BASIC DESIGN STUDY
ON
THE CONSTRUCTION
OF
THE LECTURE ROOM BUILDING
KING MONGKUT'S INSTITUTE OF TECHNOLOGY
IN THE KINGDOM OF THAILAND

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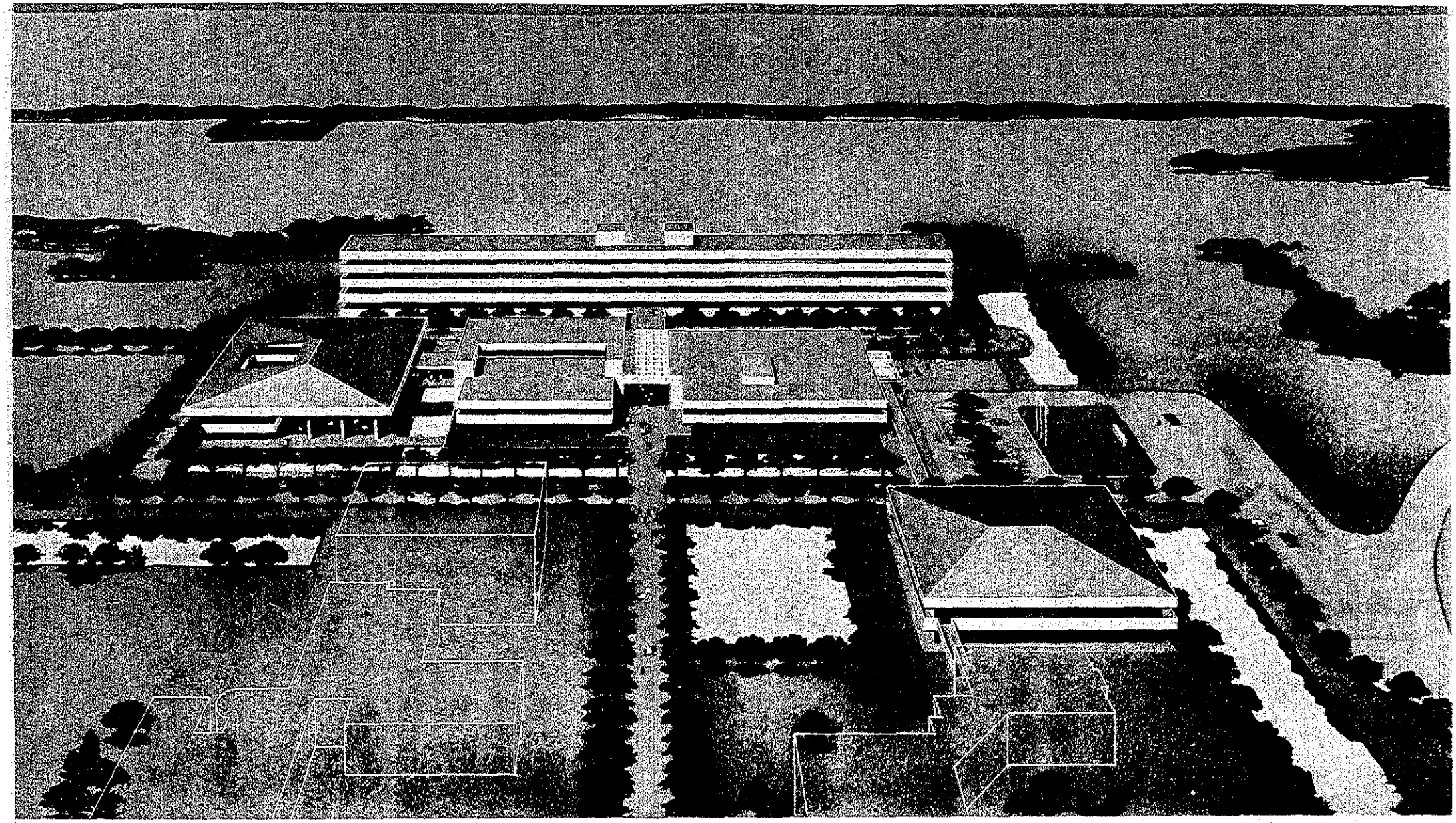
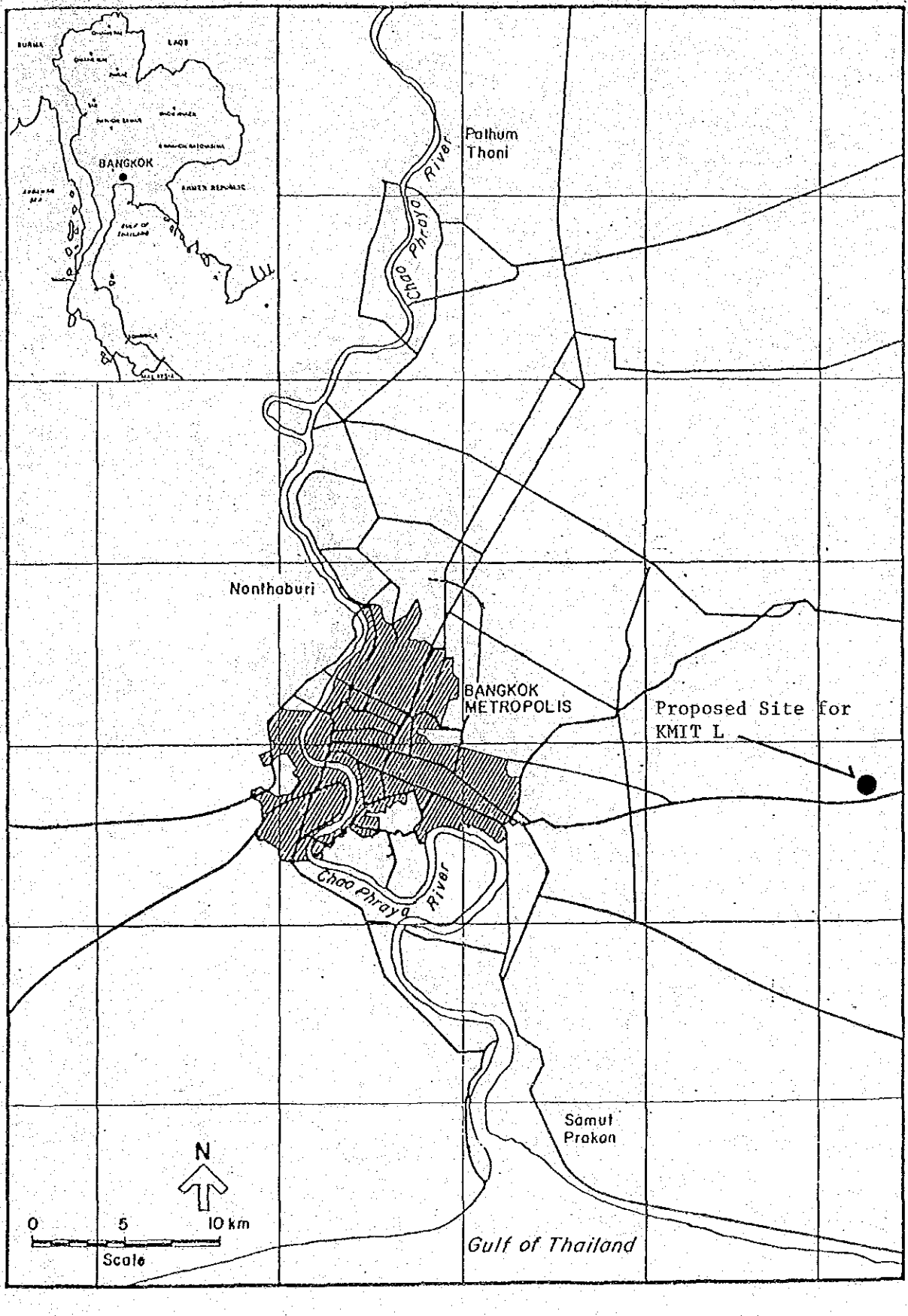


THE LECTURE ROOM BUILDING KING MONGKUT'S INSTITUTE OF TECHNOLOGY

Location of KMITL



PREFACE

In response to the request of the Government of the Kingdom of Thailand, the Government of Japan decided to conduct a basic design study on the Project to construct a Lecture Room Building, King Mongkut's Institute of Technology and entrusted the study to the Japan International Cooperation Agency. The JICA sent to Thailand a study team headed by Mr. Yoshifusa SHIKAMA, Basic Design Division, Grant Aid Dept. JICA from August 7 to 27, 1983.

The team had discussions with the officials concerned of the Government of Thailand and conducted a field survey in Ladkrabang Province area.

After the team returned to Japan, further studies were made and 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 Kingdom of Thailand for their close cooperation extended to the team.

December, 1983

Keisuke Arita
President
Japan International Cooperation Agency

SUMMARY

Up until 1970's, the Kingdom of Thailand continued a steady economic growth, establishing the basic structure of her economy through expansion of the production of agriculture, which occupied 70 percent of the entire labor force. However, the economic growth came to slow down in late '70s as a result of stagnant agricultural production due to unfavorable weather, worsening international trade balance and high rate of inflation largely due to sudden spiraling oil price.

In order to break this deadlock, the Government of Thailand took the following countermeasures: In the 5th Five-Year Social and Economic Development Plan (October, 1981 to September, 1986), the Government plans to promote development of the heavy chemical industries and to switch the economic structure from agriculture-based economy to the pattern more centered on industries by development and effective use of local energy resources including natural gas in the Gulf of Thailand. The Government further worked out the 6th Social and Economic Development Plan (October, 1986 to September, 1990) to implement balanced economic development and economic structure reform in an effort to become a member of the industrial countries.

In order to learn technology from advanced industrial countries and develop to a semi-industrial country, an important subject for the administration on education is to promote the technology education to produce competent engineers and to supply the industrial society with them, based on the well-organized project planned by the Government. The Government is now promoting the expansion of the facilities, improvement of equipment and resources for basic researches, and training and education of researchers for the higher educational institution such as universities and various technical schools. However, the implementation of such programs faces difficulty because of chronic shortage of the budget to be allocated for such items.

Under these circumstances, to establish the foundation for basic technology education and research, the Government of Thailand

planned a project to construct lecture room building at Ladkrabang (KMITL) belonging to King Mongkut's Institute of Technology (comprising Ladkrabang, North Bangkok, and Thonburi campuses), which is the only engineering college in Thailand, registering a remarkable development in past 22 years under the technical cooperation of the Government of Japan: This Institute was selected from among 14 national universities under the supervision of the Ministry of University Affairs. Along with this, the Government of Thailand requested the Government of Japan to grant aid assistance with regard to construct the lecture room building and related facilities, and to supply the equipment.

Having received this request, the Government of Japan sent a basic design study team to Thailand from August 7 to 27 in 1983 through Japan International Cooperation Agency.

The purpose of this study is to comfirm the request from the Government of Thailand and KMITL, to study the feasibility of the financial assistance, to carry out a field reconnaisance on the proposed construction site, to examine accessibility to the supporting infrastructure, and to determine layout and scale of the facilities appropriate to their activity and function, as well as to draw out the optimal basic design including selection of equipment and materials.

Ladkrabang Campus is scheduled to be established as an independent national university on early 1984 in order to improve education in technology. The purpose of this project is to build a lecture room building and related facilities in order to provide foundamental lecture and laboratory space for general requirement courses for all eight departments of KMITL as the new national university (existing departments: engineering, agricultural technology, architecture and industrial education science, new departments: industrial technology, heavy engineering, communication arts and science).

The proposed site is located in KMITL campus, Ladkrabang district, approximately 30km east of Bangkok. Approximately 20,000 square meters of a tract of land is reserved for the construction site at

central administration block in central part of the campus. Located in a swamp, the site requires filling and leveling work and is provided with various utilities and main services line.

The proposed facilities consist of 4 buildings: central lecture room/ laboratory/information service center building, central administration building, student's hall, and student's dormitory. These buildings accommodate the following:

Central lecture room/laboratory/information center building (two to five stories, 13,520m^2):

* Lecture rooms, with a total capacity of 1,800 students, mainly for general requirement courses
* Laboratories (physics, chemistry, biology, general engineering, control engineering, electronics and drafting)
* Information service center, including computer laboratory, audio/ visual production room, language laboratories, document store and audio/visual editing and printing room

Central administration building (two stories, 1,630m^2):

* Rector's and Vice Rector's offices
* Administrative faculties' room
* Seminar room
* Meeting room

Student's hall (two stories, 1,890m^2):

* Student's cafeteria
* Administrative faculty's cafeteria
* Student co-op
* Student activities conference room
* Multi-purpose hall

Student's dormitory (two stories, 1,520m^2):

* Student's room to accommodate 100 persons
* Laundry room
* Reading room

Total floor area: 18,560m^2

The Government of Japan will be responsible for the facility construction and supply of equipment and material. On the other hand, the Government of Thailand will be responsible for the cost of the site preparation, provision of utilities and services for construction, and provision of office supply and furniture estimated at approximately ¥80 million. Construction schedule is estimated to be 7 months for completion of design (including bidding and contracting) and 19.5 months for construction.

On planning and implementation of the project, the Government of Thailand will form an implementation committee in KMITL as an active body under the education policy guideline of the Ministry of University Affairs so as to comply with objective of national development plan. After the completion of the facilities, central administration office and management section of KMITL will continue to be responsible for the administration and management of the facilities.

As the project is considered as an important base for Thailand to become a semi-industrial country by supplying more competent engineers in both number and quality, as well as to serve as specific model to other higher educational institutions, the prompt implementation and completion of the project is desirable. Grant aid assistance by the Government of Japan is expected to play a crucial role in promoting the completion of the project, generating a large benefit and effect of foreign aid.

As the result of a long-term technical assistance by the Government of Japan, it is expected that industrialization of Thailand will be inspired through the assistance to found the base of technology education for KMITL with which Japan has had strong relationship, and that influence on technology education will be far-reaching. It is also expected that the friendly relationship between Japan and Thailand will be cemented.

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CHAPTER 1. OUTLINE OF THE STUDY

The Government of Thailand has set the policy in 5th National Social/ Economic Development 5 year Plan (October, 1981 - September, 1986) to give the highest priority to semi-industrialization of the country in order to achieve a stable state of national economy.

To accomplish the policy, prompt education and supply of a maximum number of competent engineers was called for as one of the main objectives. Among 14 national universities and colleges, 7 universities and colleges having engineering and technology related faculties as well as the various technical schools are expected to play an important role to fullfill the objective.

Especially, King Mongkut's Institute of Technology Ladkrabang campus (KMITL) has a faculty of engineering which has shown remarkable development in terms of educational quality as a result of technical cooperation given by the Government of Japan for past 22 years, and attains public expectation and attention as a leading force to accomplish the national objective.

King Mongkut's Institute of Technology consists of three campuses: Ladkrabang, North Bangkok and Thonbori. Ladkrabang campus will be scheduled to establish as independent national university on early 1984, as a result of a specific legistration which has been approved by the cabinet.

A new national university, succession of KMITL, is planned to and 4 more faculties to the existing 4 faculties during 6th National Plan period (1986 - 1990). As a result, enrollement capacity is expected to increase by three times from the present capacity, and the new campus plan adequate to status of new national university is currently under formulation.

In November, 1974, the main facilities of the faculty of engineering, including a telecommunication laboratory building, a library, a

memorial hall, an auditorium and a gymnasium, were completed with grant aid assistance by the Government of Japan. However, a lecture room building has not been constructed because of difficulty of budget allocation for the purpose.

Although self effort by the Government of Thailand has been expected, the construction of the building has not commenced to this date.

Since then, KMITL has added the various faculties and departments in response to society's need. Furthermore, the government's policy obliged KMITL to admit the students more than its capacity. Meanwhile, KMITL was unable to expand the facilities to sufficient capacity within the limit of allocated budget. Consequently, in addition to overcapacity of the classes, a shortage of class room against the present enrollment became so serious that the class rooms are used on weekends to meet class schedule.

Under these circumstances, KMITL requires the additional facilities not only to eliminate chronic shortage of class rooms but also to serve as a core facility to integrate the campus and a center of education and research activity in new national university. KMITL considers as an urgent matter the construction of the central lecture facilities for general requirement courses which are equally beneficial to freshman and sophomore year students in 8 faculties including 4 proposed faculties, and formulated the facility construction plan and requested grant aid assistance to the Government of Japan, through the Government of Thailand.

In response to the request, the Government of Japan dispatched a basic design study team, through Japan International Cooperation Agency (JICA), to Thailand. The study team headed by Mr. Yoshifusa SHIKAMA, Basic Design Division, Grant Aid Dept. JICA carried out a survey, from August 7th to August 27th, 1983, which is necessary to the basic design, by means of discussion with the responsible personnels of the Government of Thailand and KMITL and field reconnaisance at the proposed site.

The major scope of basic design study is as follows:

1). Confirmation on the request of King Mongkut's Institute of Technology and its background

2). Discussion of the present condition of KMITL and future plan; including a number of enrollement, a number of instructors, curriculum, proposed faculties and departments, land use, condition of school attendance, and the existing facilities and condition

3). Confirmation and discussion of the function and major activities of the proposed facilities

4). Field reconnaisance on the proposed site and supporting infrastructure

5). Assessment and discussion of general requirement of the facilities such as kind of room, scale and equipment and material

6). Study on the various technical plan for the facilities, such as architecture, building structure and utility

7). Collection and analysis of data and information necessary to estimate construction cost as well as operation/maintenance cost

8). Comparative study on Chulalongkorn University, Tamasart University and other related facilities

9). Survey on KMITL student's need by questionnaire (need for on campus dormitory, etc.)

Upon result of the above study and discussion, the main item of discussion was compiled to the minutes. The minutes was signed by the Government of Japan, represented by Mr. Yoshifusa Shikama, Leader of basic design study team, and by the Government of Thailand, represented by Dr. Kosol Petchsuwon, vice Rector of KMITL, on 19th August, 1983, confirming the basic matters.

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Minutes of discussions	Appendix 2
Organization of Authorities Concerned	Appendix 3

CHAPTER 2. BACKGROUND OF THE PROJECT

2-1. The 5th National Social Economic Development Plan (October, 1981 – September, 1986)

In Thailand, social/economic development plan has been continuously implemented for more than 20 years since 1962. The intention of the plans are to layout a guideline for efficient allocation of economic, financial and human resources and effective management of public administration to expand production and trade as well as to upgrade the infrastructure which is necessary to improve standard of living.
Between 1st Plan through 4th Plan, gross national product of Thailand increased by 14 times from 60 billion baht in 1962 to 817 billion bahts in 1981, per capita income by 8 times from 2,200 baht to 17,200 baht and export by 16 times from 9.9 billion baht to 163 billion baht. As a result Thailand improved economic and social condition, and accomplished a considerable growth of export and employment in comparison to other developing countries.
However, the economic growth in past 20 years was based on some wasteful development without effective preservation of economic resources such as land resource, and rapid rate of economic growth adversely affected social and environmental problems to cause urban congestion. Consequently the various problems such as change in cultural and social value, mental instability and difficulty to protect life and property were left unsolved, to conclude that the economic growth has not sufficiently brought about economic stability.
Also increase in energy and other prices considerably affected Thai economy, which depends energy and capital supply on import.
As it is realized that reforming of the economic structure is the necessary condition to solve the various economic problems, 5th Plan is characterized as "policy plan", in contrast to the previous Plan, aiming at serving as basis for implementation of the plan at lower level.

The main characteristics of 5th Plan are as follows:

1). Shift of emphasis from economic growth of adjustment of economic structure

The adjustment of the economic structure is crucial for Thai economy and the sectors of production to be able to respond to the trend of world economy. The Plan reconsiders the emphasis on only economic growth and realizes economic efficiency and productivity to be equally important.
Also the Plan aims to control unnecessary consumption and to establish economic standard such as energy conservation.

2). Emphasis on equity through economic/social development

The plan intends to decentralize income and economic activity to rural area, to improve social justice, and to promote to reorganize the source of income.
The Plan emphasized that the result of economic development should not benefit only a specific region, group and population but should equally benefit each sector, all regions and each person.

3). Emphasis on eradication of poverty in lagging regions

The Plan promotes the participation of poverty group to production and national development activity through their self-help effort.

4). Harmony between economic development and national security

The Plan aims at optimal level of nation's stability by attempting further harmony between effort toward economic and social development and maintaining of national security.

5). Emphasis on coordination and adjustment mechanism on planning and implementation

The Plan aims at reforming public administrative organization at national and regional level and at implementing development programs in accordance with major policy objectives.

6). Emphasis on role and cooperation of private sector

The Plan emphasizes on strengthening of the government's leader-ship since internal coordination of public sector should be further emphasized on planning and implementation of industrialization of Thai economy which was traditionally left to private sector as considered to be their role.

Summarily, following the objectives of 5th Development Plan, Thai economy could be transformed to semi-industrial structure when problem of government's finance and external trade deficit is lessened and the coordination of production structure and the improvement of economic efficiency are accomplished. Thus, the most important objectives of the development Plan is to transform Thailand from agricultural country to industrial country by increasing industrial portion in her export structure and by accelerating industrialization of national economy.

The core of the 5th Development Plan is to promote heavy chemical industries by utilizing natural gas which is supplied from the coast of the Gulf of Thailand (Eastern Coast Industrial Complex Project) to achieve industrialization of Thailand.

In the long run, a large scale scheme has been formulated to aim at transforming Thailand to a semi-industrial country during the 5th Plan period and then to a new industrial country during the 6th Plan period.

Under such national level of plan, it is urgent matter to train and educate the engineers who are pivotal to industrial society. Thus the Government of Thailand, as national policy, directs and expects the educational guideline and activity, which serve as a base for accomplishment of the objectives of the plan, to the universities having the engineering and technology related faculties and to the vocational and technical schools.

Table 2.1 Economic Projection

	1981	1986
GDP (1 billion Bahts)	817	1,859
PERCAPITA INCOME (Bahts)	17,204	35,692
LABOUR FORCE (thousand)	23,756	27,505
EMPLOYED	23,495	26,955
UNEMPLOYED	261	550
MERCHANDISE EXPORT (1 million Bahts)	162,627	444,952
AGRICULTURAL PRODUCTS (Percentage %)	48	43
MANUFACTURED PRODUCTS (Percentege %)	29	42
MERCHANDISE IMPORT (1 million Bahts)	229,877	528,536
DEFICIT IN BALANCE OF TRADE (1 million Bahts)	67,250	83,584
Percentage against GDP (%)	8.2	4.5
DEFICIT IN BALANCE OF PAYMENTS	53,014	44,529
Percentage against GDP (%)	6.5	2.4

2-2. Educational Situation and University's Education in Thailand

2-2-1. Educational System in Thailand

Thailand established the educational system in 1913 during the period of monarchy and legistlated "Primary Education Act" in 1921 to mandate the school enrollment of children between 7 - 14 years old. Since then, the act was amended in 1937 to institutionalize primary education as 4 years compulsory education, and thus official educational institution was effectuated: to become modernized public educational system consisting of 4 years primary education, 6 years secondary education 2 years university preparatory course education, and 4 years university education.

New educational plan, implemented in 1961, reformed old educational system so as to follow the trend of the educational system in the world, by reorganizing the system to 4 steps, pre-school education, primary education, secondary education, and higher education, with enrollment year of 4:3:5:4 respectively.

In 1977, 4th National Educational Plan, as a part of 4th Social/ Economic Development Plan, was formulated to implement the entire reform of educational system, including educational institution and curriculum: 6:3:3 educational system, equivalent to Japan, was introduced and higher education was reorganized to 4 - 6 years system consisting of university, teacher training program and vocational training program.

The latest educational system is classified as follows:

Institution	Years of Enrollement	Age of Enrollement
Kindergarten	2	5 - 6
(Primary Education)		
Elementary School	6	7 - 12
(Secondary Education)		
Junior High School		
(General)	3	13 - 15
(Music and Theatre)	3	13 - 15
High School		
(General)	3	16 - 18
(Military and Police)	3	16 - 18
(Music and Theatre)	3	16 - 18
(Post-secondary Education)		
University	4 - 6	19 - 24
Teacher Training Institute	2 - 4	19 - 22
Technical and Vocational Training Institute	3 - 4	19 - 22
Military and Policy Academy	5	19 - 23
Music and Theatre School	2	19 - 20

2-2-2. Extension of Education of Thailand

At compulsory education (primary education) level, although up to 4th grade 100 per cent of eligible children is enrolled in school, at 6th grade the enrollment rate drops to 50 per cent because of low family income to require the work of the children and to unable them to continue schooling, indicating the problem of full enforcement of compulsory education. The enrollment rate for higher education is 30 per cent at junior high school level, 20 per cent at high school level, and 5 - 6 per cent at higher education level except for open university, to indicate low rate of enrollment against total eligible population.

This situation appears to be partly originated from a lack of public interest in higher education but to be considerably affected by incipient level of public administration toward equality of educational opportunity, so that quantitative improvement of school education is of urgent matter to cope with a shortage of educational facility, material, equipment and teacher.

2-2-3. University Education

Currently, a number of school at higher education level is added up to 200, consisting of 14 national universities and colleges under jurisdiction of Ministry of University Affairs, 11 private universities and colleges, teacher training institutes as well as technical institutes under jurisdiction of the Ministry of Education, and the other institutes of higher education under jurisdiction of the other ministries such as military and police academy. The enrollment rate is 5 - 6 per cent of the population in eligible age group.

Of 14 national universities and colleges, only 7 universities and colleges have engineering and technology related faculties, and King Mongkut's Institute of Technology is only one University in this field. This means that a majority of national universities and colleges is teaching the field related to liberal arts and social science. In light of the present situation in which public interest in higher educational degree is growing, overproduction of university graduates with arts and social science degree could not be fully absorbed to Thai economy and society, and constitutes serious social problem. On the other hand, education of engineering related students, which is derived from society's demand to develop human resources essential to industrial society, faces the problem to overcome such as a lack of resources and facilities for required basic research which is equally important as education and training and education of researchers. At present, because of scarcity of domestic graduate programs, the solution is to depend upon higher educational institutions in foreign countries.

Although employment rate of the graduates with engineering related degree is high in comparison to the ones with arts and social science,

further expansion of employment opportunity for them in harmony with development of human resources educated in the universities and other institutes is essential to stable growth of Thai economy and society and constitutes necessary condition for education development in Thailand.

2-2-4. Public Administration on Education

14 national and 11 private universities and colleges are administered under jurisdiction of Ministry of University Affairs which was established in 1972.

The Ministry's responsibility includes establishing of universities and colleges, coordination with Social/Economic Development 5 years Plan, coordinating of request for the budget allocation, and establishing of curriculum standard.

On the other hand, the universities and colleges are delegated of authority equivalent to the departments of the ministries.

Other educational institutions, with exception of military and policy academy, are administered under jurisdiction of the Ministry of Education.

Table 2.2 Ratio of School Attendance in ASEAN Countries (%)

	Plimary Education		Middle Education		High Education	
	Male	Fmale	Male	Fmale	Male	Fmale
THAILAND	73	66	28	26	6.13	4.19
JAPAN	100	100	86	86	64	18.85
SINGAPORE	100	100	49	54	15.93	5.60
MALAYSIA	94	87	39	28	4.15	2.25
PHILIPPINES	90	88	65	47	18.16	23.05
INDONESIA	58	52	15	10	3.58	1.37

Table 2.3 Budget of Education Occupies in National Finance (1977)

THAILAND	20.8 %
MALAYSIA	19.3
JAPAN	17.0
INDONESIA	8.9
PHILIPPINES	7.4
SINGAPORE	7.3

(DATE : UNESCO STATISTIC YEAR-BOOK 1978-1979)

2-2-5. Educational Budget

The share of budget on education within total government budget is ranged between 19-20 per cent during 1979 - 1981. In 1983, the share is higher than that of national defense and economic service to become the highest allocated item, and is also the highest among ASEAN countries. (Table 2.4, Table 2.5)

Table 2.4 Annual Estimated Expenditure

(UNIT : 100 Million Baht)

year	1979	(%)	1980	(%)	1981	(%)	1982	(%)	1983	(%)
ECONOMIC	17,785.4	19.3	24,096.1	21.0	31,943.3	22.8	32,857.0	20.4	33,773.5	19.1
EDUCATION	17,786.5	19.3	22,558.1	19.7	27,932.6	20.0	32,364.6	20.1	37,212.5	21.0
DEFENCE	19,056,9	20.7	22,384.3	19.5	27,722.5	19.8	31,617.6	19.6	35,470.8	20.1
PUBLIC PEACE	5,037.1	5.5	6,050.5	5.3	7,320.8	5.2	8,321.3	5.2	9,611.7	5.4
PUBLIC HEALTH	3,877.4	4.2	4,483.4	3.9	5,265.6	3.8	6,395.2	4.0	7,625.8	4.3
PUBLIC UTILITY	6,058.7	6.6	7,157.5	6.2	10,007.7	7.1	10,330.3	6.4	10,906.8	6.2
ADMINISTRATION	2,948.8	3.2	3,551.4	3.1	4,748.3	3.4	4,309.0	2.7	5,347.5	3.0
DEBT REDEMPTION	10,027.9	10.9	12,392.9	10.8	17,5309	12.5	21,008.5	13.1	27,150.3	15.3
THE OTHERS	9,421.3	10.2	11,882.3	10.4	7,528.3	5.4	13,886.5	8.6	9,901.1	5.6
TOTAL	92,000.0	100	114,556.5	100	140,000.0	100	161,000.0	100	177,000.0	100

Table 2.5 Break Down of National Finance

(UNIT : 100 Million Baht)

year	1982	(%)	1983	(%)	(%)
CENTRAL FUND	21,966.8	13.6	17,707.8	10.0	△19.4
OFFICE OF THE PRIME MINISTER	1,268.4	0.8	1,485.1	0.8	17.1
MINISTRY OF DEFENCE	29,384.5	18.3	33,055.6	18.7	12.5
MINISTRY OF FINANCE	22,363.2	13.9	28,841.8	16.3	29.0
MINISTRY OF FOREIGN AFFAIRS	7,69.4	0.5	850.2	0.5	10.5
MINISTRY OF AGRICULTURE & CO-OPERATIVES	13,441.8	8.3	15,134.5	8.6	12.6
MINISTRY OF COMMUNICATION	10,152.8	6.3	10,676.2	6.0	5.2
MINISTRY OF COMMERCE	359.4	0.2	416.2	0.2	15.8
MINISTRY OF INTERIOR	17,254.0	10.7	19,766.0	11.1	14.6
MINISTRY OF JUSTICE	509.2	0.3	6,27.1	0.4	23.2
MINISTRY OF SCIENCE TECHNOLOGY & ENERGY	1,172.0	0.7	1,319.4	0.7	12.6
MINISTRY OF EDUCATION	27,042.5	16.8	31,156.4	17.6	15.2
MINISTRY OF PUBLICE HEALTH	6,652.3	4.1	7,919.6	4.5	19.1
MINISTRY OF INDUSTRY	738.3	0.5	818.5	0.5	10.9
MINISTRY OF UNIVERSITY AFFAIRS	4,453.8	2.8	5,097.8	2.9	14.5
THE OTHER ORGANIZATION	439.8	0.3	5,23.6	0.3	19.1
GOV'T MANAGED FIRM	2,972.2	1.8	1,595.3	0.9	△46.3
REVOLVING FUND	59.5	-	8.9	-	△85.0
	161,000.0	100	177,000.0	100	9.9

Table 2.6 Competent Authority of High Education

COMPETENT AUTHOLITY	NUMBER OF SCHOOL	CLASSIFICATION
MINISTRY OF UNIVERSITY AFFAIRS	14	NATIONAL UNIVERSITY
	11	PRIVATE UNIVERSITY
MINISTRY OF EDUCATION	1	TECHNICAL JOB EDUCATION COLLEGE
	32	JOB TECHNIC COLLEGE
	3	COMMERCIAL COLLEGE
	46	AGRICULTURAL COLLEGE
	36	TEACHERS TRAINING COLLEGE
	7	PHYSICAL TRAINING COLLEGE
	1	CLASSIC ARTS COLLEGE
	1	FINE ARTS COLLEGE
MINISTRY OF PUBLIC HEALTH	7	NURSING COLLEGE
MILITARY, POLICE	4	MILITARY, POLICE ACADEMY
THE OTHER MINISTRY	2	MILITARY, POLICE NURSING COLLEGE
	11	THE OTHER MINISTRY'S SCHOOL
PRIVATE	1	ADVENTIST HOSPITAL NURSING COLLEGE
	2	BUDDHIST COLLEGE
THE OTHERS	1	ASIAN INSTITUTE OF TECHNOLOGY (AIT)

2-3. King Mongkut's Institute of Technology

The history of development of the institute to this date has been closely tied to technical cooperation by the Government of Japan for past 22 years, which was extended to the faculty of engineering at Ladkrabang campus. The brief history of the institute is as follows:

1). Established as Telecommunication Training Center

In 1954, the Government of Thailand, in response to public need for expansion of telephone service, separated the work from Department of Postal and Telephone service in the Ministry of Communication and established Telephone Organization of Thailand (TOT).
During the period, the Government of Thailand requested to the Government of Japan its technical cooperation concerning the education of engineers and technicians who are responsible for installation, operation and maintenance of telecommunication equipment. After field study in 1959, Telecommunication Training Center was established in Nondhaburi, north of Bangkok.
Originally, the school had 7 Japanese experts as instructor, and offered one year general course and 3 months special course with enrollment of 23 students.

2). Raised to technical school status

As diploma obtained from general course was not accepted as job qualification, the center was reestablished as technical school with three years course in June, 1962. In May, 1964, the name of "technical school" was changed to "Nondhaburi Telecommunication College".
After termination of technical cooperation agreement with Japan in August, 1965, teaching in telecommunication department was handed over to the Thai instructors and newly established Radio and television technology department was taught by specialists dispatched under Colombo Plan, to continue to technical cooperation.

3). Raised to university status as King Mongkut's Institute of Technology

Under implementation of 2nd National Social/Economic Development 5 Years Plan (1966 - 1970), the Ministry of Education intended to upgrade quality of education and vocational training, and decided to add 2 years advanced course to existing 3 years course in the curriculum of the college so as to grant the graduates university degree. In March, 1968, establishing of the advanced course (undergraduate degree program) in the college and merging of Nondhaburi Telecommunication College, North Bangkok Technical School and Thonburi Technical School were approved by the cabinet.
In March, 1970, Nondhaburi Telecommunication College, under assistance of the Government of Japan, North Bangkok Technical School, or Thai-West Germany Technical School, under assistance of the Government of West Germany, and Thonburi Technical School, under assistance of UNDP, officially merged and established as King Mongkut's Institute of Technology (KMIT), and the previous schools were renamed as KMIT Nondhaburi, KMIT North Bangkok and KMIT Thonburi.
The institute is named after King Mongkut, 4th king of Chakuri monarchy (reigned between 1851 - 1868), who was dedicated to modernization of Thailand.

4). History of KMIT Ladkrabang campus

Among 3 campuses of KMIT, Nondhaburi campus site was so small ($4,000m^2$) that sufficient expansion of the facilities to develop as university campus was very difficult. And in January, 1971, a decision was made to reserve the land of 1.2 million m^2, located in Chaokun Tahan school district of Ladkrabang district, 30km east of Bangkok for new campus site to be relocated.
The Government of Thailand constructed 6 storeys lecture room administration building in the new campus site, and in 1973, requested to the Government of Japan the grant aid assistance with regard to completion of the facilities and supply of equipment mainly of the faculty of engineering, which developed as a result of the

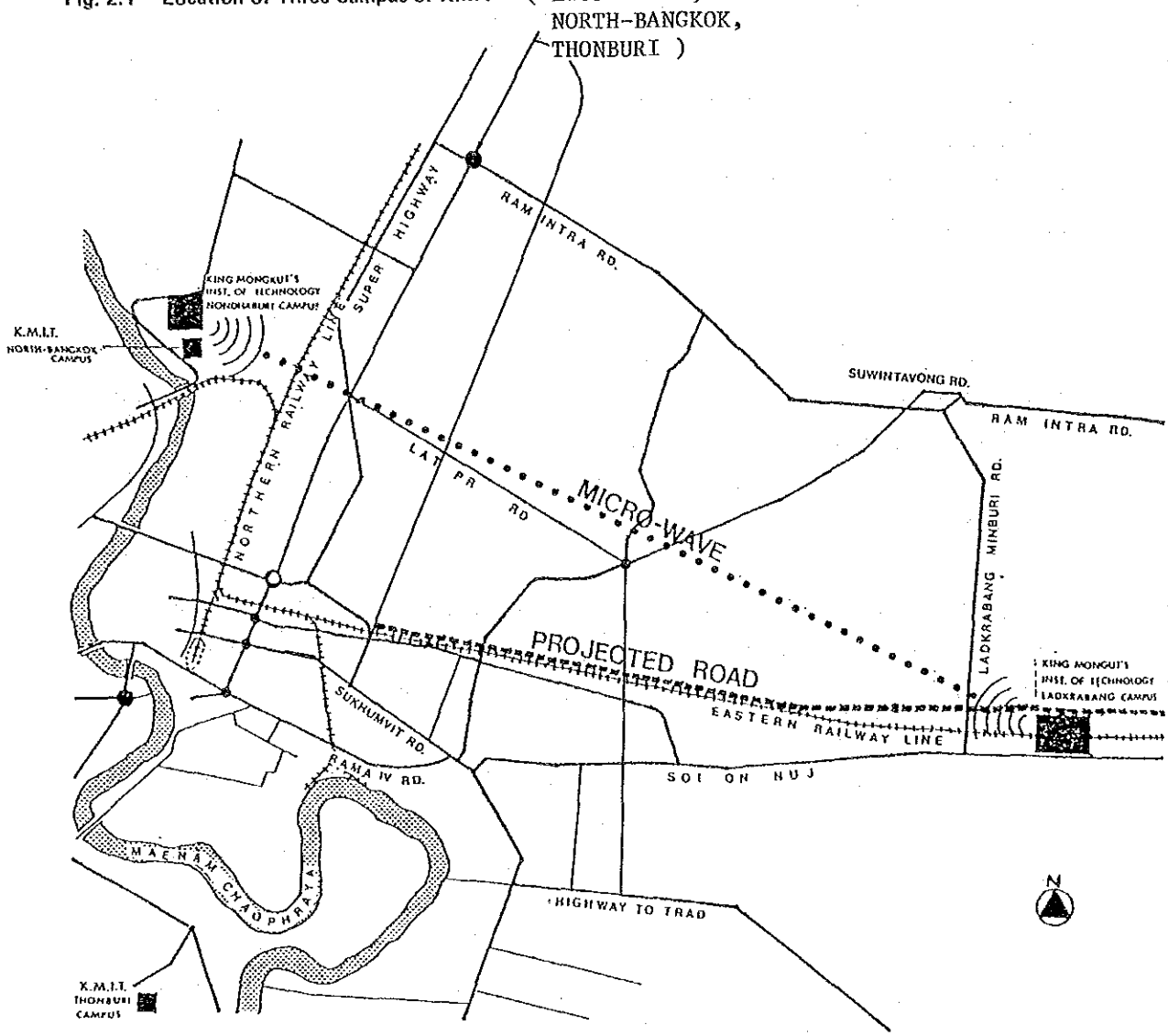
previous technical cooperation. Upon request, the Government of Japan furnished the facilities with total floor area of 8,000m^2, consisting of a telecommunication laboratory building, a library, a memorial hall, an auditorium and a gymnasium, along with equipment in 1974 - 1975. The facilities were completed in November, 1975, and inaugurated on 16th August, 1976 with presence of a King and a Queen, to be officially changed from KMIT Nondhaburi campus to KMIT Ladkrabang campus.

Meanwhile, in 1971, when relocation of the campus was decided, architectural school which was already located in Ladkrabang campus site was merged and reorganized to the faculty of architecture. In 1977, the faculty of industrial education and science building was completed in the new campus site. In 1979, agricultural school adjacent to the campus site was merged and reorganized to the faculty of agricultural technology, and in 1981, a computer center was established. At the same time, old campus in Nondhaburi is used as the facility for industrial instrumentation technology department of the faculty of engineering.

At present, KMITL is comprised of 4 faculties and a computer center with 495 faculty member and staffs and 2,811 enrollment capacity in 1983, to show three fold increase in 10 years. Technical cooperation from the Government of Japan, which continued for 22 years since signing of the agreement in 1961, was extended to 7 departments of the faculty of engineering, except for mechanical engineering department: telecommunication engineering, electrical engineering, electronics, computer engineering, control engineering, television technology, industrial instrumentation technology. During the period, 53 experts were dispatched on long term basis; 29 from Japan Telegram and Telephone Corporation, 10 from NHK, 5 from the Ministry of Posts and Telecommunication, 6 from Tohkai University, and 3 from International Telegram and Telecommunication Corporation. Also, numerous number of experts on specialized subject and assistance to installation of furnished equipment was dispatched on short term basis.

At the same time, KMITL faculty of engineering has been sending many counterpart to Japan as JICA trainee. As a majority of the

Fig. 2.1 Location of Three Campus of KMIT (LADKRABANG, NORTH-BANGKOK, THONBURI)



instructors working from the year of technical school status has only one qualification of engineer, more than 40 instructors are sent to Japan, both in long and short term, for study in undergraduate and graduate programs at the various universities and colleges (Tohkai University, Nippon University, Telecommunication College, Ohsaka University, Toohoku University and Hiroshima University), and have already obtained Bachelor's or Master's degree or are in Ph.D. program. Thus, further improvement of research activity in KMITL is expected after their return from Japan.

In summary, major events in history of KMITL are listed as follows:

1959 Field study by the Government of Japan for technical cooperation

1961 Opening of Nondhaburi Telecommunication Training Center

1962 Reestablished as 3 years technical school

1964 Raise of the status to Nondhaburi Telecommunication College

1969 Cabinet approval to merging of Nondhaburi Telecommunication College, North Bangkok Technical School and Thonburi Technical School, and to establishing of advanced course

1970 Established as King Mongkut's Institute of Technology on merging of three schools, and which were named as KMIT Nondhaburi, North Bangkok and Thonburi campus

1972 Decided to relocate Nondhaburi campus to Ladkrabang Establishing of the faculty of architecture by merging with the existing architectural school

1975 Completion of the facilities for the faculty of engineering, under grant aid by the Government of Japan.

1976 Use of Nondhaburi campus as the faculty of engineering of KMITL Ladkrabang

1977 Establishing of the faculty of industrial education and science

1979 Establishing of the faculty of agricultural technology by merging with agricultural school

1983 Cabinet approval to raise 3 KMITL campuses to the status of independent national university

CHAPTER 3. CONTENTS OF PROJECT PLAN

3-1. Objective

KMITL has based eventful incipient stage for about 10 years after its foundation, and is entering into improvement and development stage. In response to semi-industrialization policy for stabilization of national economy as a part of 5th National Social/Economic 5 years Plan drawn out by the Government of Thailand which aims to promptly educate a maximum number of competent engineer, KMITL is under process of separation from North Bangkok and Thonburi campus and of transformation to a new national university. Also, a number of the faculties will be increased to 8 from 4 at present during 6th National Plan period. (1986 - 1990)

The objective of KMITL Lecture Room Building Facilities Construction Scheme is to construct the following facilities which constitute a core of new national university and its 8 faculties, and is based on a guideline on educational development in national development plan:

1). Central lecture room/laboratory building to conduct general requirement and basic technical courses for freshman and sophomore year students in 8 faculties of the university

2). Central administration building required for administration and management of the new national university system

3). Information service/course material production center for instructors and students

4). Student's hall and dormitory for welfare and convenience of students

3-2. Present Condition and Future Plan of King Mongkut's Institute of Technology Ladkrabang (KMITL)

3-2-1. Present Condition

1). A number of student by faculty and course is as in Table 3.1.

Table 3.1 Number of Student and Classified in Course

Faculty	V/C	D/T	B/D	M/D	D/D	TOTAL STUDENT / STAFF
ENGINEERING	-	619	536	83	1	1,239/140
ARCHITECTURE	-	377	274	-	-	651/115
INDUSTRIAL EDUCATION AND SCIENCE	-	-	370	-	-	370/100
AGRICULTURAL TECHNOLOGY	204	149	198	-	-	551/110
COMPUTER CENTER	-	-	-	-	-	0/25
TOTAL	204	1,145	1,378	83	1	2,811/490

V/C : Vocational Certificate
D/T : Diplomat of Technician ---- Two Years
B/D : Bachelor Degree ---------- Three Years after D/T
(Two Years in the future)
M/D : Master Degree
D/D : Doctoral Degree

2). A list of departments is presented in Table 3.3 of Appendix. Among them, *-1 is 3 year part-time course which will be raised to faculty status, *-2 will be absorbed to a new faculty, or the Faculty of Industrial Technology, *-3 will be reorganized to a new faculty, or the Faculty of Communication Arts, and *-4 to a new faculty, or the Faculty of Industrial Education.

Table 3.2 Number of Student KMITL (1983)

No	Faculty	person	(%)
1.	ENGINEERING	1239	44.0
2.	ARCHITECTURE	651	23.2
3.	AGRI-TECH.	551	19.6
4.	INDUSTRIAL EDUC.SCIENCE	370	13.2
	TOTAL	2811	100.0

Number of Teaching Staff KMITL (1983)

No.	Faculty	person	(%)
1.	ENGINEERING	78	24.8
2.	ARCHITECTURE	80	25.5
3.	INDUSTRIAL EDUC.SCIENCE	84	26.8
4.	AGRICULTURE	72	22.9
	TOTAL	314	100.0

Number of Staff KMITL (1983) (Teaching and Administrative)

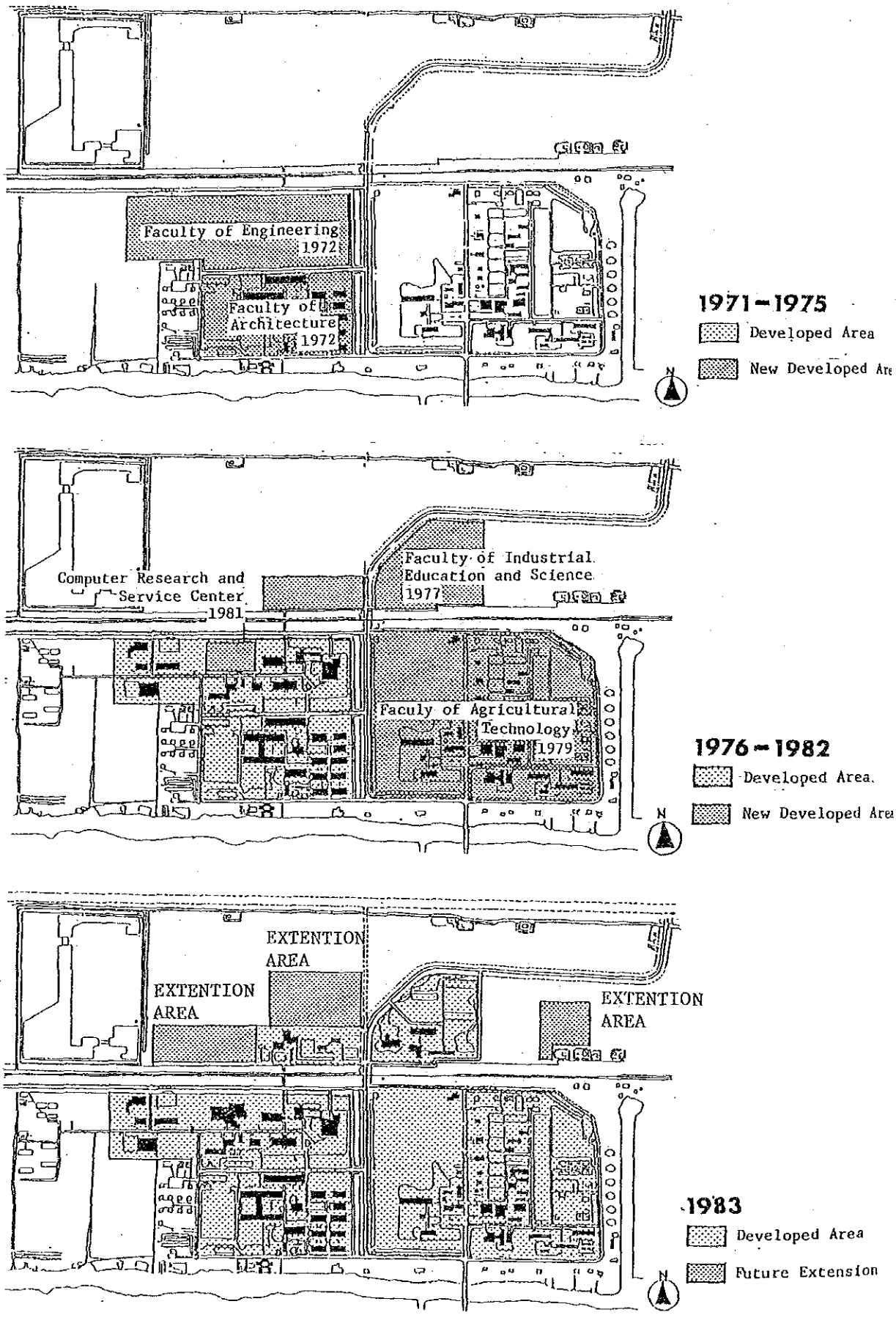
No.	Faculty	person	(%)
1.	ENGINEERING	133	26.8
2.	ARCHITECTURE	112	22.5
3.	AGRICULTURE	102	20.5
4.	INDUSTRUAL EDUC.SCIENCE	99	19.9
5.	Central Office	39	7.9
6.	COMPUTER CENTER	12	2.4
	TOTAL	497	100.0

Table 3.3 KMITL'S Faculty and Department (at present)

Faculty	Department
ENGINEERING	
	Telecommunication Engineering
	Electronics
	Electrical Engineering
	Computer Engineering
	Control Engineering
	Mechanical Engineering
* - 1	Industrial TV Technology
	Industrial Electronics
	Industrial Instrumentation Technology
ARCHITECTURE	
	Architecture
	Interior Architecture
	Industrial Design
* - 2	Construction Technology
* - 3	Communication Arts
INDUSTRIAL EDUCATION & SCIENCE	
	Industrial Chemistry
	Applied Statistics
	Applied Physics
	Applied Mathmatics
	Biological Technology
* - 4 - ①	Industrial Education of Architecture
	Industrial Education of Industrial Design
	Industrial Education of Interior Design
	Industrial Education of Telecommunication
	Plant Production Techonology
	Animal Production Technology
AGRICULTURAL TECHNOLOGY	
	Agriculture
	Agricultural Mechanics
	Floriculture & Ornamental Horticulture
	Plant Production Technology
* - 4	Animal Production Technology
	Agricultural Business Administration
	Agricultural Engineering
* - 4	Agricultural Industry

* - 1 : Three years, New faculty in future
* - 2 : Faculty of Industrial Technology in future
* - 3 : Faculty of Communication Arts in future
* - 4 : Faculty of Industrial Educaiton in future

Fig. 3.1 Developed Progress of KMITL



3). Existing Facilities

KMITL has passed 12 years since its foundation in 1971, and underwent a rapid expansion and change. The stages of its development in chronological order is as in Fig. 3.1.

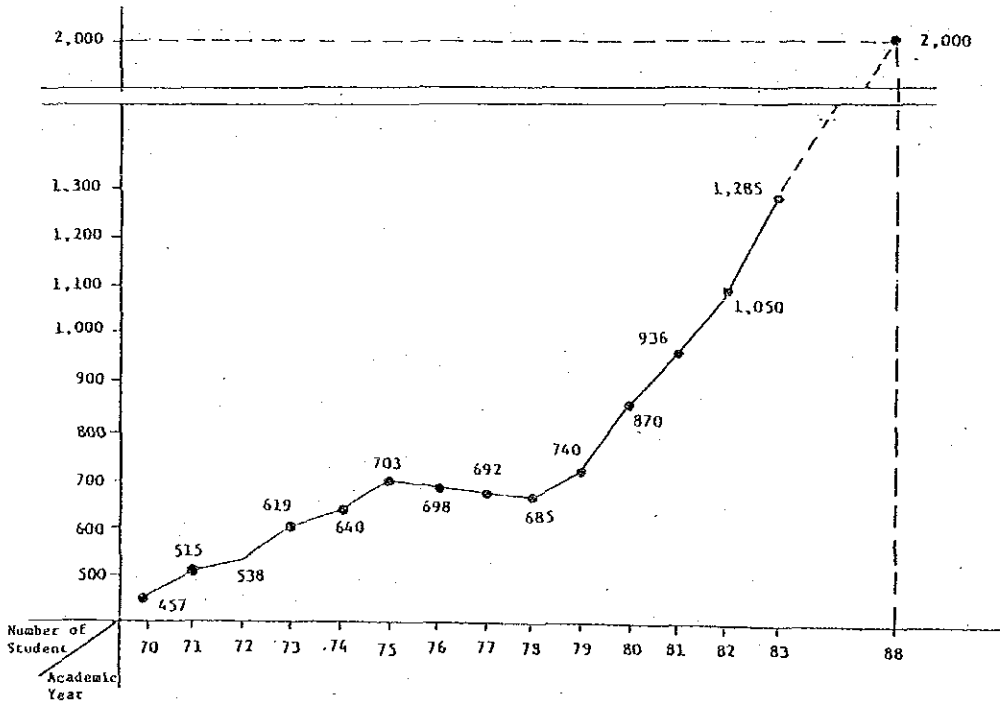
1st Stage (1971 - 1975): Technical College is formed, consisting of two faculties, the Faculty of Engineering (succession of Nondhaburi Telecommunication Training Center) and the Faculty of Architecture (merging and reorganizing of the old Construction College). The facilities of the Faculty of Engineering were newly constructed but the Faculty of Architecture utilized the facilities of former Construction College. The facilities consisting of a telecommunication laboratory building, a library, an auditorium and a gymnasium with total floor area of 8,000m^2 along with equipment were completed by financial assistance from the Government of Japan between 1974 - 1975.

2nd Stage (1796 - 1982): The Faculty of Industrial Education and Science was established, and its lecture building, lecture hall building, laboratory building and other facilities were completed. Also, an agricultural school adjacent to the campus was merged and reorganized to the Faculty of Agricultural Technology. Through the process, the College came to have 4 faculties and the campus site was expanded from the south side of the railway across the campus to the north side. During the period, a number of enrollment rapidly increased, under a guideline of 5th National Plan, as in Table 3.4 and Fig. 3.2.

Table 3.4 Transition of Teaching Staff, Student, Graduated Student at Engineering Faculty, KMITL

Academic year	Teaching staff				Student				Graduated student			
	Bachelor and below	Master	Doctor	Total	Technician degree	Bachelor degree	Master degree	Total	Technician	Bachelor	Master	Total
1961	19	1		20	23			23	23			23
62	20	3		23	30			30	30			30
63	19	3		22	85			85	33			33
64	23	3		26	110			110	38			38
65	25	3		28	135			135	34			34
66	23	4	1	28	114			114	43			43
67	24	5	1	39	154			154	33			33
68	24	4	1	29	215			215	34			34
69	28	3	1	32	320	37		357	73			73
70	33	4	1	38	394	63		457	79	33		112
71	40	5	1	46	412	103		515	116	23		139
72	47	7	1	55	399	139		538	110	56		166
73	47	10	3	60	482	137		619	114	57		171
74	53	16	5	74	402	238		640	102	71		173
75	62	13	5	80	361	320	22	703	103	131		234
76	73	16	9	98	334	312	52	698	92	101		193
77	56	33	8	97	364	297	31	692	69	120	2	191
78	35	25	6	66	383	252	50	685	109	109		218
79	41	29	6	76	412	291	37	740	82	104	7	193
80	40	28	7	75	453	358	59	870				

Fig. 3.2 Regular Number of Students at Engineering Faculty, KMITL



A number of Class rooms and the seating capacity in the existing 4 faculties is as in Table 3.5, according to the survey. The result of the survey indicates that only the Faculty of Architecture manages to provide a sufficient number of class rooms. Although the Faculty of Industrial Education and Science appears to be in satisfactory condition, a lecture hall is used to supplement the seating capacity, and due to a shortage of class rooms freshman and sophomore year students are not enrolled in the departments of the faculty, to only accept the students with diploma in technology from other technical schools as junior and senior year students. A shortage of class rooms in the Faculty of engineering is more serious than other faculties.

Furthermore, each faculty of KMITL, which underwent continuous merging and reorganizing process, appears to be loosely organized without appropriate planning, although the faculties are located in same campus area. At present, as vice rector's office has been recently completed the core facilities of the campus is said to be at the very first stage of development.

Table 3.5 Number of Existing Lecture Rooms, KMITL

Faculty of Engineering (6 stories)

Lecture room	Capacity
A-201	80
A-202	40
A-301	40
A-302	40
A-303	40
A-303	40
A-306	40
A-401	40
A-402	40
A-403	40
A-405	40
A-406	40
A-501	40
A-502	80
A-504	60
A-505	60
TOTAL	Capacity 760, Lecture room 16

Faculty of Architecture

Lecture room	Capacity
BLDG.2-109	30
BLDG.2-110	30
BLDG.3-105	20
BLDG.3-102	20
BLDG.3-202	20
BLDG.3-205	20
BLDG.4-110/111	60
BLDG.4-112/113	50
BLDG.4-114/115	50
BLDG.4-116/117	60
BLDG.4-212/213	60
BLDG.4-214/215	50
BLDG.4-216/217	50
BLDG.4-218/219	60
BLDG.5	20
TOTAL	Capacity 600, Lecture room 15

Faculty of Agricultural Technology

Lecture room	Capacity
SIENCE BLDG.204	30
SIENCE BLDG.205	30
PLANT BLDG.104	40
PLANT BLDG.105	40
PLANT BLDG.204	60
ANIMAL BLDG.104	40
ANIMAL BLDG.204	80
AGRICULTURAL ENG. & BUSINESS BLDG.	60
TOTAL	Capacity 380, Lecture room 8

Faculty of Industrial Education and Science

Lecture room	Capacity
BLDG.B (1)	220
BLDG.B (2)	130
BLDG.C 2	30
BLDG.C 3	30
BLDG.C 4	50
BLDG.C 5	30
TOTAL	Capacity 490, Lecture room 6

4). Condition of Other Existing Facilities

Foreign Language Education:

At present, two Foreign language courses are offered as a part of general requirement program in KMITL. Curriculum of foreign language course for freshman and sophomore year students in general requirement program of each faculty is shown in Table 3.6.

Table 3.6 Foreign Language Courses

(E:English, J:Japanese)

Faculty	First year		Second year	
	First Semester	Second Semester	First Semester	Second Semester
Engineering	E-I, J-I	E-II, J-II	-	-
Architecture	E-I	E-II	E-III	E-IV
Industrial Education and Science	E-I	E-II	Scientific E-I	Scientific E-II
ditto Dept. of Applied Statistics	E-I	E-II	J-I, Scientific E-I	J-II Scientific E-II
Agricultural Technology Dept. of Agriculture	Technical E	-	-	-
Dept. of Agricultural Machanics	-	-	Technical E	-
Dept. of Agricultural Engineering	E-I	E-II	E-III	-

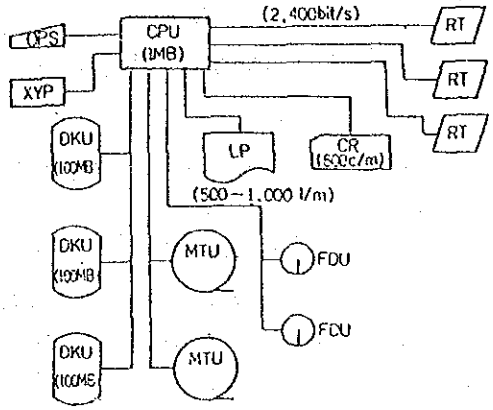
This table indicates that very few foreign language courses are offered in curriculum of all the faculties. The reason for this is found in a lack of emphasis on foreign language in general owing to engineering related university, and in a shortage of instructors, especially native speakers. Furthermore, a shortage of language laboratory room, which is supposedly supplemental to native speakers, is observed in KMITL. At present, only one language laboratory room, with capacity of 35 students, is in the lecture room building of the Faculty of Engineering. In comparison to other universities in Thailand, Chulalongkorn University and Tamasart University, a shortage of the facility in KMITL appears to be outstanding: in Chulalongkorn University, the Faculty of Engineering has its own language laboratory, while a several language laboratories are available in an independent information service center.
In connection with a shortage of the above facilities, a shortage of textbook and course materials is considered as a problem. For instance, course materials for Japanese language course, not available on the market, has to be prepared by the instructors and printed for distribution to the students in advance. Thus it is desirable to improve such facilities.

Computer Center:

The building is located in the site of the Faculty of Engineering and is an independent organization separated from the Faculty. The center was constructed to accommodate a data processing system furnished by Japan during the period of 1980 - 1981, in accordance with technical cooperation agreement between Japan and KMIT signed in 1978 for the purpose of upgrading education and research activity in the field of data processing, semiconductor and electric power.

Configuration of the system is illustrated in Fig. 3.3.

Fig. 3.3



CR : CARD READER
CPU : CENTRAL PROCESSING UNIT
DKU : DISK UNIT
FDU : FLEXIBLE DISK UNIT
LP : LINE PRINTER
MTU : MAGNETIC TAPE UNIT
OPS : SYSTEM CONSOLE
RT : REMOTE TERMINAL
composed of
•CRT(CATHODO RAY TUBE) DISPLAY
•KEY BOARD
•PRINTER
•FDU
XYP : XY PLOTTER

Education on computer in KMITL emphasizes application technology rather than hardware. Education on computer major is done by the Department of Computer Engineering and general computer training is conducted in general requirement courses for freshman and sophomore year students. At present, curriculum of general computer education in table 3.7 will be expanded to a wider scope throughout the faculties.

Table 3.7 Curriculum of General Computer Education

	First year		Second year	
	First Semester	Second Semester	First Semester	Second Semester
All Student of Faculty of Engineering	FORTRAN	COBOL	-	-
Faculty of Science Dept. of Applied Mathmatics	-	FORTRAN	COBOL	-
Dept. of Applied Statistics	-	-	FORTRAN	COBOL

5). Survey on School Attendance and Student's Housing

The result of the survey is summarized as follows:

Hometown of Students: Bangkok metropolitan area and vicinity - 30%

Other area - 70%

As KMITL is only one engineering related university, the students come from all over the country.

Means of transportation to KMITL

Train - 80%

Bus and other - 20%

A predominant number of the students uses Thai National Railway East-line which passes the campus area. The students from Bangkok metropolitan area and vicinity take a bus (buses) to a railroad station, Bangkok Central Station or Makasan Station, to further travel to Ladkrabang. Travel time is approximately 30 - 35 minutes, plus relatively long time for transfer of buses, mainly because of extremely heavy traffic congestion in Bangkok metropolitan area in recent years. Few private cars are used as means of transportation to the school.

Student's Dormitory:

At present there is no student's dormitory in KMITL, to depend on private housing. In Ladkrabang, there are four private student's dormitories to accommodate about 300 students. A size of a typical room is 3 x 3m, for two residents at 300 baht (approximately 3,000 yen) of monthly rent. Living environment of the rooms is generally unsatisfactory. Thus the necessity of student's dormitory within the campus area firstly comes from excessive travel time to school, because of the location of KMITL to which a sufficient means of transportation is not available. Thus some improvement in this respect will be required as KMITL will be reestablished as a new national university. (For reference, please see a survey students by questionnaire in Appendix 9.)

3-2-2. Campus Future Plan

1). 8 Faculties Scheme

8 facilities scheme in the Fig. 3.4 is scheduled to complete within the period of Thailand 6th National Plan (1986 - 1990). From the existing Faculty of Engineering, the Faculty of Industrial Technology will become a newly independent faculty. The faculty will be established on the basis of the existing three part-time programs in Nondhaburi campus, or Industrial TV Technology, Industrial Electronics and Industrial Instrumentation Technology, and which admit the graduates from technical schools or the applicants with diploma in technology to grant Bachelor's degree.

Fig. 3.4 History of KMITL

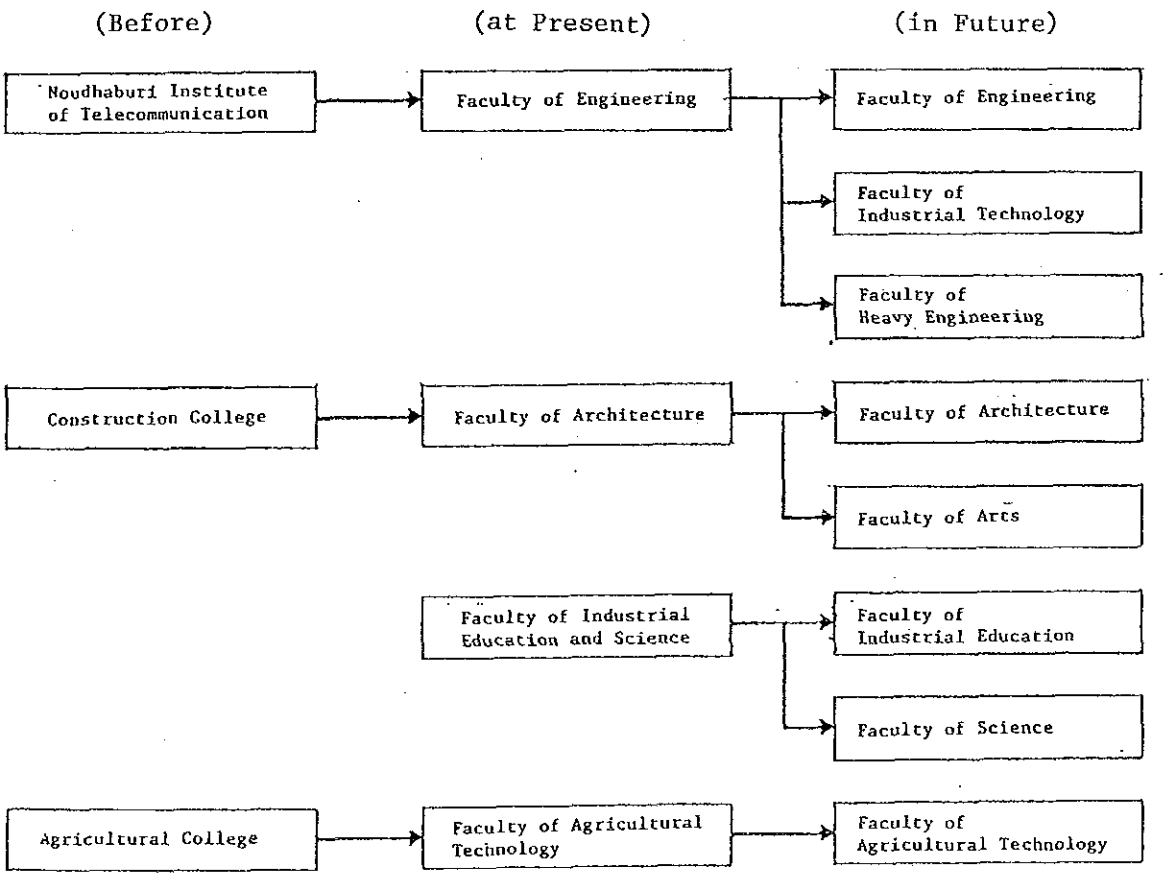


Table 3.8 Future Faculty Plan

Faculty	Department
ENGINEERING	Telecommunication Engineering Electronics Electrical Engineering Computer Engineering Control Engineering Mechanical Engineering
INDUSTRIAL TECHNOLOGY	Industrial Electronics Technology Electrical Techonlogy Computer Technology Construction Technology
HEAVY ENGINEERING	Civil Engineering Chemical Engineering Production Engineering Aeronautical Engineering
ARCHITECTURE	Architecture Interior Architecture Industrial Design
COMMUNICATION ARTS	Graphic Design Advertisement Cinematographic
SCIENCE	Industrial Chemistry Applied Statistics Applied Physics Applied Mathmatics Biological Technology
INDUSTRIAL EDUCATION	Architectural Education Construction Education Telecommunication Education Agricultural Education
AGRICULTURAL TECHNOLOGY	Agriculture Floriculture & Ornamental Horticulture Agricultural Mechanics Agricultural Engineering

Also, on the basis of the policy to promote heavy/chemical industries as a part of 5th National Plan, the Faculty of Heavy Engineering is scheduled to establish. After these two faculties will have been newly established, the Faculty of Engineering will grow to the capacity of approximately 3,000 students in 1990, and thereby is expected to absorb the growth of student enrollment currently at annual rate of 15 per cent.

The Faculty of Architecture will raise the Department of Communication Arts, which started to admit students in 1983, to the faculty status for future expansion. In addition, the Department of Construction Technology will be absorbed into the Faculty of Industrial Technology.

From the Faculty of Industrial Education and Science, the industrial education section will be separated and established as the Faculty of Industrial Education. In the existing industrial education section, all six departments in *-4- 1 of Table 3.3 are teaching only junior and senior year students, to lack a continuous educational system from freshman and sophomore year. The new faculty will be improved in this shortcoming so as to establish a foundation of KMITL for education of teachers on industrial technology.

Four courses in the Faculty of Agricultural Engineering, namely Plant Production Technology, Animal Production Technology, Agricultural Business Administration and Agricultural Industry will be absorbed to the Faculty of Industrial Education.

Altogether, 8 faculties scheme intends to consciously implement the objective of 5th and 6th National Plan, instituted by the government, from the standpoint of a new national university of KMITL, and demonstrates its willingness to respond to the society's expectation on education of engineers and their teachers.

2). Projection of Future Student Enrollment

Recently, the student enrollment in KMITL is growing at rapid rate, particularily in the Faculty of Engineering, the annual growth rate reaches at 15 - 20%. This means that KMITL is obliged to admit the students over its capacity to follow the national policy. This is partly because of inevitable consequence for only one engineering related college in Thailand and partly because of high quality of KMITL which has been accumulated through technical cooperation from Japan for the past 22 years.

KMITL projects the growth of student enrollment between 1984 - 1990 at annual rate of 15%; to reach to approximately 8,000 students in the existing 4 faculties in 1990. Coupled with 2,500 students in the additional 4 faculties, the total enrollment in the year is projected to exceed 10,000 students. And further expansion enrollment will be required, subject to national policy in future. As described before, the projection of 8,000 students enrollment in 1990 is based on annual growth rate between 1984 - 1990 of more than 15%, and the enrollment of 2,811 students in 1983 is used as base line figure for calculation. However, the figure appears to be inappropriate for the purpose, since 2,811 students include 84 graduate students in Master's and Doctoral programs of the Faculty of Engineering and 204 students Vocational Certificate program of the Faculty of Agricultural Technology. Thus, it is thought to be appropriate to consider 2,523 students, after subtracting the above 288 students from total enrollment, as total enrollment of KMITL undergraduate program in 1983, and to use it as the base line figure. Also, the projection of enrollment in the additional 4 faculties is questionable in its treatment of an increase of 2,500 students which is assumed to be separated from the growth of the existing 4 faculties at annual rate of 15%, i.e., when student enrollment and capacity increase at an university it is not conceivable that an infinite growth of enrollment capacity occurs in a basic educational unit of each department, in light of an adequate scale of enrollment capacity for an university as well as of society's need which is not limited to an increase in a number of graduates from the existing faculties and departments. Thus it is

realistic to assume that an increase in students at annual growth rate of 15% will be partly absorbed to the newly established faculties, for such situation is expected as a part of the objective to establish the faculties.

On the basis of the above logic and reasoning, in this report, the total enrollment in KMITL undergraduate program in 1990 is projected as about 6,700 students on the basis of 2,523 students in 1983, and is considered as criteria to determine basic design scale, or base figure to determine a scale of the project thereafter.

Table 3.9 Estimated Transistion of Number of Student Bachelor Degree (1986 – 1990)

Faculty \ Academic year	1983	1986	1987	1988	1989	1990
Engineering	952 *-1 (84)	1,400	1,550	1,700	1,850	2,020
Industrial Technology	*-2 203	60	180	300	420	480
Heavy Engineering	0	120	360	600	840	960
Architecture	651	680	690	700	710	720
Communication Arts	0	30	120	210	300	360
Science	*-3 128	430	500	570	640	720
Industrual Education	*-4 182	75	255	435	615	720
Agricultural Technology	347 *-5(551)	500	550	600	660	720
Total	2,523 *-6(2,811)	3,295	4,205	5,115	6,035	6,700

*-1 : (84):Master and Doctor Degree
*-2 : Part time student in KMIT Nondhabri
*-3 : First, Second year only
*-4 : Third, Fourth year only
*-5 : inc. Vocational Certificate
*-6 : all student in KMIT

3). Curriculum

Curriculum in new lecture room facilities, informed by KMITL at the time of the field survey, is as presented in Appendix 6. Although the curriculum of the additional 4 faculties is under preparation, the obtained curriculum roughly suggests its direction.
Generally speaking, students in an university is roughly classified into three stages by educational level:

(1). stage of basic education - general requirement program
(2). stage of major education - undergraduate program
(3). stage of research and application - graduate program

At KMITL graduate program is established only in the Faculty of Engineering since 1975, and yet to be established as graduate school system throughout the faculties. Thus, the stages of basic and major education constitute a major part of the educational system. And basic education is conducted in accordance with curriculum of each faculty.

Conventionally, curriculum of a stage of basic education (general requirement program), especially in engineering related universities, is based on the following 4 categories of courses:

(1). General Education Courses

Liberal Arts	Philosophy, History of Culture, Psychology, Etchics, History and Literature
Social Science	Economics, Sociology, Law and Political Science
Natural Science	Physics, Chemistry, Biology and Mathematics

(2). Foreign Language Courses
English, Japanese, Germany, French and Chinese

(3). Physical Education Courses
Lecture and Practice

(4). Basic Education Course (Semi-Major Education)
Mathematics, Physics (Lecture and Laboratory), Chemistry (Lecture and Laboratory), Basic Design, Drafting, Formative Arts, General Arts and etc.

The objective of the project is, on opportunity of development of new national university of KMITL from 4 to 8 faculties in near future, to intend a continuous education for the students in general requirement courses, which takes into account an equalization of educational level among the faculties by means of integrating a stage of basic education currently done by each faculty. At the same time, the project plans to entirely eliminate a shortage of class rooms.

As natural science courses will be offered to all the faculties or a group of 2 - 3 faculties at the same time, lecture and course material prepared by the instructors could be standardized under a single format. As to liberal arts and social science courses, which are selective in an engineering related university, a choice of selective courses previously varied with faculties could be increased as a result of integration, e.g., as a result of the integration of general education courses the students in the Faculty of engineering will be able to select liberal arts courses while the students in the Faculty of Agricultural Technology will be able to select social science courses.

The standardized education on foreign language courses receive the most advantageous benefit of the integration, to solve the variation of the quality among the faculties. As in case of general education courses, a choice of selective course in this category will be increased, e.g., the students in the Faculty of Architecture will be able to select Japanese language course.

As physical education courses are not considered as important in Thailand, at present only the Faculty of Architecture and the Faculty of Industrial Education and Science offer the courses. After the integration, a selection of the courses by the students in other faculties will become possible. A specific feature of basic education program (semi-major education) in KMITL is found in heavy emphasis

on the courses starting from general requirement program by taking many of them into curriculum. On this account, KMITL seems to further strengthen the program, particularly in the field of instrumentation dealing with machine, device and computer.

4). Master Plan (Concept of Future Layout Plan of Campus Facility)

As KMITL has repeatedly done reorganization and merging, the construction of the facilities has not been executed in accordance with a firm guideline such as master plan. Although KMITL is able to reserve a large tract of land as Lakdrabang campus site donated by Chaokum Taharn, the land use plan has not been prepared as a implementation plan for expansion of the facilities was to feasible due to a chronicle shortage of government budget.

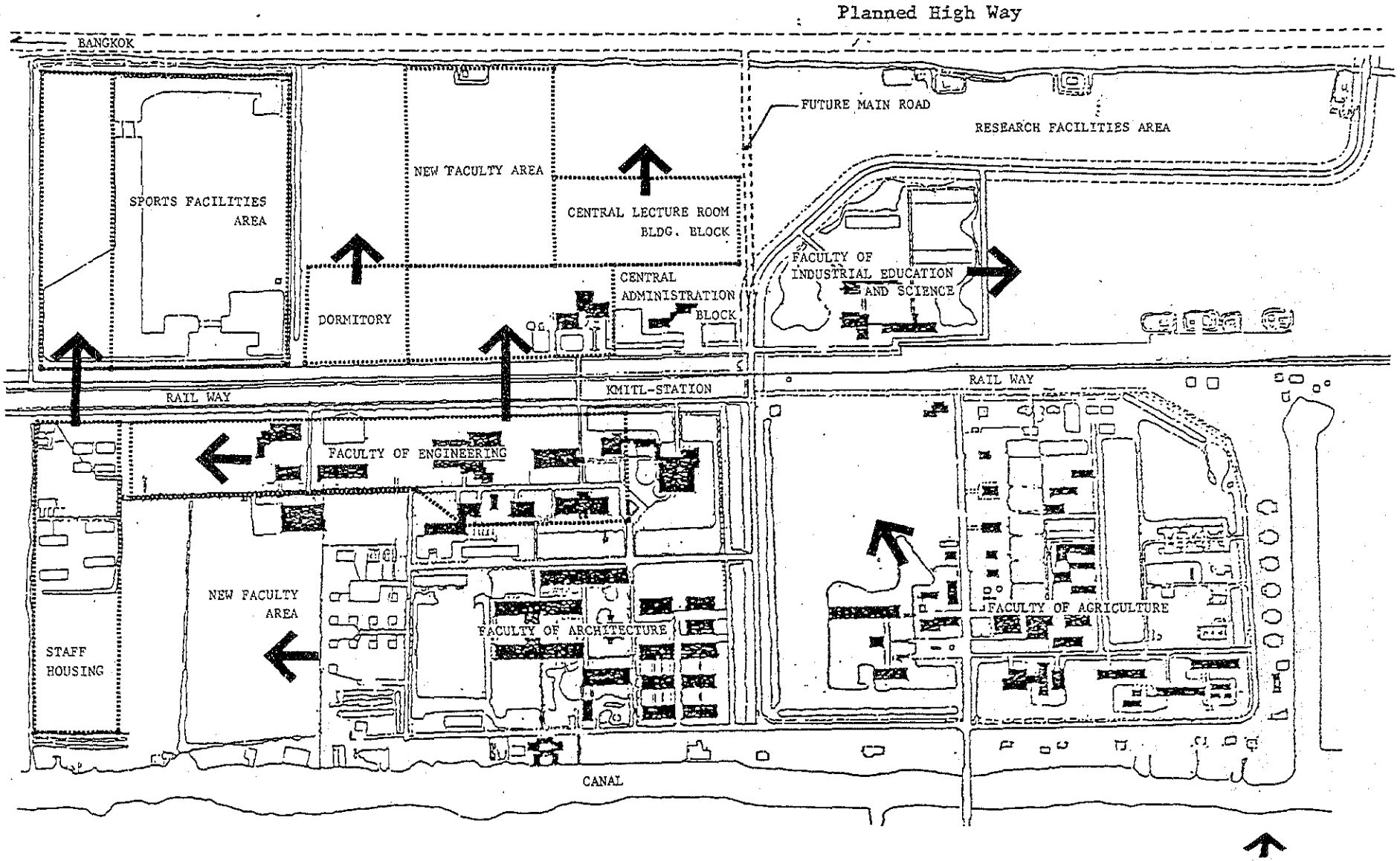
In 1977, on establishment of the Faculty of Industrial Education and Science, the area on north side of railroad track were obtained and is the site of vice rector's office and additional facilities of the Faculty of Engineering. On east side of the area, the ground station facilities for Landsat (weather satellite) is constructed, and a part of the campus area will be allotted to a national research institute.

Coupled with construction of Ladkrabang industrial estate on north side of the campus site, Ladkrabang district has considerably developed after an opportunity of the presence of the King at an inauguration ceremony of the facilities such as the anditorium furnished by the Government of Japan in 1976 as well as at the annual graduation ceremonies of KMITL. Especially, a construction plan of highway connected to Bangkok along the north side of the campus site will constitute a major factor to determine the direction of the future campus plan.

The campus site of 120ha will not be permanently regarded as a sufficient scale, considering of zoning plan under 8 faculties scheme (Fig. 3.5) and necessity for improvement of the facilities of the new national university. Furthermore, a part of the site should be reserved for the national research institute, and should be allotted to student's recreational and atheletic facilities, which provision has been left out. At present, the necessity of relocation of the existing facilities, which is already under process of planning by

KMITL, come to surface, so that recognition of the campus has been changed from an immense site to a limited site on account of 8 faculties scheme. This means that in the future plan a design concept which adapt the density of acceptable scale is required from the standpoint of efficient use of the site. This is also considered to be effective way to plan filling work of swamp land.

Fig. 3.6 Master Plan of KMITL



3-3. Objectives of Construction of Lecture Room Building

The future images of KMITL, hold by themselves, appears to be of an engineering related university system, to be surmized from the fact that KMITL established the Faculty of Agricultural Technology rather than the Faculty of Agriculture and plan to train teachers for engineers. This is exactly the basis of expectation on KMITL from Thai society and the country as a whole. KMITL, on the basis of accomplishment accumulated through technical cooperation by Japan since its establishment is said to receive a considerable expectation for the future development and expansion, being evidently observed from the transformation to a university as a result of reestablishment as KMITL in status of a new national university rather than Ladkrabang campus and of having 8 faculties in near future. Thus, the objective of the plan, as described before, is to construct the core facilities of the university as an approach to required improvement.

However, cooperation by the Government of Japan in the past was concentrated on the Faculty of Engineering, and the Faculty of Agricultural Technology and the Faculty of Architecture, which existed prior to creation of Ladkrabang campus, are undoubtedly left behind in the progress of the Faculty of Engineering; only the Faculty of Engineering has a graduate school until now, and good employment opportunity for graduates and high quality of the students of the faculty might be overinterpreted as that of the entire school. This is considered to be difficulties actually felt by KMITL administrators, no neccessiate the upgrading of the faculties as a whole. Rapid growth of student enrollment in the past few years has resulted in the improvement of the quality of entering students, but made it difficult to upgrade the quality of education itself. To correct the situation, an integrated form of basic general and technical education on freshman and sophomore year students is required for the raising of entire educational level, in place of separate curriculum varied with faculties at present. A real objective of the Central Lecture Building Facility Construction Plan is found in this viewpoint, which is an ideal way for a new national university to satisfy society's need.

On the basis of the above standpoint, this construction plan is not to simply cope with a shortage of the facilities but to strengthen the foundation of KMITL as a new national university toward further development. Thus, a concept of lifting a level of the entire educational system ranging from determination of curriculum to preparation of course materials, is thought to show the direction of the construction plan.

CHAPTER 4. OUTLINE OF THE PROPOSED SITE

4-1. Ladkrabang Campus

King Mongkut's Institute of Technology Ladkrabang campus is located in the area on other side of a canal, north of Soi On Nuj Street, approximately 30km east of a central part of the City of Bangkok. The campus site is very large with land area of 120ha, and in its central part Thai National Railway Eastern-line connecting between Bangkok and Alanya Platate is passing in east-west direction. The station nearest to the campus area, Hau-Takae Station, is located on east side of the campus, and recently a station was completed within the campus area for use at peak hours in the morning and evening as a result of an increase in students traveling to and from the campus. On the north side of the campus, the construction of highway is planned by Highway Department of Bangkok Metropolitan Administration (BMA) after 5 - 10 years. On completion, the highway will become a major route for automobile traffic to the City of Bangkok. The highway will be extended in north-south direction center road and in perpendicular to the railroad, and will provide an access to the faculties.

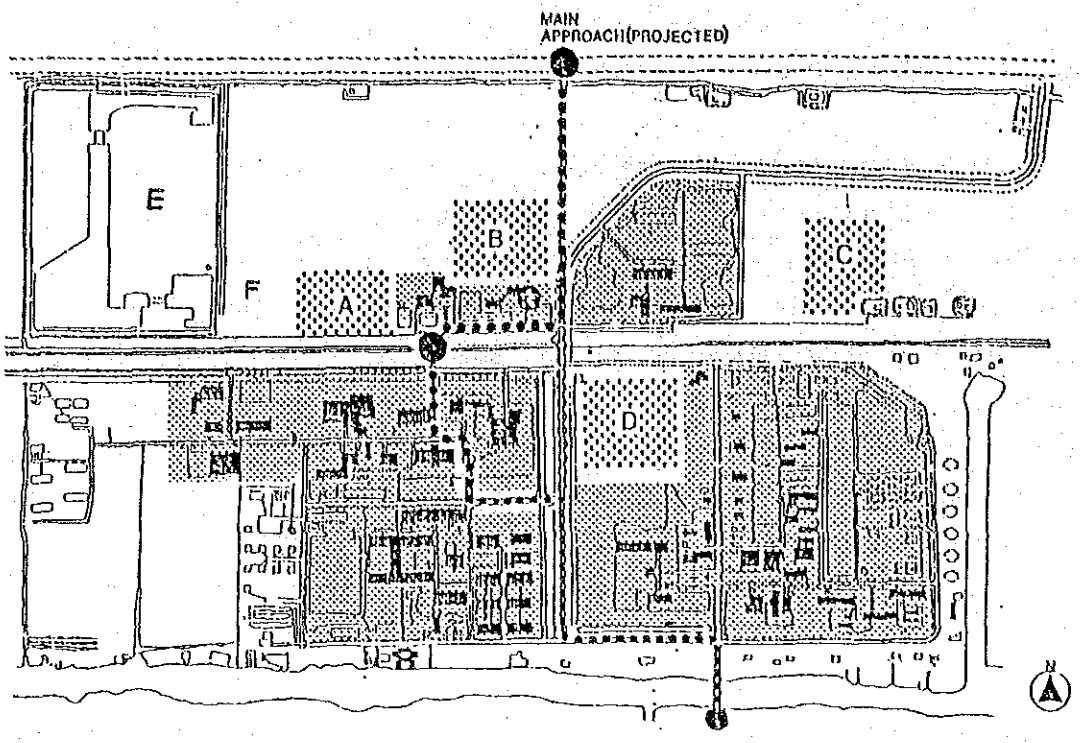
4-2. Proposed Site

In the campus site, illustrated in Fig. 4.1, 4 alternative sites for a site of the construction plan, namely Site A, B, C and D, have been studied, to obtain the following preliminary findings:

Site A: Planned as the site of the Faculty of Heavy Engineering as a part of 8 faculties scheme

Site B: Appears to be most suitable to a core facility such as central lecture room building, because of its location at around center of the campus along north-south main road

Site C and D: Currently used as an experimental farm of the Faculty of Agricultural Technology



Consequently, Site B has been selected as the most suitable site, to carry out the detailed study. For the site of student's dormitory, KMITL proposed an area on west side of Area E in the plan (proposed as a playground), which is located in swamp land at present to seemingly require high cost for provision of the infrastructure. Thus, Area F adjacent to the playground, for which the provision of the infrastructure is relatively easy, has been selected and studied as a proposed site for student's dormitory.

4-3. Natural Condition

KMITL is located in the suburb of Bangkok, and under the hot and humid climate condition similar to Bangkok; annual average temperature of 28.5°C and annual average relative humidity of 74.7%, with dry season and rainy season (May - October) which brings daily squall for 1 - 2 hours. Predominant wind direction is constantly South from February to September, and North-East from October to January. On construction planning, creation of a space to shade strong sun light and to employ natural ventilation is used as basic design concept.

The site has a land area of 120ha, in largely flat swamp land. The existing buildings in the site were constructed on the ground with filling of 1 - 1.5m, and is recorded of settlement at annual rate of a few centimeters due to poor soil condition. Also, the area without filling is subject to flood during rainy season. Thus can attention should be headed on measures to deal with settlement around the buildings, flood and storm water drainage.

4-4. General Condition of Surrounding Area

The facilities, which was completed in 1974 with grant aid by the Government of Japan, are equipped with soundproof structure to cope with noise from an airport in southern part of Ladkrabang planned to relocate Ungouhao International Airport. However as the study team was informed of an cancellation of the airport plan, the soundproof factor is not considered in the design of the proposed facilities. Neighbouring area in north side of the campus has Ladkrabang Industrial Estate, which recently attracted many industries. Because of possible independence and interaction between KMITL and the industries in the estate in future, the area is highly potential for effective industrial development. At present, 36 industries, including Japanese companies such as Isuzu Motors, Yammer Motors, Hino Automobile and Meiji Pharmacy. (Appendix 10)

4-5. Condition of Infrastructure

1). Site

The proposed site is located in the inundated grass land, under condition similar to the other areas of the campus where the facilities are not constructed. As a result of discussion between KMITL and the study team, it is agreed upon that KMITL will do filling and leveling work on implementation of the project.

2). Access to the Site

The main road of the campus is paved to 14m wide with two lanes for both traffic, and is connected to unpaved/embanked access road to the site, which is free from flooding and safe for transportation of heavy equipment and material during the construction work.

3). Water Supply

Water supply in the campus is provided by well, which is installed at each block. A new well with capacity of 40 m^3/h, installed by KMITL, will be available at a block of the lecture building construction site, and can be sufficiently used for the project.

4). Sewage

As there is no public sewage system accessible to the site, sewage treatment will be done through septic tank and ground filtration. Other water will be discharged to the open ditches around the facilities.

5). Electricity

As the main power line (22kV) is installed by Metropolitan Electricity Agency (MEA) along the main road of the campus accompanied by a substation to transform it to lower voltage, the supply of electricity to the proposed facilities will be sufficiently secured.

6). Telephone

At present, telephone service is provided for KMITL through microwave line. However, the proposed facilities will be served by cable line, as 600 cable is installed by Telephone Organization of Thailand (TOT) up to the vicinity of Ladkrabang Police station.

4-6. Circumstances of Construction

In this chapter, relating factors between recent situations of Ladkrabang where KMITL is located and building construction are to be discussed.

Ladkrabang district is in Bangkok metropolitan area and is located 30 kilometers east of Bangkok metropolitan area. Ladkrabang is characterized as a suburban agricultural area as same as adjacent Prakanong, Bangkapi and Minburi, and famous in low land which is partially at the sea level.

Traffic depends upon main roads in the near area and mainly upon water ways in the other. Construction work requires soil-filling work before commencement of the project. In rainy season, water is a struggling factor in soil-filling work which consists of banking, punping water out and filling new soil. According the previous discussion, timing of the commencement and the rainy season becomes a crucial factor.

Ladkrabang market is located approximately one kilometer east of KMITL. It is the central area of the Ladkrabang district where temples, schools and commercial shops are concentrated. Ladkrabang had labor force which was not skilled but abundant and economical.

Although, housing development wave expanded to Ladkrabang whose land price was relatively lower in Bangkok metropolitan area. Large enterprises took place in industrial park in Ladkrabang. So construction work became very active. It has become difficult to obtain economical labor because employment opportunities increased in construction work. Obviously it gave influence to the construction procedures which tended to depend on human-wave tactics.

Construction work rationalization was to be noticed in regards to construction sites in Bangkok in recent years.

Pipe scaffolding, concrete agitator truck, tower crane and wearing safety cap are good examples. These examples can be seen in Ladkrabang. Maximum daily amount of pouring concrete has increased amazingly because of use of concrete plant and agitator truck.

New technical changes have brought quality control problem of concrete as a new factor.

Countermeasures for quality control of building construction have been required more increasingly.

CHAPTER 5. BASIC DESIGN

5-1. Basic Design Principle

Primary principle of basic design on lecture building construction plan is, without any doubt, to make it suitable to climate, environment, culture and social and economic condition of Thailand. Convenience, function, simplicity of maintenance and administration and durability is considered as important factors, with reference to the information on the similar facilities of other universities in Bangkok obtained on basic design field study as well. Also, simplicity as an university facility is an important element.

On the other hand, as mentioned in Chapter 3, Ladkrabang campus, because of its history to have grown through merging with originally independent schools, lacks a sense of integration as KMITL to a large extent. On occasion of its independence as a new national university, the facilities are expected to have appropriate and symbolic appearance as core facility of KMITL. This factor will be considered as an important element of basic design principle, to design the facility which also becomes a symbol of Ladkrabang campus.

Other important basic design principles are as follows:

1). Considering of the campus site plan after an expansion of the university to 8 faculties which will considerably limit the extent of land use, high density of the facilities to a reasonable extent is intended for the benefit of cost reduction on filling and piling work. However, a maximum height of the buildings will be limited to 6 storeys, being the highest in the campus, to take into account a problem of settlement of the buildings located on soft ground.

2). To minimize the negative impact of highly densed buildings, the ceiling of the class rooms will be designed to be high from the floor (3.5 - 4m), to increase an air space per person for ventilation.

3). Lecture and laboratory buildings will not be equipped with airconditioners. Airconditioning zone will be centralized.

4). Longer side of the building is limited and is installed of expansion joint so as to prevent uneven settlement.

5). A landmark will be furnished to consider the entering traffic from the north side in future.

6). On selection of finish material, the material, which is suitable to the climate condition and not susceptible to fading and discoloration, will be used. Also, hollow brick will be used in important places.

7). An appropriate measure will be taken to prevent uneven settlement around building which is caused by different settlement rate between the filled ground and the building.

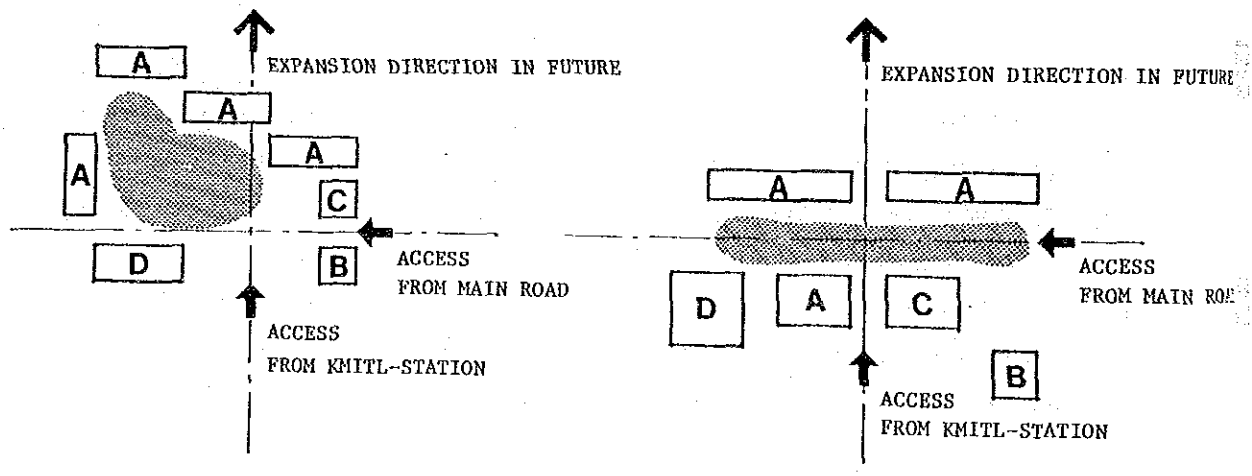
8). On an attempt to effectively coordinate the buildings and the surrounding open space, planting of vegetation is planned to positively use a green shade space outside of the building and to achieve a harmony between the building and natural environment.

A : CENTRAL LECTURE ROOM / LABORATORY

B : CENTRAL ADMINISTRATION

C : INFORMATION SERVICE CENTER

D : STUDENT HALL



ALTERNATIVE - A
(PLAZA TYPE LAYOUT)

ALTERNATIVE - B
(MALL TYPE LAYOUT)

5-2. Building Layout Plan

The layout plan will be drawn out in accordance with basic design principle, and the following items are taken into consideration as determinant factors on planning.

1). Conceptualization of symbolic appearance
2). Relatively high density of land use
3). Consideration to the appearance of the building from entering traffic from the north side in future
4). Simple layout of the building
5). Easy access from the main road
6). Securing of a route from railroad station
7). Way to connect the building with the existing office buildings

At the first state of planning, the following two concepual designs, Alternative A and B are prepared for comparison.

A specific feature of Alternative A is found in a layout of the buildings to spirally surround a square in counter-clockwise, to create an atmosphere with a full of variety in combination of the buildings and the square. 3 lecture and laboratory buildings of 5 stories are laid out along their diagonal axis, to generate a gentle impression on the whole buildings.

On the other hand, Alternative B is feature the parallel arrangement of the facilities, such as Lecture/Laboratory Buildings and Information Service Center, on the both side of an axis perpendicular to the north-south bound main road of the campus, separating two rows of buildings in 25m apart. The central part will be provided with a mall type of shaded promenade. As a result, the buildings will be arranged in compact and high dense fashion to create a powerful and symbolic impression as a whole.

On the basis of the above features, Alternative B is selected so as to satisfy a set of determinant factors listed earliers.

5-3. Facilities Plan

Data base determination of scale of the lecture building construction plan is a projected enrollment of 6,700 students in 1990 when Thailand 6th National Plan will have been fully implemented and KMITL 8 faculties scheme will have been completed and operated at full scale.

Scale of a central lecture room building, a laboratory building, a central administration building, an information service center and a student's hall is determined as of the year of 1990, which is 5 years after the completion of the facilities if the construction plan will have been executed in accordance with the proposal.

5-3-1. Central Lecture Room/Laboratory Building

A majority of the class rooms is planned at a capacity of 30 students. However the size of the rooms is determined on the basis of a capacity of 40 students in order to cope with an increase of students in future. A lecture hall with a capacity of 150 students is designed to have a maximum area of flat floor and to use as multi-purpose facility, so as to meet KMITL's need which prefers to avoid a lecture hall type of the room in KMITL campus.

Of the laboratory rooms, the ones which are a source of noise and vibration will be arranged far away from class rooms to a possible extent. At the same time, according to KMITL curriculum plan, a significant amount of time in general requirement program for freshman and sophomore year students will be assigned to laboratory sessions of semi-major education courses. As this will necessitate a frequent movement of the students between the class rooms and laboratory rooms, both rooms are planned to locate in proximity to save the travel time.

5-3-2. Central Administration Building

The central administration building should be planned as a facility for central organization of a new national university, KMITL. The facilities planned in the central administration building are as follows:

1). Senior Staff Rooms: used as the offices of a rector and 4 - 5 vice rectors, secretary rooms, and guest rooms

2). Seminar Rooms and Meeting Rooms: KMITL holds a training session on telecommunication for developing countries once a year, and the participation from Asian countries has increased every year; 21 participants from 10 countries in 1980.

3). Administration Office: At present, a number of staff in KMITL central office consists of 20 in Administration Affairs Section, 10 in Academic Affairs Section, 10 in Student Affairs Section, and 3 in Planning and Development Section, to be totaled to 4 3 staffs. After the completion of the new facility, 33 staffs will move to the new offices except for 10 staffs in Student Affairs Section which deals with registration to remain in existing vice rector's office. As the projection of a number of the staff in 1990 according to KMITL is one and a half time of the present number, a scale of the offices is set for a capacity of 50 staffs.

5-3-3. Information Service Center

One of the problems in engineering related universities in Thailand is observed in a shortage of textbooks for major education, for the marketing of translated textbooks is currently not feasible because of relatively small number of students in engineering related major. Thus, at present each university's staffs assume responsibility for supply of the course materials. In addition to textbooks, this situation is same in supply of other course materials such as video tape and film. Information service center, thus, is designed to provide a facility for improvement of the situation. Also, installation

of the equipments in the facilities will require airconditioning system in many rooms. Together with effective maintenance of the equipments, it is appropriate to integrate the various functions such as computer terminal rooms and language laboratory room into the center, though basically laboratory facilities.
As a result, the center consists of the following facilities:

- Course Material Preparation Rooms
  - Document store
  - AV editing/printing room
  - AV production room
- Special Laboratory Rooms
  - Language Laboratories
  - Computer Laboratories

5-3-4. Student's Hall

Student's hall will consist of the following facilities;

1). Student's cafeteria, administrative staff's cafeteria and auxiliary facilities
2). Student's conference room
3). Multi-purpose hall

The seating capacity is 330 for student's cafeteria and 50 for administrative staff's cafeteria. The administrative staff's cafeteria is designed to be used by visitors.

5-3-5. Student's Dormitory

In addition to student's rooms to accommodate 100 students in total, laundry room and reading room will be planned as necessary facilities.

5-4. Scale of Facilities

Scale of each facility is approximately as follows.

1. Central lecture room, Laboratory & Information Service Center Building

1-1 Central Lecture room & laboratory Block

Room Name	Capacity (Person/Room)	Room	Floor Area (sqm)	
Lecture room (Large)	150	2	640	
Lecture room (Middle)	60	5	660	
Lecture room (Small)	30	40	2,550	
Physics Lab. *-1	60	2	450	
Chemistry Lab. *-1	60	2	450	
Biology Lab. *-1	30	2	320	
Basic Engineering Lab.	60	1	190	
Machine Control Lab.	30	1	190	
Electronics Lab.	30	2	320	
Drawing room	60	2	510	
Corridor, Lav. Staircase, etc			4,340	m^2
TOTAL			10,620	m^2

*-1 : incl. Preparation room, Teaching Staff room

1-2 Information Service Center Block

Room Name	Capacity (Person/Room)	Room	Floor Area (sqm)	
Computer Lab.	60	2	380	
Document store		1	530	
AV Editing & Printing		1	60	
AV Producting room		1	380	
Langage Lab.	30	2	190	
Corridor, Hall, Staircase, Lav. etc.			800	m^2
TOTAL			2,340	m^2

1-3 Bridge & Covered Way

	Floor Area (sqm)	
	560	
TOTAL	560	m^2

* SUB TOTAL

1.1 + 1.2 + 1.3

= 10,620 + 2,340 + 560

= 13,520 m^2

2. Central Administration Office Building

Room Name	Capacity (Person/Room)	Room	Floor Area (sqm)
Senior staff room	30	6	300
Seminar room	60	2	190
Conference room	50	1	200
Administrative office		1	320
Corridor, Hall, Staircase, etc.			620 m^2
TOTAL			1,630 m^2

3. Student Hall

Room Name	Capacity (Person/Room)	Room	Floor Area (sqm)
Dining hall	330	1	580
Staff dining room	50	1	100
Kitchen		1	190
Co-op		1	130
Student activities conference room	35	1	100
Multi-purpose hall			380
Corridor, Staircase, etc.			410 m^2
TOTAL			1,890 m^2

4. Student Dormitory

Room Name	Capacity (Person/Room)	Room	Floor Area (sqm)
Boader's room	2	50	880
Washing room, Shower room & WC		2	100
Reading room		2	160
Corridor, Staircase, etc.			380
TOTAL			1,520 m^2

Total Facilities floor area 18,560 m^2

5-5. Building Element Plan

In architectural element plan, climate condition in the region and nature of facility maintenance and administration plan after the completion will be determinant factors. Under hot and humid climate condition, or impact of sun light, wind, and rain on the buildings should be throughly taken into consideration. At the same time, maintenance-free structure should be introduced to each element where possible so as to minimize operation and maintenance cost of the facilities.

1). Roof

As roof is subject to a largest impact of sun light and rain, maintenance-free and durability factors should receive the close attention. Roof structure frequently observed in a region is slant roof of corrugated asbestos sheet on wooden shed structure built on top of reinforced concrete buildings, so as to reduce the construction cost. However, as roofing material, asbestos sheet will not have semi-permanent durability under severe climate condition in the region, but starts to be eroded by weathering in 10 - 15 years. Thus, under the plan asbestos sheet should be used as roof cover for insulation and concrete slab as primary roofing material.

2). External Wall

In consideration of annual dominant wind direction and sunshine condition, the buildings are principally designed of east-west orientation on their lengthwise with windows on south and north side so as to employ natural ventilation. No openings are installed on east and west side but hollow space in the form of double wall is provided for insulation. Eaves or sun shade are installed for shading at the openings on south and north side. As finish paint on external wall is subject to discoloration and mold growth under hot and humid climate coordination, a selection of paints should be carefully done and hollow brick and washed aggregate material will be used in connection with paint finishes.

3). Floor

Since the open corridors are installed in most parts, rain fall is blown into the corridors during a squall. Thus detail of the entrances to the rooms will be required to have a design which prevents rain water. Also, a design is required to deal with rain drop skipping from the above.

Determination f floor level on ground floor should be based on a highest water level in the past, and in the existing campus facilities the floor level is lifted of 1m above railroad floor level to avoid the possible flooding.

5-6. Construction Material and Method Planning

1). Objective

Because of educational facility, the materials should be selected to create functional and durable space for use of a great number of people.
At the same time, the materials should be selected to shorten construction period, to reduce construction cost, and to minimize operation and maintenance cost.

2). Selection Criteria of Construction Material and Method

Durability: Materials to bear long time use without deformation, contortion, discoloration, and deterioration

Preference to Use of Local Material: Materials ordinarilly used by local workers and easily obtained for maintenance and operation, coupled with objective to promote local production

Safety: Materials in proper position to provide fire resistance, water resistance and/or waterproof

3). Construction Material Plan

a) Structural Material (for major structure)
   Pillar, beam, floor and stair: Reinforce concrete
   Wall: Concrete block or brick
b) External Finish Material
   Roof: Double layer structure to employ insulation material
   External finish: Washed aggregate, hollow brick or paint
   Fixture: Stainless steel, alminium, or steel
   Eave: Concrete panel, metal, or asbestos cement board
c) Interior Finish Material (for major rooms)
   a. Class Room
      Floor: Cement mortar trowelled
      Wall: Paint
      Ceiling: Sound absorptive sheet

b. Laboratory Room

Floor: Cement mortar or tile

Wall: Paint

Ceiling: Sound absorptive sheet

c. AV Production Room and Language Laboratory Room

Floor: Felt carpet

Wall: Sound absorptive board

Ceiling: Ditto

d. Meeting Room

Floor: Felt carpet

Wall: Paint or vinyl paper

Ceiling: Sound absorptive board or similar material

e. Hall

Floor: Terrazzo or mortar

Wall: Paint

Ceiling: Paint

f. Office

Floor: Vinyl tile or felt carpet

Wall: Paint or vinyl paper

3). Criteria of Color Coordination Planning

The plan will be based on climate condition, coordination with surrounding environment, and education and research facility plan.

Climate Condition: a selection of color of materials and paint free from discoloration and feeding under strong sunshine and high precipitation and humidity.

Coordination with surrounding Environment: a selection of tone of color to provide consistency with the existing facilities and harmony with surrounding environment.

Identity of Education and Research Facility: light color to hide a spot and stain, as well as calm tone of color to provide a sense of cleanliness

5-7. Structural Planning

As Thailand is located outside of major earthquake belt, occurrence of sensible earthquake is rare to give a damage to structures.
Wind pressure will have a small impact on the structure because of the location of the campus outside of influence by typhoons; recorded maximum instant wind velocity is around 28.8m/s.
Ladkrabang district, a location of the proposed site is located at approximately 30km north of Bangkok and within low Land, altitude of 1.3m above sea level, in apart of Thai central delta zone. Soft cohesive soil layer covers 20m from surface and alternate layers of cohesive soil and sand thereafter. Although distinctive bearing stratum exists at 50m in depth, as installation of pile in this layer will be not economical. Thus 1st sand layer, which exists at approximately 23m in depth, will be used as a bearing stratum; to provide pile foundation by taking into account surface friction force.
Rate of settlement in the area is recorded between 1979 - 1980 at approximately 5cm annually, equivalent to the rate in the City of Bangkok. As cohesive soil in upper layer is in the state of incomplete consolidation, a complete measure will be required to deal with possible settlement as a result of filling.

5-7-1. Structural Design Standard, Building Standard Law and Calculation Method

In Thailand, Building Bye-Law of Bankgkok Metropolis (BLBM) regulates design standard, and Thailand Industrial Standard (TIS) regulates construction material. The Building Bye-Law includes regulations on wind load, liveload, tolerable stress of material, threshold stress of material, and combination of load. This design will be in accordance with the Building Bye-Law on wind load and liveload where applicable, and otherwise supplemented by Building Code of Japan. Tolerable stress of material will be in accordance with standards of Architectural Institute of Japan, as the applicability has been verified by material testing on the construction.

Structural calculation in Thailand is done by combination of tolerable stress method and ultimate strength method. On this design, tolerable stress method, which is generally used in Japan, will be used for the calculation, in accordance with the various standards of Architectural Institute of Japan.

5-7-2. External Force and Load

Seismic force is not considered in the calculation.

1). Wind Load

Wind load is calculated by means of multiplying velocity pressure by wind force coefficient. For wind force coefficient, values indicated in Standards of Architectural Institute of Japan will be used.
For velocity force, following values indicated in Building Bye-Law of Bangkok Metropolis are used:

Height of Structure	Minimum Wind Velocity Force kg/m^2
$H \leq 10m$	50
$10m < H \leq 20m$	80
$20m < H \leq 40m$	120
$40m < H$	160

2). Dead Load

Load of the object fixed on the buildings such as structural and finish material is calculated in accordance with actual conditions.

3). Live Load

Live load is calculated in accordance with the actual conditions. Generally, design load is used of a value indicated in Building Bye-Law of Bangkok Metropolis, otherwise supplemented by Standards of Architectural Institute of Japan. A value of is equipment to that used for floor and frame design. Typical surcharge used in the plan is as follows:

Room	Live Load (kg/cm^2)
Class Room	400
Physics Laboratory Room	500
Chemistry Laboratory Room	400
Office and Meeting Room	300
Hall	400
Reference Room	600

Calculation of vertical surcharge on Column and foundation will be done in accordance with Building Bye-Law of Bangkok Metropolis, with downward adjustment by a number of supported floor.

5-7-3. Structural Material and Construction Method

Structural materials are determined in accordance with shape of structure, scale, use, construction and material cost, and construction schedule. Usual structural materials are all locally available, but steel materials are expensive compared to Japan due to dependence of supply on import. Structural materials used in the construction work are presented as follows:

1). Concrete

Local ready-mixed concrete or concrete mixed on site will be used. Because of mixing and placing under high temperature, an appropriate measure will be required on mixing, agitation, transportation, placing and curing. Specification of concrete is as follows.

Type: Normal concrete
Strength: 210 kg/m^2
(4 week compressive strength of cylinder test price)
Slump: 8cm
Cement: Normal portland cement
Fine aggregate: River sand (salt content to be less than 0.02%)
Coarse aggregate: Crushed stone (maximum size of 20mm)
Mixing agent: AE water reducing admixture

2). Reinforcing Steel

The reinforcing steels, which are locally produced in accordance with ASTM and JIS standard, will be used. Sizes of the reinforcing steel which are easily available are as follows:

Round Bar;	SR24 diameter:	6 and 9mm
Deformed Bar;	SD30 diameter:	10 and 12mm
	SD40 diameter:	16, 20, 25 and 28mm

3). Structural Steel and Light Structural Steel

Light structural steel will be locally supplied, including procurement of materials and manufacturing.
Heavy structural steel members will be manufactured in Japan and fabricated on site, in light of possible impact on level of technology and construction schedule, although procurement of material and manufacturing could be locally done.

4). Pile

Concrete piles of the various shapes of cross section are manufactured in Thailand. Although varied with the diameters, the maximum length of piles are approximately 25m, to allow transportation and driving without joint. In this work, square piles are used because of effective terminal bearing capacity and surface friction force.
As piles are generally driven by drop hammer, a bearing capacity will be verified by test piling. Pile formula is used of the one recommended by basic structure and design standard of Engineering Institute of Thailand (EIT) as follows:

$$Q_u = \frac{1}{F_s} \times \frac{ewH}{S + 1/2 \times \sqrt{\frac{2ewHL}{AE}}}$$

Qu : Ultimate bearing capacity of pile
Fs : Safety factor
e : Efficiency of Pile driving
w : Weight of hammer
H : Height of hammer
S : Penetration value of Pile
L : Pile length
A : Area of Pile section
E : Modulus of elasticity of Pile considered effect of circumferential soil

5). Block, Brick and Other Materials

Locally manufactured concrete blocks and bricks will be used in non-structural wall for partitioning. In between less than 4m square section of block or brick walls, supporting columns or lintels will be installed.
Although the various flooring methods using precast concrete beam are employed in Thailand, as a result of an examination of utility piping space to indicate a limitation by span, the methods will not be used for this project.

5-7-4. Superstructure Planning

Superstructure will be of concrete frame type in many parts, which is widely used in Thailand and economical. Only a part which is intended to make a large span for functional reason will be made of structural steel, precast concrete beam or structural steel space truss. Walls will be made of concrete block and brick since horizontal force is not required. As horizontal force to work on building will be small, framing plan is done mainly against vertical force.

5-7-5. Foundation Planning and Measure against Settlement

1) Subsoil Condition

Subsoil condition of the proposed site is as previously described. Soil survey was carried out at two points in the site. A result of the analysis of the data along with a record of soil survey on 4 points at a telecommunication laboratory building and other locations of KMITL campus indicates a possible settlement due to incomplete consolidation of very soft cohesive soil extended to approximately 15m in depth within cohesive soil layer to approximately 20m in depth. Thus, bearing stratum will be chosed in 1st sand layer which starts from approximately 23m in depth.

2). Foundation Plan

On the basis of the above subsoil condition, the buildings of the proposed facilities will be supported by pile foundation, as in case of the existing buildings. Friction resistance to the piles from the soft cohesive soil layer, which extends down to approximately 15m in depth, is not expected due to settlement by consolidation. Thus, a tip of the piles will remain at 26m in depth of 1st sand layer. Resistance force of the piles will be provided by terminal bearing capacity and surface friction force along the piles between 15m and 26m in depth of cohesive soil and sand layers. Footing will be installed at approximately 2m deep from the existing ground level so as to minimize uneven settlement between the soil above the footing and the surrounding soil. Thus, the actual pile length will be 24m.

3). Measure against Settlement

Settlement of the buildings is not required of any measure as sand layer where a tip of the piles is settled has N value of 30 and deeper cohesive soil layer N value of more than 40, to be very hard. On the other hand, uneven settlement between the buildings and surrounding ground, caused by settlement of upper soft cohesive soil layer as a result of consolidation, will become a problem. As this settlement is unavoidable, the following measures will be taken:

a. A floor of the ground floor is made to structural floor supported by beam frame.
b. Pipes installed under the floor will be supported by floor slab.
c. Pipes extended from the buildings to an exterior will be carefully intalled in joint part, so as to prevent disturbance to their function such as physical damage.

5-8. Mechanical and Electrical Planning

Principles of mechanical and electrical planning of the proposed facilities are as follows:

1). Close coordination with architectural planning function
2). Design suitable to natural and living condition
3). Selection of system and equipment to provide simple operation, maintenance and inspection
4). Running cost reduction and energy saving

5-8-1. Airconditioning and Ventilation Planning

Design of airconditioning system and selection of equipment and machinery will be based on economy of operating cost and simplicity of operation and maintenance.
Where possible, coordination with architectural planning function is attempted by means of using natural ventilation, minimizing heating by sun light, and maintaining a sufficient air space for living environment.

1). Airconditioning System

Airconditioning system of individual control unit will be installed in the selected rooms which require specific temperature and humidity condition. Rooms required of airconditioning system are as follows: senior staff offices, meeting rooms, seminar rooms, document store, AV editing/printing room, AV production room, language laboratories, computer laboratories and administrative staff's cafeteria (also guest's cafeteria). In accordance with operating condition and scale, the various types of airconditioning unit will be used: package type, split type window-cooler etc.

2). Design Criteria (Temperature and Humidity)

Design Criteria for Exterior
Temperature: 36°C, Relative humidity: 75%
Design Criteria for Interior
Temperature: 28°C ±2°C DB, Relative humidity: 50 - 60%

3). Forced Ventilation System

To maintain good living environment, exhaust fans will be installed in laboratories (discharge of gases), lavatories and machine rooms.

4). Ceiling Fan

The following rooms will be required of the ceiling fans: class rooms, laboratory rooms (except for computer Lab.) and drafting rooms.