out after EEPIS is opened.

SEMESTER			I	II	III	IV	V	VI	TOTAL
SUBJECT									(hour)
A. GENERAL SUBJECTS		T/P							
EE.101	PANCASILA	88/–	2/–	2/–					88
EE.102	INDONESIAN	44/–		2/–					44
EE.103	ENGLISH	176/–	2/–	2/–	2/–	2/–			176
EE.104	INDUSTRIAL MANAGEMENT	88/–				2/–	2/–		88
EE.105	KEWIRAAN	22/–	1/–						22
EE.106	RELIGION	22/–	1/–						22
EE.107	TECHNOLOGY CONCEPT	22/–	1/–						22
SUB TOTAL		462/–	7/–	6/–	2/–	4/–	2/–		462
B. BASIC SCIENCE & ENGINEERING									
EE.201	MATHEMATICS	242/–	3/–	3/–	3/–	2/–			242
EE.202	PHYSICS	44/66	2/3						110
EE.203	CHEMISTRY	22/–	1/–						22
EE.204	TECHNICAL DRAWING	22/66	1/3						88
EE.205	ELECTRICAL MATERIALS	22/44			1/2				66
EE.206	ELECTRIC CIRCUITS	66/132	2/3	1/3					198
EE.207	ELECTRICAL MEASUREMENT & INSTRUMENTATION	44/110	1/2	1/3					154
EE.208	ELECTROMECHANICAL WORKSHOP	22/88		1/4					110
EE.209	COMPUTER LANGUAGE	44/88	1/2	1/2					132
EE.210	QUALITY CONTROL	66/–				3/–			66
SUB TOTAL		594/594	11/13	7/12	4/2	5/			1188
C. ENGINEERING									
EE.301	ELECTRICITY & MAGNETISM	44/66	1/1	1/2					110
EE.302	ELECTRONIC DEVICES	88/132	2/3	2/3					220
EE.303	ELECTRONIC CIRCUITS	220/330		2/3	3/6	5/6			550
EE.402	SIGNAL PROCESSING	44/–			2/–				44
EE.304	DIGITAL ELECTRONICS & MICROPROCESSOR	154/396			2/3	2/3	2/6	1/6	550
EE.305	ELECTRIC POWER SYSTEM	44/132			1/3	1/3			176
EE.306	AUTOMATIC CONTROL	88/132			2/3	2/3			220
EE.307	MAINTENANCE & REPAIR	44/132					1/3	1/3	176
EE.308	APPLIED ELECTRONIC CIRCUITS	66/198					2/4	1/5	264
EE.309	INDUSTRIAL ELECTRONICS	88/264					2/6	2/6	352
EE.310	COMPUTER AIDED PROBLEM SOLVING	88/132			2/3	2/3			220
EE.311	COMPUTER INTERFACE	44/66						2/3	110
EE.312	OPT-ELECTRONIC	44/66					2/3		110
EE.500	PROJECTS	–/264					–/4	–/8	264
SUB TOTAL		1056/2310	3/4	5/8	12/18	12/18	9/26	7/31	3366
TOTAL		2112/2904	21/17	18/20	18/20	21/18	11/26	7/31	5016
Theory: 42.11%, Practice 57.89%									

Table 3-3 Tentative Carricula to be executed in the Department of Electronic Engineering

SEMESTER / SUBJECT	T/P	I	II	III	IV	V	VI	TOTAL (hour)
A. GENERAL SUBJECTS								
EE.101 PANCASILA	88/–	2/–	2/–					88
EE.102 INDONESIAN	44/–		2/–					44
EE.103 ENGLISH	176/–	2/–	2/–	2/–	2/–			176
EE.104 INDUSTRIAL MANAGEMENT	88/–				2/–	2/–		88
EE.105 KEWIRAAN	22/–	1/–						22
EE.106 RELIGION	22/–	1/–						22
EE.107 TECHNOLOGY CONCEPT	22/–	1/–						22
SUB TOTAL	462/–	7/–	6/–	2/–	4/–	2/–		462
B. BASIC SCIENCE & ENGINEERING								
EE.201 MATHEMATICS	242/–	3/–	3/–	3/–	2/–			242
EE.202 PHYSICS	44/66	2/3						110
EE.203 CHEMISTRY	22/–	1/–						22
EE.204 TECHNICAL DRAWING	22/66	1/3						88
EE.205 ELECTRICAL MATERIALS	22/44			1/2				66
EE.206 ELECTRIC CIRCUITS	66/132	2/3	1/3					198
EE.207 ELECTRICAL MEASUREMENT & INSTRUMENTATION	44/110	1/2	1/3					154
EE.208 ELECTROMECHANICAL WORKSHOP	22/88		1/4					110
EE.209 COMPUTER LANGUAGE	44/88	1/2	1/2					132
EE.210 QUALITY CONTROL	66/–				3/–			66
SUB TOTAL	594/594	11/13	7/12	4/2	5/			1188
C. ENGINEERING								
EE.301 ELECTRICITY & MAGNETISM	44/66	1/1	1/2					110
EE.302 ELECTRONIC DEVICES	88/132	2/3	2/3					220
EE.401 ELECTRONIC CIRCUITS	132/198		2/3	2/3	2/3			330
EE.402 SIGNAL PROCESSING	44/–			2/–				44
EE.403 DIGITAL ELECTRONICS & MICROPROCESSOR	88/132			2/3	2/3			220
EE.305 ELECTRIC POWER SYSTEM	44/132			1/3	1/3			176
EE.306 AUTOMATIC CONTROL	44/66			2/3				110
EE.404 MAINTENANCE & REPAIR	44/132						2/6	176
EE.405 COMMUNICATION CIRCUITS & SYSTEM	132/198			2/3	2/3	2/3		330
EE.406 TRANSMISSION LINES WAVE-PROP & ANTENNA	132/198				2/3	2/3	2/3	330
EE.407 NETWORK & SWITCHING	88/132					2/3	2/3	220
EE.408 COMPUTER AIDED PROBLEM SOLVING	22/66			1/3				88
EE.409 MICROWAVE	44/66					2/3		110
EE.410 APPLIED COMMUNICATION SYSTEMS	110/198				2/3	2/3	1/3	308
EE.411 OPTICAL COMMUNICATION	44/66						2/3	110
EE.412 RADIO WAVE MEASUREMENT & INSTRUMENTATION	88/132					2/3	2/3	220
EE.500 PROJECTS	–/264					–/6	–/6	264
SUB TOTAL	1188/2178	3/4	5/8	12/18	11/18	12/24	11/27	3366
TOTAL	2244/2772	21/17	18/20	18/20	20/18	14/24	11/27	5016

Theory: 44.73%, Practice 55.27%

Table 3-4 Tentative Carricula to be executed in the Department of Electronic Communication Engineering

3-3-3 Number of Applicants and Employment after Graduation

(1) Number of applicants for admission

A large number of applicants have applied to the six existing polytechnics for admission. For example, at the Bandung Polytechnic, the number of applicants was 16 times as many as the prescribed capacity. The drop-out rate is only several percent in the polytechnics.

The ratio of applicants to successful applicants to the Non-degree faculty (DIII), ITS (1982/1983) may be applied to the prediction of applicants to EEPIS.

The ratio was 7.2 : 1, i.e. 3,095 applicants to 433 successful applicants. EEPIS has an Electronic Engineering Department, and Electronic Communication Engineering Department, both of which are popular among applicants. If advanced experimental equipment is introduced from Japan and technical cooperation is extended by Japan, the ratio of applicants to EEPIS would not be less than that of the Non-degree faculty of ITS.

(2) Prediction of employment after graduation

In fact, incomplete employment of graduates from higher education institutions is one of the difficult problems that Indonesia faces at present. However, graduates from engineering faculties, especially from electronic engineering and related departments, have few problems in employment compared with graduates from social science faculties.

The first graduates left the six existing polytechnics in 1985. The number of graduates was far less than the number of jobs available in each polytechnic; though the research has not been made on the ratio of employment and number of employees by field. As a whole, social demand for polytechnic graduates is great, though some of them would not necessarily get jobs in companies they have wanted to work for.

Home electrical appliance manufacturers are typical employers of graduates from electronic engineering departments of diploma program at present stage. Polytechnic graduates are supposed to work as supervisors and technicians in research and development departments in the above manufacturers. The estimate of the demand for such supervisors and technicians around 1990 is shown in Table 3-5.

Year	Total employees[1)]	Supervisor[2)]	Technician in research and development department[3)]
1989	18,132	960	184
1990	18,489	979	187
1991	18,846	998	192

(Source: Technical Cooperation Long-term Experts Survey Report)

Table 3-5 Estimate of Employment Trend in Home Electrical Appliances Industry

1) Increase in number of employees, average: 357/year
This figure is based on the following estimation approach; "Comparative Advantage of Electronics and Wood Processing Industries in Indonesia", Institute of Development Economics, 1981.

2) The ratio of supervisors to total employees is 0.053:1 on the basis of the survey in local manufacturing firms.

3) The ratio of technicians in research and development department to total employees is 0.0102 : 1, on the basis of the same survey as 2).

The estimate shows that the number of supervisors and technicians in research and development department will be about 1,000 around 1990.
On the other hand, about 2,200 graduates leave electric/electronic departments of existing academies.
When the Second Polytechnic Plan has been completed, 672 graduates will leave Electronic Engineering Department of 3-Year course of polytechnics.

Academies with electric/ electronic department	Location	Graduates per Year (estimated)
Academy of Technology	Bandung	570
Academy of Technology	Bandung	660
Institute of Technology	West Java	480
Technical Academy of Surabaya	Surabaya	510
Total		2,220

(Source: Technical Cooperation Long-term Experts Survey Report)

Table 3-6 Current Status Quo of Education of Middle-level Skilled Manpower Specialized in Electric/Electronic Engineering in Academies

The following conclusion is based on the above analysis

1. The Home Electrical appliance manufacturing industry will grow year by year, but it will not offer increased job vacancy sufficiently to absorb all polytechnic graduates.

2. Polytechnic graduates are needed by government sector, manufacturing industries other than electronics industry and electronics industry other than the home electrical appliance manufacturing industry (HEAMI), all of which have sufficient employment size:
   Government sector implies PERUMTEL, PLN and PERTAMINA. etc. Manufacturing industries other than electronics industry implies machinery, transportation, *equipment, metal and fertilizer, the* total employment size of which is 70 times as large as that of HEAMI. And employment size of electronics industry excluding HEAMI is 9 times as large as that of HEAMI. As electronics technology is increasing applied to other industries, middle-level skilled manpower specialized in electronic engineering will be more and more needed.

Industry	Year	Number of employees	Production (million Rp)
Home electrical appliances manufacturing industry	1980	14,527	47,342
	1981	16,142	46,134
	1982	15,340	54,134
	1983	15,429	53,951
All electronics industries	1980	122,842	379,731
	1981	132,445	533,050
	1982	139,653	576,740
	1983	142,259	551,128
All manufacturing industries	1980	976,579	2,148,681
	1981	1,011,784	2,711,552
	1982	1,067,017	2,970,266
	1983	1,119,630	3,379,524

(Source: Technical Cooperation Long-term Experts Survey Report)

Table 3-7 Number of Employees and Production by Industry

The above recognition deals with the employment trend all over Indonesia. More specifically, Surabaya is thriving with industry-oriented development projects including surrounding cities such as Gresik and the population of greater Surabaya has reached 3 million. As far as graduates from EEPIS (120 per year) are concerned, industries in Surabaya will presumably have enough capacity to employ the graduates.

Descriptions on an estimate of employment for the graduates are based on the technical Cooperation Long-term Experts Survey Report written in November, 1985.

3-3-4 Sukolilo Campus Master Plan

(1) Sukolilo Campus Master Plan (1978)

In 1978 the Sukolilo Campus Master Plan was prepared to integrate the

ITS campuses scattered over Surabaya into one campus located in the Sukolilo district on the east of the city.
The outline of this master plan (1978) is described as below.

1. Site;
   187.5 Ha, swampland (paddy field in the past)

2. Facilities:
   Lecture rooms, laboratories, office rooms, workshop, computer center, central office, student dormitory, staff house, for Sarjana Program; floor area of approx. 48,000 m2.

3. Content of plan:
   Land use, pedestrian and vehicular traffic circulation, green network, construction phasing plan, standard design criteria, floor area, module, section, live load, service installations, and layout plan of the above facilities.

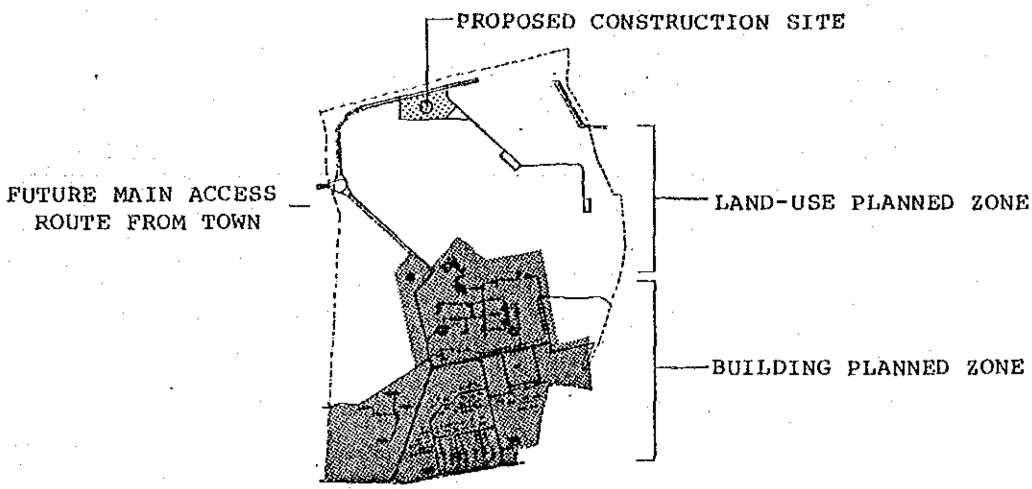

Fig. 3-3 Scope of Sukolilo Campus Master Plan (1978)

The Master Plan (1978) indicated that the proposed construction in the present project was beyond the scope of facilities construction and the proposed site was planned as an orchard.

(2) ITS plan to expand the master plan (1978)

When most of the facilities in the scope of the Master Plan (1978) were completed, ITS started a plan to remove facilities of Sarjana Program and Non-degree Faculty still left in the city onto Sukolilo Campus. At the same time, the plan was made to set up new polytechnic on the ITS campus. Therefore, ITS prepared its own master plan covering the whole area of 187.5 ha. on the Sukolilo Campus based on the master plan (1978).
ITS's master plan of the Sukolilo Campus is to be completed by 2000. And the future number of students and staff of ITS in this master plan is scheduled as follows:

	1984	1994	2000
Number of students	6,051	16,200	20,000
Number of academic staff	350	1,522	2,000
Number of administration staff	221	2,156	5,000
Number of students accommodated in dormitory	250 (4%)	1,600 (10%)	4,000 (20%)

(Source: ITS)

Table 3-8 Future Number of Students and Staff in ITS's Master Plan

One of the buildings of the Non-degree Faculty has already been constructed in accordance with ITS's Master Plan.
Apart from the EEPIS Project, the Surabaya Shipbuilding Polytechnic is scheduled to be built on the Sukolilo Campus financed by the World Bank. There is no plan for both polytechnics to share same facilities and they are to be built separately.

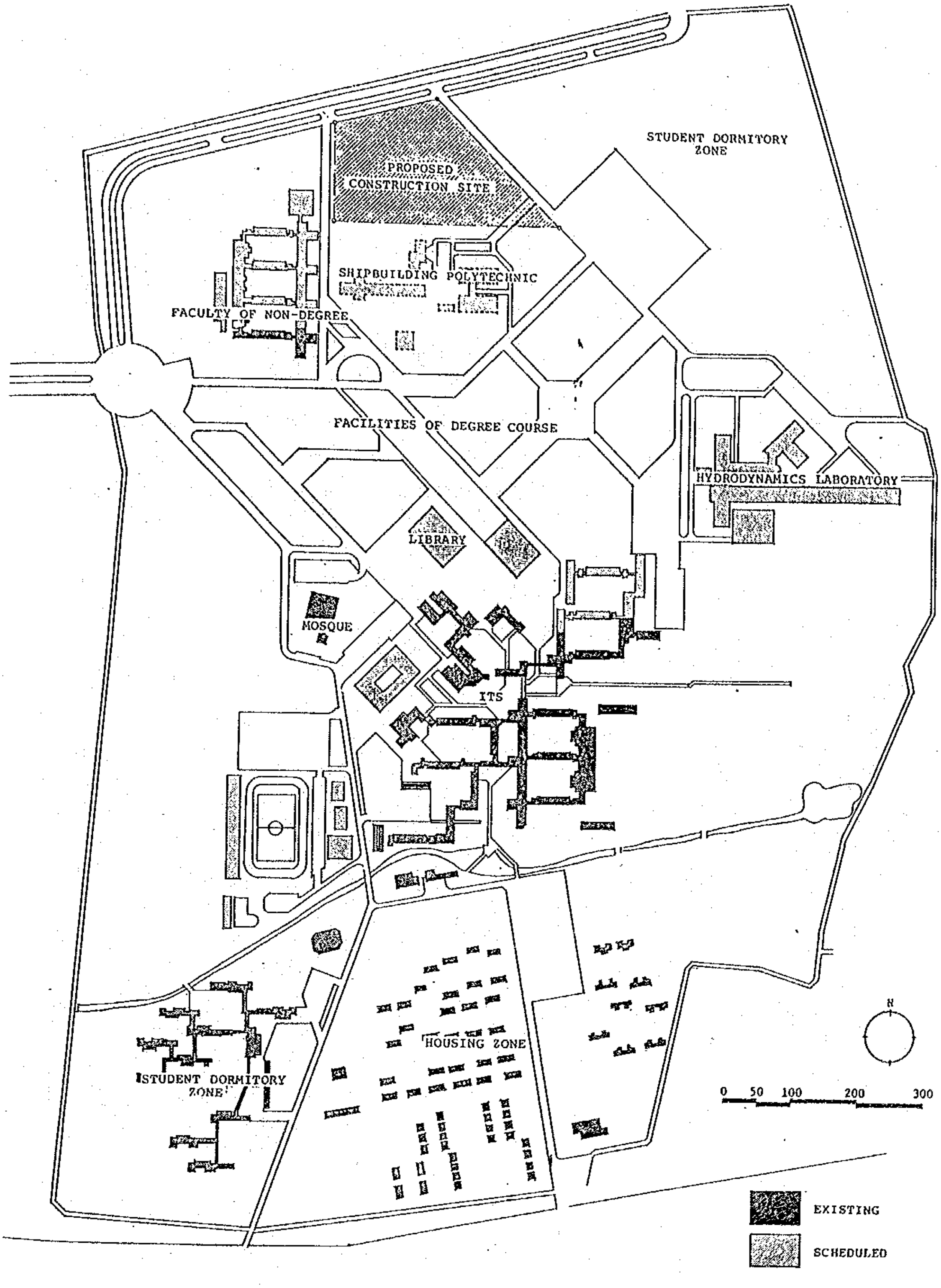

Fig. 3-4 ITS Sukolilo Campus Master Plan

3-3-5 Proposed Construction Site

(1) Proposed construction site

1) The proposed site of EEPIS is situated in the Sukolilo district, Surabaya, approximately 7 km east of the center of the city, which takes approximately 15 minutes by car.

2) The Sukolilo district is in swampland near the sea, not a part of the old town. As guessed from this situation, physical conditions such as geology and infrastructure are not desirable at present. However, the Sukolilo area is designated as a school and residential area by the Surabaya municipality and the proposed site occupies a part of ITS Sukolilo Campus. Therefore, this site is considered to be suitable as a site for education facilities.

3) Since the proposed construction site is within the ITS campus and separated from surrounding residential areas, no trouble will be caused to inhabitants with respect to environmental or legal problems.

4) At present, convenient public traffic service is not available between the downtown and the Sukolilo area. The EEPIS staff and students have to use their own vehicles such as motorcycles and cars. However, a wide, straight road between downtown and Sukolilo Campus is under construction and is expected to gradually improve transportation condition for the staff and students.

Fig. 3-5 Location of Sukolilo Campus
(Base Map: Surabaya & Perkembangannya Map, Published by P.T. Pembina, 1983)

(2) Natural conditions

1) Configuration

The proposed construction site is flat land. It was originally used as paddy fields and is damp even during the dry season.

2) Soil conditions

According to the soil investigation report for the site which was conducted by ITS, the soil of the site is classified into 3 strata; the first stratum is a very soft layer from the present surface to a depth of 10.0m and consists of clayey silt and fine sand with an average N value of 0 - 3, the second stratum is a layer from 10.0 m to 16.0 m deep, and consists of silty sand and small amount of clay with an average N value of 7 - 20, and the third stratum is a layer from 16.0m to 30.0m deep and consists of silt and sand with an average N value of 16 - 30.

The water level is -0.5m in the dry season, and is estimated to be higher by 0.2 - 0.3m in the rainy season.

(3) Infrastructure

1) Electric Power

Electric power is supplied to the Sukolilo Campus in 3 - phase, 20kV, 50Hz. The power supply plan made by the Indonesian side shows that power will be supplied to the Sukolilo Campus from 2 substations (Sukolilo Substation and Kenjeran Substation).

At present, power is supplied to the existing buildings on the Campus from the Sukolilo Substation.

Power to the proposed buildings will be supplied at low voltage of 380V/220V from a new substation on the site which will be constructed on the responsibility of the Indonesian side.

One (1) line from the Sukolilo substation and another one (1) line from Kenjeran substation, therefore, two lines in total will be led to the substation which is to be constructed on the site.

Power supply facilities after the low voltage power receiving panel in the electric building is to be included in the Project (Japanese work).

Power failures occur about 4 times per month on average, more frequently in the rainy season. Voltage regulation is said to be ± 5% but it actually exceeds ± 10%.
Countermeasures for voltage regulation are required.
(Refer to Fig. 3-6)

2) Telephone
At present 4 telephone lines (Central Office Line) are led in from the Darmo Telephone Station to the existing ITS administration office building on the Campus. A digital telephone exchange equipment (E-PABX) is installed in this building. Between the E-PABX installed in the proposed building and the E-PABX in the existing ITS administration office building will be connected with tie-line.

The tie-line to the MDF (main distribution frame) of the proposed building shall be installed by the Indonesian side.
(Refer to Fig. 3-6)

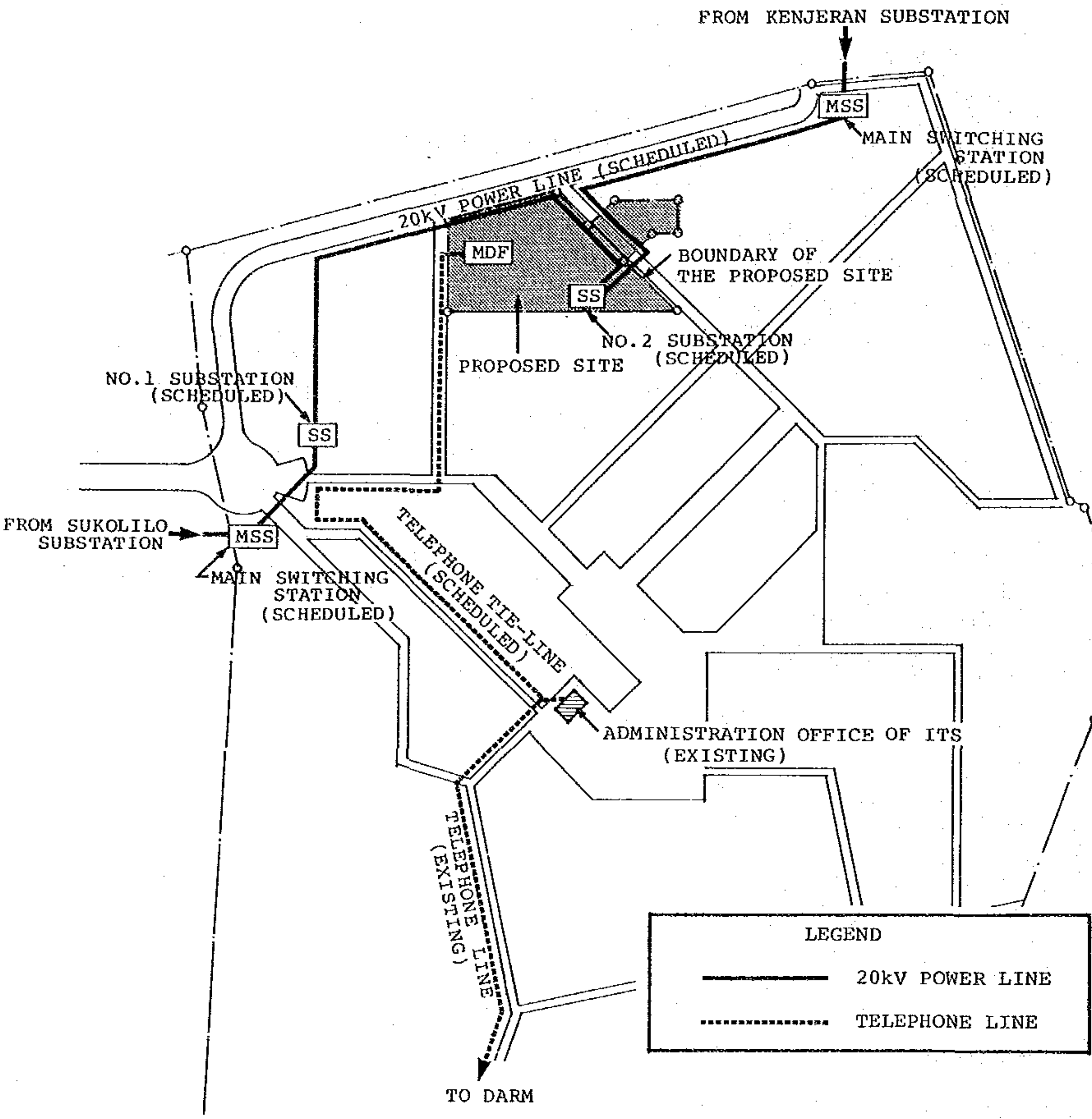

Fig. 3-6 Power and Telephone Line for the Proposed Construction Site

3) Water supply

The main municipal water work is in progress under the road in residential area to the north of the site but is now suspended at the bridge across the river. It has not been decided when the main work will be completed and when water supply service from the north is available.

Existing buildings of the Sukolilo Campus draw the municipal water pipe from the south of the Campus. ITS is preparing the annual water supply piping work plan to extend the above piping. The plan indicates that the water supply main (pipe diameter: 150mm) will be laid near the site in the 1985/1986 work. The data of water pressure by standard pipe diameter shows that the water supply pipe 65mm in diameter maintains a water pressure of 3.5kg/cm2. Actually, the water supply pressure seems to be considerably lower in the dry season.

The quality of municipal water is normally neutral but sometimes shows strong alkalinity. The water contains dissolved solid which may cause trouble such as scale to water supply pipe and equipment. Normally, the water is boiled before use as potable water.

4) Sewerage

A sewerage main is not laid around the site. Generally, soil water and waste water are treated in septic tanks and penetration pipes in Indonesia.

3-3-6 Outline of Facilities and Equipment

EEPIS uses the curricula which is different from those used in Stratum I in universities and Faculty of Non-degree in the vocational/professional stream. In EEPIS, practice such as experiment and technical drawing amount to as much as 55-58% out of the total education hours, as stated in 3-3-2, Education Plan.

The experiment in EEPIS covers a wide range in electronics and electronic communication engineering, and pieces of experiment equipment widely vary with experiment subjects.

On the other hand, the remaining 42-45% of the education hours is allotted to the lectures of the general subject and basic specialized theories.

According to the research on the home town of the students newly admitted to the faculty of Non-degree of ITS (DIII at the same level as EEPIS), 80% of such students come from places other than Surabaya such as East, Java, Bali Island, and Madura Island, and bear considerable lodging expenses.

The above research suggests that the students at EEPIS will have the same tendency. Therefore, the construction of the Student Dormitory is considered necessary for the Project.

In consideration of interelationship among these educational functions, it is considered appropriate that facilities are to be roughly divided into the section of Lecture, Laboratory & Administration building and the section of Student Dormitory. For the purposes of the Project, the following facilities and equipment should be included in the scope of the Project.

(1) Facilities

1) Lecture, Laboratory & Administration Building

a. Academic Department:
Classrooms, laboratories, workshops, library, office rooms for teachers, etc.

b. Administration Department:
Administrative offices, etc.

c. Cafeteria (to be jointly used for Student Dormitory)

2) Student Dormitory

3) Others

(2) Equipment

1) Educational equipment:

Equipment used in the laboratories, workshops, technical drawing room etc. and technical books for library.

3-3-7 Staff Recruitment Plan

The roles and qualifications of EEPIS teaching staff are stipulated as shown below. (EEPIS sets no express regulations for number of training years and the kind of organization for training in the academic staff training and practice training.)

(1) Lecturer: Teaching Theory and Assessment
(graduate from SI + teacher training)

(2) Instructor: Teaching Practice/Laboratory and Assessment
(Graduate from SI + Practical Training)
(Graduate from D3 + Experience + Practical Training)

(3) Lecturer's assistant: To assist Lecturer
(Junior Graduate from S1 + Training)

(4) Instructor's assistant: to assist Instructor
(graduate from D3 + training)

(5) Technician: to set up and repair laboratory equipment
(graduate from STM + practical training)

The role of academic and administrative staff and the recruitment plan are shown in Fig. 3-9 and 3-10.

1. Academic staff

Academic staff		1986	1987	1988	1989	Total
Lecturer		2	3	5	5	15
Instructor		4	6	10	10	30
Lecturer's assistant		-	3	3	3	9
Instructor's assistant		-	5	5	5	15
Technician	Electronic Engineering Department	-	2	3	3	8
	Electronic Communication Engineering Department	-	2	3	3	8
Total		6	21	29	29	85

(Source: ITS)

Table 3-9 Academic Staff Recruitment Plan

2. Administrative staff

Director of EEPIS	1
Head of Department	2
Secretary	3
Administration	2
Financial & Accountant	1
Others (6 security guards, 3 cleaners, 2 gardeners, 2 typists, and 2 librarians)	15
Total	24

(Source: ITS)

Fig. 3-10 Administration Staff Recruitment Plan

Six graduates (1986) from the Sarjana program of ITS have been nominated to join EEPIS academic staff, and will be dispatched to PEDC to join the teacher education and training in and after 1986.

3-4 Technical Cooperation

The Government of the Republic of Indonesia has requested the Government of Japan to extend Project Type Technical Cooperation to provide the effective education at EEPIS after the opening.

In response to the request, the Government of Japan has decided to conduct a study for technical cooperation, and Japan International Cooperation Agency dispatched the Preliminary Survey Team in July, 1985 to confirm and evaluate the content of the request and to clarify the outline of the relevant plans. Subsequently in October, 1985, Japan International Cooperation Agency dispatched the Technical Cooperation Long-Term Experts, and discussed the basic concept education plan of EEPIS with EEPIS Establishment committee and the survey was carried out.

The outline of the Project Type Technical Cooperation that is considered acceptable by the Government of Japan at present is described as below;

(1) Objectives of technical cooperation.

To transfer know-how and techniques necessary for EEPIS staff who have to educate students effectively by adopting the curricula shown in 3-3-2.

(2) Period of technical cooperation.

Necessary period after the signing of the record of discussion on the technical cooperation. (the longest period shall not exceed 5 years.)

(3) Content of technical cooperation

1) Dispatching Japanese Experts

The Long-term Expert Team consists of team leader, coordinator, and experts in electronic engineering and electronic communication engineering, and in data processing. A Short-term Expert will be dispatched if necessary.

2) Training Indonesian counterparts in Japan

Indonesian counterparts will be trained in Japan during the period of technical cooperation if necessary. It is proposed that training period will be one year including Japanese language training course.

(3) Supply of equipment

Supplementary equipment required after opening of EEPIS will be supplied, if necessary.

Technical cooperation such as the dispatch of Long-term Experts and training of Indonesian counterparts in Japan will be supported mainly by the Ministry of Education and National Technical College Association.

CHAPTER 4
BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4-1 Design Policy

(1) Facilities are to meet the environmental conditions of Surabaya.

Surabaya is under severe climatic conditions, subject to heavy rain and strong sunlight irrespective of seasons, rainy or dry. To cope with these conditions, special considerations should be required for facility design.
Moreover, consideration to avoid damage from floods and insects should be required, because the proposed construction site is located in swampland near the sea.

(2) Facilities should conform to the Sukolilo Campus ITS Master Plan.

ITS has made a Master Plan covering whole Sukolilo Campus which includes the proposed construction site, as stated in 3-3-4, and the scheduled construction is under way. Therefore, the facilities design should basically follow the policy of the Master Plan.

(3) The design criteria of the facilities and equipment should have sufficient appropriateness.

The facilities of the Project are a part of the Sukolilo Campus ITS Master Plan, therefore design criteria, such as the function of rooms, floor size and grade of finish, should be basically equal to the present situation of the existing facilities of the Sukolilo Campus. In addition, architectural consideration should be given to the fact that part of the facilities accommodates precise educational equipment for electronics engineering.

(4) Maintenance cost of the facilities should be minimized.

Natural ventilation and natural lighting should be utilized to a great extent, and local construction method and local building materials should be used effectively. Ease of maintenance and reduction in cost can be expected after completion of the facilities, because of this consideration. Moreover the enlargement of the local portion can thus be expected.

4-2 Site Plan

(1) Site

1) The site is located at the north end of the Sukolilo Campus, which includes the existing ITS facilities.

Area of approximate 3.7 ha. is allocated to the Lecture, Laboratory & Administration Building and area of approximate 0.6 ha. to Student Dormitory.

The site is flat but swampy, requiring soil filling.

In future, a front gate of the whole campus of ITS will be set up at the west side of the Campus. Passing through the front gate, drivers or riders arrive at the site via the Campus circular road to be constructed along the boundary line of the Campus while pedestrians arrive at the site from south via the pedestrian mall to be constructed between the polytechnic buildings and the Non-Degree Faculty buildings, in the north-south direction. The site was used as a paddy field in the past, and has no large trees to be preserved.

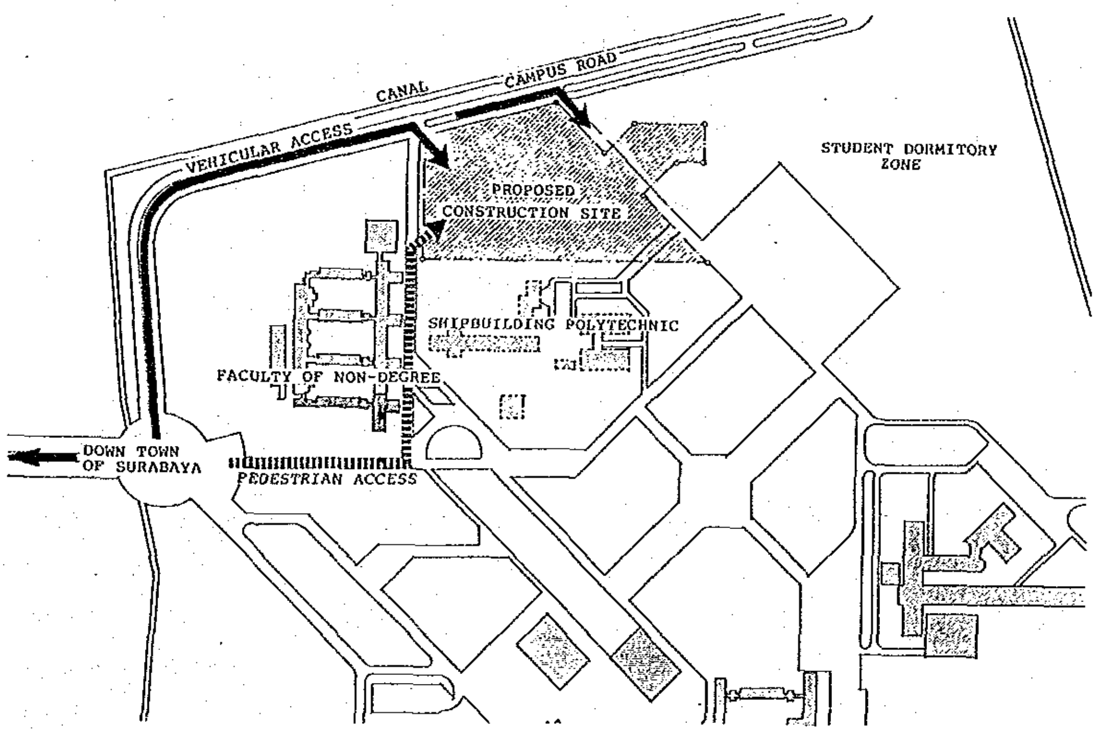

Fig. 4-1 Location of the Proposed Construction Site

(2) Layout Plan

1) Sukolilo Campus ITS Master Plan

The basic principle of vehicular traffic and pedestrian linkages of the Master Plan is shown below.

Vehicles such as automobiles and motorcycles park in the common parking lots provided near the buildings from the Campus circular road, where from drivers and riders reach the facilities on foot. Pedestrians move along the pedestrian mall forming the spine of the Campus, covered walkways, and pilotis.

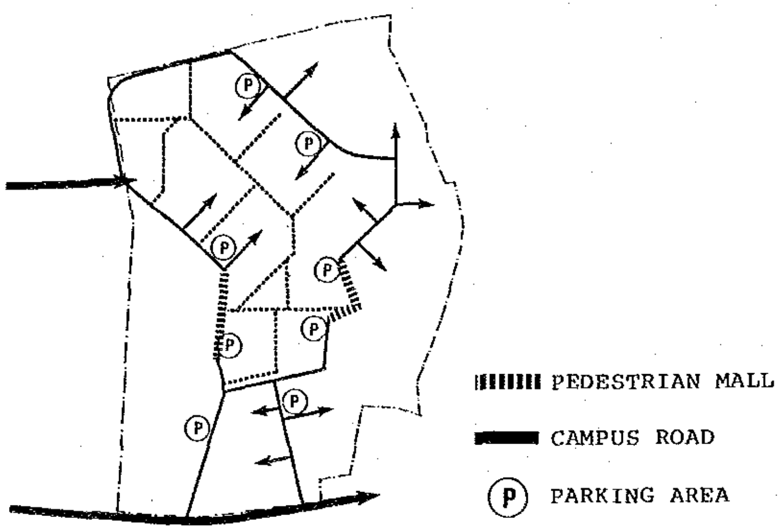

Fig. 4-2 Vehicular Traffic and Pedestrian Linkages of Sukolilo Campus Master Plan

The basic principle of facilities layout of the Master Plan is shown below.

Classrooms, academic staff rooms, library, and administration offices are laid out near the pedestrian traffic line, since they should be located in a quiet environment because of their functions and because they are less likely to generate noise. The laboratories, workshops, and cafeteria are laid out near the vehicular traffic line, since services, such as teaching materials, fuel, food are required and they are more likely to generate noise.

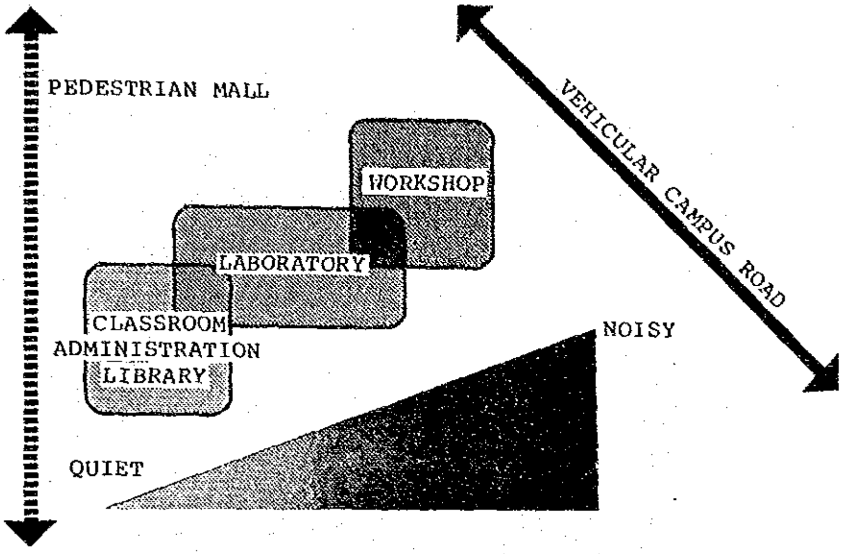

Fig. 4-3 Facilities Layout Concept of Sukolilo Campus Master Plan

2) Layout Plan

The basic principle of the Sukolilo Campus Master Plan should be applied to the layout plan for EEPIS and the following layout is considered to be most appropriate.

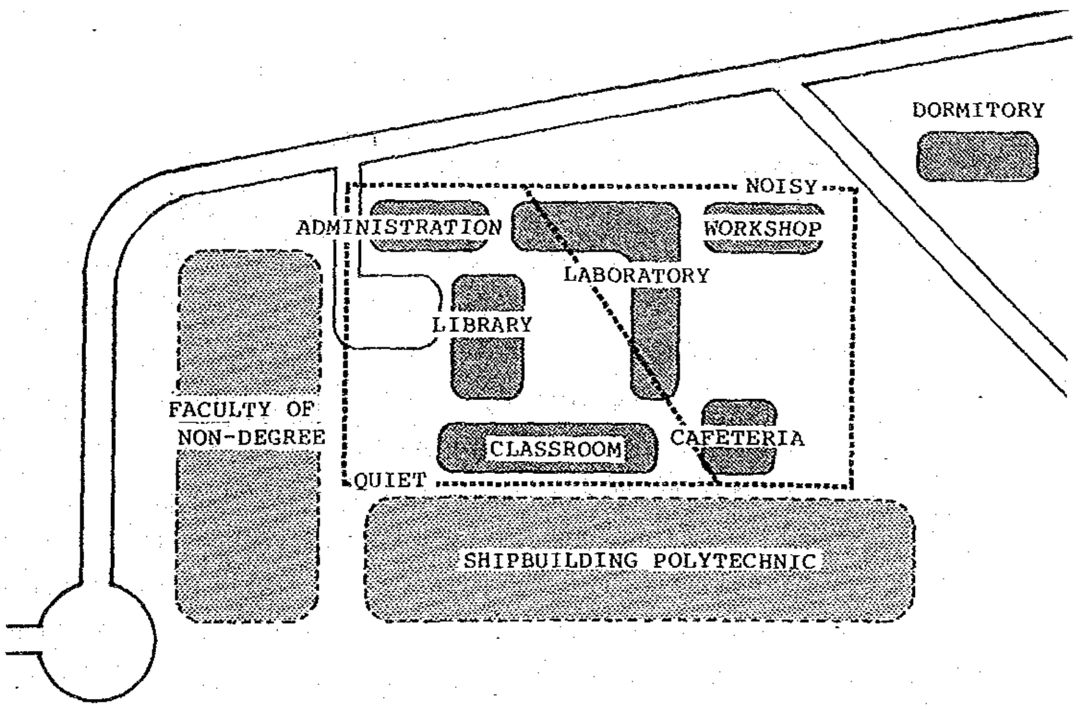

Fig. 4-4 Site Plan Concept of EEPIS

The Student Dormitory will be located in the northeast part of the Campus, which is the student dormitory zone in the Master Plan. Separation of vehicular traffic and pedestrian linkage is considered and the traffic circulation plan for EEPIS is shown in Fig. 4-5.

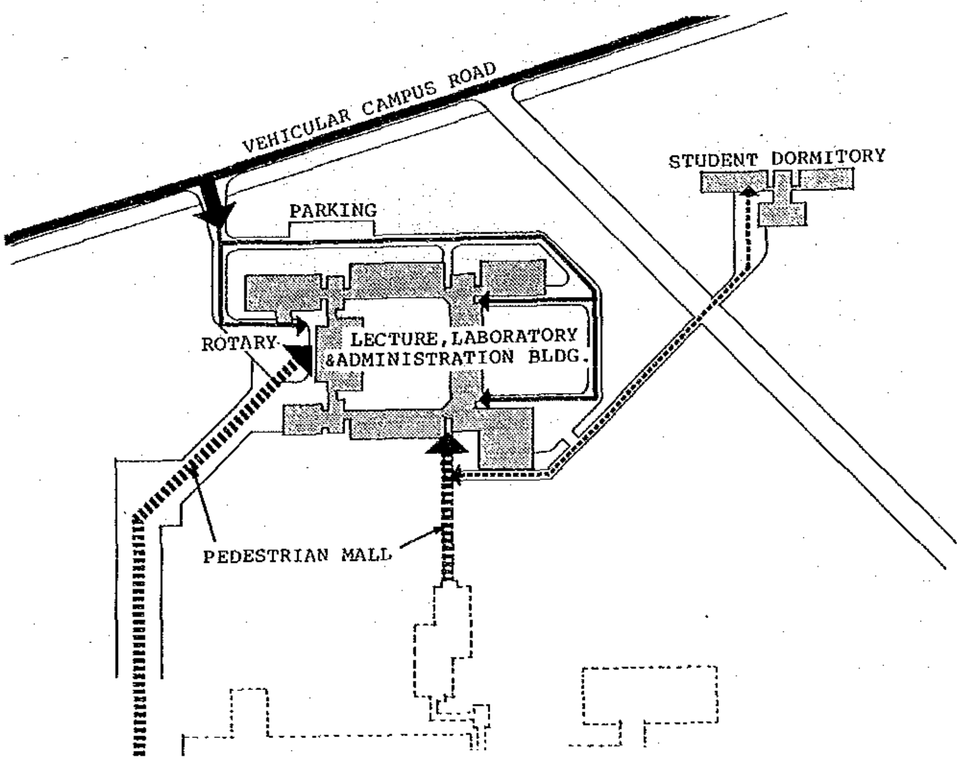

Fig. 4-5 Circulation Plan of EEPIS

The rotary is proposed on the west of the Lecture, Laboratory & Administration building, and the road within the site along the northeast boundary line in consideration of convenience in emergency, ambulance car service, service for the cafeteria and supply of equipment, parts, and books.

In Surabaya the wind direction is north-south, in most cases. Therefore, each building should be laid out basically on the east-west axis for better natural ventilation.

Some laboratories will be air-conditioned for their functions. These rooms need not to be laid out on the east-west axis if the afternoon sunlight is shut off. Therefore, a court surrounded by buildings including the air-conditioned rooms can be proposed. The external appearance will be designed to harmonize with the surrounding existing ITS buildings. On the contrary, the appearance to the court will be designed to express the characteristics of EEPIS.

The court will be planned to have enough space to allow a variety of student performances. The court is 50m or wider, and thereby natural ventilation can be enjoyed sufficiently.

The workshop will be located at the northeast end of the building because it is the source of noise caused by metal shearing, etc. The cafeteria will be located at the southeast end of the building for the service to the kitchen and for the convenience of dormitory students for breakfast and supper.

A substation to supply power to the EEPIS buildings will be constructed at the southern part of the site, and the electric building (Japanese work) will be located adjacent to this substation to accommodate a low voltage power receiving panel and an emergency generator. A guardhouse is not necessary for each building of the Campus, except for the entrances to the ITS Sukolilo Campus.

4-3 Architectural Plan

4-3-1 Planning

(1) Lecture, laboratory & Administration Building

1) General Concept

Student rooms are designed in the outer-corridor style to basically face the north or the south for better natural ventilation and lighting in the rooms and corridors. The wing consisting of air-conditioned laboratories faces to the east and is also designed in the outer-corridor style. The building is designed so that the wings for student rooms enclose a large court.

The outer-corridor surrounds the court in a square shape, passing upper part of the library on the second floor level and connecting with academic staff rooms and administration offices. The corridor forms the trunk of the Lecture, Laboratory & Administration Building.

Rooms for academic and administrative staff, which accommodate fewer people than student rooms, are designed in the inner corridor style on the east-west axis. This is because an excessively long corridor is not preferable. The inner corridor style has poor ventilation. Nevertheless, if heat isolation and natural ventilation are considered deliberately, comfortable living conditions could be ensured in Surabaya.

The wing for academic and administrative staff is provided with an entrance hall facing the rotary for academic and administrative staff or visitors who come to the Building by car. Students and academic and administration staff coming on foot from the pedestrian mall enter the building at the entrance hall in front of the library without crossing automobile road.

The floor surface of toilets is supposed to be always wet and toilets are likely to generate odors. Therefore, the toilet is well apart from the rooms for natural ventilation.

Staircases are located properly to be used as fire escapes in case of emergency. The staircase and toilet are designed to be usable regardless of artificial lighting in the daytime.

2) Education block

The laboratories and workshop with large-size and heavy equipment are laid out on the first floor to ease maintenance in the future. The communication laboratory is located on the third top floor to facilitate parabola antenna experiment and antenna measurement which are carried out on the roof, and to shorten the length of cable connecting the laboratory with the equipment on the roof floor.

The laboratories for digital, computer, electronic(1), electronic(2), communication(1) and communication(2) require air conditioning to maintain the operation accuracy of the equipment.

The laboratories are provided with the preparation rooms, which serve as the technician office and equipment store room, where simple repair of equipment is performed. The dark room for PC Board processing and development is provided on the first floor.

Similar to the existing polytechnics, the locker rooms are provided adjacent to the workshop,where students change their own clothes into working clothes for experiment and practice.

The library is located at the center of the building, to be accessible from the classroom, rooms for academic and administration staff.

Rooms for academic staff are subdivided into 1 person room, 2-person room, and 5-person room, which are used according to the rank and number of the staff, and located on the second and the third floors.

3) Administration block

The reception counter is provided, facing the entrance hall. The administration office is connected with the reception counter for the convenience of business communication. The medical room is also provided for the sudden sickness and accidental injury during experiment. The Director's room is on the first floor and faces the rotary, to enable the Director to observe the activities of the entire school easily.

4) Cafeteria

The cafeteria is located at the southeast end of the Building, and designed in collonnade style with neither windows nor doors. The cafeteria of existing ITS building and dormitory building are of the same type without any problems in daily use.

The cafeteria of EEPIS is designed to seat 230 assuming that academic and administration staff and 360 students take lunch in 2 shifts. The kitchen does not require large floor area because of the simple menu, e.g., rice and stewed beef with vegetables. A self-service counter is provided. The kitchen and attached room are enclosed by walls for the maintenance of kitchen equipment, with carefully designed ventilation.

5) Calculation of the number of main rooms

Number of classrooms and laboratories forming the major part of the Building is determined according to the following calculations.

. Classrooms

The Departments, Electronic Engineering and Electronic Communication Engineering, consist of 2 classes each and the education period is 3 years.

Thus, the total number of classes is 12.

The curriculum shown in 3-3-2 indicates that practice and experiment hours occupy 55% of the total education hour while lecture hours 45%. The lecture hour percentage is translated into 6 classrooms (12 x 0.45 = 5.4). Of the 6 classrooms, 4 rooms are for 30 students and 2 rooms are for 60 students, because some lectures of the subjects are given to two joint classes at the same time.

Two seminar rooms are provided for the beginning of semesters when lecture hours increase and for seminars for senior students. If classrooms are used at average occupancy rate of 70% (about 60% in Japan), the number of necessary rooms is 8 (5.4/0.7 = 7.7); this is equal to the above 6 classrooms plus 2 seminar rooms. In addition, a large classroom is provided for the purpose of lectures by guest lecturers and special lectures for all students in one grade by means of audio-visual education aids.

This room accommodates 150 students, that is, 120 students (one grade) with an allowance of 30 students (25%) for lecture meetings.

. Laboratory

The subjects of the curriculum which is shown in 3-3-2 Education Plan can be classified into groups which can share the same classrooms or same workshops. The maximum practice hours per week in a year of each group can be obtained by picking up the larger amount of hours which are calculated by summing up the practice hours of each group in each semester, former (I, III, V) and latter (II, IV, VI).

Subject group	Subject	Practice hours per week (hours/week)		
		Electronic Engineering Department (2 classes)	Electronic Communication Engineering Department (2 classes)	Total
Electrical experiment	Electric circuits	6	6	12
	Electrical Measure & Inst.	4	4	8
	Electrical Materials	4	4	8
	Electricity & Magnetism	2	2	4
				32
Electronics experiment	Electronic Device	6	6	12
	Electronic Circuits	18	12	30
	Applied Electronic Circuits	*10*	*0*	*10*
	Project (Electronic Engineering Department)	16	–	16
				68
Digital experiment	Digital Electronics & Microprocessor	18	6	24
	Computer Interface	6	0	6
				30
Automatic control experiment	Automatic Control	6	6	12
	Industrial Electronics	12	0	12
	Maintenance & Repair (Electronic Engineering Department)	6	0	6
				30
Communication experiment (1)	Comm. circuits & Systems	0	6	6
	Applied Comm. Systems	0	12	12
	Network & Switching	0	6	6
	Maintenance & Repair (Communication Engineering Department)	0	12	12
				36
Radio frequency and microwave experiment	Transmission Lines, Wave-Prop. & Antenna	0	6	6
	Microwave	0	6	6
	Radio Wave Measure & Inst.	0	6	6
	Project (Communication Engineering Department)	0	12	12
				30
Computer	Computer Language	4	4	8
	Computer Aided Problem Solving	6	6	12
				20
Electric power system experiment	Electric Power System	6	6	12
Communication experiment (2)	Opto Electronics	6	(6)	6
Physics experiment	Physics	6	6	12
Workshop	Electromechanical Workshop	8	8	16
Technical drawing	*Technical drawing*	6	6	12

Table 4-1 Analysis on Practice Hours per Week

The total practice hours of each subject group are hours assigned to laboratories per week. Total education hours per week are 38 hours. Therefore, if the total number of practice hours per subject group is 38 or less, these subjects can be carried out in one laboratory. Of the above subject groups, the electronic experiment group requires 68 hours in total, so that it requires 2 laboratories. Practice for each subject group other than the electronic experiment group can be carried out in one laboratory.
As a result, the following laboratories are necessary for this Project.

- . Electrical laboratory
- . Electronic Laboratories (2 laboratories)
- . Digital Laboratory
- . Automatic Control Laboratory
- . Communication Laboratory (1)
- . Radio Frequency & Microwave Laboratory
- . Computer Laboratory
- . Electric Power System Laboratory
- . Communication Laboratory (2)
- . Physics Laboratory
- . Workshop
- . Technical Drawing Room

The number of laboratories in the above is determined on the basis of the Technical Cooperation Long-term Experts Survey Report written in November, 1985.

. Academic Staff Room

The ranks of teachers, such as Senior, Assistant Senior and Junior, are stipulated by the Ministry of Education and Culture, apart from the rolls of teachers such as Lecturer and Instructor.

The rank is determined according to the capability and experience of the teacher. The size of the teacher's office is also standardized, 1 person/senior's room, 2-3 persons/assistant senior's room, 4-5 persons/ junior's room.

In the Project, the number of the academic staff rooms is estimated according to the conditions presented by the Indonesian side as shown in the following table

	Senior	Assistant senior	Junior	Total
Lecturer	2	5	8	15
Instructor	4	10	16	30
Lecturer's assistant	0	0	9	9
Instructor's assistant	0	0	15	15
Technician	0	0	16	16
Total	6	15	64	85

(Source: ITS)

Table 4-2 The Number of the Academic Staff by Rank

Technicians use the preparation rooms attached to each laboratory as their office, so no office is provided for their own use.

The standard planning grid in the Sukolilo Campus ITS Master Plan is adopted in the Project, and therefore academic staff rooms are planned as follows.
6 office rooms (1 person) for senior class, 8 office rooms (2 person) for assistant senior-class, 8 office rooms (5 person) for junior-class. Some shortage of the office room for juniors is assumed to be covered by adequate management.

6) Estimate of floor area of main rooms

. Classrooms
The standard floor area per student recommended by the Ministry of Education and Culture is $2.0m^2$ in a 30-seat classroom and $1.7m^2$ in a 60-seat classroom. In the case of a Polytechnic attached to Institute of Technology, Bandung (ITB Polytechnic), the 24-seat classroom has floor area of $67.2m^2$, or $2.8m^2$ per student.
Though very large desks (2-seat, 1.5 x 0.75m) are adopted in the ITB

polytechnic, in this Project,3-seat, 2.1 x 0.5m of a desk is considered to be sufficient for effective education.
The size of the classrooms was determined considering the layout of desks and chairs and the planning grid which is adopted in the Sukolilo Campus Master Plan.
The 30-seat classrooms were designed to have a seating capacity of 36. Because 10 to 20 percent more students than fixed capacity are sometimes enrolled.

The planning is as follows: (1) 30-seat classroom has floor area of $69.8m^2$, or $1.9m^2$ per student (36 students) and, (2) the 60-seat classroom has floor area of $103.7m^2$ or $1.7m^2$ per student.

The floor area per student is almost equal to the standard floor area of the Ministry of Education and Culture.

The floor area per student is about 1.2 times as big as that of high schools and universities in Japan, but it is appropriate to adopt the standard floor area of the Ministry of Education and Culture in this project considering the high temperature throughout the year in Surabaya.

. Laboratory

The standard size and floor area of laboratories are required to be $14.4 \times 9.6m = 138.2m^2$ in the ITS Master Plan.
The floor area of this Project is subject to the following conditions; experiments are performed by a class of 30 students, an experiment table is used by 3 students from one side, and 10 tables are used together with another table for teachers. The size of the experiment table will be 2.1 x 1.2m. The laboratory will be provided with experiment equipment in addition to the above 11 tables. Thus, the floor area and size are determined, with the standard laboratory size of the Sukolilo Campus ITS Master Plan taken into account. Some laboratories will be longer or shorter than the above standard size, depending on the space occupied by experimental equipment or space necessary for experiments.

The average floor area is $4.6m^2$ per student in average, being within the scope of the standard floor area of the Ministry of Education and Culture, 4.0 - 5.0m^2.

- Academic Staff Room

The Ministry of Education and Culture recommends the standard floor area per teacher for teacher's office; 18-21m^2 for senior, 9-11m^2 for assistant senior, and 6-7m^2 for juniors.

Basically, the Project adopts the standard planning grid of the Sukolilo Campus ITS Master Plan and consequently specifies the floor area as follows; 17.3m^2 per senior, 8.7m^2 per assistant senior, and 6.9m^2 per junior.

Although some of the floor area for the rank of teacher is somewhat larger than that of standard of educational facilities in Japan; 20m^2, 7.2m^2, and 4m^2 respectively.
The above floor area is appropriate considering the meteorological conditions and office customs in which layout of the desks are well spaced.
In addition, the size and floor area of the rooms, such as preparation room, laboratory, library and meeting rooms, are determined depending on the arrangement of furniture and equipment. Sukolilo Campus ITS Master Plan, the standard floor area of the Ministry of Education and Culture, the present situation of existing polytechnics, and the standard of similar facilities in Japan are also considered for the determination.

(2) Student Dormitory

According to the Sukolilo Campus ITS Master Plan, in the year of 2000, the capacity of the student will be 20,000 in total and of the student dormitory will be 4,000 i.e. the rate of accommodation is 20%.
Following the above rate of accommodation, this Project applies the same rate. The number of students accommodated in the Student Dormitory will be 72 (The number of total students x 20% = 360 x 20% =72.)
This means that the Student Dormitory will accommodate 75% of freshmen from area other than Surabaya.

The number of the bed rooms is 18, each room accommodating 4 students. The floor area of a bedroom is 21.6m^2, or 5.4m^2 per student. The floor area is equal to that of the existing ITS student dormitories. In the EEPIS Student Dormitory, each bedroom will be provided with an access door to the balcony where students can hang out laundry to dry in good weather as is the case with the existing ITS dormitories.
The Student Dormitory is proposed to be occupied by male students only. Meals for students in the Student Dormitory will be served in the cafeteria in the Lecture, Laboratory & Administration Building.
A rather long walk to the cafeteria may cause some inconvenience to students at first. It is recommended that such inconvenience be solved in the future plan of other facilities including female student dormitories in the student dormitory zone that are expected to be strategically laid out by the Indonesian side.
Toilets and showers will be provided in accordance with the specifications of the existing ITS student dormitory. They are designed to utilize natural ventilation and lighting similar to the toilets in the Lecture, Laboratory & Administration Building.

4-3-2 Section Plan

As stated in 4-1, in Surabaya, three countermeasures should be primarily considered in section planning of building; prevention of intruding rain water, shielding of direct sunlight, and flood control.
The height of each floor is 4.0 m in the Lecture, Laboratory & Administration Building and 3.0 m in the Student Dormitory. The existing natural ground level shall be filled up to the design ground level by a height of 60 cm (the Indonesian work). The first floor level will be 60 cm higher than the design ground level considering possible floods. Both the storey height and floor level are in accordance with the criteria of the Sukolilo Campus ITS Master Plan.
The roof will have rather steep gradient of average 35 deg. to prevent rain water from entering and will be finished with the same clay roof tiles as those used for the existing ITS facilities for harmonization of appearance. The backing of the roof tile will be steel frames in combination with posts of reinforced concrete on concrete slabs laid out above the top floor. This design is considered to be effective to resist termite damage.

(1) Lecture, Laboratory & Administration Building

The ceiling height is 3.0 m in classrooms and laboratories with no air-conditioning, and 2.7 m in air-conditioned laboratories and rooms for teaching and administrative staff.
The balcony will be 1.8 m in depth and provided with sun louvers to shut out strong sunlight. No one will be allowed to go out to the balcony except for maintenance service. This design is made on the assumption that the floor of balcony may be left wet in bad weather unless rain water intrudes through openings. The corridor will be designed not to be intruded by rain water because it is frequented by staff and students during breaks.
Classrooms will be provided with projected window on the balcony side, and with fixed glass louvers which is left open above transoms on the corridor side to get natural ventilation.
Rooms for teaching and administrative staff will be also provided with projected window on the balcony side, and with inswinging window above transoms on the corridor side so that they can be opened for natural ventilation.

(2) Student Dormitory

The balcony and eaves at the edge of the corridor will be 1.5 m in depth because the storey height is 3.0 m, which is lower than that of 4.0 m of the Lecture, Laboratories & Administration Building.
Like the existing ITS student dormitory, the Student Dormitory will not provided with suspended ceilings and the soffit surface of the concrete slab of the upper floor will directly finished to have enough ceiling height.
Transom windows will be provided with fixed open louvers both on the corridor side and on the balcony side, to ensure natural ventilation constantly. Mosquito screens will be mounted inside the louvers to prevent insects at night.
The section plan is made for keeping the corridor floor dry while leaving the balcony floor wet in bad weather, as is the case with the Lecture, Laboratory & Administration Building.

4-3-3 Building Material Plan

The building material plan is based on an integral review of factors for each building component, such as required functions, local construction conditions, and construction period, construction cost and reduction of maintenance cost. In Surabaya, climatic conditions such as rainfall, sunlight and wind have a considerable influence on the building material plan.

(1) Structural materials

The locally adopted combination of reinforced concrete frames and brick walls will be used as a basic structural method.
Cement, aggregates, reinforcing steel bars, and brick are locally available and acceptable both in quality and quantity.

(2) Finishing Materials

Considering that EEPIS facilities are to be situated in the scope of the Sukolilo Campus ITS Master Plan, finishing materials used for the existing ITS facilities have been studied. The material and grade of finishing should be basically the same as those of the ITS facilities provided that such materials are acceptable with respect to function and maintenance.

1) Roof

The roof is finished with the same type of clay roof tile as that of the existing ITS facilities to harmonize with the proposed facilities with ITS facilities in appearance.
In the EEPIS facilities, the uppermost story will use reinforced concrete slabs, where reinforced concrete posts are erected to support roof trusses which are constructed with lightweight steel gauge and timber.
Clay roof tiles are laid on the trusses as stated in the section plan. The flat roof such as the roof of the corridor will be waterproofed with polyurethane membrane which features easy workability and high durability.

2) Exterior walls

Exterior walls at exposed portions, such as gable walls, and exterior walls of toilets and staircases, will be of reinforced concrete construction considering waterproof resistance, and other exterior walls are of brick.

Exterior walls will be mortared and troweled. The weathered portion is finished with spray tiles and the other exteriors with paint.

Exterior walls of the existing ITS buildings are finished with paint. However, paint-finished buildings require re-painting once every several years to extend the building service life.

Paint is locally available without difficulty but temporary work such as scaffolding for re-painting cause greater maintenance costs.

On the other hand, sprayed tiles have excellent weather resistance and eliminate the need of re-coating over a long period, though they are somewhat more expensive than paint.

Under the climatic conditions in Surabaya, rooms do not require air conditioning, excluding rooms for special purposes, if the openings on exterior wall are carefully designed to ensure natural ventilation.

3) Floors

Following the existing ITS buildings basically, the floors of living rooms and corridors will be finished with cement tiles. Cement tile is most commonly used in Surabaya, featuring excellent durability and easy maintainability as well as low cost.

The floor of the computer laboratory and large classroom will be finished with plastic tiles. The plastic tile has the effect of inhibiting dust and reducing the floor weight in the computer laboratory, where the floor will be thicker for electric cabling. The plastic tile effectively reduces the noise level of footsteps in the large classroom. The floor of the entrance hall is finished with terrazzo tiles. Terrazzo tile allows the selection of bright colors compared with monotonous and blackish cement tiles, though it is more expensive than the cement tile.

Terrazzo tile has good durability and maintainability, and causes no problem in waterproofing if carefully designed to be protected from direct rain water.

4) Interior wall

Interior walls of reinforced concrete or brick will be mortared, troweled, and finished with paint.

Wood partition walls will be partially employed to reduce construction costs by lightweight design and reduce the construction period, with sound insulation properties taken into account. Material of baseboard is selected from cement tiles, terrazzo tiles, hardwood baseboard with painting finish or mortar troweled baseboard, depending upon wall finish, with waterproofing and durability taken into account.

5) Ceilings

Like the existing ITS building, suspended ceilings will be provided for the EEPIS building to conceal piping and the ducting for air conditioning and to make the indoor environment comfortable.

Main rooms will be provided with non-flammable pre-finished gypsum board ceilings on wood setting beds, and the toilet with asbestos board ceilings.

Like the existing ITS Student Dormitory building, no suspended ceiling will be provided in the Dormitory, but the soffit of the concrete slab will be finished directly with sprayed color cement considering the lower height of the storey, 3.0m.

6) Fittings

Wooden windows will be used in the EEPIS buildings, basically, because they are used in the existing ITS buildings and satisfy the requirements of exterior fittings of the EEPIS building, and feature ease of maintenance. Lumber should be selected carefully to make the specified wooden windows because insufficiently dried lumber will cause warps, bends, or other defects.

In the EEPIS Building, steel sashes will be selectively used for the portions which are susceptible to rain water in order to prevent damage by termites as are found in wooden windows of weathered portions without eaves such as the exterior wall of the staircase in the existing ITS buildings.

The Lecture, Laboratory & Administration Building will not be provided with mosquito screens since in the Sukolilo Campus, mosquitoes and flies are rarely found in the daytime. However, mosquito screens are provided in transom windows of bed rooms in the Student Dormitory, where students study late at night.

4-3-4 Structural Plan

Indonesia is situated in the Euro-Asian seismic zone, where many earthquakes have occurred in the past.
However, the proposed construction site is included in an area less subject to earthquakes and the zone coefficient is low.
The high constant ground water level (-0.5m) of this site has some influence on structures. Careful consideration should be given to structures, especially construction under the ground such as water reservoir tanks and septic tanks.

(1) Super Structure

The super structure is proposed to be 2 or 3 storeyed buildings of Rahmen Structure of reinforced concrete, in consideration of the local environment, the area and soil of the site. The roof structure will consist of posts on concrete slabs, steel beams constructed at an average gradient of 35deg., and clay roof tiles.

(2) Type of foundation

The Buildings in the Projects will be lower storeyed: Lecture, Laboratory & Administration building will be 3-storeyed while Student Dormitory will be 2-storeyed. Therefore a direct foundation could be adopted if the soil conditions were good.
However, the soil conditions of the proposed site are soft as stated in 3-3-5. The pile foundation is considered appropriate among the types of foundations. In this area, the precast concrete pile with blow driven sytem is commonly used without serious problems and this sytem will be applied to this project.

(3) Loads and external forces

Loads and external forces on buildings will be as follows.

1) Dead load: Will be calculated by the weight of the structural and finishing materials, and fixed indoor equipment to be actually used.

2) Live load: Will be calculated in accordance with Japanese Building Standards and Indonesian standards, depending on the use of each room.

3) Seismic force: Will be calculated with the following factors in accordance with Indonesian Standards.
Zone coefficient: Zone 4, C=0.05
Coefficient of building type: 1.0
Coefficient of importance: 1.5

(4) Main building material

1) Concrete: Fc=225kg/cm2
(compression strength at 28 days)

2) Reinforcing bar: SD35 or equivalent (19mm or more)
SD30 or equivalent (16mm or less)

3) Steel frame; SS41 or equivalent

4-3-5 Service Plan

(1) Electrical facilities plan

1) Power supply and distribution facilities

. High-tension electric power
The work for high-tension equipment (20kV) including a substation will be executed by the Indonesian side. The substation building shall be constructed at the proposed construction site.

. Low-tension electric power
Adjacent to the substation constructed by the Indonesian side, the Electric Building will be constructed, provided with a low-tension power- receiving panel and a low-tension switch board, and power

will be supplied to the Lecture, Laboratory & Administration Building and Student Dormitory.

Receiving electric system is 3-phase, 380/220v, 50Hz.

The cables from the secondary side of the transformer to the low-tension power receiving panel will be included in the work by the Indonesian side.

The electric capacity necessary for the Project will be about 650kVA.

An induction type automatic voltage regulator (IVR) will be provided at the secondary side of the low-tension power receiving panel.

. *Generator*

A generator will be provided in the Electric Building as emergency power source for fire extinguishing equipment and emergency lighting. The capacity of the generator will be about 50kVA.

The system and scope of work of power supply is shown in Fig. 4-6.

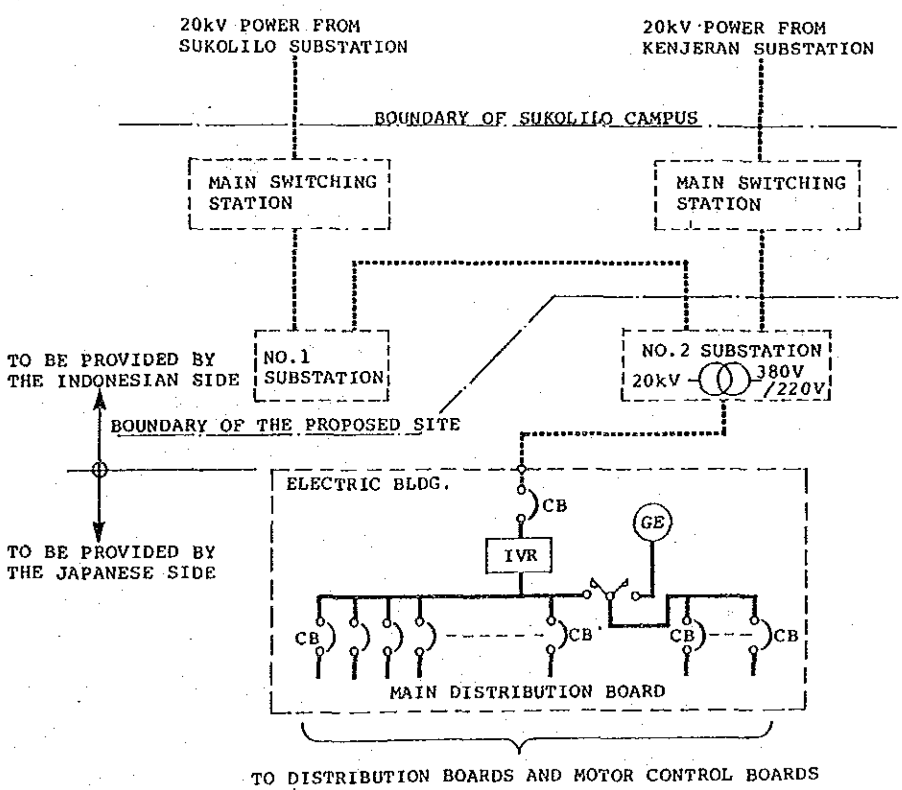

Fig. 4-6 Outline of Power Supply System

2) Motor control

The motor control system will supply power to the air conditioning and plumbing equipment, and control the operation of such equipment.

The Administration office will be provided with an alarm panel that indicates equipment failure and water level.

3) Lighting fixtures

Fluorescent lamps will be mainly used as light source. Lighting fixtures are of ceiling surface type (rooms with ceilings) and of pendant type (rooms without ceilings).

Except for stores and toilets, at least one of the lighting fixtures in each room will be connected to the generator circuit.

Illumination level will be in accordance with the following table. Table value of illumination level for the laboratory and preparation room is set a little higher than that of classroom for the use of precision instrument.

Room	Average Illumination Level
Classrooms	250 - 350 Lux
Seminar room	250 - 350 Lux
Laboratory	350 - 400 Lux
Preparation room	350 - 400 Lux
Technical drawing room	550 - 650 Lux
Library	250 - 350 Lux
Rooms for academic staff	300 - 400 Lux
Meeting room	
Office	300 - 400 Lux
Dining room	50 - 150 Lux
Entrance hall	50 - 150 Lux
Corridor	30 - 50 Lux

4) Socket outlets

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

The socket outlet type is of 2-pin + 2 earthing pin type commonly used in Indonesia.

5) Power supply for educational equipment

Each Laboratory will be provided with a distribution board, and power will be supplied to equipment.

Computers, communication equipment, and measuring instruments will be supplied with power through the automatic voltage regulator (AVR).

6) Telephone system

The Administration Office will be provided with a telephone exchange equipment, and the following rooms with extension lines.

Lecturer's Room	Office
Instructor's Room	Preparation Room
Meeting Room	Library
Director's Room	Kitchen Staff Room
Administration Office	Entrance Hall of Student Dormitory

The telephone exchange equipment will have a capacity of about 5 central office lines and 70 extension lines.

7) Public address system

The public address system will be provided for the purpose of general communication in the building.

An amplifier will be installed in the Administration Office to send messages to classrooms, laboratories, offices, corridors, etc.

No public address system will be installed in the Student Dormitory. If communication is required, a telephone can be used instead of a public address system.

8) Fire alarm system

A receiving panel will be installed in the Administration Office. Fire alarm push button, bell, and indication lamp will be provided at upper part of fire hydrant boxes.

The fire hydrant pump will be an automatic start type, being interlocked with a fire alarm signal transmitter.

No fire detector will be installed.

9) Lightning protection system

The lightning protection system will be installed in accordance with Indonesian standard.

(2) Air conditioning facilities plan

. Design ambient temperature and humidity

The design outside air temperature and humidity (in summer) is as shown as follows.

Outside air temperature	: 33 deg C (D.B.)
Outside humidity	: 27 deg C (W.B.)

Design Conditions for Surabaya by American Society of Heating, Refrigerating and Air-Conditioning Egineerings Handbook

Design indoor air temperature : 25 ± 2 deg C

. Rooms to be air-conditioned

The air conditioning system will be provided to the following laboratories, etc.

Digital Electronic Laboratory
Computer Laboratory
Electronic Laboratory (1)
Electronic Laboratory (2)
Communication Laboratory (1)
Communication Laboratory (2)
Library
Class Room (1) (150 seat)

The educational equipment in these laboratories needs the control of indoor air temperature and pressure. On the other hand, environmental conditions in class rooms, library, dining rooms, etc. will be maintained by natural ventilation as specified by the architectural plan.

Rooms for academic and administrative staff, offices, meeting rooms, etc. will be provided with independent air conditioners by the Indonesian side. Sleeves will be provided for the future installation of air conditioners.

1) Air conditioning equipment system

The air conditioning equipment system will employ air-cooled packaged type air conditioners that enable to control indoor air pressure in order to prevent dust, dirt, etc. from intruding into laboratories.

2) Duct system

The single duct system will be employed to supply and return cooled air.

3) Piping system

The piping system will be employed to drain condensate from air conditioners. Piping material will be polyvinyl chloride pipe.

4) Ventilating system

Ventilating system will be provided to exhaust heat and odors from educational equipment.

5) Automatic control system

A automatic control system will be provided to control air conditioners by a remote controller in the administration office for the purpose of effective operation maintenance. Indoor thermostats will control the room air temperature.

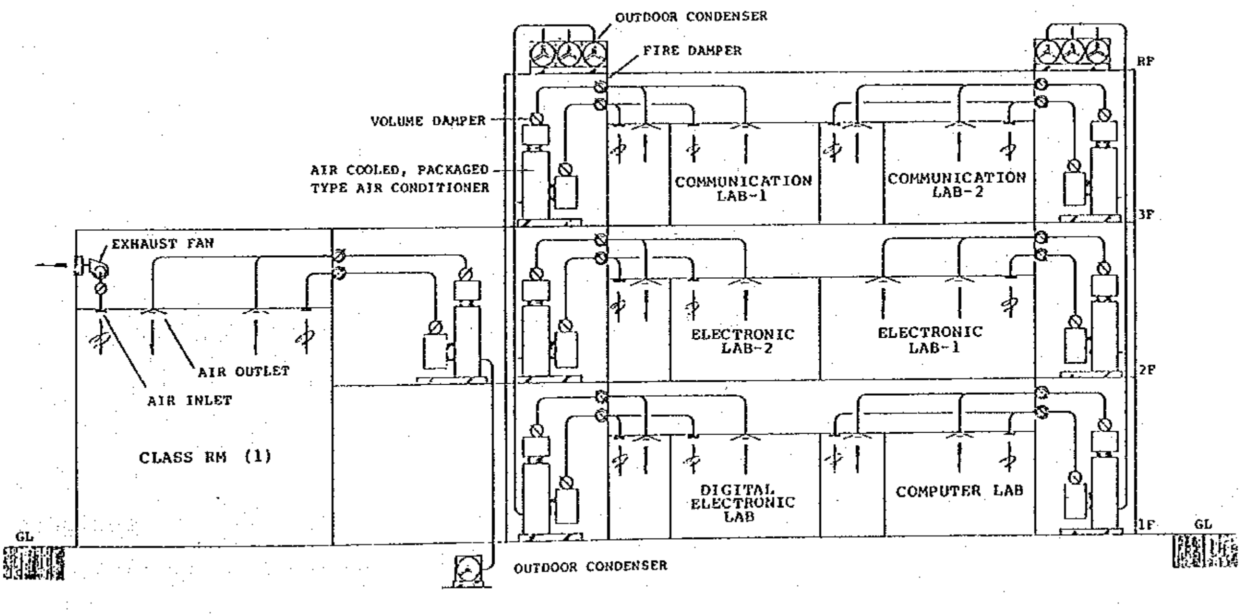

Fig. 4-7 Schematic Ducting Diagram

(3) Plumbing and sanitary facilities plan

1) Potable water supply system

City water pipes 65mm in diameter will be laid at the southwest boarder line of the site, and led into the concrete reservoirs which will be installed underground near the Lecture, Laboratory & Administration Building and Student Dormitory.
City water will be lifted to each FRP-made elevated tank and supplied to the necessary area by gravity. The piping material will be Galvanized steel pipe.

2) Drainage and vent system

The drainage system will employ a separate system for soil water and waste water in buildings.
Soil water will be combined with waste water outside the buildings.
The combined drainage will be treated in a septic tank before being penetrated into soil through penetration pipes.
Stack system for vent will be employed.
Piping material will be polyvinyl chloride pipes for soil, waste water and vent.

3) Sanitary fixture installation

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

4) Gas piping system

LPG gas piping will be laid for the kitchen of the dining room.
The piping material will be galvanized steel pipe.

5) Kitchen equipment installation

Gas ranges and a refrigerator will be installed in the kitchen of the dining room.

6) Interior fire extinguishing system

The Lecture, Laboratory & Administration Building will be equipped with interior fire extinguishing system in accordance with Japanese Fire Law.
Interior fire hydrant pump will be installed in the pump room and