

No. 5

**BASIC DESIGN STUDY REPORT
ON
THE PRODUCTIVITY DEVELOPMENT PROJECT
IN
THE REPUBLIC OF SINGAPORE**

**NOVEMBER 1983
JAPAN INTERNATIONAL COOPERATION AGENCY**

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PREFACE

As a result of discussions between the Government of the Republic of Singapore and the Government of Japan on the ASEAN Human Resources Development Project which Singapore has taken up in response to the proposal of Japan, the Government of Japan decided to conduct a Basic Design Study on the Productivity Development Project and entrusted the study to the Japan International Cooperation Agency (JICA). The JICA sent to Singapore a study team headed by Mr. Eizen Irei of the Second Economic Cooperation Section, Economic Cooperation Bureau, Ministry of Foreign Affairs, from May 29 to June 18, 1983.

The team had discussions with the officials concerned of the Government of Singapore (National Productivity Board) and conducted a field survey. 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 Republic of Singapore for their close cooperation extended to the team.

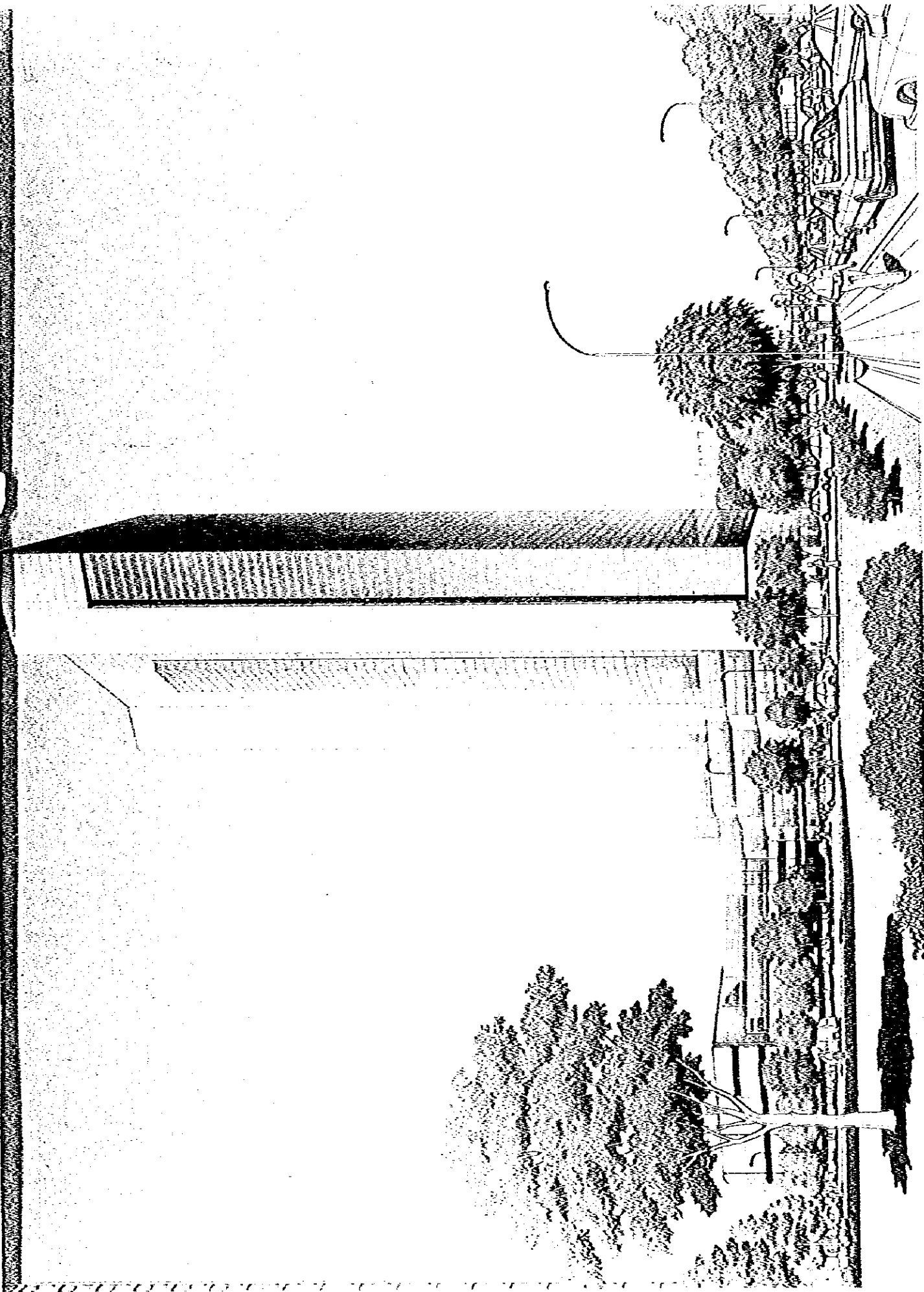
November 1983



Keisuke Arita

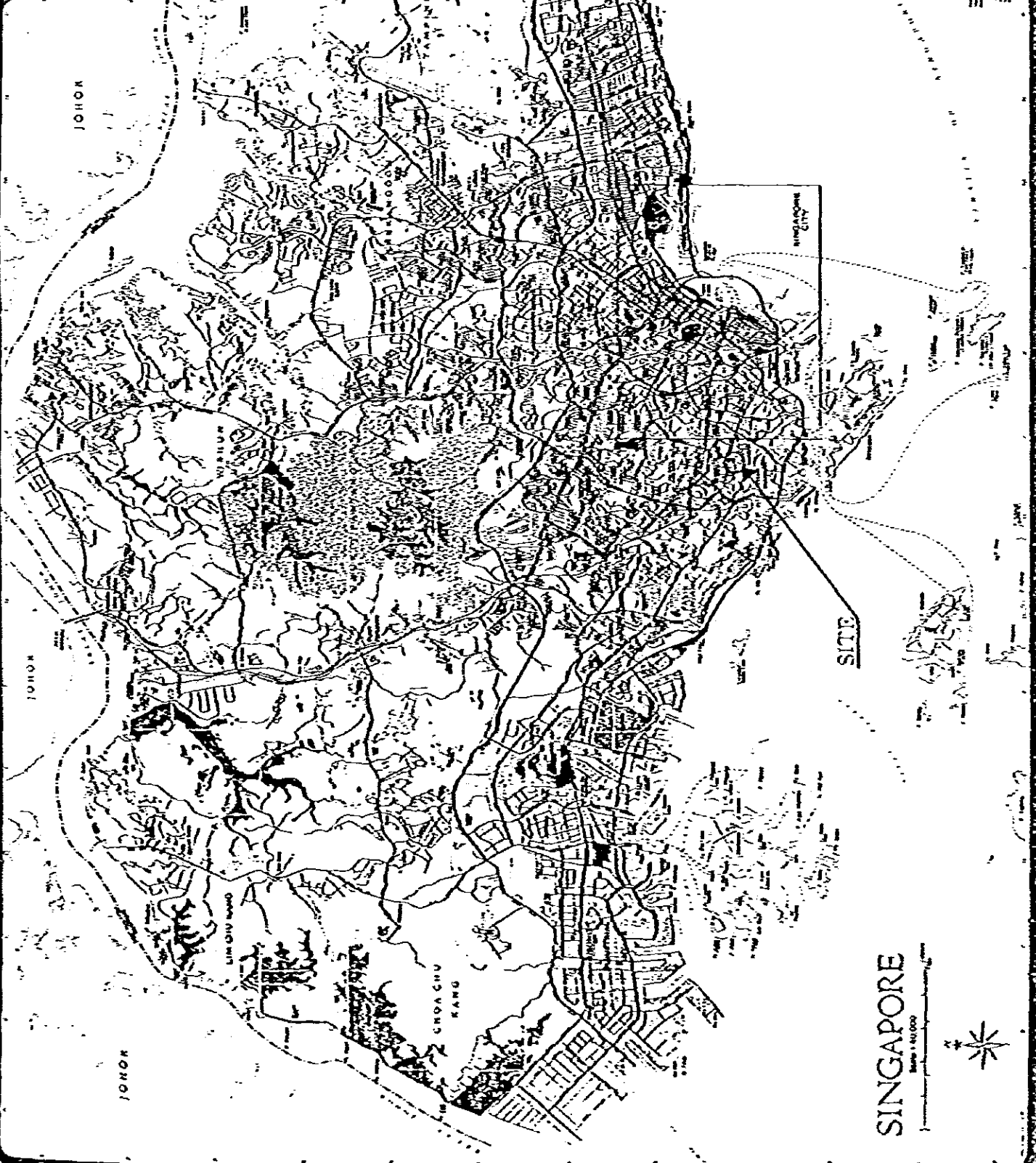
President

Japan International Cooperation Agency





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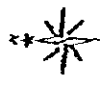


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SUMMARY

The Government of Singapore has successfully solved its unemployment problems and is experiencing a rapid economical growth through its industrialization policies. In mid 1979 it has adopted a strong policy to change its industrial structure from a labour intensive type to a technology intensive type in order to attain an even higher economic growth.

In Singapore, the human resource is to be its only resource, and the government is naturally eager to emphasize its development and promotion. Particular emphasis has been placed on technical education, and advancement has been made in the improvement of technical skills.

The Government, spearheaded by the NPB (National Productivity Board), has been promoting the "Productivity Movement" throughout the country. Through this movement, productivity improvement techniques are to be introduced and disseminated in such fields as Management and Supervisory Development (MSD), Labour Management Relations (LMR) and Occupational Safety and Health (OSH).

While promoting the movement, the Government of Singapore has shown interest in the postwar economic growth of Japan, especially in Japan's approach to productivity movement from the human aspect.

At the time of his visit to ASEAN countries, former Prime Minister, Suzuki proposed to assist the "Human Resource Development Project", and as a result of thorough discussions between the two governments to determine the conditions of cooperation, it has been decided to take up the "Productivity Development Project" as the "Human Resource Development Project" in Singapore. It has been decided to apply Japanese technical cooperation and grant aid to promote the Project.

In response to this request, the Japanese Government, through the Japan International Cooperation Agency, dispatched a basic design study team to Singapore for 21 days from May 29, 1983.

This project, termed the Productivity Development Project (PDP), is being promoted so as to make the "Productivity Movement", under the sponsorship of the NPB more widespread and substantial from the viewpoint of human aspects of productivity. Grant aid and technical cooperation is being requested from the Government of Japan. Grant aid from Japan will involve the purchasing of equipment and the development and procurement of training materials. As for technical cooperation, it is planned that Japanese experts will be dispatched to Singapore and that Singaporean personnel will be trained in Japan over a period of five years from 1983 to 1987.

The major fields of activities of the project are training, resource centre, planning and research, and promotion. Technical cooperation from Japan will cover all of these fields. Training is to be on Labour Management Relations (LMR), Management and Supervisory Development (MSD) and Occupational Safety and Health (OSH). According to the training plan, 59,200 persons are to be trained in the first five years and the total of trainees is expected to reach 200,000 in fifteen years.

In order to implement the Project, the Government of Singapore is planning to develop the organization of the NPB which is to become the core of this movement, and to construct a new building for its headquarters. The basic design of this building has been prepared as part of this Basic Design Study. A 22 storey building is to accommodate administrative offices, a training centre, an OSH centre, a resource centre and a parking building. The total floor area is to be approximately 38,407 m².

The proposed site for the building faces Jalan Bukit Merah to the north and Bukit Merah Central to the east, and has an area of approximately 8,200 m². The site is rectangular (approx. 140m x 60m) with its longer axis in the north-south direction. It is almost flat with no obstructions, except two trees which have to be removed.

Electric power, telephone service, city water, storm drainage, sewerage and gas supplies will be provided without difficulty.

Soil condition of the site is such that the bearing stratum for the building exists approximately 8 to 12 m below the ground surface. Piles will have to be driven in accordance with soil investigation results.

The equipment to be provided for this project includes equipment for training (mainly A/V equipment), equipment for the resource centre, equipment for occupational safety and health, equipment related to computers, and equipment for dissemination and promotion, all of which are to meet the objectives of NPB activities and which are expected to be utilized very frequently.

The development and purchase of training materials is also planned. For all 43 training courses for which technical cooperation is being extended, texts, manuals, VTR, slides, etc. are to be provided as required. At the time of development and purchase, specific execution experiences and productivity improvement accomplishments which have been proven in Japan will be taken into account instead of the mere transfer of knowledge.

The completion target is the end of 1985 and equipment and training materials will be furnished in two stages. All equipment is to be installed in the building within two months after its completion. The total overall project cost is set at 7,902 million yen, of which 2,500 million yen is to be borne by Japan and 5,402 million yen (S\$46,569,000) is to be borne by Singapore.

The budget required for the operation and maintenance of the NPB has increased sharply over the last three years (S\$3.29 million in 1980, S\$9.12 million in 1982 and S\$13.99 million in 1983). Of the S\$13.99 million in 1983, grants from the government are to be S\$10.86 million and revenues from courses are to be S\$3.13 million.

The NPB plans to expand its organization along with the progress of the PDP. It plans to increase its staff from 108 persons as of July 1, 1983 to 390 persons by 1987.

The project is expected to achieve the following:

- Training activities will be carried out more smoothly and effectively when A/V equipment and materials are used in classrooms.
- The improvement and enlargement of the resource centre, through the development of training materials and the collection and processing of information etc. will be highly beneficial to PDP activities.
- Through the provision of experiment apparatus, equipment and tools for OSH, practical research and training will be possible.
- By improving the computer systems of NPB, the training of computer professionals and users, and the effective collection, processing and analysis of information on training and education as well as on management efficiency and productivity will be achieved. This is in line with the national policy of acquiring more advanced technology.
- Promotion and research activities will become more efficient due to the support provided by the resource centre.
- By development and purchase of training materials, and by their utilization, a big step will be made towards the development of training methods and means which are most appropriate for Singapore.

As a means of achieving its national objectives of promoting the productivity movement throughout the nation, the Government of Singapore has decided to take up the "Productivity Development Project-PDP" with the assistance of Japan. Techniques of improving productivity, including those of Management and Supervisory Development, Labor Management Relations and Occupational Safety and Health are to be introduced and disseminated under the PDP plan.

As a result of an evaluation of the effects and continuity of the implementation of the PDP, it has been confirmed that this Project will be significantly effective. It is significant that the Project to be implemented with grant

aid from the Government of Japan, and its early implementation is urgently recommended. The construction of the new NPB building is crucial to the success of this project, and its completion on schedule by the end of 1985 is of vital importance.

With the special situation of Singapore taken into account, manuals will be prepared by Singapore counterparts on the basis of the advice given by the Japanese experts dispatched for long and short terms.

It is expected that through the smooth implementation of this project, the spirit of cooperation in the field of productivity will be strengthened between Japan and Singapore as well as with other ASEAN countries.

INTRODUCTION

CHAPTER ONE INTRODUCTION

The Government of Singapore has been actively pursuing an economic policy of "Industrialization based on Introduction of Foreign Capital" in an effort to solve the problems faced regarding unemployment and international payments. At the same time, it has been emphasizing the development of human resources as its sole available resource. Emphasis is also being placed on education, especially in the technical fields.

The labour force available in Singapore is small and is estimated to be approximately one million in total, of which four hundred thousand are engaged in the manufacturing industry. The population increase has been at the rate of 1.2 percent per annum. Under these circumstances, in order for the country to compete internationally and to continue to achieve a long-term economic development in the future, Singapore will be required to break away from its labour-intensive industrial structure and convert its industry to become more technology-oriented and more value adding.

As a part of measures to achieve this goal, the Government of Singapore has been promoting the "Productivity Movement" throughout the country with NPB (National Productivity Board) spearheading it. Under this Movement, the technique of improving productivity is to be introduced and disseminated in such fields as management and supervisory development (MSD) and labour management relations (LMR).

During the course of promoting this Movement, the Government of Singapore has looked towards the amazing postwar economic growth of Japan, and in particular, to Japan's approach to the Productivity Movement from the human aspect.

At the time of his visit to ASEAN countries, former Prime Minister, Suzuki proposed to assist the "Human Resource Development Project", and as a result of thorough discussions between the two governments to determine the conditions of cooperation, it has been decided to take up the "Productivity Development Project" of the Government of Singapore as the "Human Resource Development Project". It has been decided to apply Japanese technical cooperation and grant aid to promote the Project.

The Government of Japan has accordingly dispatched to Singapore in March 1983, through the Japan International Cooperation Agency, a preliminary study team to confirm the requests for grant aids of the Singapore Government.

Based on the result of this study, the Japan International Cooperation Agency dispatched, for 21 days starting May 29, 1983, a "Basic Design Study Team" headed by Mr. Eizen Irei of Economic Cooperation Section of the Economic Cooperation Bureau of the Ministry of Foreign Affairs. The itinerary and the composition of the study team are as shown in the APPENDIX 2, 3.

Discussions of the Team with NPB were carried out as shown in APPENDIX 1, and the Minutes of Discussion were confirmed by both sides. The Minutes of Discussion are as shown in APPENDIX 4.

Further to this, a Basic Design Study Team was dispatched from August 25, 1983 for 10 days and the basic design was confirmed by NPB, subject to the approval of the Government of Singapore.

The itinerary and the composition of the Confirmation Team are as shown in APPENDIX 5, 6.

This Report summarizes the design of the Project and its evaluation, based on the local field surveys, results of discussions, between the teams and information collected in Singapore.

BACKGROUND OF THE PROJECT

CHAPTER TWO BACKGROUND OF THE PROJECT

A. GENERAL SOCIAL CONDITIONS

1. Geographical Conditions

a. Location

Singapore is situated south of Peninsula Malaysia between the latitudes of 1°9" and 1°29" north (approximately 137 Km from the Equator), and between the east longitudes 103°38" and 104°6". It consists of a main island and about 50 small islands surrounding it. It is connected with the Peninsula Malaysia by means of a 4 Km causeway, which runs across the Johor Strait.

b. Surface Area and Geographical Features

The Island is 41.8 Km east-west and 22.5 Km north-south, and the total land area is 617.9 Km² including surrounding islands.

Topography is almost flat with an average elevation of 10 m above sea level, the highest being the Bukit Timah area which is 166 m above sea level.

Land utilization in 1981 is as shown below:

	<u>Area in Km²</u>
<u>Total land Area</u> (main island and offshore islets)	<u>617.9</u>
Built-up area (including new industrial sites)	288.6
Farm holding area (of licensed farms, excluding land occupied by pure rubber and coconut plantation)	74.9
Cultivable wasteland	91.4
Forest	28.6
Marshland	22.4
Others (inland waters, open spaces, public gardens, cemeteries, non-built-up areas in military establishments, quarries, rubber and coconut plantations)	112.0

c. Climate

Because it is located immediately under the Equator and is subjected to the Asian Seasonal Wind, it is hot and humid throughout the year. The average maximum daytime temperature is 30.7° and the average minimum daytime temperature 23.7°C. The lowest temperature recorded in the past 32 years was 19.6°C and the highest 34.8°C. Maximum humidity is at night, and reaches more than 90% before dawn. Humidity in the afternoon during the dry season will normally be in the range of 70%. Throughout the year there is no clear distinction between wet and dry seasons, however, there are two seasons called north-eastern monsoon season between November to March and southeastern monsoon season between May and September. Rainfall is more during the northeastern monsoon season. The average annual rainfall is 2,388.7 mm. The maximum annual rainfall is recorded at 3,452.4 mm and the minimum at 1,563.4 mm. The special features of the south-east monsoon season is that there are thunder storms called Sumatras accompanied by strong winds.

(Refer to SUPPLEMENTS 1 to 7 for climatic data)

2. Social Conditions

a. Population

The population of Singapore as of June 30, 1981 was 2,443,302 (Male: 1,236,267, Female: 1,207,035), an increase of 29,400 (1.2%) from the previous year.

Rate of population increase was about 25% from 1962 to 1966, but as result of the positive implementation of family planning by the Government, the rate has dropped to the level of 1.7% after 1969, and has been 1.2% since 1977. Composition of the population by ethnic group is Chinese, Malay, Indians and others. In 1981, population figures were Chinese 1,876,900, Malay 357,000, Indians 165,500 and others 52,900. The percentage of respective groups in the entire population are, 76.8% Chinese, 14.6% Malay,

6.4% Indians and 2.2% others.

(Refer to SUPPLEMENT 8 Population Distribution and SUPPLEMENT 9 Population by Age and Sex in 1982)

b. Languages, Literacy Rate

The four official languages are English, Malay, Chinese and Tamil.

Governmental and business transaction, are normally conducted in English. Bilingualism, i.e., English with Chinese, Malay or Tamil, is being promoted.

Of the population of people older than 10 years 1,996,378 as of 1980, 84% can read and write, the literacy by sex being 92% for males and 76% for females, of the 84% of literacy population, approximately 62% can read and write in one language only.

Those who can read and write in more than two official languages account for 37.5% of the entire population, of which 60.1% understand English and Chinese, while 30% understand English and Malay.

B. RELATED SOCIAL CONDITIONS

1. Economy

a. Outlook

The basis of the Singaporean economy was established by the British East India Company in 1819, main functions of which were that of small scale port and harbour facilities. Toward the end of 19th Century and the beginning of 20th Century, it started to flourish as an international transshipping point of tin and rubber products, and as the largest international re-laying center for the trade between the East and the West after the opening of Suez Canal.

In June 1959, Singapore was granted internal self-government with the exception of military and diplomatic powers.

Population increase in Singapore was large, becoming 1,579,000 in 1959 when it became independent from 938,000 in 1947. Unemployment rate at that time was 13%, and the deficit in international payments increased and inflation worsened.

Under these circumstances, the Government established an economic policy based on the industrialization, and promoted "the first and second (1960 ~ 1970) Development Plans" and enacted the Industry Establishment Law and Economic Expansion Incentive Act, setting out a positive foreign capital introduction policy. The Economic Development Board (EDB) and the Jurong Town Corporation were established consequently as promotion organizations.

In August, 1965 Singapore separated from the Malaysia Federation and to further promote its economic development, and improve its international payment position, introduced export industries, fostered its international finance market and promoted marine transportation and tourism in its industrialization policy based on the introduction of foreign capital. As a result, it attained a per capita income of S\$4,547 (US\$2,218 at the conversion rate

of S\$2.05/US\$1), which is next highest to Japan in Asia. The problem of unemployment was resolved in the 1960's, and in the 1970's Singapore was compelled to import many unskilled labourers from neighboring countries, as a result of the implementation of its Family Planning Programme. From the outlook that neighboring countries which have abundant unskilled laborers will be in a better position than with Singapore, in the case of labour-intensive industries, Singapore has adopted the policy of converting its domestic industries to more capital-intensive, more technology-intensive and more export-oriented industries from those of its former labour-intensive industries.

As a matter of course, for Singapore with scarce natural resources, the basis of its economic policy was to attain and maintain high levels of growth, requiring industrialization with high technology levels and high value added characteristics.

In spite of the effect of the so-called oil crisis of 1973, Singapore had attained the gross economic growth rate of 6.8% (Japan -1.2%) in 1974, 4.1% (Japan 2.4%) in 1975 and 7% (Japan 5.3%) in 1976. This trend continued on to 1977 and 1978 when it attained 7.8% (Japan 5.3%) and 8.6% (Japan 5.0%) respectively, in spite of the worldwide trend of stagnation in economy, and the rise of trade protectionism. Gross domestic product growth rate reached 9.3% (Japan 5.1%) in 1979, 10.2% (Japan 4.4%) in 1980 and 9.9% (Japan 3.2%) in 1981.

(Refer to Table 2-1 and 2-2)

TABLE 2-1 TRANSITION OF MAJOR INDICES

	GDP (million S\$)	Nominal Growth (%)	Net- growth (%)	GNP per Capita (S\$)	Consumers Price Indices	Unemploy- ment	Foreign Currency Reserve (US\$ billion)
1969	4,610	16.1	13.4	2,499	-	6.7	2,533
1970	5,320	15.4	13.4	2,825	-	6.0	3,100
1971	6,279	18.0	12.5	3,228	-	4.8	4,095
1972	7,524	19.8	13.3	3,763	(100.0)	4.7	4,930
1973	9,438	25.4	11.3	4,547	(117.7)	4.5	5,800
1974	11,738	24.4	6.8	5,529	(144.0)	4.0	6,503
1975	12,507	7.4	4.0	5,881	(147.7)	4.5	7,486
1976	13,626	9.6	7.0	6,329	94.2 (144.9)	4.5	8,261
1977	14,852	9.3	7.8	6,813	97.2 (149.5)	3.9	9,023
1978	16,294	9.8	8.6	7,464	101.9	3.6	11,474
1979	18,186	11.2	9.3	8,221	106.0	3.3	12,562
1980	20,729	14.0	10.2	9,293	115.0	3.0	13,760
1981	25,530	15.8	9.9	10,940	124.4	2.9	-

Note: Figures in parenthesis are old price indices based on 1972 = 100.

Bibliography: Japan-Singapore Association "Situation of Singapore"

TABLE 2-2 REAL GNP/GDP GROWTH OF SELECTED COUNTRIES, 1978-1982

Country	1978	1979	1980	1981	1982P
	Percentage Change Over Previous Year				
Total OECD	4.0	3.1	1.2	1.5	-1/2
United States	4.7	2.4	-0.3	2.3	-1 3/4
Japan	5.0	5.1	4.4	3.2	2 1/2
West Germany	3.1	4.1	1.9	0.2	-1 1/4
France	3.8	3.3	1.1	0.2	1 1/2
United Kingdom	3.7	1.6	-2.0	-2.0	1/2
Italy	2.7	4.9	3.9	-0.2	3/4
Canada	3.9	3.2	0.5	3.8	-5
ASEAN					
Indonesia	6.9	5.3	9.6	7.6	4.5
Malaysia	6.6	9.2	7.8	6.9	3.9
Philippines	6.8	6.1	5.4	3.7	2.6
Singapore	8.6	9.3	10.2	9.9	6.3
Thailand	10.1	6.1	5.8	7.6	4.5
Selected Northeast Asian Countries					
Hong Kong	10.3	12.8	9.8	11.0	4
South Korea	11.6	6.4	-6.2	6.4	6
Taiwan	13.9	8.1	6.6	5.5	4

Source: OECD Economic Outlook, December 1982
& Official Sources

Bibliography: Economic Survey of Singapore 1982

b. Industry

Tables 2-3 and 2-4 show the contribution to real growth in gross domestic product by industry in 1980 - 1982. It is natural that as a country with the lack of natural resources and domestic market, Singapore has to depend her existence on promotion of industrialization, particularly, on export-oriented industries. In this regard, the Government has placed emphasis on the betterment of its investment climate, i.e. development of industry complexes, introduction of foreign capital, and provision of a modern infrastructure.

Since 1968, the economy of Singapore has achieved an enormous growth which reached a gross domestic product growth rate of 10.2% in 1980. However, in 1981 and 1982, the rate dropped sharply to 9.9% and 6.3%, respectively, indicating that its economy was gradually being affected by the worldwide recession. (Refer to SUPPLEMENTS 10 and 11)

In manufacturing industries the production index dropped by 10.7% as compared to the same period in 1982. (Nihon Economic Journal dated June 25, 1983).

At present, the major industries of Singapore are the electronics, electrical and general mechanical production industry, oil refining industry and the transport industry centered around shipbuilding. These accounted for 65% of all value added industries in 1980, breakdown of which was 30%, 21%, and 14%, respectively. That in 1981 was 32.5%, 17.6%, and 12.2%, respectively. (Refer to SUPPLEMENT, 12, 13, and 14)

TABLE 2-3 CONTRIBUTION TO REAL GROWTH IN GDP
BY INDUSTRY, 1980-1982

Industry	Per Cent		
	1980	1981	1982P
TOTAL	100	100	100
Goods Sector	27	28	8
Agriculture & Fishing	-	-	-1
Manufacturing	22	20	-17
Construction & Quarrying	5	8	26
Services Sector	73	72	92
Utilities	2	2	2
Trade	16	13	15
Transport & Communication	21	22	27
Financial & Business Services	29	29	36
Other Services	5	6	12

Source: Department of Statistics

TABLE 2-1 GDP BY INDUSTRY AT 1968 FACTOR COST, 1980-1982

Industry	1980	1981	1982P	1980	1981	1982
	\$ Million			Percentage Change Over Previous Year		
TOTAL	12,161	13,369	14,218	10.2	9.9	6.3
Goods Sector	3,724	4,122	4,209	11.1	10.7	2.1
Agriculture & Fishing	159	155	146	1.9	-2.3	-6.3
Manufacturing	2,910	3,192	3,013	11.8	9.7	-5.6
Construction & Quarrying	655	775	1,050	10.7	18.3	35.5
Service Sector	9,331	10,357	11,319	11.9	11.0	9.3
Utilities	357	383	402	7.7	7.3	4.8
Trade	3,139	3,319	3,475	7.2	5.7	4.7
Transport & Communication	2,335	2,656	2,942	13.9	13.8	10.8
Financial & Business Services	2,163	2,581	2,953	22.4	19.4	14.4
Other Services	1,337	1,418	1,547	5.7	6.0	9.2
Less Imputed Bank Service Charge	894	1,110	1,310	na	na	na

Source: Department of Statistics

2. Labour Situation

a. Employment and Unemployment

The working population (over 15 of age) as of June 1981 was 1,146,000 as against the total population of 2,443,300. This was an increase of 3.8% from that of June 1980. However, the working population as of June 1982 was 1,170,000, an increase of 2.1% from that of June 1981, indicating a slight decrease in the rate of increase. On the other hand, the actual working population increased from 63% in 1981 to 63.4% in 1982.

(SUPPLEMENT 15 Estimates of Labour Force between 1966 to 1981.

Also refer to Table 2-5 Population and Labour Force, 1980 - 1982.)

TABLE 2-5 POPULATION AND LABOUR FORCE,
1980-1982 (AS AT JUNE)

Mid-Year	Population	Population Aged 15 & Over	Labour Force ^①			Dependency Ratio ^②	Participation Rate	Un-employment Rate
			Total	Employed	Un-employed			
			Thousand					
1980	2,413.9	1,758.6	1,102.5	1,068.9	33.5	2.2	62.7	3.0
1981	2,443.3	1,819.6	1,146.0	1,112.8	33.2	2.1	63.0	2.9
1982P	2,471.8	1,847.5	1,170.5	1,140.5	30.0	2.1	63.4	2.6

① Refers to economically active persons aged 15 and over.

② Dependency Ratio = Total Population/Labour Force

Source: Labour Force Surveys

The working population of women has been increasing in recent years, i.e. 40.0% in 1978 to 44.8% in 1981. This is due to the fact that there are various jobs available which can be taken up by women, and that the geographical condition is such that factories are located near the housing area.

The Government has also implemented a flexible policy whereby housewives are given the opportunity of working part-time in the government offices.

Employed population increased 4.5% to 1,112,800 in 1981 from 1,064,800 in 1980. In 1982, however, it became 1,140,500, a 2.5% decrease in the rate of increase compared to the previous year.

TABLE 2-6 PERSONS OF 15 YEARS AND OVER EMPLOYED BY INDUSTRY GROUP

Industry Group	June 1980		June 1981		Annual Change	
	No.	%	No.	%	No.	%
Total	1,064,800	100.0	1,112,800	100.0	48,000	4.5
Manufacturing	322,600	30.3	338,000	30.4	15,400	4.8
Construction*	63,600	6.0	66,300	6.0	2,700	4.2
Commerce	228,400	21.4	242,100	21.7	13,700	6.0
Transport, Storage and Communications	119,800	11.2	127,200	11.4	7,400	6.2
Financing, Insurance, Real Estate and Business Services	79,300	7.5	85,000	7.6	5,700	7.2
Community, Social and Personal Services	224,300	21.1	230,000	20.7	5,700	2.5
Others†	26,800	2.5	24,200	2.2	-2,600	-9.7

* Excludes construction workers living on worksites.

† Agriculture and fishing, mining and quarrying, electricity, gas and water, and activities not adequately defined.

Sources: 1980 Census of Population
1981 Labour Force Survey

Table 2-6 shows the employed population (15 years old and over) by industry group in 1980 and 1981.

From the table, it is apparent that while the employment in commerce, financing, insurance, transport and communication

increased, as to the rate of increase, manufacturing decreased from 6.6% in 1980 to 4.8% in 1981.

Looking from the occupational structure, professional, technical, administrative and managerial workers increased from 13.8% in 1981 to 14.4% in 1982 as against the entire employment population. On the other hand, white collar workers (clericals, sales and service) are stable at 40.7% while blue collar workers (production and related) decreased slightly from 39.0% in 1981 to 38.5% in 1982. Apart from the decrease in the industry production, the major cause of decrease in blue collar workers was the mechanization and automation of the production facilities. (Table 2-7)

TABLE 2-7 OCCUPATION STRUCTURE, 1980-1982
(AS AT JUNE)

Occupation	Per Cent		
	1980	1981	1982
TOTAL	100.0	100.0	100.0
Professional, Technical, Administrative & Managerial Workers	13.6	13.8	14.4
Clerical, Sales & Service Workers	40.1	40.7	40.7
Production & Related Workers	38.8	39.0	38.5
Others	7.5	6.5	6.4

Source: Labour Force Surveys

Rate of unemployment decreased due to the increase in the employment opportunity and the low rate of increase in working population. Unemployment rate was 3.0% in 1980, 2.9% in 1981 and 2.6% in 1982, which is practically full employment.

b. Productivity

Labor productivity is defined as production against employment labor force. Table 2-8 shows the productivity growth by sector for the period 1980 to 1982.

TABLE 2-8 PRODUCTIVITY GROWTH BY SECTOR, 1980-1982

Sector	1980	1981	1982P
	Percentage Change Over Previous Year		
TOTAL	4.5	5.3	2.0
Manufacturing	5.3	9.2	-4.6
Construction	6.6	0.3	11.2
Trade	0.9	-0.4	-2.3
Transport & Communication	9.4	10.6	8.1
Financial & Business Services	11.4	7.0	4.0

Source: Department of Statistics and Central Provident Fund Records

The productivity of the entire industry was, 4.3% in 1970, 4.5% in 1980, 5.3% in 1981 and 2.0% in 1982. This is lower than Korea 6.5%, Hong Kong 6.0% and Taiwan 6.4% (five year average).

Drop in the productivity in manufacturing sector was due to the rapid decrease in production rather than in labor force, while the decrease in trade sector was the result of increase in employment as compared to that in production. On the other hand, productivity increase in construction sector was attributable to the mechanization of construction methods.

c. Labour Administration

The Ministry of Labour is the government agency which has the control over labour administration such as worker-employer relations, employment service, employment regulation and conditions, safety and sanitation of industrial workers, national holidays, restriction of foreign labourers, statistics on labour, and international labour cooperation.

To supplement the roles of the Ministry of Labour, there are such governmental agencies as the National Productivity Board, the Central Provident Fund, the Industrial Arbitration Court, the National Wage Council and the Singapore Labour Foundation.

In 1968, the Government enacted the Employment Act and the Industrial Relations Act which regulate employment and working conditions regarding working hours, leave with pay, holidays, sick leave, special allowances, etc. For example, these Acts provide that working hours are to be 8 hours a day, 44 hours a week with one day off weekly, 11 days of national holidays with pay a year, and annual leave with pay of 7 days for persons who have not yet worked 10 years and 14 days for those who have working more than 10 years.

Other basic labour relations laws are the Central Provident Amendment Act of 1968, the Trade Union Amendment Act of 1968, the Trade Dispute Act and the Factories Act of 1973 and the Workmens' Compensation Act.

d. Wage Level

Table 2-9 shows the average weekly earning per occupation in Singapore for the years 1980 - 1982.

TABLE 2-9 AVERAGE WEEKLY EARNINGS, 1980-1982
(AS AT AUGUST)

Occupation	1980	1981	1982	1981	1982
	Dollars			Percentage Change Over Previous Year	
ALL WORKERS	161.38	184.05	212.25	14.0	15.3
Professional, Administrative, Managerial & Related Workers	377.88	410.84	482.48	8.7	17.4
Clerical, Sales, Service & Related Workers	130.83	143.98	162.25	10.1	12.7
Production, Transport & Other Manual Workers	110.44	129.13	143.14	16.9	10.8

Source: Ministry of Labour

Since 1972, the National Wages Council-NWC which consists of representatives from the Government, labourers and employers, has been making recommendations regarding wages for all workers. Although these recommendations are considered as guidelines, wages are generally set within that range.

Between 1972 to 1974, the Council recommended a considerable increase of wages, but as the recession became serious after 1975, the policy is to avoid losing international competitive power because of the inflation caused by wage increase. After 1979, however, the turn of the Government policy of strengthening industry structure from the labour-intensive industry resulted in a high wage policy, recommending the raise from previous 6 ~ 7% to 20%. This policy ended in 1982 and thereafter, "Wage raise commensurate with the increase in labour productivity" has become the national policy.

NWC's recommendation was S\$32 + 6% ~ 10% in 1981 and S\$18.5 + 2.5% ~ 6.5% in 1982. In 1983 however, it was S\$10 + 2% ~ 6%, the lowest wage raise recommendation of the past 4 years.

3. Education

a. Educational System

The first feature of the education system in Singapore is the availability of schools teaching in four languages (English, Chinese, Malay and Tamil), second, advancement to higher education by the qualification tests.

Selection of the language out of 4 official languages for children rests on parental authority. Children are to learn two languages, one of which should be the English language.

A reform of the education system is in progress in Singapore. It was implemented in January 1980 for primary education and in 1981 for secondary education. Under the new system, the first 3 years of primary education place emphasis on learning of the languages rather than acquiring knowledge. Depending on the achievement of these 3 years, the children are classified into 3 categories, i.e. normal bilingual course, extended bilingual course and monolingual course. The normal bilingual course is for 3 years up to 6th grade, the extended bilingual course and monolingual course are for 5 years up to 8th grade, to complete primary education.

There are no provisions for remaining in the same grade, but children are transferred to other courses depending on their achievement. After the children complete the normal and extended bilingual courses, they take the Primary School Leaving Examination (PSLE) and go on to middle school.

Those who complete the monolingual course and pass their examinations, receive completion certificates and enter vocational training schools or start working.

Those who have taken the PSLE are separated according to their achievements to secondary special, secondary express and secondary normal courses. Students of the secondary special course

are to master both English and Chinese as their mother language. Students of the secondary express and secondary normal courses are to master either English or Chinese and the other as their second language.

Students completing the 4 years middle school education of the secondary special and secondary express courses take the General Certificate of Education (GCE) 'O' Level Examinations, and go on to the pre-university level. Students completing the secondary normal course take the Certificate of Secondary Education Examination (CSE), and if their achievements are good, are allowed to take the GCE 'O' Level Examination after supplementing their studies for some years. Others go on to vocational training or start working.

Pre-university level is 2 years of junior college or 3 years of pre-university school centers. In order to enter a junior college, students must attain good marks in the GCE 'O' Level Examination, where language (English in particular) is considered important. Alternatively after taking the GCE 'O' examination, students may either go to polytechnic schools, study for diplomas in engineering, applied arts or start working. Those who finish the 2 or 3 years pre-university level education become eligible to take GCE 'A' Level Examination. After passing, they enter higher educational institutions such as the National University of Singapore.

b. School Education

Though primary education in Singapore is not compulsory, it is free and the attendance rate is as high as 84.5% for primary school and 53.7% for middle school. Classes are divided into morning and afternoon classes, which are held five days a week in general. There are two terms a year starting in January and ending in December.

Number of schools in 1980, was 507 including both public and private schools (primary, middle, and high schools) with 501,978

children. As to public schools, there were 303 primary schools, 111 middle schools, 22 integrated grade and middle schools and 8 junior colleges as of December 30, 1981. Number of primary school children was 289,519 (136,977 girls) and number of teachers was 9,405 (6,254 women). Number of middle school and pre-university level students was 175,460 (89,686 girls) and the number of teachers was 8,165 (4,546 women).

As for higher educational institutions, there are the National University of Singapore, Ngee Ann Polytechnic, Singapore Polytechnic and Institute of Education. There used to be the Nanyang University and the Singapore University, but the Nanyang University and the Singapore University were merged in July 1980 to form the National University of Singapore in order to maintain a high level of educational standard. On the other hand Nanyang University Campus in Jurong will be utilized as the Nanyang Technological Institute for the training of practical industrial specialists. (Table 2-10)

TABLE 2-10 ENROLLMENT AND OUTPUT OF GRADUATE
TECHNICAL AND SKILLED MANPOWER, 1980-1982

	Enrolment			Output		
	1980	1981	1982	1980	1981	1982
National University of Singapore	8,630	9,950	11,090	1,770	2,190	2,400
Engineering	1,750	2,140	2,120	270	320	350
Science	1,630	1,890	2,100	280	460	580
Others	5,250	5,920	6,870	1,220	1,410	1,470
Nanyang Technological Institute	-	-	570	-	-	-
Engineering	-	-	570	-	-	-
Singapore Polytechnic	5,010	5,420	5,550	1,390	1,440	1,710
Engineering	4,340	4,580	4,550	1,210	1,260	1,440
Others	670	840	1,000	180	180	270
Ngee Ann Polytechnic	2,860	3,140	3,660	880	580	750
Engineering	1,910	1,990	2,310	580	430	460
Others	950	1,150	1,350	300	150	290
Institutes of the Vocational and Industrial Training Board	11,650	10,090	10,690	7,790	5,820	6,650
Joint Industrial Training Centres	1,290	1,220	1,240	330	580	680

Source: Various Institutions, Economic Development Board

As to the contents of education, industrial technology education is emphasized in addition to the learning of the languages throughout middle school, high school (commerce, technology and science courses) and university. The Government also provides special technical educational institutions such as crew members training school, nurses training school.

c. Vocational Training

(1) The Vocational and Industrial Training Board - VITB

In 1979, the Industrial Training Board and the Adult Education Board were merged as VITB. VITB is a national institution for vocational training and continuing education. It provides at its 15 training centers 70 different education and training courses in technological fields under both full-time and part-time schooling systems. It also conducts license examinations of the skill level of trainees and issues certificates to those who pass the examinations. Training courses depending on the educational background and capability of trainees are offered, the highest being a course in which graduates of the GCE 'O' level are trained for 3.5 years for a diploma in applied arts. This course is on graphic design and interior design and the number of trainees registered was 74 as of January 1981. In addition, there are courses on industrial technology, namely, Industrial Technician Certificate (ITC), National Trade Certificate (NTC) and Certificate of Competency (COC).

Continuing Education and Training Programmes (CET) are ones which give workers the opportunity to develop lifetime careers, and in some cases participation is sponsored by their employers. In 1982, there were 10,691 participants in the training course. VITB also established two levels of courses on business studies in 1982, i.e. Certificate in Business Studies (CBS) and Preliminary Certificate in Business Studies (PCBS). In 1982, number of trainees in PCBS and CBS were 324 and 640, respectively.

(2) Joint Industrial Training Scheme

The Manpower Department of the Economic Development Board operates 4 training centers in the joint efforts with the Japanese Government and 3 large foreign enterprises. These foreign enterprises are, Tata of India, BBC Brown Boveri of West Germany and Phillips of Holland. Trainees are

those who have completed 10 years education or those who have completed vocational training schools and are between 16 and 25 years of age. The period of training is for 4 years: two years in the training center and two years on-the-job. (Table 2-11)

The Japan-Singapore Training Center which was established through the cooperation of the Japanese Government has mechanical, electrical, electronics, instrumentation and control courses, with 274 trainees as of May 1983. In the past 3 terms from November 1979 to April 1983 there were 237 participants.

Training Centers receiving cooperation from foreign enterprises have been conducting training courses similar to those of the Japan-Singapore Training Center. Training courses are conducted 44 hours a week for 50 weeks a year and last for 2 years. Total hours is 4,400. Trainees receive S\$240/month the first year and S\$280 the second year. Persons who have completed 4 years of training are qualified as craftsman by EDB, and those passing the license examination are presented with NIC certificates.

TABLE 2-11 ENROLLMENTS IN INDUSTRIAL TRAINING CENTRES

Training Centre	Courses	In-Centre	Completed 2-years	Total
Tata-Government Training Centre	Tool & Die Making Precision Metal Machining	398	618	1,016
*BEC Borwa-Boveri Government Training Centre	Precision Mechanics Tool & Die Making Precision Plastic Mould Making Precision Metal Machining Auto-lathe Setting Precision Optics	441	849	1,290
Phillips-Government Training Centre	Precision Metal Machining	140	419	559
Japan-Singapore Training Centre	Precision Plastic Mould Making Electrical & Electronics Instrumentation & Controls Industrial Machinery Maintenance	233	94	327
Total Enrolments		1,212	1,980	3,192

* With the closure of Rollei Singapore (Pte) Ltd. BEC Brown-Boveri has taken over the role.

Source: Economic Survey of Singapore 1982

(3) Vocational Training by EDB

EDB has Specialists Training Centres for training of senior engineers in production technique and for training of computer software engineers in cooperation with Japan, West Germany and France.

Japan-Singapore Institute of Software Technology trains those who have completed GCE 'A' level education to be specialists in the field of computer programming and system analysis. Actual activities of this Center started in February 1982, and the number of students is planned to be 350.

German-Singapore Institute is for training specialists in production technology and engineering. Students are those with either GCE 'A' level education or with NTC-2 certificates. The Centre was started in February 1982 and is said to have a capacity for 500 students.

French-Singapore Institute is for training technicians in electro technology in such fields as instrumentation, automation, use of computers and microprocessors. Activities of this Centre started in August 1983 with a capacity for 500 students.

PRODUCTIVITY MOVEMENT

CHAPTER THREE . . . PRODUCTIVITY MOVEMENT

A. TARGET

The Singapore Government has been promoting the policy of industrialization based on introduction of foreign capital, and has virtually attained complete employment and is enjoying a high rate of economic growth. In order to maintain this high rate of economic growth, the Government is making every endeavour to improve production technique by receiving technical assistance from advanced industrial countries and by promoting technology-oriented education.

One of the problems it faces is a low rate of population increase and a decline in the rate of increase of its labor force. Manpower is the only resource available in Singapore. It is necessary for Singapore to improve its labour productivity by developing and training its manpower resources in order to keep an advantageous position in the international competition and to insure that its economic growth is maintained.

Improvement of productivity can be attained by betterment of technology and management systems. As for the betterment of technology, EDB has taken up various incentive policies to encourage automation, mechanization and computerization of its industries, and fruitful results have been attained thus far. For the betterment of management systems, contributions of men of learning and experience who are graduates of both local schools and those abroad have been relied upon together with input from consulting firms and multi-national enterprises.

No matter how much efforts are made towards the betterment of technology and management systems, it is of no avail unless workers have the will and attitude to improve productivity. Therefore, the importance of the human aspect cannot be neglected in the improvement of productivity.

The Singapore Government is therefore promoting the Productivity Movement which emphasizes training of managers and supervisors. Attendance record of this manager and supervisor training course was 7,500 in 1982, and it is planned to enlarge the course each year up until 1987, the annual enrollment after that year to be 15,000. In total, NPB will be training approximately 200,000 managers and supervisors in the following 15 years according to its present plans.

The Singapore government has requested the Japanese Government for technical assistance regarding the technique and dissemination of its successful improvement in productivity by emphasizing human aspects, such as working attitudes and labour management.

NPB has in the past been carrying out consulting and training activities in limited areas of productivity, but it has now become necessary for it to reorientate, upgrade and expand its organization and retrain its staff in order to serve as the agency to promote the new human aspect of productivity.

The Singapore Government, therefore, plans to construct a new NPB building which is to become the center of its training, promotion and research and to serve as the headquarter of the Productivity Movement.

In its new headquarters building, through technical cooperation and grant aid from the Japanese Government, the objective of NPB is to train and promote productivity consciousness among various levels of its people, and stabilizing the Movement within the society and contribute to the overall development of its economy and public welfare.

B. BACKGROUND

In May 1972, NPB was established as a statutory board of the Government. Its roles were to undertake consultation and training activities at limited levels within the broad range of problems of productivity. Their activities were mainly individual consultation to small- to medium size enterprises, and training activities were of secondary nature. The Government organized the Committee of Productivity (COP) in April 1981 to examine the improvement of such matters as productivity, work attitude and labour management. COP submitted a report to the Government in June 1981 in which the human aspect of productivity was emphasized, and in which the Japanese labour management system was studied. In September 1981, the National Productivity Council (NPC) consisting of representatives from the Government, labour union and employers was established as an organization to discuss and guide the Productivity Movement.

Since submission of the COP report and the establishment of NPC, the Productivity Movement in Singapore has added activities of human consideration, and NPB has been given the role as the leader in the promotion of the Movement. The activities of the new Productivity Movement actually started in September 1981.

C. ACTIVITIES OF NPB

1. Role

The 4 major roles of NPB are as follows:

- (1) Inculcating productivity will
- (2) Improving labour-management relations
- (3) Training managers and supervisors
- (4) Assisting others to achieve higher productivity, including training of instructors, on the job training and investigation on productivity.

2. Activities

Activities of NPB are to act as the leader in the Productivity Movement. Its activities are classified as follows:

- a. Inculcating the concept of "productivity will" among Singaporeans by promoting and disseminating the principles of productivity improvement and productivity concept.
- b. To provide training courses for managers and supervisors for training in new management systems and principles and techniques of productivity.
- c. To develop healthy labour-management relations by enhancing team work and communication between labour and management.
- d. To observe the rate of increase in productivity and the development of the Productivity Movement by defining strategies for the promotion of the Productivity Movement and conducting research and systemizing the concepts and actuality of productivity.

Other than the above, research activities with regard to Occupational Safety and Health (OSH) are also considered roles of NPB.

The following types of courses were conducted from April 1982 to March 1983.

Executive Development Programmes

- Diploma in Business Administration
- Diploma in Personnel Management Programme
- Diploma in Management Accounting and Finance
- Diploma in Marketing and Sales Management Programme

People Management Skills Programmes

Supervisory Training Programmes

- Supervisory Development Modular Programme
- Section - Leader Course

Performance Appraisal Programmes

- Certificate in Performance Appraisal
- Performance Appraisal - Skills Content Course

Quality Control Circle Programmes

- Quality Control (QC) Circle Facilitator Course
- Quality Control (QC) Circle Leader Course

Work Excellence Programme

Computer Training Programmes

- Certificate in Computer Programming
- Certificate in Computer Data Processing
- Computer Data Processing for Managerial Personnel
- National Computer Centre (NCC) Training Library for System Analysis
- Computer Evaluation and Selection Course

Occupational Safety and Health Programmes

- Safety Officers Training Course
- Training Course for Safety Committee Members
- Shipyards Safety Instruction Course for Shiprepair Managers
- Shipyards Safety Instruction Course for Supervisors
- Building Construction Safety Supervisors Course
- Industrial Safety and Health for Supervisors
- Industrial First Aid Course
- Designated Factory Doctors Course
- Safety Management Course

Diplomas and Certificates are given to those who successfully completed their courses or training. In case of courses where examinations are not required, Statements of Attendance are given to those who have had an attendance record of more than 75%.

In-company training with the enterprises are programmed specially to meet the need of individual enterprises.

NPB provides management consultation services, such as for performance appraisal, QCC and the Work Excellence Committees (training centered around labour-management consultation).

In addition to activities mentioned above, NPB publishes a monthly circulation "Singapore Productivity News" as well as "Productivity Digest" every other month.

3. Organization and Staff

NPB is an organization under the Ministry of Labour. The Chairman is at the equivalent level of a cabinet member, and under the Deputy Chairman and Executive Director, there are six Divisions supplemented by Administrative Division.

Fig. 3-1 shows the organization and staff members as of June 1983. Staff members account for 108 persons. NPB is operated and managed by the Board of Directors and representatives from the Government, labour unions, employers, experts and scientific organizations.

Due to the shortage of instructors, NPB receives assistance from local men of learning and from foreign scholars and specialists. NPB is planning to strengthen its faculty in the future.

ORGANISATION CHART
NATIONAL PRODUCTIVITY BOARD (NEP 1 JUN 83)

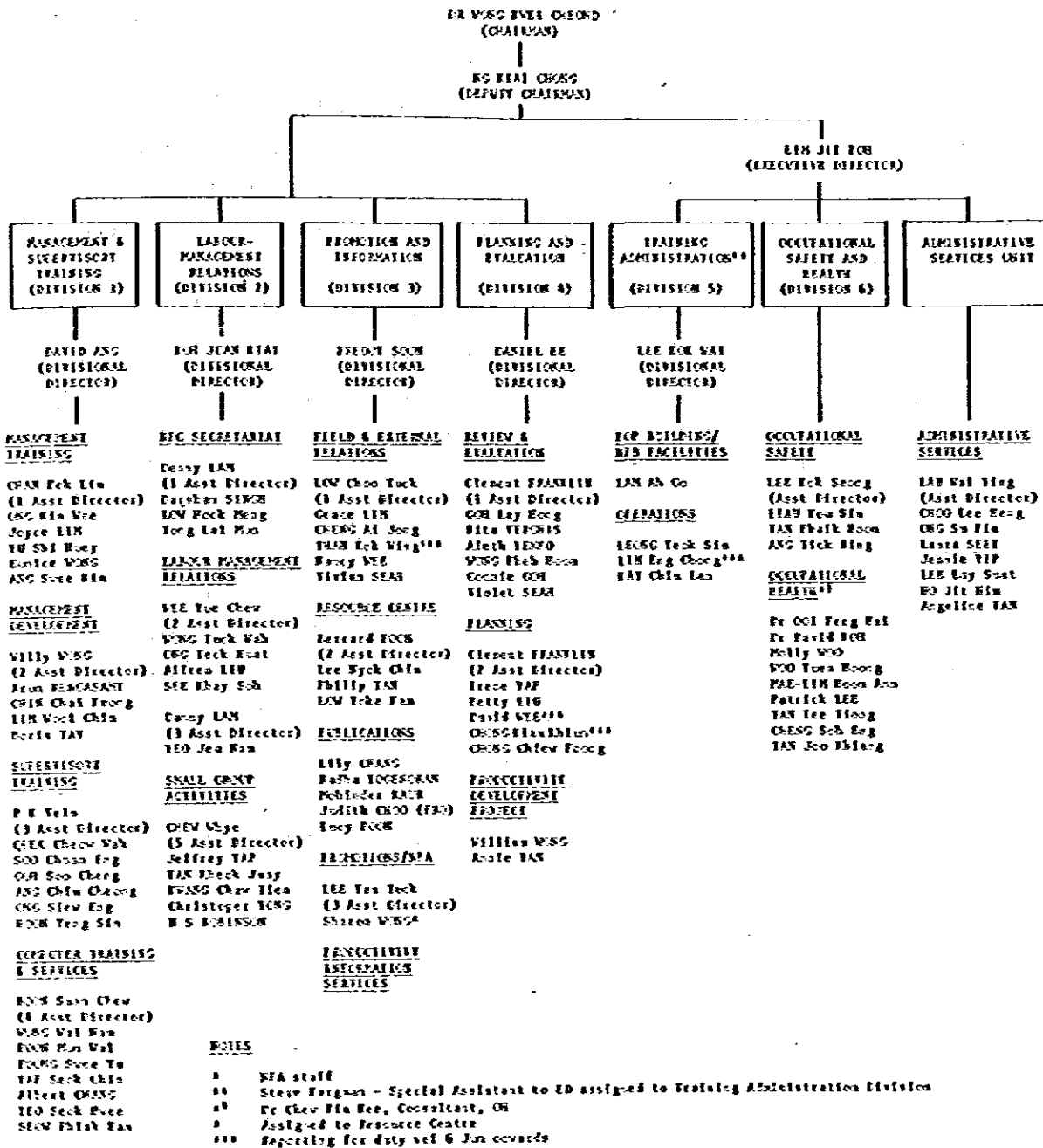


FIG. 3-1 ORGANIZATION AND STAFF MEMBERS AS OF JUNE 1983

4. Present Facilities, Equipment and Material

The head office of NPB is presently located in the Cuppage Centre Building on Cuppage Road, occupying spaces on the 6th and 8th floors. The administrative office is on the 8th floor and classrooms for training are located on the 8th floor. On the 6th floor is the library and additional offices. There are ten classrooms in all, including an audio-visual classroom. There is a branch in the industrial complex in Jurong with 5 classrooms.

Present equipment and material for training are overhead projectors, 16 8/m movie projectors, 35 8/m slide projectors, cameras and a limited number of video cameras, video cassette recorders, film strip projectors and monitor television sets, all of which are used for training activities.

5. Related Organizations of the Productivity Movement

To introduce more knowledge and higher level of skills into various trades, the Skills Development Fund (SDF) was established in 1979, and monetary assistance is being given to promote technological development and improvement of workers.

SDF also subsidizes trainees of recognized NPB courses at the rate of 70% and 50% of the tuition. There are 13 courses which receive the 70% subsidy and 5 courses which receive the 50% subsidy as of 1983.

The National Productivity Association (NPA) which was organized under NPB is open to anyone who is interested in productivity. Members are entitled to enjoy privileges of receiving reduction in the tuition for NPB training courses.

6. Budget

The budget of NPB is assisted financially by the Ministry of Finance. Its rapid growth are witnessed by its budget of S\$3.3 million in 1980, S\$4.9 million in 1981, S\$9.58 million in 1982 and S\$14 million in 1983. Breakdown of the budget for the year 1983 is as follows;

	S\$ Million
Expenditure for Manpower	6.34
Other Operational Expenditures	<u>7.65</u>
Total	13.99
Revenue from Courses	3.13
Grant from Government	10.86

Note: IS\$ = 116 Yen as of May 1983

DESCRIPTION OF THE PROJECT

CHAPTER FOUR DESCRIPTION OF THE PROJECT

PRODUCTIVITY DEVELOPMENT PROJECT. PDP

1. Objectives

The Singapore Government is planning the promotion of its productivity development movement by accepting technical cooperation from Japan, and as it has been explained in the previous Chapter, NPB is to be responsible for carrying out this program. In order to promote the Productivity Movement, strengthening of the NPB activities of training, research, promotion and dissemination is necessary. To this end, it is necessary for it to reinforce its organization and staff, and it is planned to construct a new headquarter building to accommodate these new activities. Functions of the new headquarters is to include its administrative offices, many classrooms for training and research, an auditorium, a Resource Centre and Library (for A/V material as well as for literature). The objective of this Project is to provide, by grant aid of the Japanese Government training equipment for rooms other than offices equipment such as A/V training aids, equipment for preparing development and promotional material (A/V equipment and printing facilities) and equipment for investigation and development (including computer equipment).

2. Activities

The period of activities is tentatively set for 5 years from 1983 to 1987. The 3 years until completion of the new NPB Building is to be the first phase and the remaining 2 years the second phase.

Activities of PDP being planned by NPB are the following four items:

- a. IMR, MSD and OSH activities which relate to training have 13 courses, 21 courses and 11 courses, respectively, 45 courses in total.

Plans for the development and provision of training software for the 43 courses is to within the scope of the Basic Design Studies. Table 4-1, 4-2 and 4-3 show the starting years and scales of the courses. Total number of trainees during the 5 year period up to 1987 is expected to reach 59,185.

TABLE 4-1 LABOUR MANAGEMENT RELATIONS (LMR)

Course No. & Title	Year to Start	Scale			
		Hrs.	No. of Trainees in a Class	Times/Year	Target No. to be Trained
1 JC Advance Course	1984	15	30	84/4	2,520
2 JC Basic Course	1984	30	30	84/4	2,520
3 LMR Practice in Prod'y Impr't Course	1984	60	25	45/4	1,125
4 QCC Course for Top Mgt	1984	7	30	42/4	1,260
5 QCC Facilitators Course (I) *	1983	63	25	200/5	5,000
5' QCC Facilitators Course (II) *					
5'' QCC Facilitators Course (III) *					
6 QCC Leaders Course *	1983	21	25	200/5	5,000
7 QCC Members Course	1984	15	25	70/4	1,750
8 Problem Solving Course	1985	30	30	30/3	900
9 New Empl. Induction Course	1984	30	50	52/4	2,600
10 New Empl. Trainers Course	1984	30	30	8/4	240
11 Prod'y Induction Course for Managers	1984	15	50	130/4	6,500
12 Prod'y Induction Course for Supervisors	1984	15	50	130/4	6,500
13 Work Excellence Programme	1983	60	30	114/5	3,420
Sub Total					39,335

TABLE 1-2 MANAGEMENT AND SUPERVISORY DEVELOPMENT (MSD)

Course No. & Title	Year to Start	Scale			
		Hrs.	No. of Trainees in a Class	Times/Year	Target No. to be Trained
1 Senior Mgt Course	1984	40	40	10/4	400
2 Mgt Development Course (Core)	1984	40	40	16/4	640
3 Supervisory Course (Core)	1983	80	20	85/5	1,700
4 Distribution Supervisors Course	1984	40	20	10/4	200
5 Construction Supervisors Course	1984	40	20	10/4	200
6 Human Development Course	1983	80	20	10/5	200
7 Training Development Course	1983	80	20	15/5	300
8 Training Instructors Course	1983	40	20	20/5	400
9 Production Management Course	1985	250	40	7/3	280
10 Industrial Engineering Course	1985	100	40	9/3	280
11 Management Consultant Course	1986	300	40	3/2	120
12 Corporate Planning Course	1986	100	40	3/2	120
13 Personnel Management Course	1983	80	40	18/5	720
14 Staff Development Career Planning Course	1983	20	20	25/5	500
15 Performance Appraisal Course	1983	30	25	35/5	875
16 Productivity Facilitators Course	1983	40	40	12/5	480

(Cont'd)

Course No. & Title	Year to Start	Scale			
		Hrs.	No. of Trainees in a Class	Times/year	Target No. to be Trained
17 Corporate Strategy Course (Mfg)	1985	40	40	4/3	160
18 Corporate Strategy Course (Retail)	1985	40	40	4/3	160
19 Mgt Structural Strengthening Course (Mfg)	1986	40	40	5/2	200
20 Mgt Structural Strengthening Course (Retail)	1986	40	40	5/2	200
21 Computer Courses (Assistance in the form of short term experts)					
Sub Total					8,135

TABLE 13. OCCUPATIONAL SAFETY AND HEALTH (OSH)

Course No. & Title	Year to Start	Scale			
		Hrs.	No. of Trainees in a Class	Times/Year	Target No. to be Trained
1 Safety Officers Course	1983	164	25	15/5	375
2 Safety & Health Management Course	1983	30	25	27/5	675
3 Safety Committee Members Course	1983	29	25	75/5	1,875
4 OSH for Supervisors of General Factories	1983	25	30	33/5	990
5 Shipyard Managers Course	1983	20	25	19/5	475
6 Shipyard Supervisors Course	1983	15	25	25/5	625
7 Safety Course on Press Machines & Related Machines for Supervisors	1984	25	30	31/4	930
8 OSH Course for Petrochemical Supervisors	1985	35	30	5/3	150
9 MRT Safety Course for Supervisors	1983	25	25	26/5	650
10 Building Construction Safety Supervisors Course	1983	25	25	69/5	1,725
11 Occupational Hygiene Technician Course	1984	120	20	8/4	160
Sub Total					8,630
Grand Total					56,100

- b. The Resource Centre is to supplement the activities of Planning and Research, Promotion and Training, and is aimed at strengthening and expanding the functions of NPB. Editing, publishing, collection and distribution of printed matters, video tapes, slides, etc. which are necessary for information exchange, training software and publicity promotion is to be performed in this Centre. Training materials for these activities is also being planned within the scope of the Basic Design Studies.
- c. Planning and Research is to support publicity promotion and training activities. Studies and research on methods to develop the productivity of Singapore are being planned.
- d. As for the dissemination and promotion, plans are to develop education and dissemination methods for the Productivity Movement with emphasis on the human aspect.

3. Organization

To smoothly implement and substantiate the activities of PDP, the organization of NPB is to be strengthened and its functions expanded. For this purpose, NPB has promoted PDP to the stage where the activities are well underway and its organization has already been established as stated in Chapter 3. Strengthening of its staff is an important matter of the future.

Fig. 4-1 shows the staffing plan from 1983 to 1987.

FIG. 4-1 STAFFING PLAN FOR PDP

	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>
PDP					
Planning and Research	19	21	23	23	23
Promotion	32	35	44	46	47
Labor-Management Relations	44	57	59	60	61
Managerial and Supervisory Development	40	44	58	67	79
Occupation Safety and Health	22	23	26	26	27
Resource Centre	11	20	35	39	42
<u>Total</u>	168 (236)	200 (279)	245 (337)	261 (360)	279 (390)

NOTE: Figures in parenthesis are staffing plan for PDP including administration staff, subject to approval of the Ministry Finance.

B. CONSTRUCTION PLAN OF THE NEW NPB BUILDING

To further develop and expand PDP activities which are centered around NPB, NPB is to build a new headquarter building to become the base of its operations, activities and researches. Though the detail design and the construction of the building are to be undertaken by the Government of Singapore, the Basic Design was planned within the scope of this Basic Design Studies Report together with the planning of training equipment and materials.

The proposed site for construction faces Jalan Bukit Merah on the north and Bukit Merah Central on the east, and is located near the Japan-Singapore Training Centre, covering an area of 8,202 m².

The new NPB Building will have its administration office, training Centre Resource Centre and OSH Centre. Together with parking and common spaces, it will be a 22 storey building with a total floor area 38,407 m².

The Training Centre will include 30 lecture rooms, 1 seminar room and an Auditorium with a capacity for 466 persons. Resource Centre will include a library for books and audio-visual aids and a studio, in which development of promotion, research and training materials is to be carried out. The OSH Centre will be a facility where training and experiments on occupational safety and health are to be conducted. See C-3 of Chapter 6 for detailed description of the facilities.

The above are subject to the approval of the Ministry of Finance, Singapore, and other relevant authorities.

C. PLAN FOR EQUIPMENT

The objectives of plans for training equipment are based on the following 5 items:

1. Equipment for Training

Audio-visual training equipment and materials, etc. to be provided in the classrooms where training courses are conducted as the nucleus of PDP.

2. Equipment for Resource Centre

Equipment and materials for producing A/V training materials, printing equipment for producing text books and reference materials, and equipment and materials for information collection and exchange are to be provided.

3. Equipment for Occupational Safety and Health

A laboratory where methods of controlling occupational safety and health are to be experimented, and display models of apparatus and tools which contribute to the occupational safety and health are to be provided.

4. Equipment and Materials Relating to Computers

These are roughly divided into the following three objectives:

a. Computers used for training

- . For technical training of computer specialists
- . For education and training of computer professionals and programmers
- . For education and training of managers of enterprises

b. Computerization of training operations

- . To improve efficiency in editing training materials
- . To maintain records of trainees
- . For controlling training information

c. Control and provision of PDP related information

- . Statistics and analysis of Productivity-related information
- . Productivity information services (PINS)
- . Publication management
- . Collection of information regarding rationalization of working environment, i.e. QCC/WIT, etc.

5. Equipment for Dissemination and Education Promotion

Equipment and materials for the dissemination toward enterprises and organizations of the PDP concept.

D. DEVELOPMENT AND PROCUREMENT PLANS FOR TRAINING MATERIALS

It has become evident through investigations made by the Japanese technical cooperation mission that training material which will be required for the implementation of PDP cannot be sufficiently obtained by procurement of existing material. Especially regarding matters of Japanese productivity improvements and occupational safety and health, material suitable to local Singapore conditions is not available for procurement and must be newly developed.

1. Type of Materials

- a. Instructor manual
- b. Texts for trainees
- c. A/V materials (video, tapes, films, slides)
- d. Auxiliary materials (bibliography, reference material, etc.)

2. Those which Must be Newly Developed

- a. Instructor manual

LNR, MSD will require all new manuals, while OSH will not require trainer manuals (method of training is different from others).

- b. Texts for trainees

There are some materials which will suffice with slight revision, but for labour-management relations, management supervisory development and productivity improvement, development of new material will be essential because those of Japan are uniquely Japanese.

- c. A/V materials to be used for training courses to be developed

Refer to attached Tables 7-1, 7-2 and 7-3.

d. Translation of brochures

Small brochures on PDP, labour-management consultation, small group activity (including typical Japanese QC circles), etc., which are considered to be useful, will need to be translated into English.

3. Those Which Require Revision

a. Texts for trainees

Partly revise existing ones in Singapore to incorporate useful matter of those used in Japan.

b. A/V materials to be used for training courses to be developed.

See attached Table

4. Those Which are to be Purchased

At the initial stage of discussions, NPB requested the purchase from English spoken countries, but it was proposed and affirmed that A/V materials and books in Japanese would also be necessary if Singapore is to learn Japanese-oriented management.

a. Those to be purchased overseas

- (1) Training packages
- (2) A/V materials, including films, video tapes and slides.
- (3) Books

b. Those to be purchased from Japan

- (1) Of A/V materials - slides
- (2) Of A/V materials - VIR
- (3) Books

E. DESCRIPTION OF THE JAPANESE TECHNICAL COOPERATION

Technical cooperation from Japan is to be provided for the promotion of PDP. The contents of the cooperation program is to support the objectives of PDP by training and guiding NPB staff and instructors on the six phases of subjects, i.e. Planning and Research, Promotion, Labour Management Relations, Management and Supervisory Development, Occupational Safety and Health and Resource Center. The Organizational Chart of the Project is as shown in Fig. 4-2.

The period for technical cooperation will be for five years from June 1983. The first phase, until the completion of the new NPB Building, will place emphasis on establishment of basic plans for PDP and on making preparation for the various training courses. The second phase will emphasize implementation of training courses after the completion of the new NPB Building.

The technical cooperation consists of long-term and short-term dispatch of experts from Japan and accepting of trainees from Singapore in Japan. Fig. 4-3 shows the relationship between long-term experts and their counterparts in 1983.

The technical cooperation outlined above, corresponds to the plans for training equipment and materials provided under the Basic Design Studies as follows:

1. Training courses for Labour Management Relations, Management and Supervisory Development, Occupational Safety and Health to which technical cooperation is to be given, are to use materials which are to be provided under the grant aid programme.
2. Activities of the Resource Centre will use equipment and materials to be provided under the grant.
3. Technical cooperation is planned in harmony to the completion of the new NPB Building, and the timing of procurement of equipment and materials, development and purchase of materials for training and the schedule of dispatch of experts and accepting of trainees in Japan are to be coordinated. (Refer to Tentative Schedule of Implementation of Technical Cooperation, SUPPLEMENTS 24 to 27)

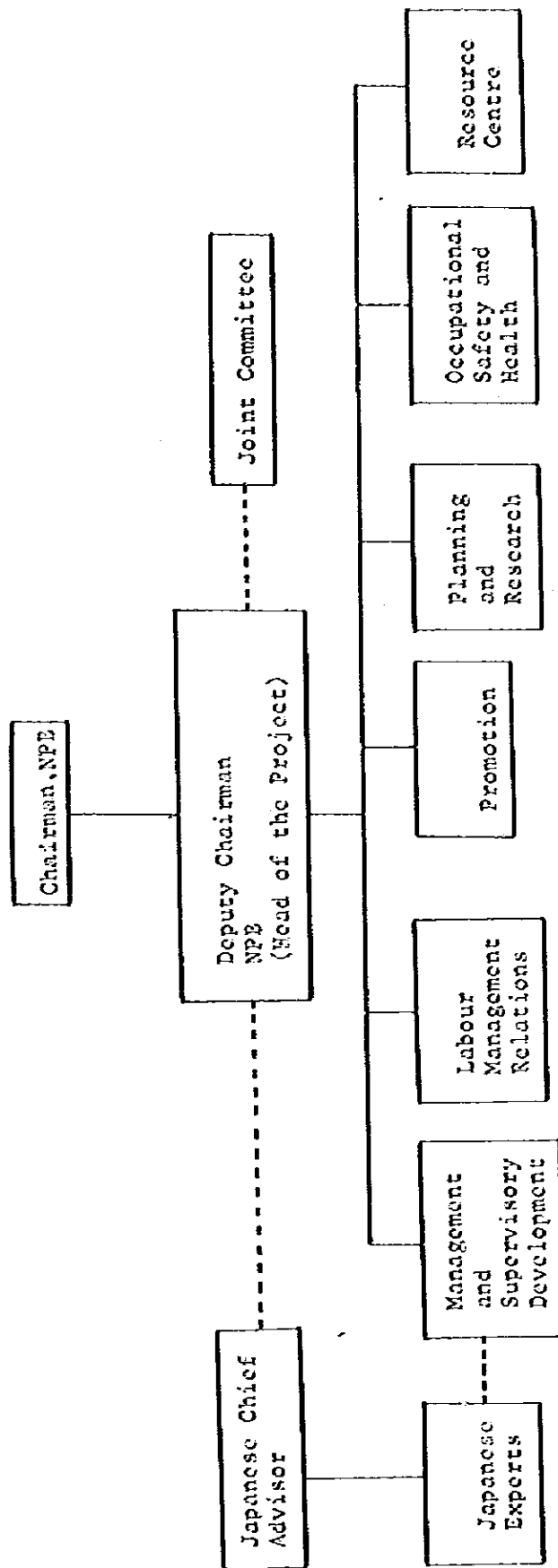
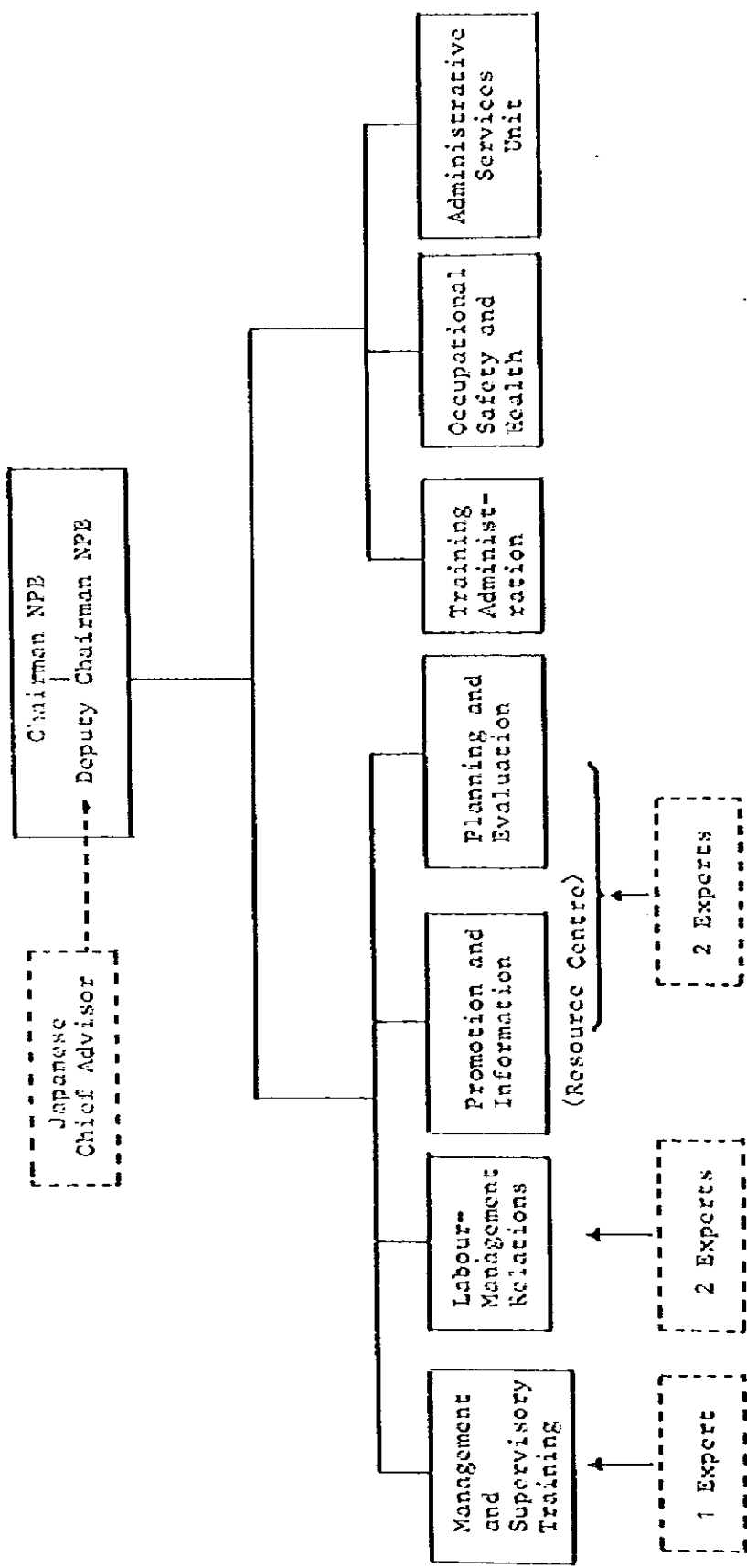


FIG. 4-2 ORGANIZATION CHART OF THE PROJECT



1983

Note: 1 JICA coordinator for 1983.

FIG. 4-3 ORGANIZATION OF COUNTERPART

BUILDING SITE

CHAPTER FIVE BUILDING SITE

A. GENERAL

Proposed building site was released on Dec. 9, 1982 from the Housing and Development Board (HDB) to the National Planning Board for use of the new NPB Building. The use of the site for the NPB Building was authorized by the Ministry of National Development on Jan. 26, 1983. Outline of the proposed site is as follows:

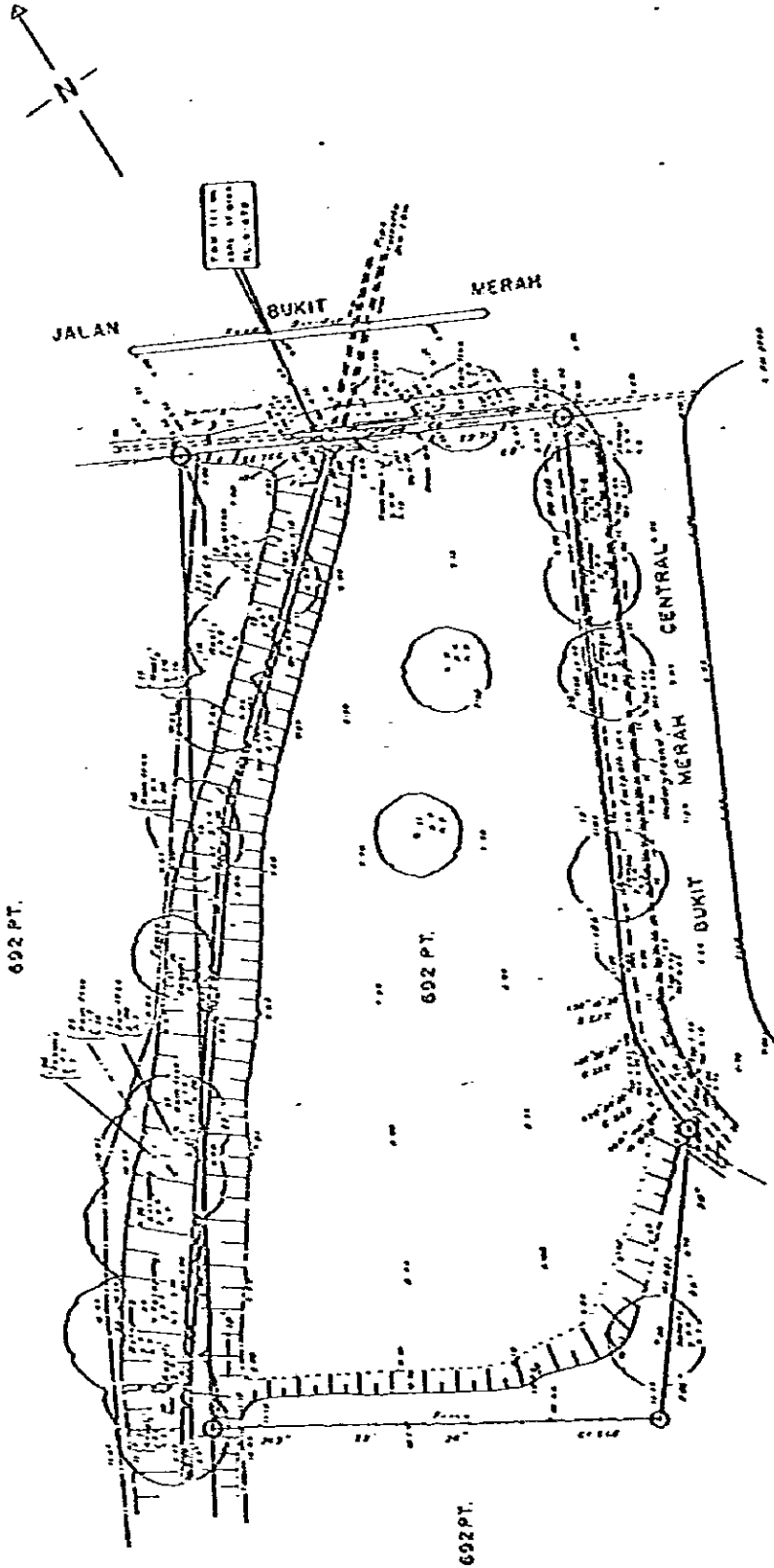
B. SITE CONDITIONS

1. Location

The north side of the proposed site faces the Jalan Bukit Merah Street which runs roughly in the east-west direction in the southern part of Singapore. The site is located approximately 700 m west of the Japan-Singapore Training Centre which is near the intersection of Jalan Bukit Merah Road and Henderson Road. The east side of the site faces the Bukit Merah Central Road. Widths of Jalan Bukit Merah Road and Bukit Merah Central Road are approximately 32 m and 22 m respectively. (Fig. 5-1)

2. Shape

The site is rectangular (approx. 140 m x 60 m) in shape, the longer axis being in the north-south direction. Elevation at the south side of the site is about 2 m higher than the north side, however the site is, on the whole, flat with no obstructions requiring removal except existing trees at two locations. An existing drainage ditch crosses the north-west corner of the site. (Fig. 5-2)



- Notes:
1. Surveyor for Malayan
 2. Provisionally based on P.O. 100
 3. All levels are based on M.S.L. at datum (1948) for prep datum.
 4. Features shown are indicative only.
 5. These names have been used and intended and should be maintained.
 6. All measurements taken on 11.11.1950.
 7. Boundaries are subject to final survey.

Wang Yu Yung
 WANG YU YUNG
 Surveyor General
 Malaya

TOPOGRAPHICAL SURVEY OF LOT 692 PT.
 AT JALAN BUKIT MERAH

Scale. 1 : 1,000

FIG. S-1 SITE AREA

3. Site Area

The total area of the site is 8,202 m².

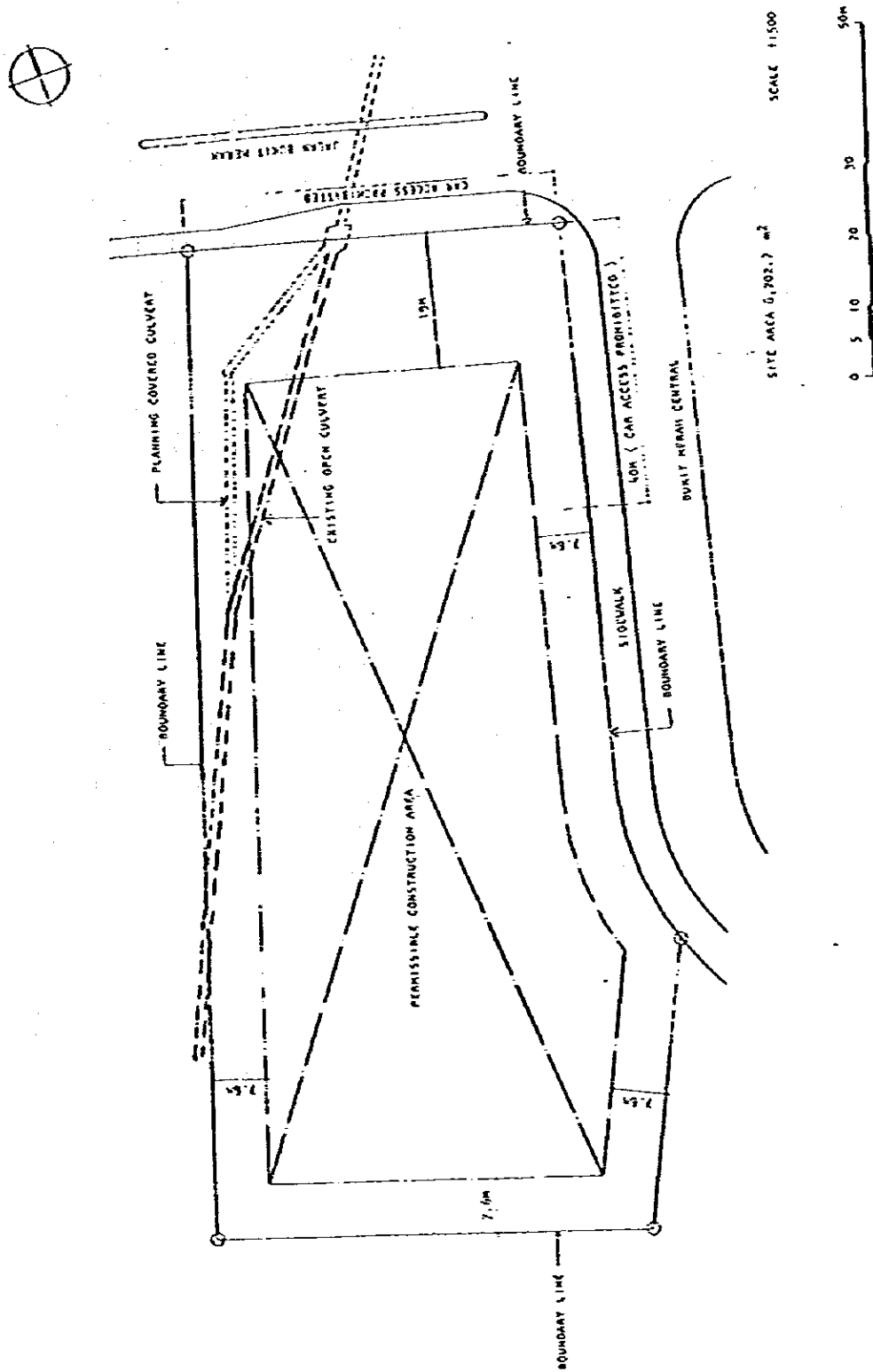


FIG. 5-2 SITE CONDITIONS

4. Statutory Regulations

a. Floor-area ratio

Maximum and minimum ratios between the total floor area of the building permitted by the code to the area of the site are regulated to 300% maximum and 250% minimum. A building with total floor area within the range of 24,606 m² and 20,505 m², which is 300% and 250% respectively of the 8,202 m² site area conforms to the regulations. The area of car parking spaces is not included, and is extra.

b. Height regulations

There are no limiting restrictions on building heights.

c. Setback

In order to provide wide green areas around building, regulations provide that buildings are set back from the roads and site boundary lines. Required setback distance is 19 m from the road boundary of Jalan Bukit Merah on the north side of the site and 7.6 m from the road boundary of Bukit Merah Central on the east side. Setbacks of 7.6 m from the land boundary lines on the west and south sides of the site are required. (Fig. 5-3)

d. Car access limitations

Car access to the site from Bukit Merah Central will not be permitted within a distance of 40 m from the intersection of Jalan Bukit Merah and Bukit Merah Central. (Fig. 5-3)

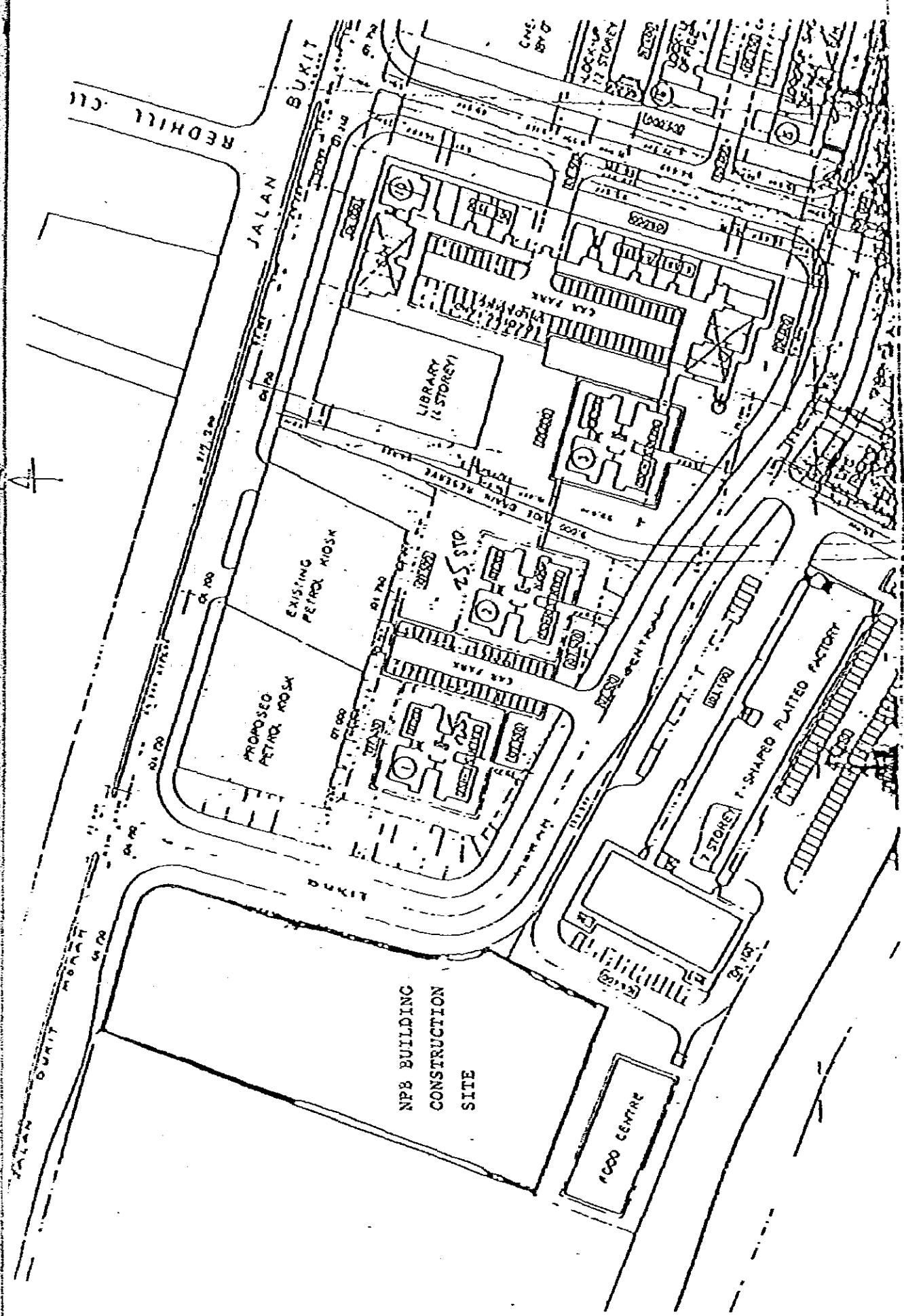


FIG.5-3 SITE CONDITION PLAN

e. Relocation of drainage ditch

Existing open drainage culvert transversing the northwest corner of the site, as shown in site plan, is to be relocated and reinstalled as a covered culvert by the NPB before commencement of the construction of the new NPB Building. (Fig. 5-2 and 5-3)

C. ENVIRONMENT

There are no high-rise office buildings in the district of the site which is located outside the central commercial zone of the city. Housings and industrial developments line both sides of Jalan Bukit Merah Road intermittently in this area. Green areas are still plentiful. Along the opposite side of Bukit Merah Central are three 25-storey housing towers. On the south side of these housing towers is a seven storey flatted factory. Another flatted factory exists on the west side of the site. These factories are engaged in the manufacturing of electrical appliances, textile products, etc., and are not sources of noise or air pollution. The opposite side of the intersection of Bukit Merah Central and Jalan Bukit Merah is a vacant lot where it is said that a gasoline stand is to be constructed. The north side of Jalan Bukit Merah is the proposed site for a vocational training school and other facilities.

D. GEOLOGY

Soil investigation was conducted by the NPB in May 1983 at four points shown in SUPPLEMENT 16. Results of the investigation at each point are as shown in SUPPLEMENTS 17 to 23. From results of the investigations made at these four points, it has been found that the thickness of the soft and loose upper strata is not constant. Especially at Borehole No. 2, extremely soft muddy clay and silty clay has been observed.

This rules out the adoption of a shallow spread footing whereby settlement and uneven settlement would be anticipated. Therefore, piling will be required for the building foundation to obtain bearing on the very dense silty sand stratum or on the hard weathered siltstone or sandstone existing at depths of 8 to 12 m below the existing ground surface.

E. INFRASTRUCTURE

1. Outline of Infrastructure

Infrastructure in Singapore is well developed. Especially in urban areas, facilities equal to those in the major cities in Japan are provided.

2. Electricity

In Singapore, all electric service cables are provided underground. A 22 KV extra-high-tension electric service cable and a 6 KV high-tension cable exist under the walkway along Jalan Bukit Merah on the north side of the building site. In addition, a 6.6 KV high-tension cable exists along the south boundary of the site. As the provisions of the Public Utilities Board (PUB) provide that the service line for this project is to be a 22 KV extra-high-tension line, a branch service from the existing extra-high-tension service cable along Jalan Bukit Merah will be required. (Fig. 5-4)

3. Telecommunication

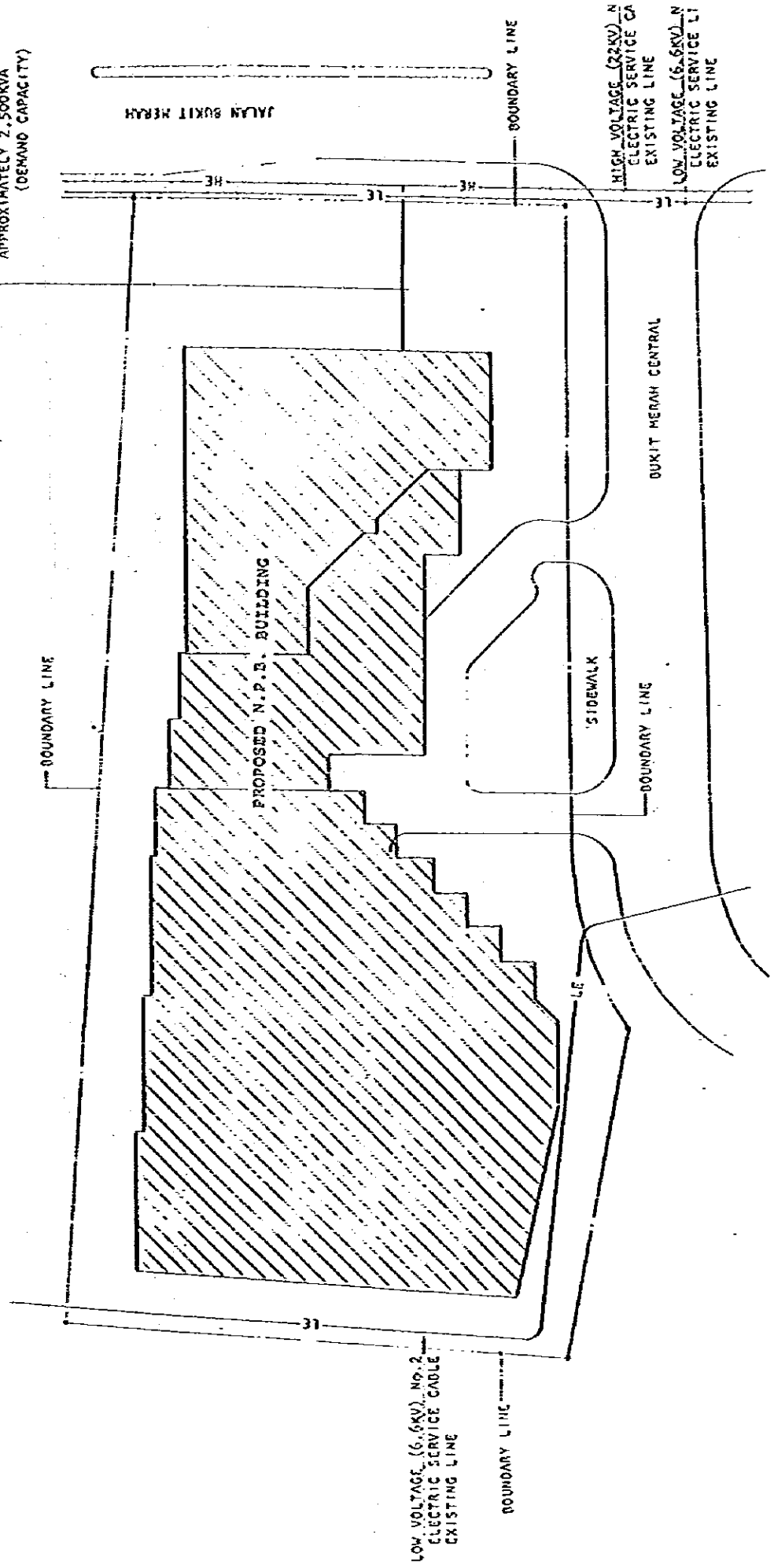
All telephone service cables are also provided underground. For this project, a service cable exists under Bukit Merah Central on the east side of the site. Branchout for this project can be taken from the Telecoms Plant manhole existing at the boundary of the site. (Fig. 5-5)

4. Water Supply

A 900 mm diameter water supply main exists under the sidewalk along Jalan Bukit Merah on the north side of the site. The main is exposed at the open storm drainage culvert transversing the site. A 150 mm diameter branch is already provided within the site and the flow is presently closed with a stop valve in the manhole. (Fig. 5-6)



HIGH VOLTAGE (22KV) N
ELECTRIC SERVICE CABLE
PLANNING LINE
APPROXIMATELY 2,500KVA
(DEMAND CAPACITY)



LOW VOLTAGE (6.6KV) NO. 2
ELECTRIC SERVICE CABLE
EXISTING LINE

BOUNDARY LINE

FIG. 5-1 ELECTRIC SERVICE CABLE

SITE AREA 8,202.7



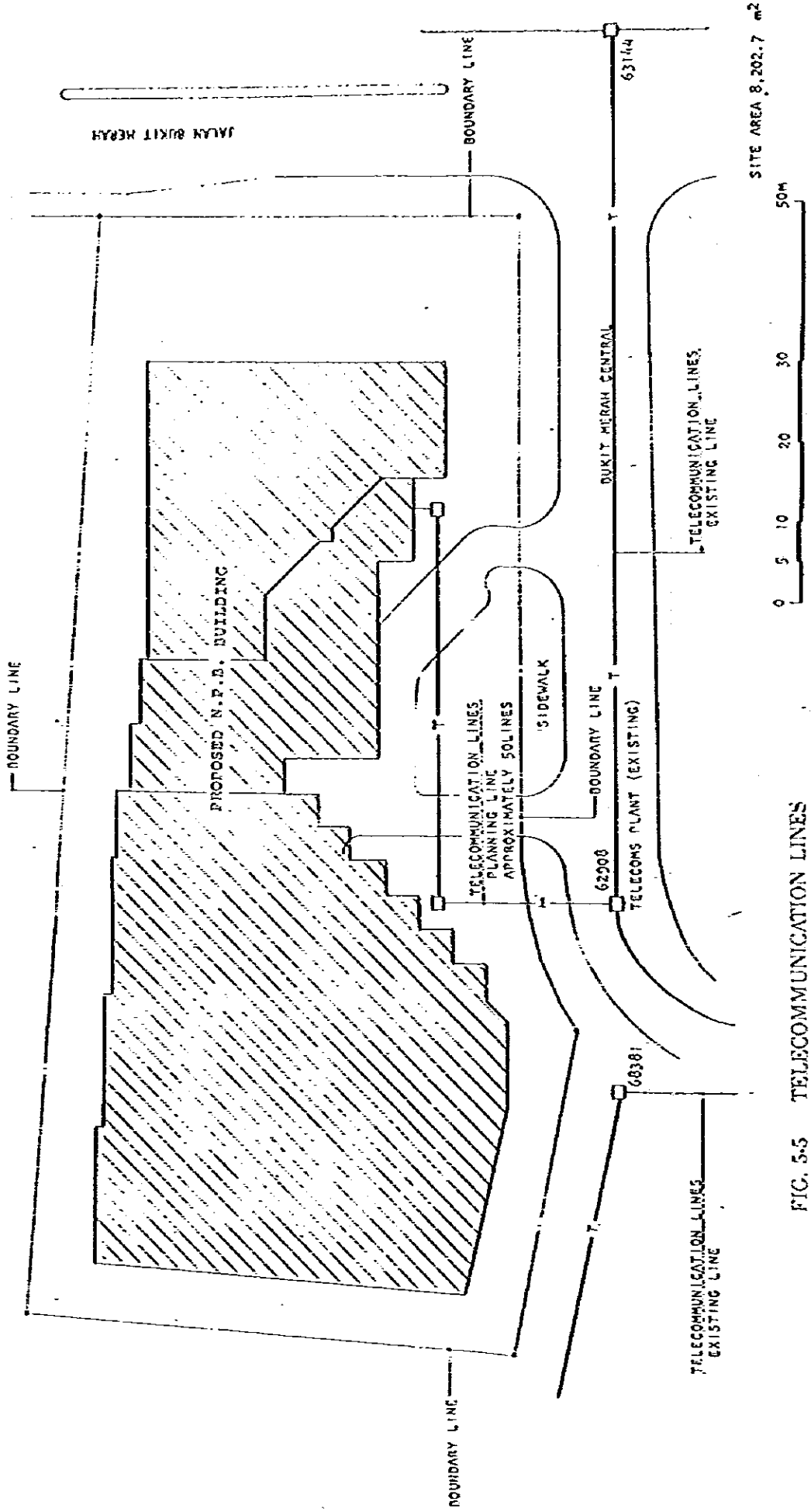
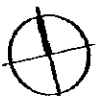
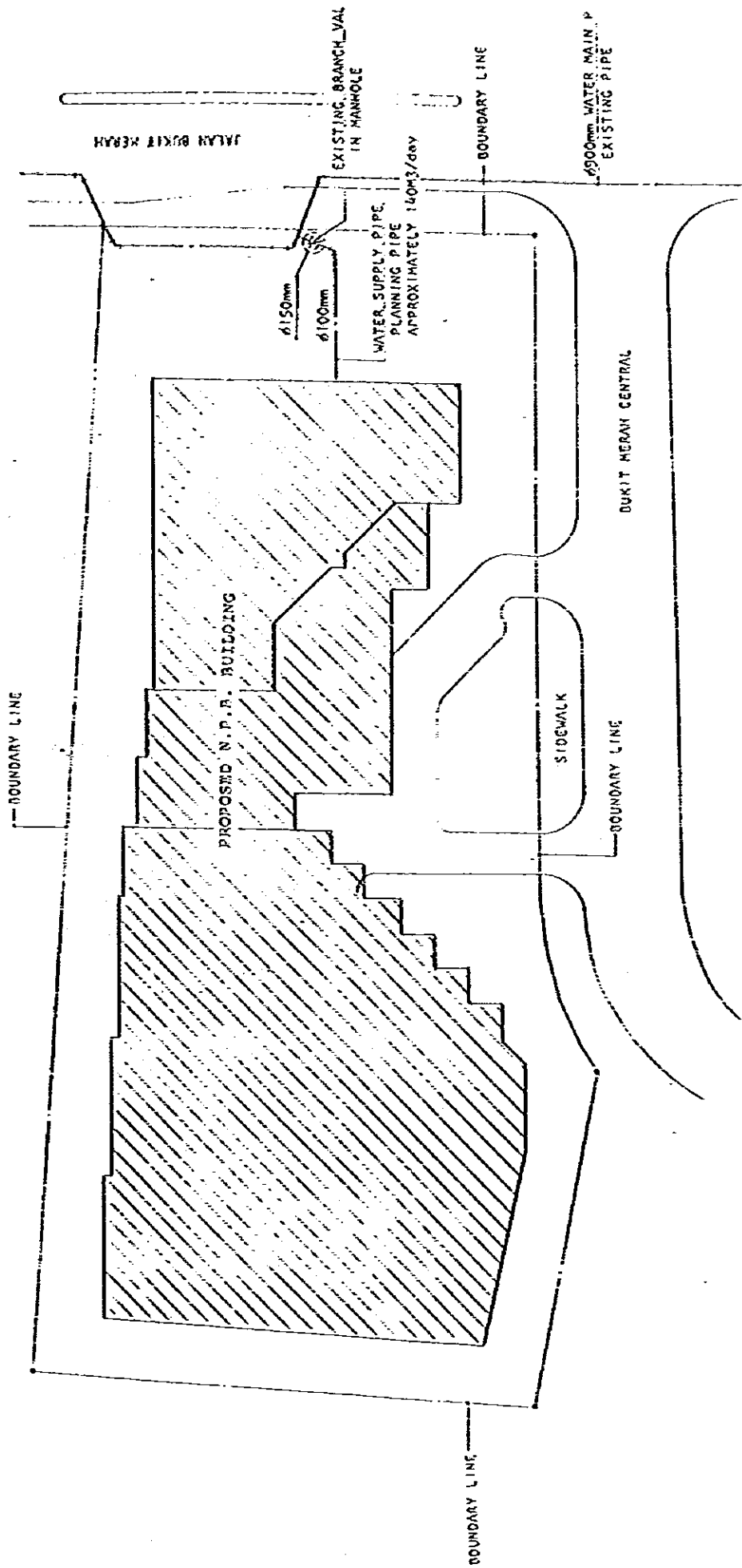


FIG. 5-5 TELECOMMUNICATION LINES



SITE AREA 8,202.7 m²



FIG. S-6 WATER MAIN PIPE

5. Storm Drainage

Storm drainage and sewerage are provided as separate systems in Singapore. An open culvert type storm drain exists along the west boundary of the site. This line cuts across the site at the northwest corner. Since the present location of the existing open culvert will be an obstacle to this project, it must be partially relocated and replaced with a covered culvert. Another open culvert exists between the site and the walkway along Jalan Bukit Merah on the north side of the site. Rainwater from the construction site and the walkway is drained into this culvert. A 600 mm diameter storm drainage pipe is embedded under the walkway along Bukit Merah Central on the east side of the site. (Fig. 5-7)

6. Sewerage

No septic tanks are required as sewerage can be discharged directly to the public sewerage system. Underground sewerage lines exist on the north and east sides of the site. They are 305 mm and 225 mm in diameter respectively. These sewerage lines converge at the intersection of Jalan Bukit Merah and Bukit Merah Central, and flow eastward along Jalan Bukit Merah. Since the utility service core of the proposed building is on the east side, discharge is to be made to the existing 225 mm diameter sewerage line. (Fig. 5-8)

7. City Gas

City gas service is well provided in Singapore. A medium pressure 600 mm diameter supply line exists near boundary line at the north side of the site along Jalan Bukit Merah. A low pressure 300 mm diameter supply line exists on the opposite side of the same road. As the supply required for this project is only for kitchens and a part of the laboratories, a branch service is required from the 300 mm low pressure line existing across the street. (Fig. 5-9)

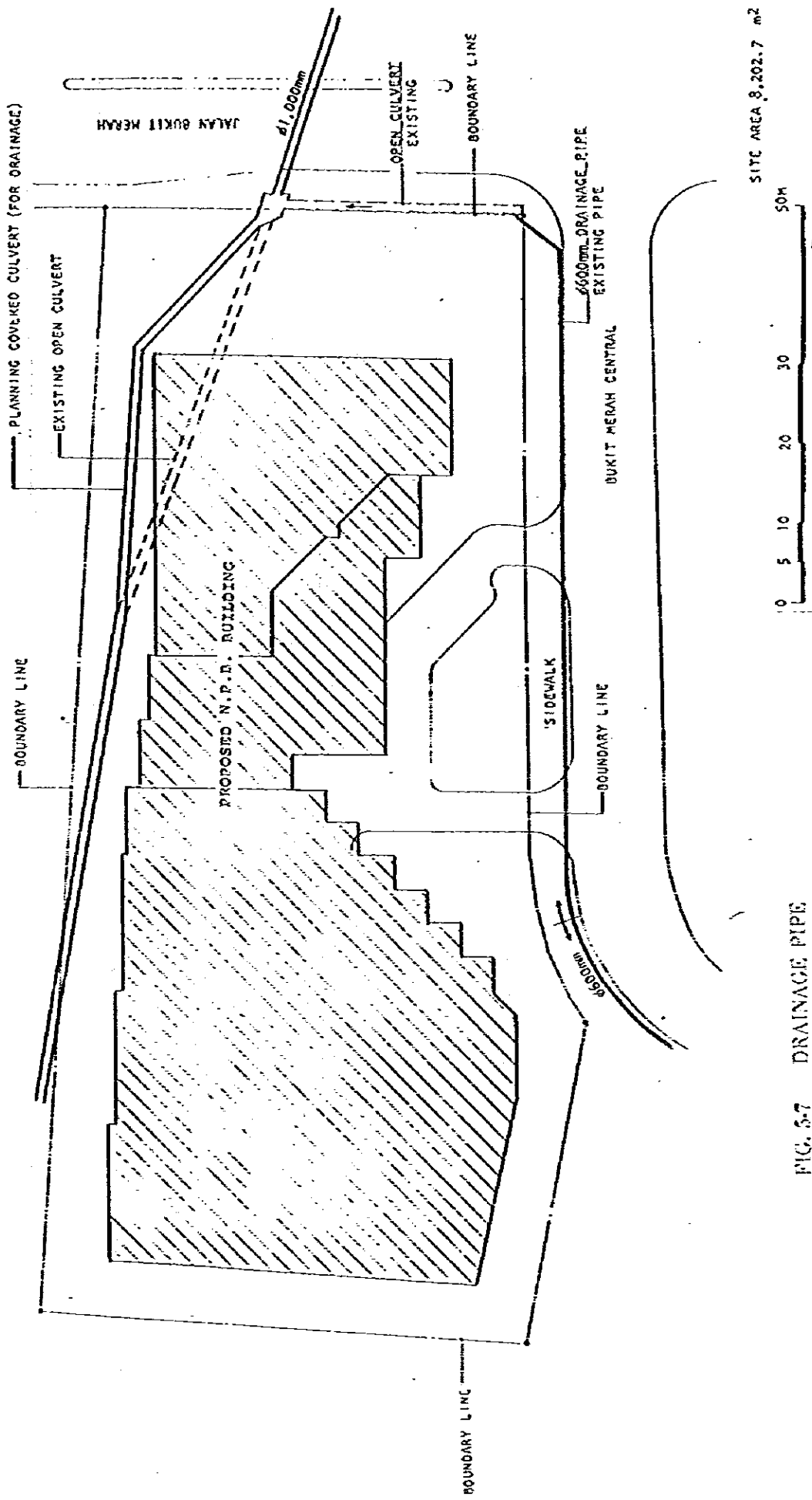


FIG. 5-7 DRAINAGE PIPE

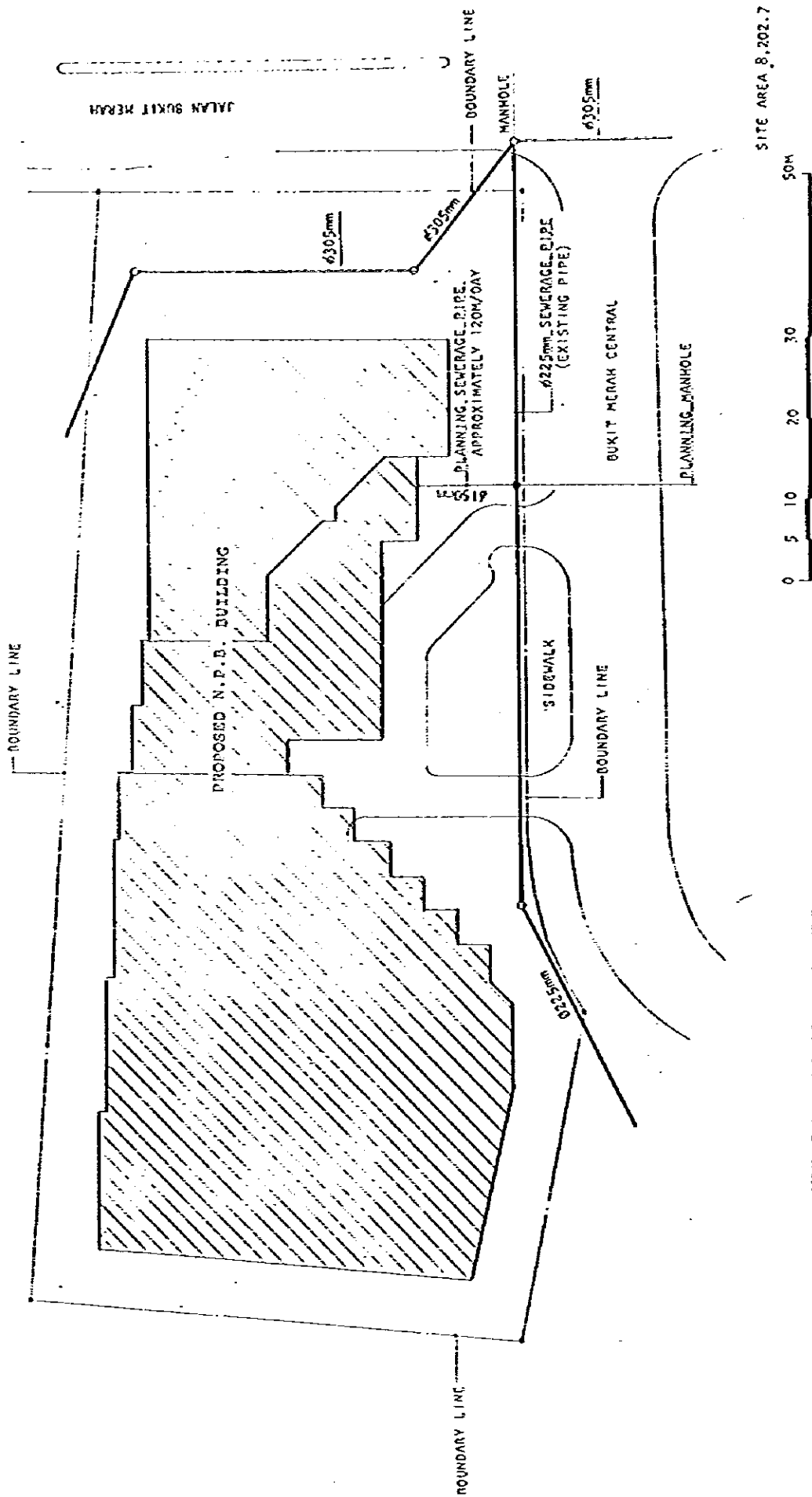


FIG. 5-8 SEWERAGE PIPE

BASIC DESIGN OF FACILITIES

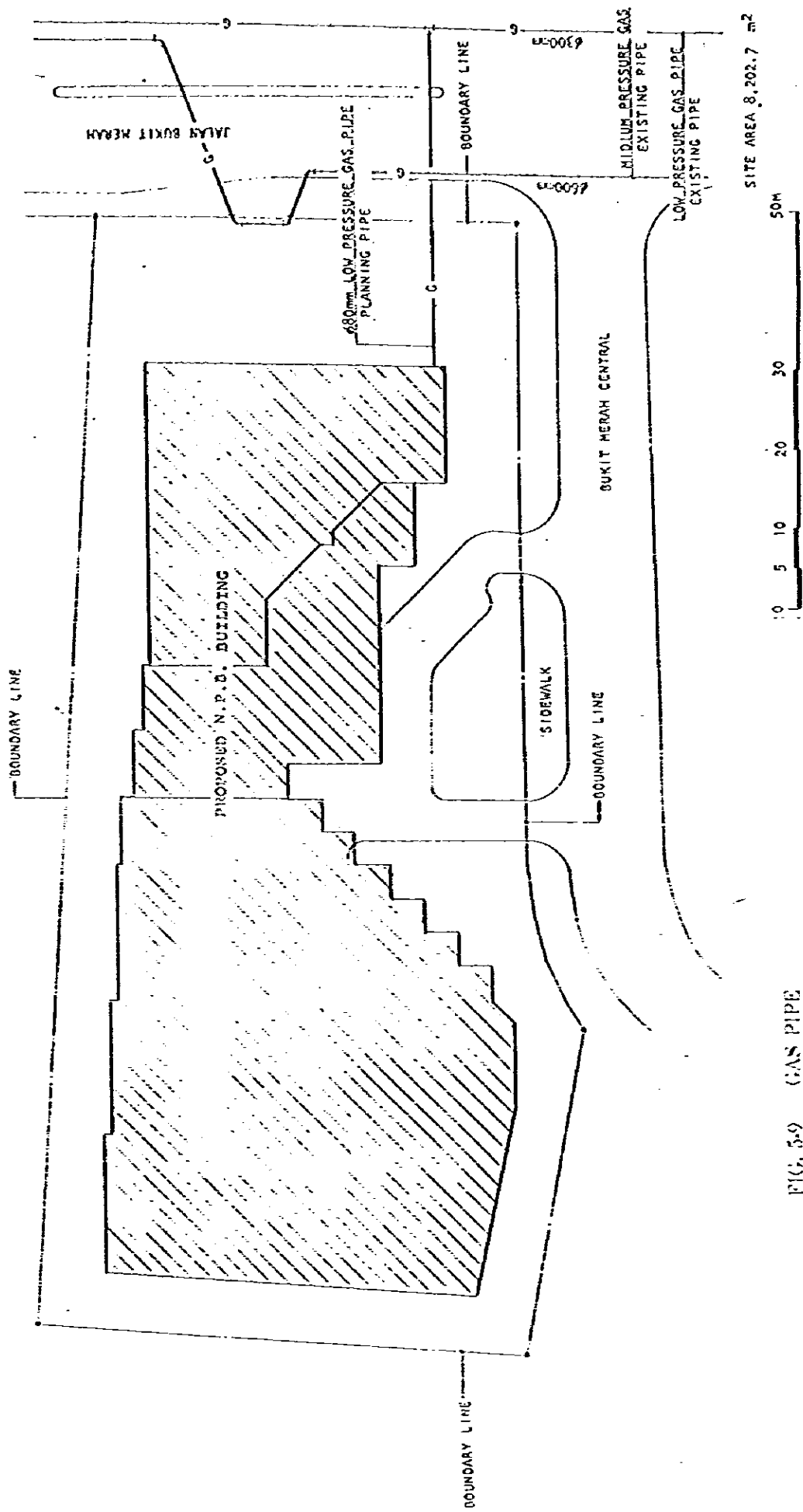


FIG. 5.9 GAS PIPE

CHAPTER SIX BASIC DESIGN OF FACILITIES

A. DESIGN PRINCIPLES

Design principles in the development of basic design for the new NPB Building are as follows:

- (1) Create a dynamic building design to symbolize the Productivity Movement.
- (2) Site planning to achieve high efficiency by effective use of limited land area.
- (3) Planning with due considerations given to the environment.
- (4) Facilitated operation, maintenance and control of equipment with considerations given to energy conservation.
- (5) Secure as large open space as possible in site planning for planting.

B. SITE PLANNING

Site planning principles based on the design principles in the preceding paragraph, is to locate the tower as close as possible to the north Jalan Bukit Merah, the road in front of the premises. This is not only to improve visual identity of the building, but also to ensure that the building fits in with the three neighbouring high-rise apartment buildings to form urbanized environment.

Multi-tier parking space will not be located in front of the building because of character of the facility with less people to gather. Therefore, the parking lot is to be located in the rear east side of the premises. This location facilitates entry and exit of vehicles. In relation to these facilities, as large open space as possible has

been reserved on the east side of the premises. This open space provides a front yard at the main approach to the building. This layout is an urban-environmental solution at the intersection of space extent in two directions along Jalan Bukit Merah and Bukit Merah Central. By securing this open space, east side environment has been incorporated in the premises to achieve an environmental harmony.

C. BUILDING DESIGN

1. Outline of Facilities

Proposed new NPB Building consists of a main facility having five functions, a parking lot, and areas for common use. Rough estimates of the floor areas of the respective facilities are as follows:

(1) Main Facility	Floor area, m ²
1) Offices for Trainers and Other Staff	5,838
2) Training Centre	6,973
3) Resource Centre	2,695
4) OSH Centre	771
5) Others	2,874
<u>Sub-total</u>	<u>19,151 m²</u>
(2) Parking lot	7,454
(3) Common use area	11,802
<u>Total</u>	<u>38,407 m²</u>

2. Number of Storeys and Heights

New NPB Building consists of lower building portion with an auditorium built over the 3-tier parking space, and 22-storey tower portion. Podium is to be approx. 25.5 m high, and the tower, approx. 104 m.

3. Composition of Facilities

Composition of each facility, floor area of each composite room, and room locations are as shown below.

	DESCRIPTION	ACTUAL SPACE SQ M	FLOOR LOCATION
1	<u>OFFICE FACILITIES</u>		
1.1	Conference Room	-	4th floor
1.2	Office Rooms	688	22nd floor
1.3	Office Area w/Director's Room	3,630	17th - 21st floors
1.4	General Office Ara	688	16th floor
1.5	Computer User Room	60	13th floor
1.6	Computer Room	302	13th floor
1.7	Meeting Rooms	270	17th - 21st floors
1.8	Reception	200	1st floor
1.9	Photocopying Room	-	Each floor
1.10	Stationery Storerooms	-	Each floor
	TOTAL OFFICE FACILITIES	5,838	
2	<u>TRAINING FACILITIES</u>		
2.1	Course Administration	500	3rd floor
2.2	Store	-	3rd floor
2.3	Lecture Rooms	3,180	8th - 14th floors
2.4	Computer Training Room	208	13th floor
2.5	Syndicate Rooms	260	12th & 14th floors
2.6	Seminar Room w/Lounge	602	4th floor
2.7	Auditorium and VIP Room	3,389	3rd - 4th floors
2.8	Language Labs	88	4th floor
2.9	Lecture Rooms w/ Lounge	631	15th floor
2.10	Micro Computer Room	115	13th floor
	TOTAL TRAINING CENTRE	6,973	

DESCRIPTION	ACTUAL SPACE SQ M	FLOOR LOCATION
3 RESOURCE CENTRE		
3.1 Print Library	1,326	5th - 6th floors
3.2 Audio Visual Library	234	5th floor
3.3 Studio	256	1st floor
3.4 Post Production Rooms	264	2nd floor
3.5 Preview	57	2nd floor
3.6 Microteaching	65	2nd floor
3.7 Store Room for Props	95	1st floor
3.8 Meeting Room/Powder Rooms	57	1st floor
3.9 Printing Room (Open office)	219	3rd floor
3.10 Hardware Store & Maintenance Workshop	-122	1st floor
TOTAL FOR RESOURCE CENTRE	2,695	
4 OCCUPATIONAL SAFETY & HEALTH CENTRE		
4.1 Safety Equipment Display Room	357	4th floor
4.2 Industrial Hygiene Laboratory	349	4th floor
4.3 Industrial Ventilation Simulator Room	65	4th floor
TOTAL FOR OSH CENTRE	771	
5 OTHERS		
5.1 Display Area	-	1st floor
5.2 Canteen	909	3rd floor
5.3 Bookshop	56	3rd floor
5.4 Sick Bay/First Aid	11	1st floor
5.5 Recreation Facilities	1,118	5th - 6th floor
5.6 NPA Room	780	7th floor
TOTAL FOR OTHER FACILITIES	2,874	
Build-up area	19,151	
Circulation space	11,802	
TOTAL	30,953	

DESCRIPTION	ACTUAL SPACE SQ M	FLOOR LOCATION
Car Park	2,461	1st floor
Car Park	2,532	Mezzanine
Car Park	2,461	2nd floor
TOTAL FOR CAR PARK	7,454	
TOTAL BUILDING & CAR PARK	38,407	

4. Bases for Room Area Calculations

Bases for calculations of number of number of rooms and their floor areas on main facilities are as listed as follows:

JUSTIFICATION FOR SPACE REQUIREMENTS

Floor	Description	Use/Features	Norms	Total (Sq m)	Actual (Sq m)
<u>1. OFFICE FACILITIES</u>					
4th	1.1 Conference Room	a) To house up to 50 persons b) May be converted into 2 rooms by removable partitions	3 sq m per person	150	-
22nd	1.2 Office Rooms	a) For Chairman, Deputy Chairman, Executive Director, 10 Divisional Directors, 17 Assistant Directors	Civil Service norms 24 sq m C/M = 70 D/C = 58	720 JAP. EX = 54	688
17th ~ 21st	1.3 Office Area	a) 300 executive, administrative and professional staff	E/O = 57 BOARD RM = 171 DINING ROOM = 77 12 sq m	3600 KITCHENETTE = 31 SHOWER RM = 24	3,630
16th	1.4 General Office Area	a) 75 general staff	8 sq m	600	688
13th	1.5 Computer User Room	To house VDUs for staff use of computer facilities		60	60
13th	1.6 Computer Room	To house CPU and other peripherals including EDP staff work area (a mainframe computer will be provided by the Japanese under the PDP)		300	302
17th ~ 21st	1.7 Meeting Rooms	a) For 279 staff with 116 hours meeting time and 30 senior staff with 464 hours (4 times) meeting time).	3 sq m per person x 10 persons capacity = 30 sq m Number of rooms	30 + 30 = 60 60 x 5	

Floor	Description	Use/Features	Norms	Total (Sq m)	Actual (Sq m)
1st	1.8 Reception	<p>b) Average 5 staff per meeting</p> <p>c) 276 days x 7 hours available per meeting room</p> <p>d) 50% utilization</p> <p>e) Capacity for 10 persons</p> <p>Reception-cum-waiting area for visitors. The area will also house operators cum receptionists and PABX.</p>	<p>" $\frac{(279 \times 116)}{5 \times 276 \times 7 \times 0.5} + (30 \times 464)$</p> <p>" 9.58 (say 10 rooms)</p>	300	270
Each Floor	1.9 Photocopying Room	For low volume copying of office and training materials, will house photocopying and collating machines.		60	-
	1.10 Stationery Storerooms	In view of size of building, there is a need for 3 stationery stores, each of 50 sq m. For storing stationery and training materials.		150	-
22nd	1.11 Kitchenette	For preparing refreshments for visitors/participants		40	
	Total Office Facilities			6180	5,838

Floor	Description	Use/Features	Norms	Total (Sq m)	Actual (Sq m)
3rd	2. <u>TRAINING FACILITIES</u> 2.1 Course Administration Lecturer's Rooms & Lobby	Houses course inquiry counter, workstations for on-line information processing, storing high usage brochures and course pamphlets for distribution.		120	500
	2.2 Store	For bulk storage of course admin. and training materials		100	-
5th ~ 12th ~ 14th	2.3 Lecture Rooms	Capacity of 500 persons a) Training Targets = 23,000 b) Class size = 30 or 45 (equally distributed) c) Average duration = 60 hrs d) Usable time per room = 2000 hrs e) Utilization = 70% f) No. of classrooms: Class size = 30 (capacity = 40) $\frac{11500 \times 60}{30 \times 2000 \times 0.7} = 16.4$ = 15 (say) Class size = 45 (capacity = 50) $\frac{1150 \times 60}{45 \times 2000 \times 0.7} = 10.9$ = 10 (say)	18 sq m rear projection space and 2.3 sq m per person Total space required [18 + (2.3 x 40)] x 15 + [18 + (2.3 x 50)] x 10 110 x 4 = 400 440 x 6 = 2640 + 10-13th = 2750 3300	3300	3,180

Floor	Description	Use/Features	Norms	Total (Sq m)	Actual (Sq m)
13th	2.4 Computer Training Room	2 for computer training room	2 x 110	220	208
12th , 14th	2.5 Syndicate Rooms	For classes breaking into smaller discussion groups, for management exercises, role play and syndicate discussions.	15% of course duration involve syndicate work which will be conducted in groups of 6 Utilization = 60% $\frac{15000 \times 75 \times 0.15}{6 \times 2000 \times 0.6} = 23.4$ = 24 say 3 sq m per person capacity = 6 persons Total space required = $24 \times 3 \times 6 = 430 \text{ sq m}$	$5 \times 4.85 = 24.25$ $\times \frac{2}{48.5}$ $5 \times 7.35 = 36.75$ $\times \frac{2}{73.5}$ $48.5 + 73.5 = 122$ $122 \times 6 = 732$	260 602 678 1,389
4th 15th	2.6 Seminar Room w/Lounge	For 100 persons	4 sq m per person for seminar type layout	400	602
3rd 4th	2.7 Auditorium & VIP Room	Capacity of 500 persons. This will cater to large seminars organized by NP8.	2 sq m per person	1000	678
4th	2.8 Language Labs	One laboratory with capacity for 40 persons. It will have 40 booths requiring about 77 sq m of space (say 80 sq m)	80 50 x 2 = 100	80	88
15th	2.9 Lecture Rooms w/Lounge				631
13th	2.10 Micro Computer Room				115
Total Training Centre				5650	6,973

Floor	Description	Use/Features	Norms	Total (Sq m)	Actual (Sq m)
6th ~ 5th	3 <u>RESOURCE CENTRE</u> 3.1 Print Library	a) Reception area for loans b) Catalog cabinets/micro fiche readers c) Periodicals and reading lounge d) Reading area: 100 x 3.5 sq m e) Book area for 80,000 books at 167 books per sq m	75 648 + 396 = 1044 20 75 350 <u>480</u> 1000	1000	1,326
5th	3.2 Audio Visual Library	a) Area for catalog and microfiche readers b) Space for carrels:- 50 x 4 sq m per carrel c) Previewing Room d) Tape storage for 5000 tapes at 167 tapes per sq m e) Maintenance of software area	20 200 20 30 <u>100</u> 370	370	234
1st	3.3 Studio	Video Production Studio and Control Rooms	200 + 52 = 252	300	256
2nd	3.4 Post Production Rooms	a) Editing room and ear- b) Duplication room c) Graphics & animation room d) Dubbing room	40 40 40 40	254	254
2nd	Preview				57

Floor	Description	Use/Features	Norms	Total (Sq m)	Actual (Sq m)
2nd	3.5 Microteaching	This is a one-man operated, video production system for producing simple materials for individual trainer's use. The Japanese are providing 5 units under the PDP. Each system occupies 30 sq m.	28.75 x 2 = 30 x 2 23.5 x 1	150	65
1st	3.6 Store Room for Props	30 sq m x 5 units = 150 sq m		250	95
	3.7 Dark Room	Storage of props and carpentry workshop. Set design workshop		50	-
3rd	3.8 Printing Room (Open Office)	For photographic processing		120	219
	3.9 Hardware Store and Maintenance Workshop & Meeting Room	For heavy-duty printing, platemaking, etc. The Japanese will be providing printing equipment under the PDP.		100	122 57
		Total for Resource Centre		2500	2,695
4th	4. OCCUPATIONAL SAFETY AND HEALTH CENTRE 4.1 Safety equipment	For displaying exhibits related to industrial safety The exhibits may range from personal safety kits to industrial equipment safety guards and will be used in conjunct with training.		300	357

Floor	Description	Use/Features	Norms	Total (Sq m)	Actual (Sq m)
4th	4.2 Industrial Hygiene Laboratory	For special analyses and experiments and will also be used for practical training of industrial hygiene technicians	374 + 35	150	349
4th	4.3 Industrial Ventilation Simulator Room	For experiments with the Industrial Ventilation Simulator. (This will be provided by the Japanese under the POP.)		100	65
		Total for OSH Centre		550	771
	5. <u>OTHERS</u>				
	5.1 Display Area	For display of materials and exhibits, particularly for special exhibitions to provide productivity, including occupational safety and health.		300	-
3rd	5.2 Canteen	To accommodate up to 300 persons	300 x 2 sq m	600	909
3rd	5.3 Bookshop	For marketing NPB publications		30	56
1st	5.4 Sick Bay/First Aid			30	11
5th	5.5 Recreation Facilities	a) Squash Courts: 2 x 65 sq m	130		
6th		b) Physical exercise Room	78 x 2 = 156		

Floor	Description	Use/Features	Norms	Total (Sq m)	Actual (Sq m)
7th	5.6 NAP Room	c) Staff Lounge with TV & reading facilities d) Changing Rooms: 2 x 50 sq m	200 :77 100 :23	500	1,118 780
		Total for other facilities		1460	2,874
		Built-up area Add 40% circulation space	40% is the norm for a building with training and office facilities	16340 6536	19,151 11,802
		Total		22876	30,953
1st	Car park				2,461
2nd	Car park				2,532
For	Car park				2,461
2nd	Car park				7,454
					38,407
					<u>38,407</u>

5. Floor Planning

Provision of high-rise design has been intended in accordance with basic design principles. Composite facilities include Secretariat, Training Centre, Resource Centre, etc., as mentioned in the Outline of Facilities, hereinbefore. The facilities require no rooms of special type, complicated floor plans and no problem is anticipated to be posed in piling up floors of same type plan (typical floor) to a high-rise building.

For high-rise building portion, an L-shaped floor plan for office spaces has been selected because of consideration that: both large and small rooms can be provided, to avoid sightlines into neighbouring HDB apartment buildings, and building orientation with considerations given to energy conservation. At the center of the L-shaped office space, six elevators (including one for emergency fire use) as the main transportation means in the building are placed and shorter circulation lines are intended.

Lower building portion located at the south portion of the premises is provided for an auditorium which requires large spaces, dining facilities where assembly of many people is expected and building composition, this lower portion is clearly separated from the high-rise portion where provided mainly with office spaces.

Project facilities are planned in two main blocks of (1) parking space with special facilities above and (2) the high-rise building blocks join, entrance hall is placed in relation to open space mentioned hereinbefore. A clear vertical space of the sizes as large as possible is to be provided as a mobile and active space of the feature to receive visitors and as the face of the building.

6. Building Use on Each Floor

a. High-rise tower

The tower consists of partial basement floor, and 22-storey aboveground floors. Studio related rooms of Resource Centre

are located on the Ground floor to facilitate carrying in various equipment. Training Centre and Resource Centre are located functionally on lower 3rd through 15th floors with considerations being given to entry and exit of many trainees. Upper 16th through 22nd floors are to be used for Secretariat of the NPB. Basement floor is provided only with utility machine room.

b. Low-rise podium

Entire 1st floor through 2nd floor spaces are to be devoted to parking spaces without automatic storage machines. Staircase and escalator spaces are to be provided at the joining portion with the high-rise tower so as to connect the tower and the podium, and also to facilitate vertical transportation. The auditorium which requires large space is to be located above the parking spaces. In the spaces other than the auditorium which occupies two-storey height, are to be placed with dining facilities, OSH Centre and recreation facilities. Thus low-rise podium and the high-rise tower are featured individually with function and characteristics.

7. Column Spacing

Column spacing in principle for the low-rise podium is to be 8.0 m x 8.0 m to facilitate car circulation in the parking spaces.

For the high-rise tower, the column spacing is to be 12 m x 8.4 m as determined in consideration of structural economy and standard material size of 1.2 m as well as room sizes of each room of the Training Centre and Resource Centre, and the library. This column spacing provides flexibility against future changes of room partitioning.

8. Storey Height Planning

Storey height for the 1st and 2nd floors of the high-rise tower is to be 5 m to meet the requirements to secure sufficient spaces for the entrance hall as well as to provide higher ceiling for

the studio and related rooms. In order to ensure a ceiling height of more than 2.8 m for lecture rooms in accordance with laws and regulations, storey height of the Training Centre and OSH Centre is to be 4.0 m. Required ceiling height for offices of Secretariat and similar facilities ranges from 2.6 m to 2.8 m, and the storey height is to be 4.0 m accordingly. Storey height for parking spaces is to be 3.0 m to assure 2.4 m head clearance under the sprinkler heads.

9. Finishing

a. Exterior finish

Exterior finish of the building is to reflect the design principles established hereinbefore to identify the NPB activities and symbolize the PDP campaign. High rise tower is proposed to be of aluminium curtain wall as developed from the above design principles. Aluminium curtain walls have not been employed widely in Singapore, however, selected for this Building because of their simple design with smooth surface, light-weight construction, easy building maintenance, and as a spread-head of wide future use in Singapore to symbolize the activities of the PDP. Low-rise podium is to be of porcelain tile exterior finish, in contrast with that of the high-rise tower.

b. Roof

Auditorium roof and the roof to cover large open vertical space at the foot of the high-rise tower require large span frames, and roof frames of structural steel truss have been employed. Roof consists in principle of concrete roof slab placed with heat insulation and concrete topping.

c. Interior finish

Floor finish of general office rooms and corridors is to be carpet. Floor finish of the OSH Centre is to be vinyl tile in consideration of special room use. Floor finish on the

ground floor is to be ceramic tile. Walls of entrance hall are to be ceramic tile in contrast with exterior aluminium material. Wall finishes in general are to be gypsum wall-boards, paint finish over steel studs, or cement plaster, paint finish over brickwork. Ceiling finish in general is to be acoustic fibre-glass boards, or gypsum board, paint finish. Finish and shapes of walls and ceiling of the auditorium are to be determined with due considerations given to the acoustics.

D. STRUCTURAL DESIGN

1. General

In Singapore, structural frame system of reinforced concrete construction is generally adopted also for high-rise buildings. Therefore, reinforced concrete construction can be adopted without posing any problem for this new NPB building. However, employment of structural steel construction for the high-rise building has been proposed.

Structural design standards in Singapore is based on BS (British Standards), and reinforced concrete and structural steel construction shall conform to the requirements of BS CP110 and BS 449, respectively.

2. Structural Design

a. Foundation

As the result of test borings carried out at four different site locations, pile foundation is to rest on the silty sand or weathered silty sandstone supporting layer at 8.0 to 12 m below the ground level. H-shape steel is recommended for piles, and the piles shall be hammer driven. Pile bearing strength shall be confirmed by load tests.

b. Structural framing

(1) High rise tower

Columns and girders of principal frame of the building are recommended to be structural steel. Floor slab is recommended to be composite metal deck and slab of reinforced concrete. Structural steel construction has been adopted because of the reasons as follows:

- (a) Since this structure is for the new NPB Building which is to be constructed under productivity development campaign, its construction method is to be for a step towards new construction technology.
- (b) By this construction method, gross weight of the building can be reduced, and piles and foundation become more economical.
- (c) Construction period can be reduced by employing shop-fabricated products including curtain walls to reduce work volume on site, and by rational use of construction equipment.
- (d) Employment of fabricators and welders is practically possible, and real structural steel, high-rise buildings are under construction in Singapore. It is a good opportunity to have an experience with new construction method.
- (e) In comparison with traditional reinforced concrete construction method of the labour intensive type, structural steel construction method requiring high technology of processing, fabrication, welding and erection is more suited to the national policy of Singapore, which is aiming at knowledge intensive type high technology.
- (f) Sectional sizes of steel columns and beams are smaller than those of reinforced concrete construction.

(2) Low-rise podium

Low-rise podium for parking spaces is to be of reinforced concrete construction. Column spacing appropriate for parking spaces is to be basically 8.0 m x 8.0 m, which is to be provided adequately with reinforced concrete construction. Auditorium roof requiring larger span is

to be of structural steel truss and beams with steel decks and lightweight concrete slab. External walls and partitions are to be of brickwork.

3. Live Loads and Structural Materials

a. Live loads

Live loads for typical rooms are as shown below.

Lecture Rooms		300 kg/m ²
Seminar Room		360
Computer Training Room		500
Language Laboratory		400
Library	Storage	800
	Others	600
Studio		500
Printing Room		800
Post Production Room		500
Office Room		400
Computer Room		500
Canteen		300
Bookshop		600
Auditorium	Seating area	360
	Stage	500
Kitchenette		300
Parking area		200

Note: For rooms not listed above, live loads shall conform to the Standards of Singapore wherever applicable.

b. Structural materials

Concrete and reinforcing steel shall conform to the requirements of Singaporean standards. Structural steel to be imported shall be equivalent to JIS standard products.

Concrete: Class 10 - 45 (as applicable)

Reinforcing bars: Deformed bars Y10 ~ Y32 (as applicable)

Structural steel: JIS SM50A (steel for welding): for columns and girders.

: JIS SS41 (Structural steel for general use): for beams and piles

E. UTILITIES PLANNING

Utilities planning described herein is a proposed scheme based on the Basic Designs and any alternative solution therefore can be selected in the detail design without any objection.

1. Electrical

a. Outline of planning

Laws and regulations regarding the provision of electrical equipment are well provided for in Singapore, and planning is to be performed in accordance with these provisions. Safety factors and ease of maintenance are also to be stressed in planning. The optimum selection of material and equipment is possible due to the favourable free trade situation prevailing in this country.

b. Receiving and transforming equipment

Electric service to this building is recommended to be a 3ph-3W, 22 KV, 50 Hz service line provided by the PUB (Public Utilities Board) to a PUB installed switchboard in a transformer room to be provided on the ground level of the building. The total demand of the building is estimated roughly as 2,500 KVA. Transformer banks are to be installed in transformer rooms in the basement and in the penthouse. The primary 22 KV supply is to be stepped down to 3ph-4W, 400/230 V, 50 Hz and distributed to individual low-voltage panelboards. Local distribution panelboards and power control panelboards are to be fed from these low-voltage panels.

Major equipment:

- | | |
|----------------------------|-------------------------------|
| (1) Panelboards | Enclosed type |
| (2) 22 KV circuit breakers | Vacuum circuit breakers (VCB) |

(3) 400 V circuit breakers Air circuit breakers (ACB) and
molded-case circuit breakers

(4) Transformers Dry type

c. Emergency generator equipment

Two 400 KVA air cooled generators are to be provided, one in the generator room in the basement floor and one in the pent-house. These are to supply emergency power to loads prescribed by local regulations such as for emergency lighting, emergency evacuation lighting, fire pumps and elevators. Water supply and drainage pumps are also to be connected to the emergency power supply.

d. Main feeders and power equipment

Electric power is to be supplied from low tension panelboards in transformer rooms to distribution panelboards for lighting and to power control panelboards.

e. Lighting and convenience outlets

Distribution panels are to be installed in electric rooms on each floor for power supply to lighting fixtures and convenience outlets. Rooms having concentrated loads such as training rooms are to be provided with additional distribution panelboards.

FL40W flourescent lamps are to be used as standard fixtures for illumination. Incandescent lamps to be used where required. Lighting for the auditorium is to be mainly incandescent to enable control of lighting levels. Standard lighting intensity for office spaces is to be average 500 lux.

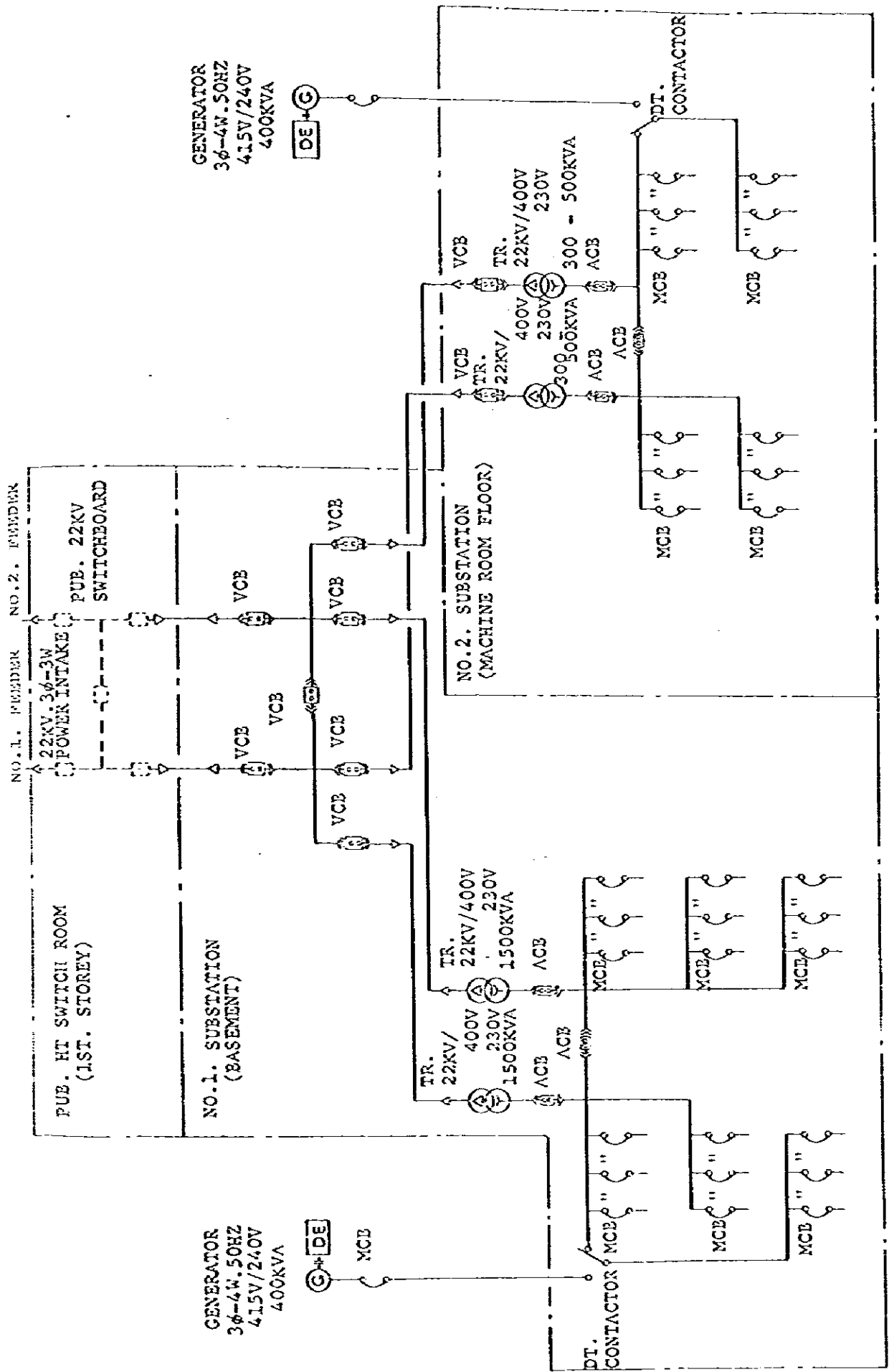


FIG. 6-1 POWER SUPPLY SYSTEM SINGLE LINE DIAGRAM

f. Telephone conduit system

Supply of material and installation of incoming service cable, terminal boards on each floor, telephone wiring within the building and telephone sets are to be performed by TELECOMS. Telephone work to be provided under the building work is the provision of conduits for the incoming service cable, telephone lines to the telephone exchange room, and for wiring to individual outlets. PBX equipment, trays for cables to the telephone terminal board, and telephone piping shaft on each floor are also to be provided under the building work.

g. Communication system

(1) Public address system

An emergency address system is to be utilized for public address. The master control unit of the emergency address system is to be installed in the control office.

(2) Electric clocks

A crystal oscillation type master clock is to be installed in the control office. Slave clocks are to be installed in public areas such as elevator halls and lobbies throughout the building.

(3) TV antenna

A TV antenna is to be installed on the roof, and conductor mains installed in the electric shafts. Branch conductors and outlets are to be provided as required on each floor.

(4) Following devices are also to be installed.

(a) Indication device to show the presence or absence of key personnel.

(b) Monitoring ITV device.

h. Lightning protection

Lightning arrestor system is to be provided in accordance with applicable laws and regulations.

2. Air Conditioning

a. General

Air conditioning is necessary throughout the year in Singapore where shows highest use ratio of cooling system among five ASEAN countries. Also up-to-date overseas air conditioning technology including that of Japan has been introduced. For operation and maintenance of the air conditioning system, conservation techniques of energy and manpower have been applied as a recent trend. Air conditioning system most widely employed in relation to heat source, in principle, is closed circuit system with motor-driven turbo refrigerators, because of two reasons as follows:

- (1) Electric motor-driven turbo refrigerators of higher safety are preferred because of stable electric power supply condition with almost no power supply failure and voltage fluctuations in Singapore.
- (2) Because of very high construction cost of underground structures in Singapore due to geological condition, basement heat storage tank structures are seldom employed.

Secondary side (air side) system of the air conditioning equipment is mainly single duct system with rarely installed window side fan coil units.

Annual average relative humidity in Singapore is as high as 70%, and dehumidifying system is necessary to maintain proper room environment. However, reheating dehumidification method

is rarely used and cooling dehumidification method is used instead, thus room temperature in many buildings is kept rather low, down to about 20°C.

In view of above considerations, air conditioning system suitable to the present conditions in Singapore is to be selected. Also air conditioning items of Japanese technology, which are to contribute to development of air conditioning technology in Singapore in future with no difficulty in operation and maintenance are to be added.

b. Air-conditioning Heat Source

Refrigerators are to be installed in machine room on the basement floor, and chilled water is to be supplied to air conditioners on each floor. Refrigerators are to be motor driven and multiple refrigerators are to be installed. Back-up refrigerators are employed in general for medium-size or larger buildings in Singapore, which are also to be installed in this Project. Refrigerators of energy saving type are to be adopted. Piping system is to be closed circuit system, and because of large building load fluctuations expected, a system with constant flow on the primary side and variable flow on the secondary side is to be used. Chilled water pumps with variable flow on the secondary side are to be of revolution control type equipped with a frequency converter for energy saving. In this Project, partial overtime and 24-hour operation is required. Possible countermeasure for partial loading in the closed circuit system is either installation of a closed type heat storage tank or combination of small capacity refrigerators. However, since closed type heat storage tank system requires complicated control, combination of small capacity refrigerators is recommended. (FIG. 6-2)

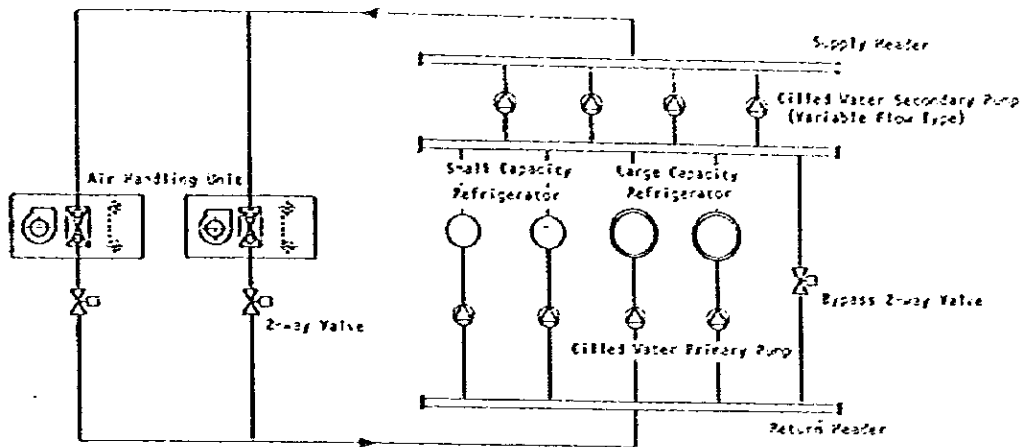


FIG. 6-2 CHILLED WATER SCHEMATIC DIAGRAM

c. Air Conditioning System

As outlined hereinbefore, central duct system is mainly used in Singapore. In this Project, air handling units suited to single duct system are to be installed on each floor to meet floor plan arrangement on the typical floor. Air conditioning system on the typical floor is as described as follows:

- (1) Air handling units are to be installed at two locations on each floor. Air flow volume for each air handling unit is to be approximately 100,000 m³/Hr. (FIG. 6-3)

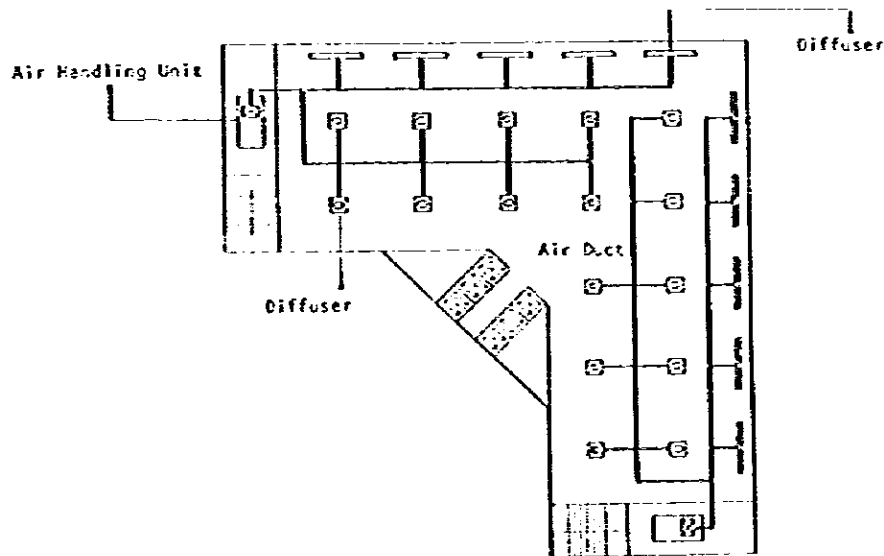


FIG. 6-3 TYPICAL FLOOR PLAN

- (2) Standards for minimum volume of air induction are established in Singapore. To meet these standards, it is necessary to introduce constant volume of air all the time. There always exist cooling load for outside air, as the enthalpy of outside air is always higher than that of inside rooms because of climatic conditions in Singapore. From the energy saving point of view, air source total heat exchangers are to be inserted in the outside air intake ducts. Since operating hours of air handling units vary on each floor, an air source total heat exchanger is to be installed for each air handling unit so that outside air intake and exhaust air discharge can be performed independently on each floor. (FIG. 6-4)

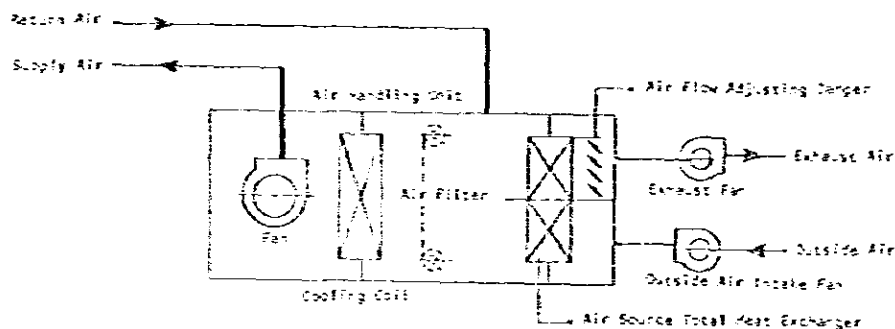


FIG. 6-4 AIR HANDLING UNIT AIR DIAGRAM

- (3) Due to the fact that air conditioning hours vary for each room on the typical floor and also that perimeter zone is also serviced by the same air handling units of inside rooms, low average load factor against the full capacity of the air handling units is expected. Also VAV (Variable Air Volume) units are to be used in the room temperature control system in order to prevent room temperature drop (overcooling) in rooms with smaller load, which is a deficient feature of single duct system. VAV units control the temperature in each room and perimeter by zones. An example of VAV control zoning on the typical floor is as shown below. (FIG. 6-5)

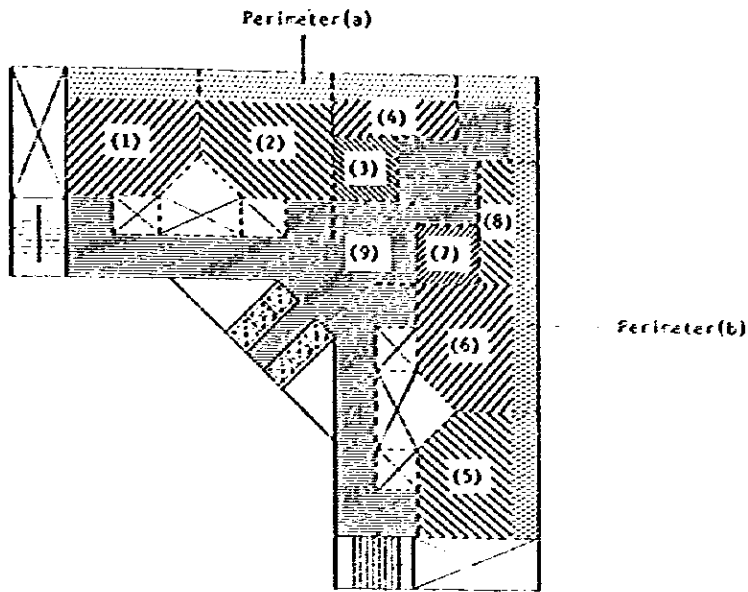


FIG. 65 TYPICAL VAV ZONE LAYOUT

Each air handling unit is to be provided with a variable air volume fan equipped with a scroll damper in order to recover the power of the fan equivalent to the air volume reduced due to the use of the VAV units. (FIG. 6-6)

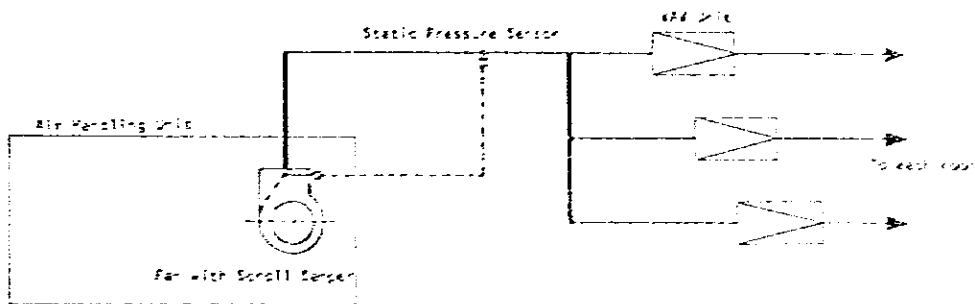


FIG. 6-6 VAV SYSTEM SCHEMATIC DIAGRAM

d. Automatic Control System

Mini computer system for building utility service control is to be provided as a key base for the development of automatic control concept. Software is to include, in addition to system programmes, control programmes as follows:

- (1) Receiving and transforming equipment:
 - (a) Power demand control
 - (b) Process control at the time of power supply failure
 - (c) Electric reclosing control at the time of power supply recovery
 - (d) Lighting control

- (2) Air conditioning equipment
 - (a) Scheduled control of power supply
 - (b) Group control of heat source
 - (c) Supervisory control of power supply condition

- (3) Fire protection equipment
 - (a) Supervisory control for fire
 - (b) Air conditioning control to stop operation in case of fire

- (4) Recording
 - (a) Hourly and daily recording and reporting of equipment operation
 - (b) Operation time integration for power equipment

Instructions from the mini computers for building utility services are to be transmitted through an exclusive use circuit to relay boards at various locations and further to each control point. Control on the secondary side is to be performed with a pneumatic control system.

e. Outline of Energy Saving System

Energy saving system used for air conditioning is summarized as follows:

- (1) Use energy saving type motor driven turbo refrigerator
- (2) Select refrigerators by dividing according to optimum refrigerator capacity for improvement of refrigerators efficiency during smaller load operation.
- (3) Use variable flow type chilled water secondary pumps.
- (4) Use air source total heat exchangers to reduce outside air load.
- (5) Use VAV units to prevent overcooling in the rooms during smaller load operation.
- (6) Use mini computers for building utility services for optimum operation of utility equipment.

Since increase in initial cost is unavoidable when these energy saving measures are taken, some measures may be omitted when required by the construction conditions. However, each of the above energy conservation items is an independent system and partial deletion of the items will have little influence on the other.

3. Water Supply and Drainage

a. General

Up-to-date equipment and materials from other countries have been introduced for water supply and drainage systems in Singapore, partly due to its character as a free port country. Water supply and drainage treatment facilities in Singapore are complete and of advanced countries.

No problems will be posed in introducing latest Japanese technology in the water supply and drainage systems in the Project facilities.

b. Water Supply System

Proposed building is 100 m high, which is 10 Kg/cm² in terms of water head. Since appropriate water pressure for a wash basin faucet is less than 5 Kg/cm², water supply is to be provided with elevated water tanks at two levels. Lift pumps, two each for higher and lower building portions are to be installed and operated automatically and alternatively. Lift pumps are to be provided with emergency power supply so that they can be operated during power supply failure. Water reservoir is to be installed in the basement machine room. In view of hygiene, they are to be of the above-floor type and two tanks or single tank with inside partition, are to be provided. PVC lined steel pipe is recommended for the piping of water supply system. (Fig. 6-7)

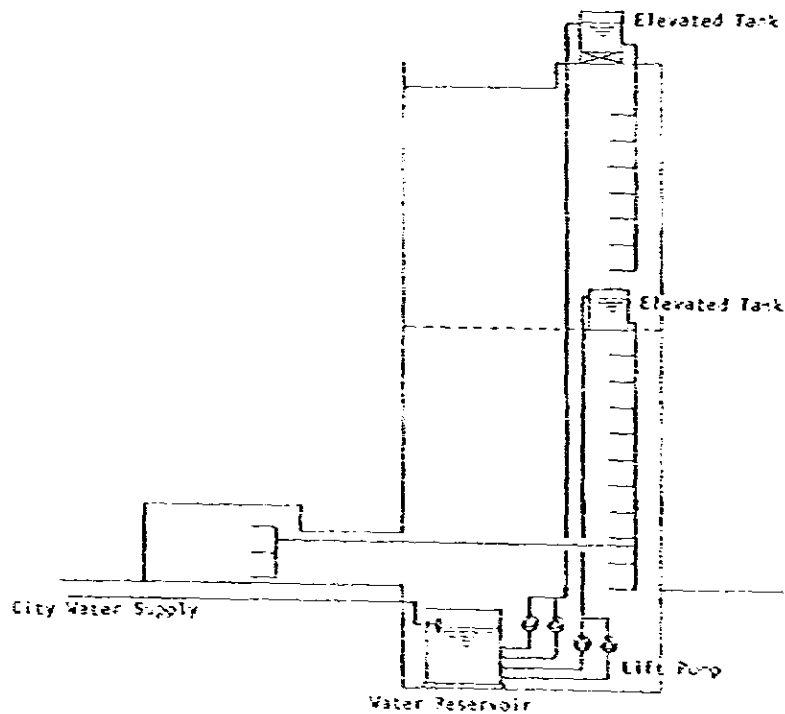


FIG. 6-7 WATER SUPPLY SCHEMATIC DIAGRAM

c. Domestic Hot-water Supply

No central hot-water supply system is applicable to this Project. Domestic hot-water is to be supplied to individual kitchen and shower room zones. Hot-water heat source for kitchen heating water is to be city gas, however, for shower rooms and pantries located on higher floors, electric hot-water heaters are to be used for safety against fire.

d. Drainage

Three drainage systems in the building of sewage, waste, and storm drainage are to be provided. Sewage and waste drainage is to be combined together at the outside of building and connected to sewer main located outside the site. Proposed site is located in an area where discharge of sewage is permitted, no septic tank is to be installed. Storm drains are to be connected to the storm drainage main. Waste drains from kitchen and parking area are to be provided with grease traps and gasoline traps respectively, and to be connected to the waste drainage pipe.

e. Kitchen Equipment

The canteen and kitchen are designed to suit the local style of preparing dishes. The kitchen will have sufficient space for different food vendors to prepare and sell different dishes.

f. Special Drainage

In the Project, special waste water containing acid, alkalis, heavy metals, etc., will be produced from OSB laboratories. This water must not be drained into the building sewer, and it shall be stored in individual polyethylene tanks for disposal by a special trade.

g. Special Gas Supply

Special gas (O_2 , C_2H_2 , H_2 , He, etc.) for the laboratories of OSH is to be supplied to testing equipment from cylinders installed on balcony of the laboratory, through stainless steel pipes. The pipes are to be installed exposed on the ceiling for safety.

4. Fire Protection Equipment

Fire protection equipment listed below are to be provided in accordance with governing laws and regulations.

- a. Sprinkler equipment and water-tanks
- b. Wet risers
- c. Hose reels
- d. Halogen gas equipment
- e. Automatic fire alarm system
- f. Emergency announcement system
- g. Emergency telephone system

5. Elevator Planning

The number of the elevators of this building, the size of its cage and speed were studied as shown in Case A (for 24 passengers) and Case B (for 20 passengers).

a. Outline of the Building

22] NPB-Office room	400 persons (Working hour 8:30 - 17:00, Lunch time 12:30 - 13:30)
21		
20		
19		
18		
17		
16		
15] Lecture room	1,000 persons (Max.) (9:00 - 12:00: 840 persons) (14:00 - 17:00: ") (19:00 - 22:00: 1,000 persons)
14		
13	- Computer room	
12] Lecture room	
11		
10		
9] NPA	
8		
7] Resource Library	
6		
5		
4] Seminar room	
3		
2] Lecture office	
1		
M] Resource Centre	
0		
1] Studio	
1] Entrance lobby	
B1	- Electric room	
	- Machine room	
Floor	Floor Usage	Capacity

b. Result from Transportation calculation

Item	Case	A	B
(1)	Number of lifts	6	6
(2)	Loading capacity/ cage	24 persons/cage	20 persons/cage
(3)	Speed (m/minute)	210 m/min.	210 m/min.
(4)	Number of stops	each floor	each floor
(5)	Capacity	1,116 persons (1,240 x 90%)	1,116 persons (1,240 x 90%)
(6)	Round trip time (second)	187.9 seconds	174.9 seconds
(7)	Lifting capacity in 5 min.	183.9 persons	164.7 persons
(8)	Percentage of lifting ability in 5 min. (%)	16.5%	14.8%
(9)	Average Operating interval (second)	31.3 sec.	29.2 sec.

(1) Elevator Specifications

It has been decided upon studies to install 6 units of the elevator of Case A (24 passengers) and to settle the velocity to 210 m/min. In accordance with the regulations in Singapore, it has been determined to use 1 of the 6 units for emergency cases. (Such kind of lift is called fire lift in Singapore, and remains for the exclusive use of the fire-fighting team at fire.)

(2) **Transportation Calculation Conditions and Assumptions**

- 1) The number of the NPB personnel being 400 and the number of the trainee being 840 is assumed to be max. 1,240 in total at peak hour. (8:30 - 9:00, 17:00 - 17:30)
- 2) The transportation ability for 5 min. is calculated:

$$\frac{\text{passengers in 5 min.}}{\text{number of persons at peak hour (1,240)}} \times 100 = \%$$

(3) **Evaluation Standard and Examination**

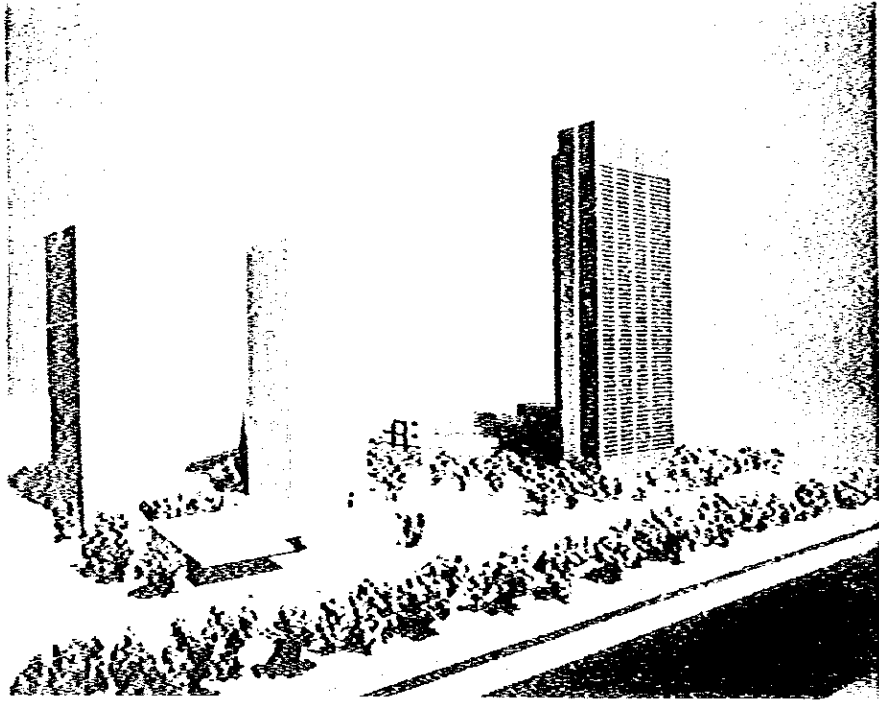
◦ **Qualitative Evaluation**

The general standard of the average operating interval (acc. to building data collections) is set to be 30 - 35 sec. in case of standard service. The interval in Case A of this planning is set to be 31.3 sec. and can be affirmed as a satisfying specification.

◦ **Quantitative Calculation**

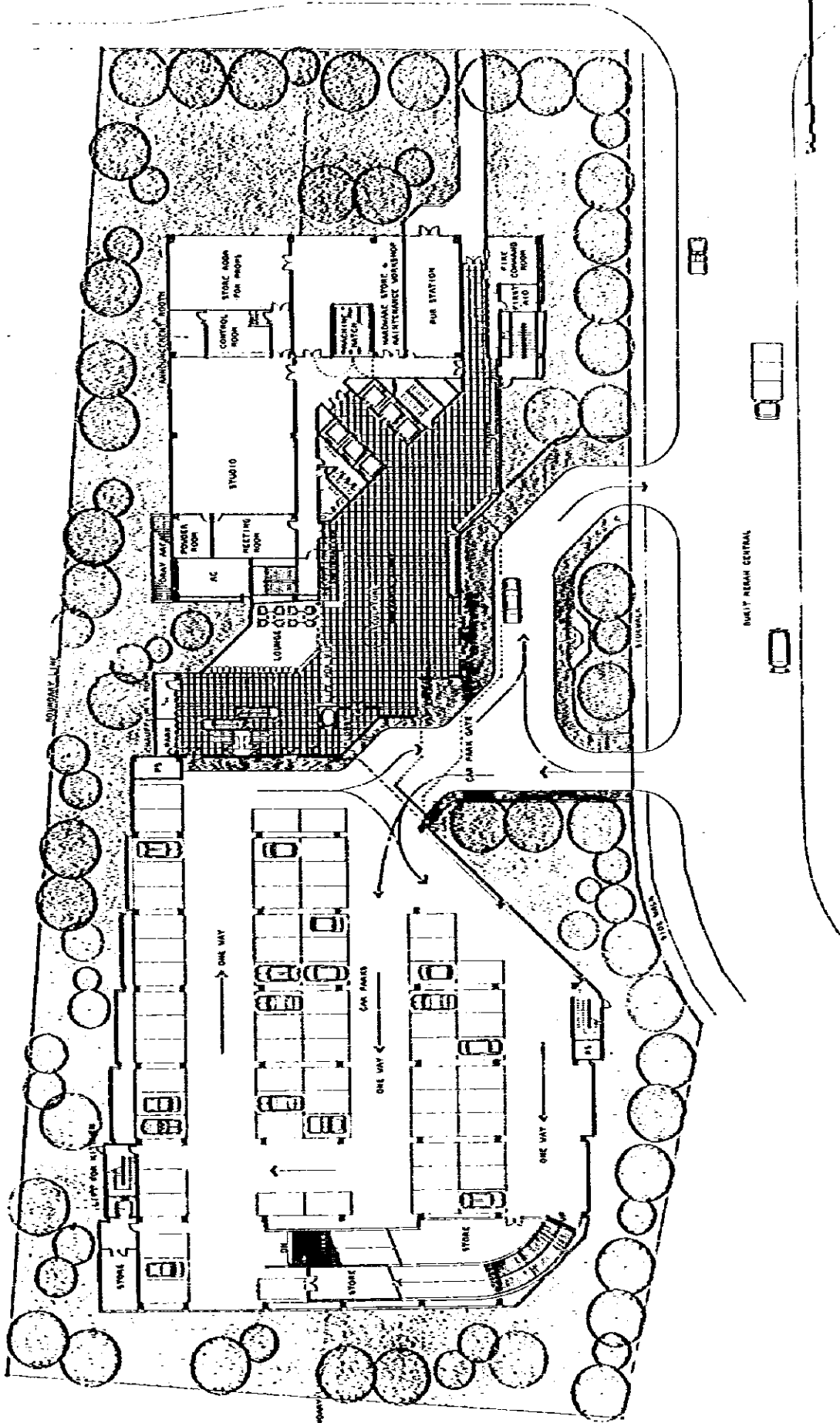
The general standard (above) of the operation ability during 5 min. is set to be 20% in case of buildings possessed by own companies, and 15% in case of rented buildings. Supposing that the purpose of the building of this planning has an intermediate role of the above the value 16.5% of Case A can be affirmed as a satisfying specification.

F. BASIC DESIGN DRAWINGS



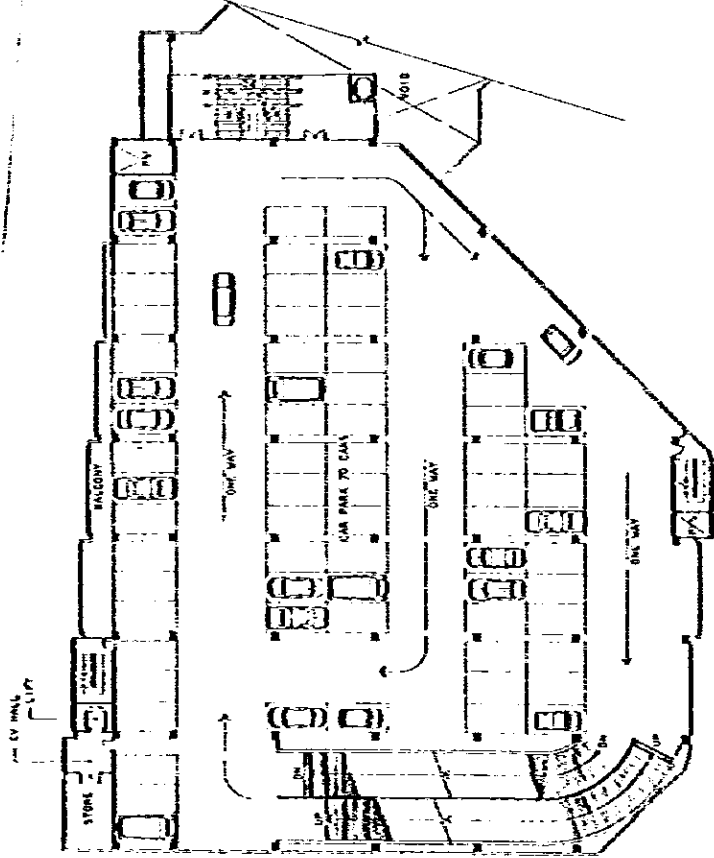


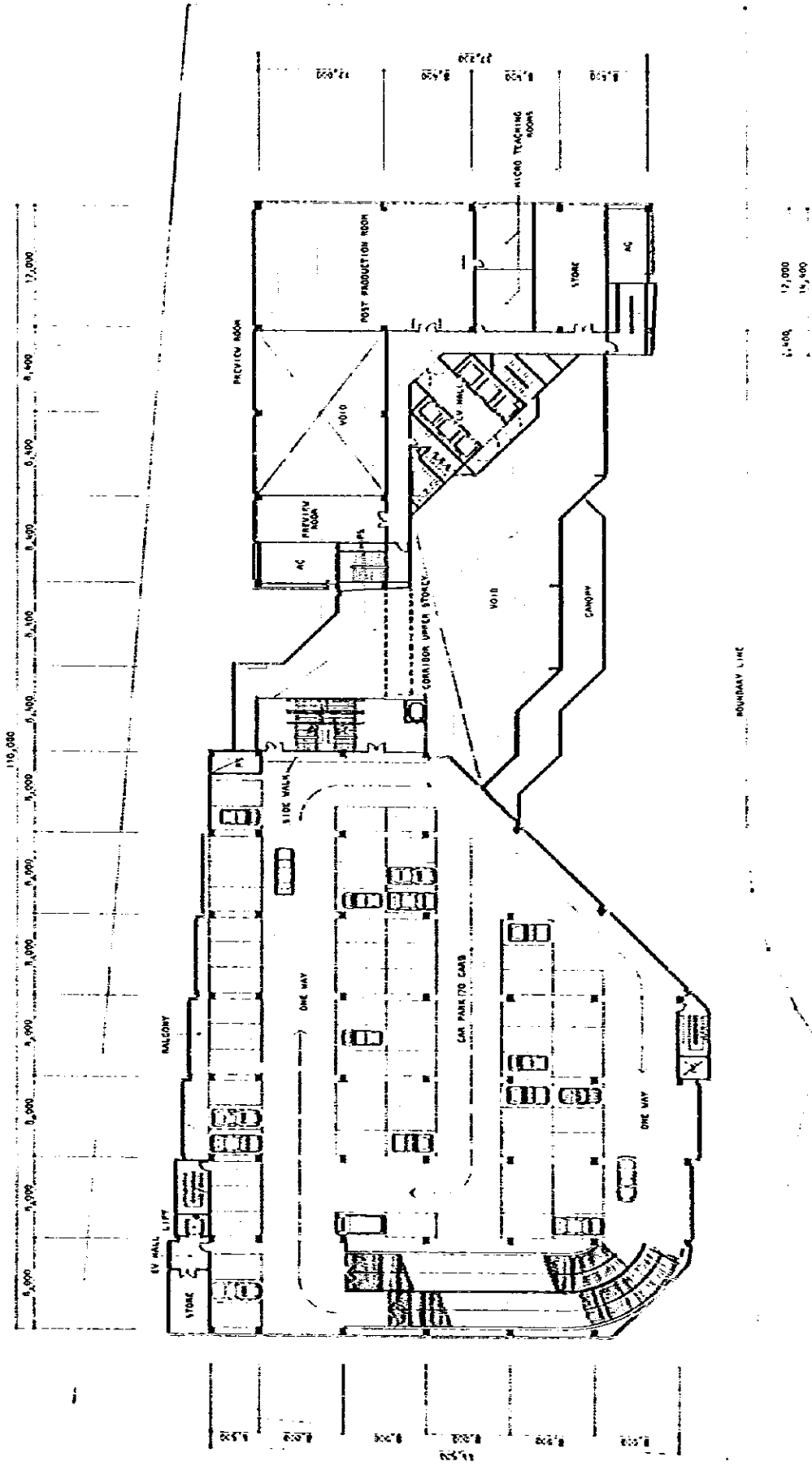
JALAN BUKIT MENA

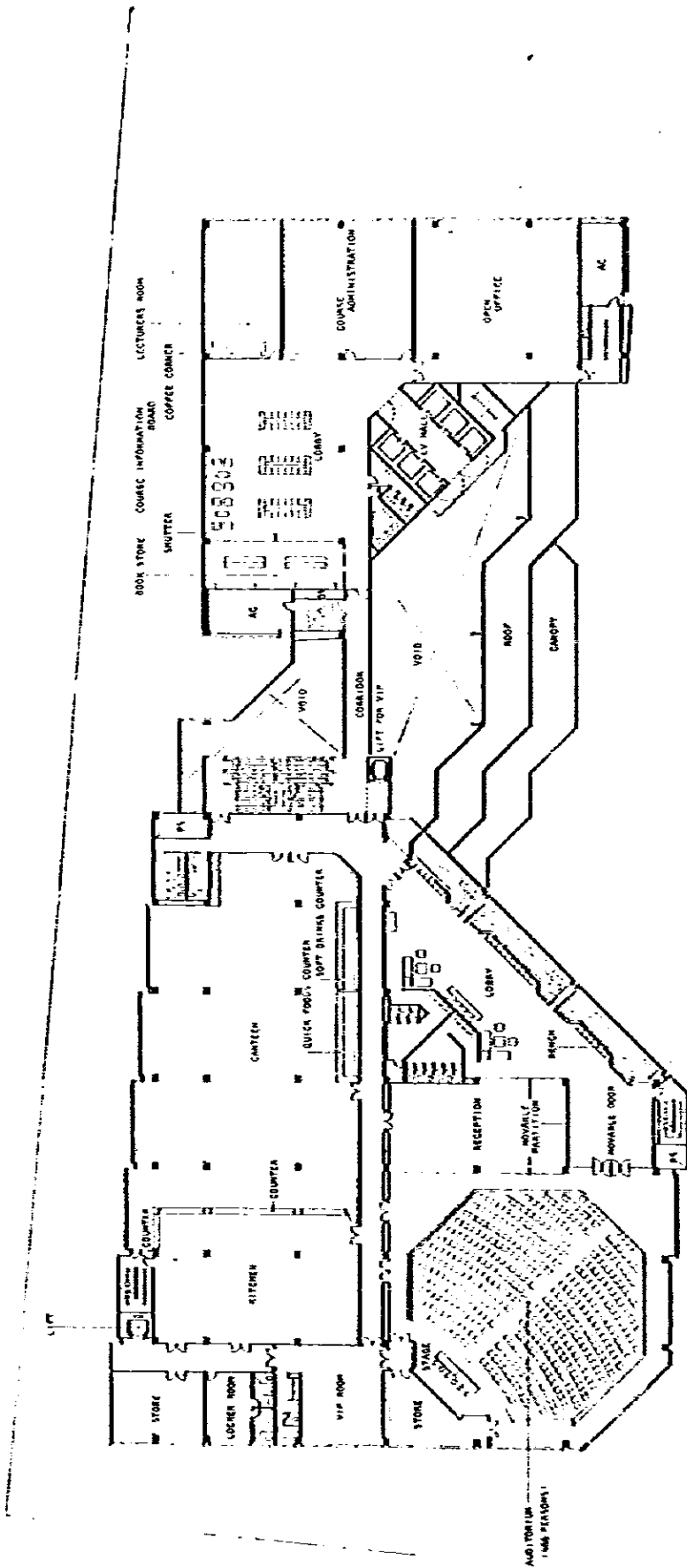


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SITE PLAN · 1ST STOREY PLAN







INDUSTRIAL VENTILATION ROOMS & EXPERIMENT ROOM

STORE OF MEDICINE & CHEMICAL SUBSTANCE

ATOMIC ABSORPTION

ELECTRONIC BALANCE

MICRO SCOPE

GAS CYLINDER

INDUSTRIAL VENTILATION ROOM

EXPERIMENT ROOM

INDUSTRIAL VENTILATION ROOM

EXPERIMENT ROOM

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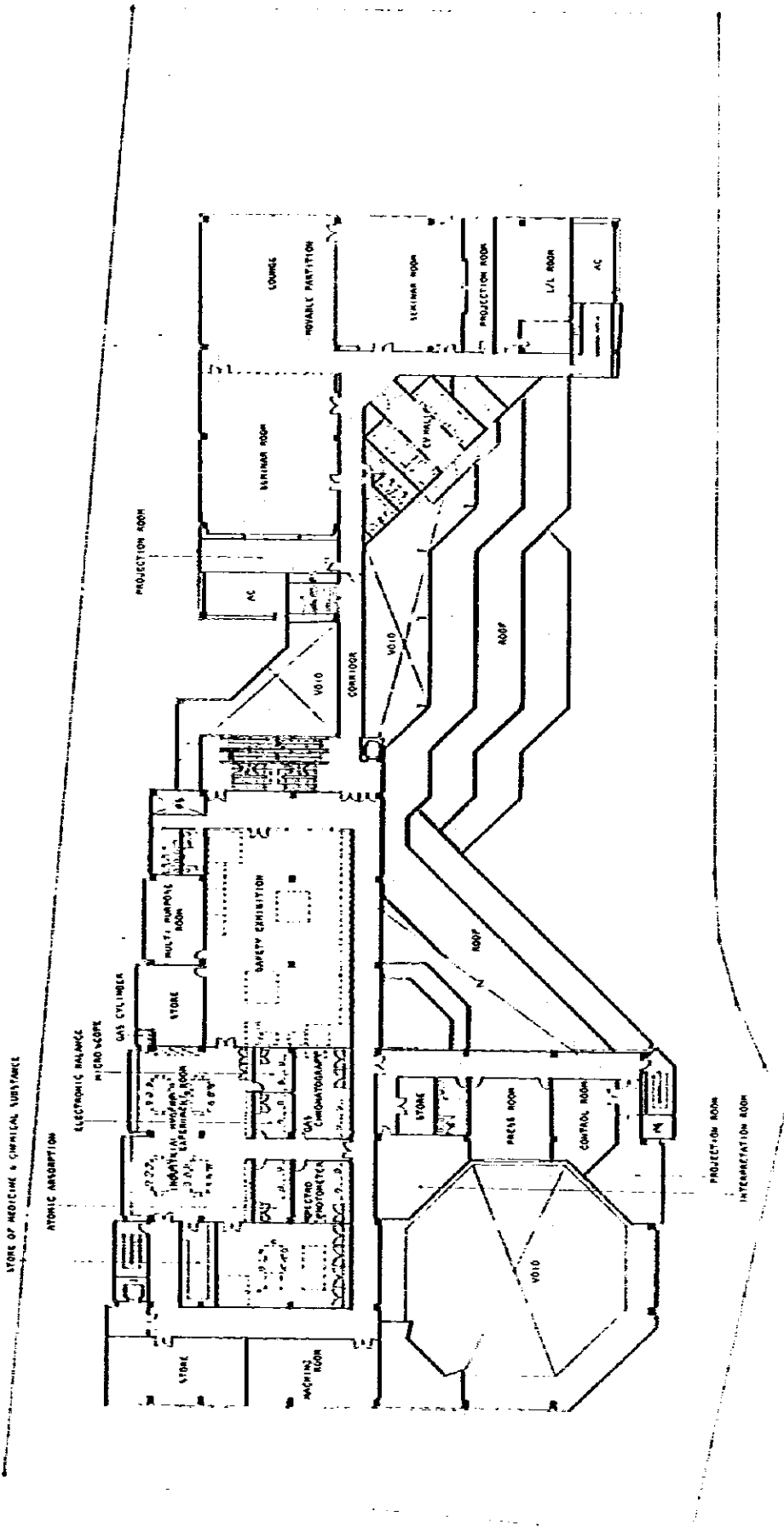
EXPERIMENT ROOM

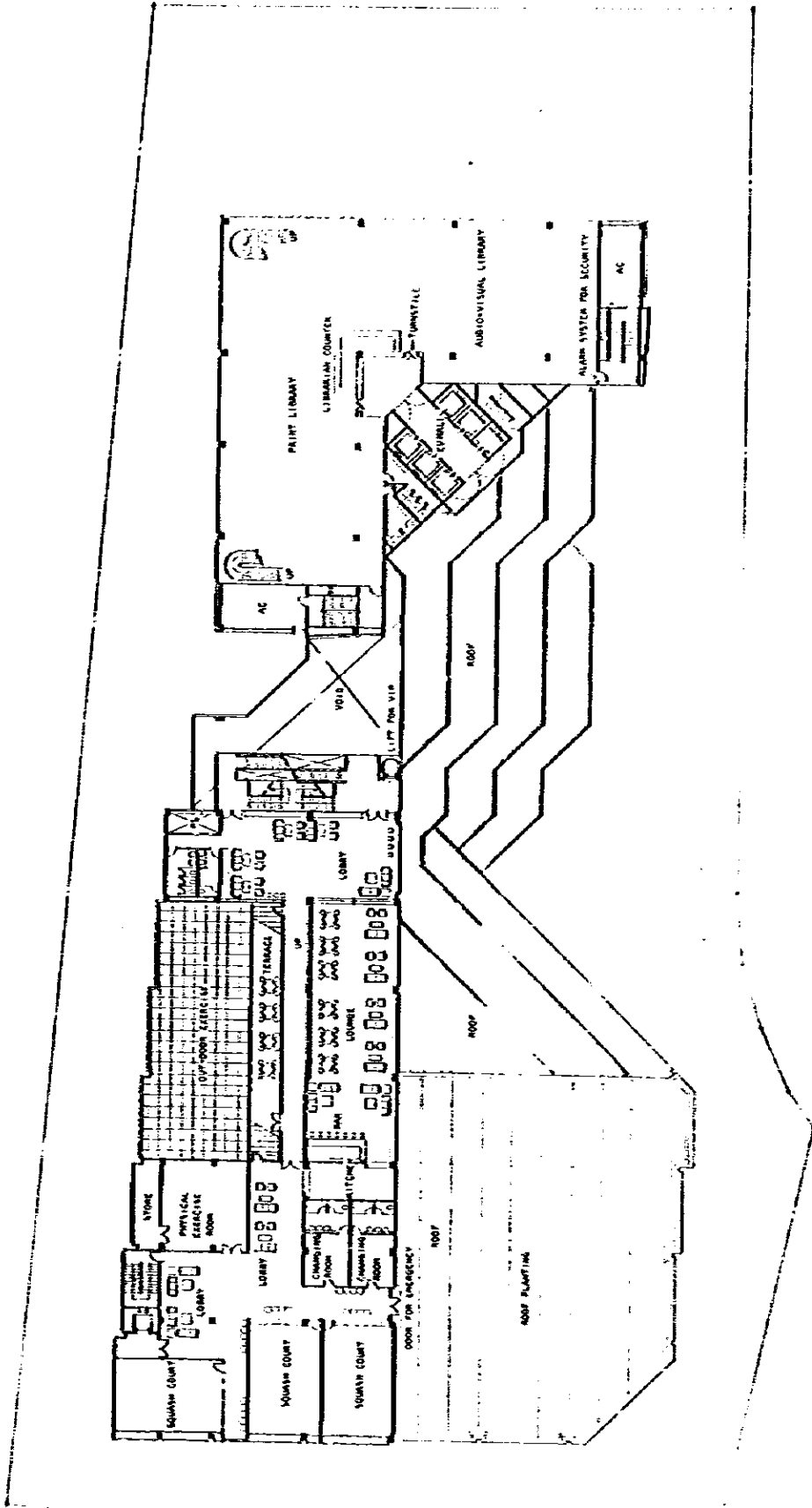
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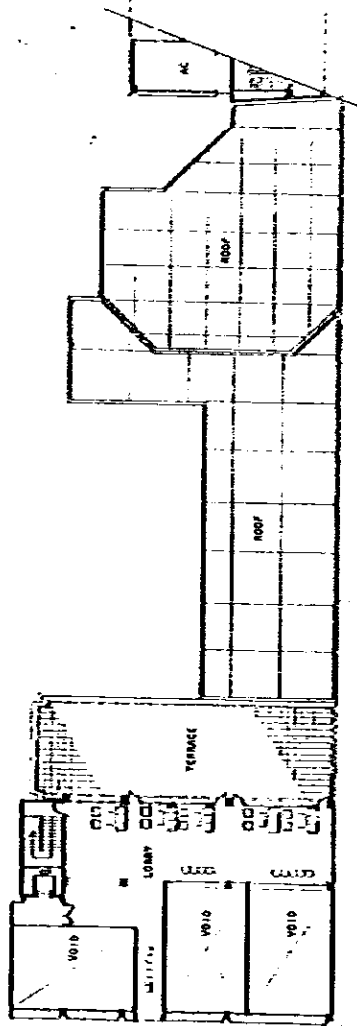
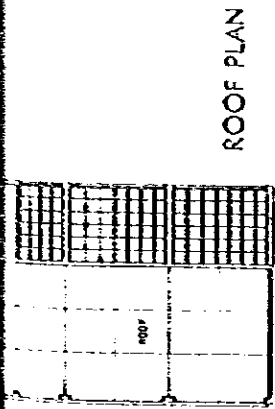
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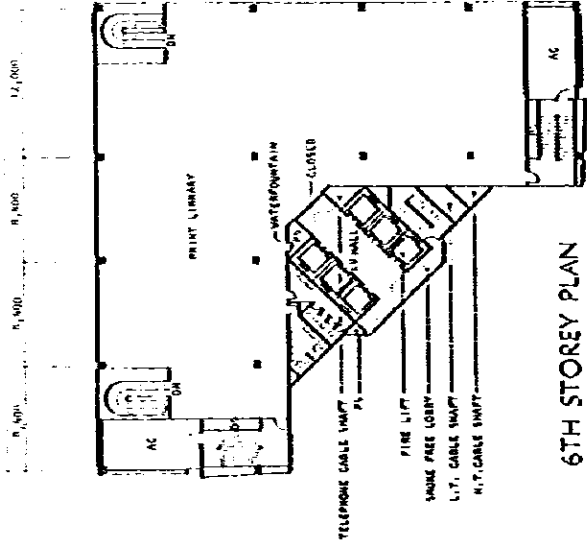
EXPERIMENT ROOM

EXPERIMENT ROOM

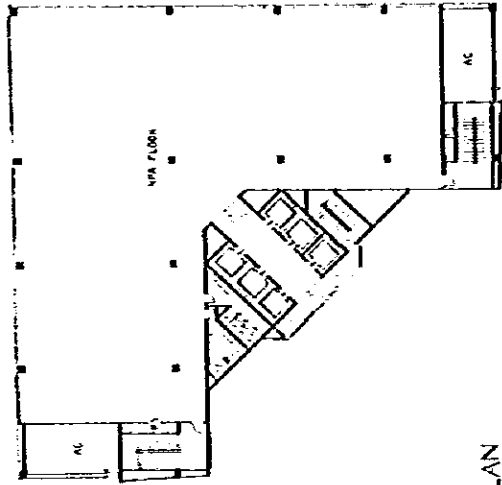




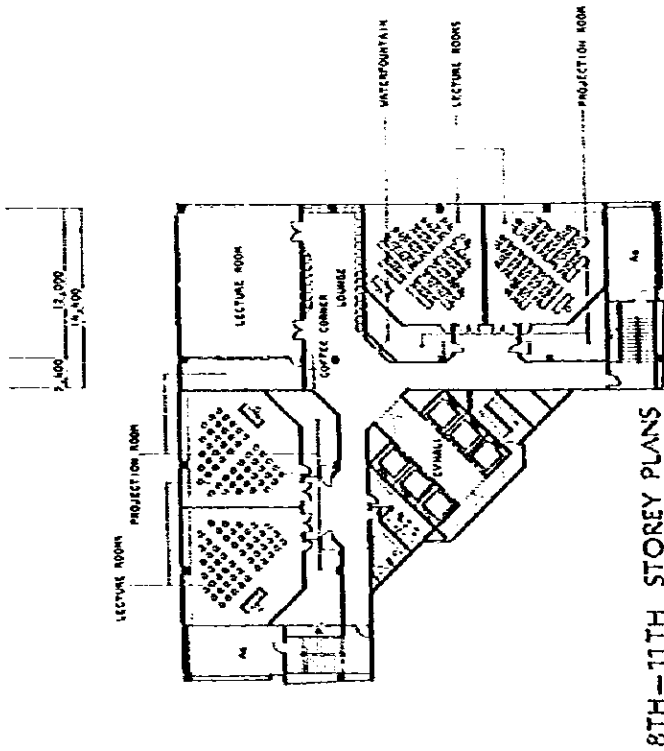




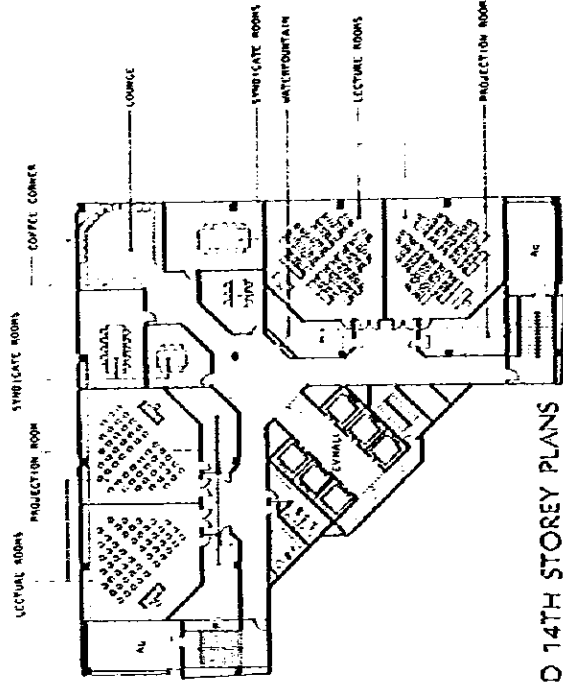
6TH STOREY PLAN



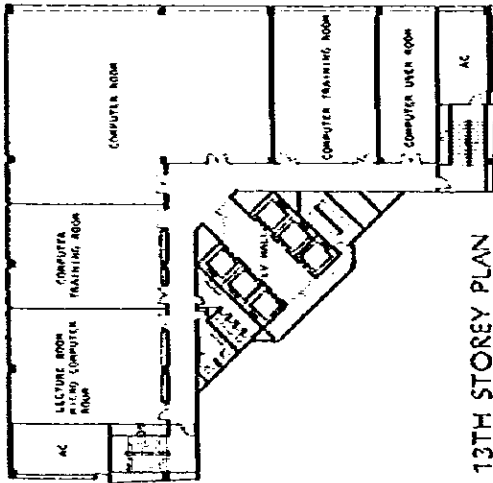
7TH STOREY PLAN



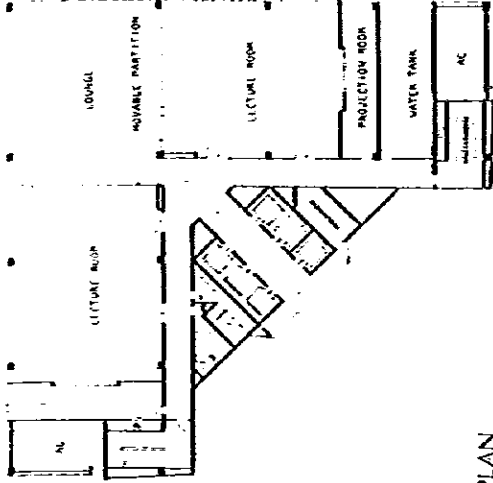
8TH-11TH STOREY PLANS



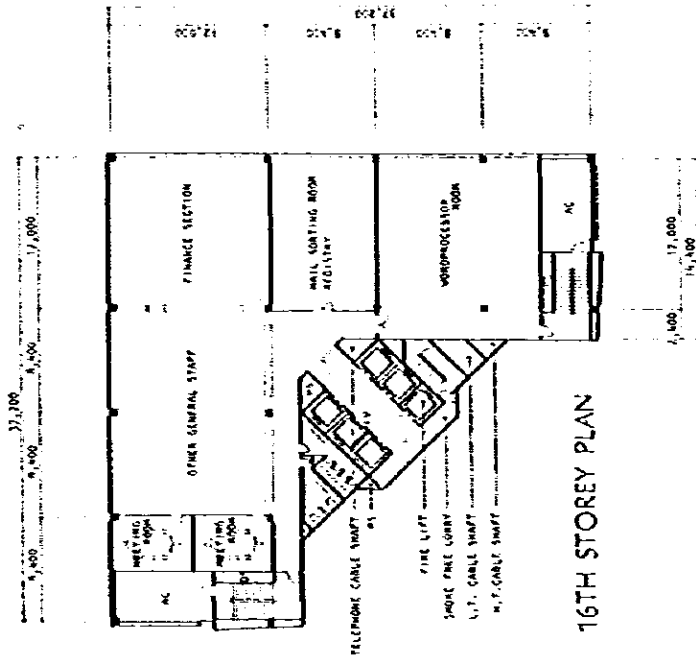
12TH AND 14TH STOREY PLANS



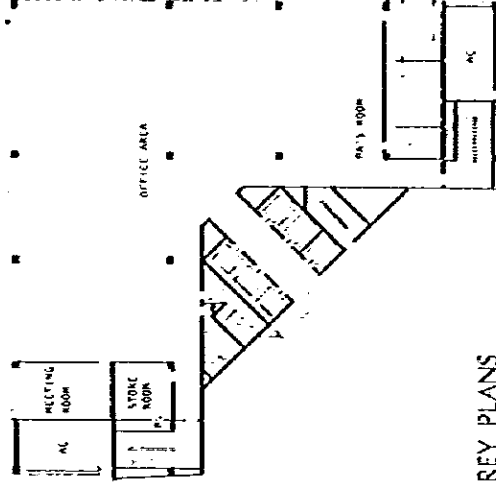
13TH STOREY PLAN



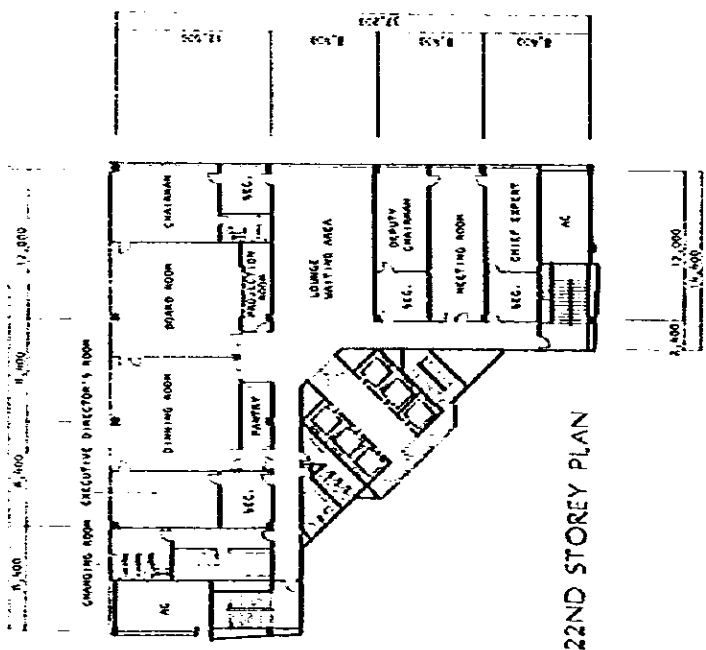
15TH STOREY PLAN

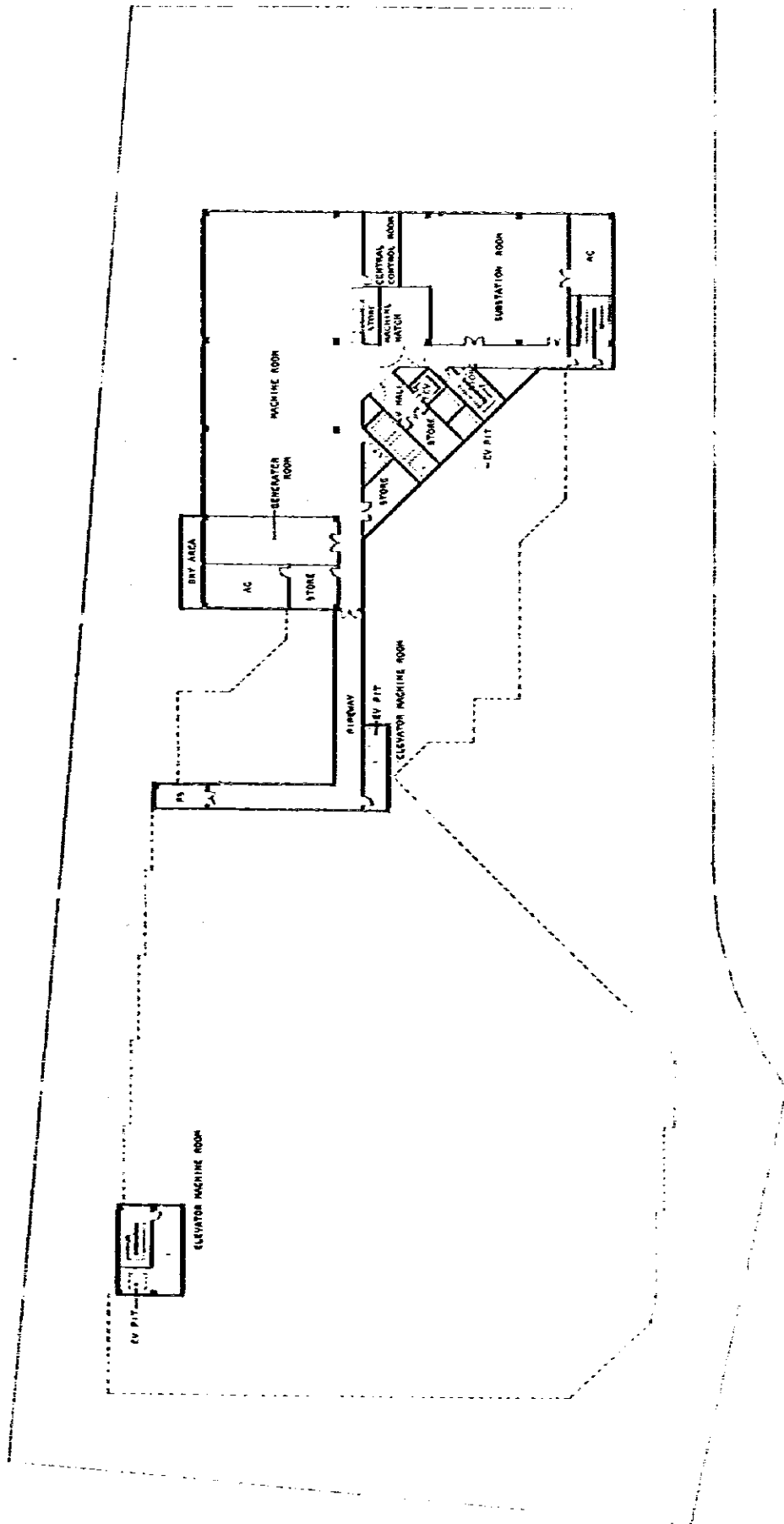


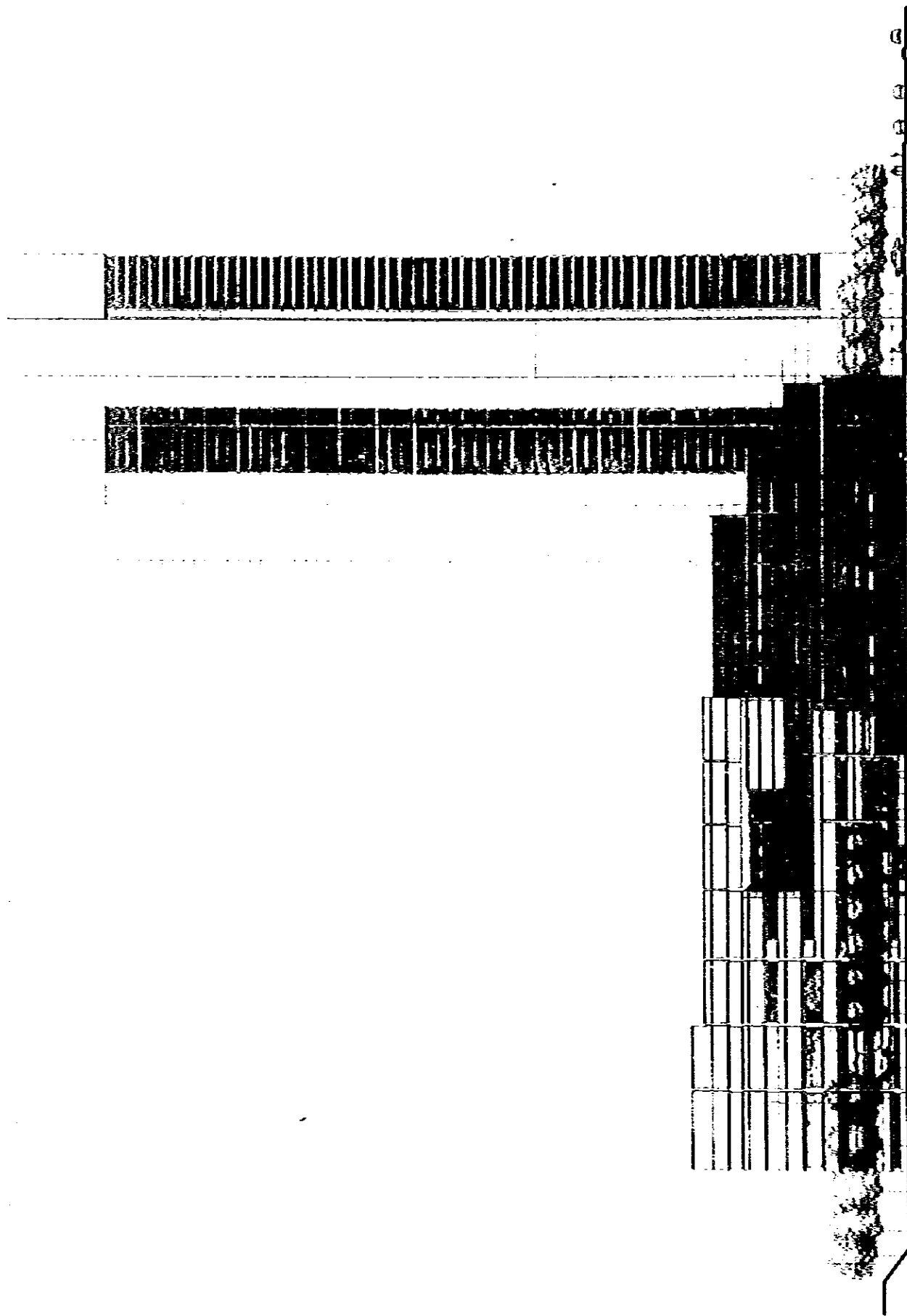
16TH STOREY PLAN



17TH-21ST STOREY PLANS



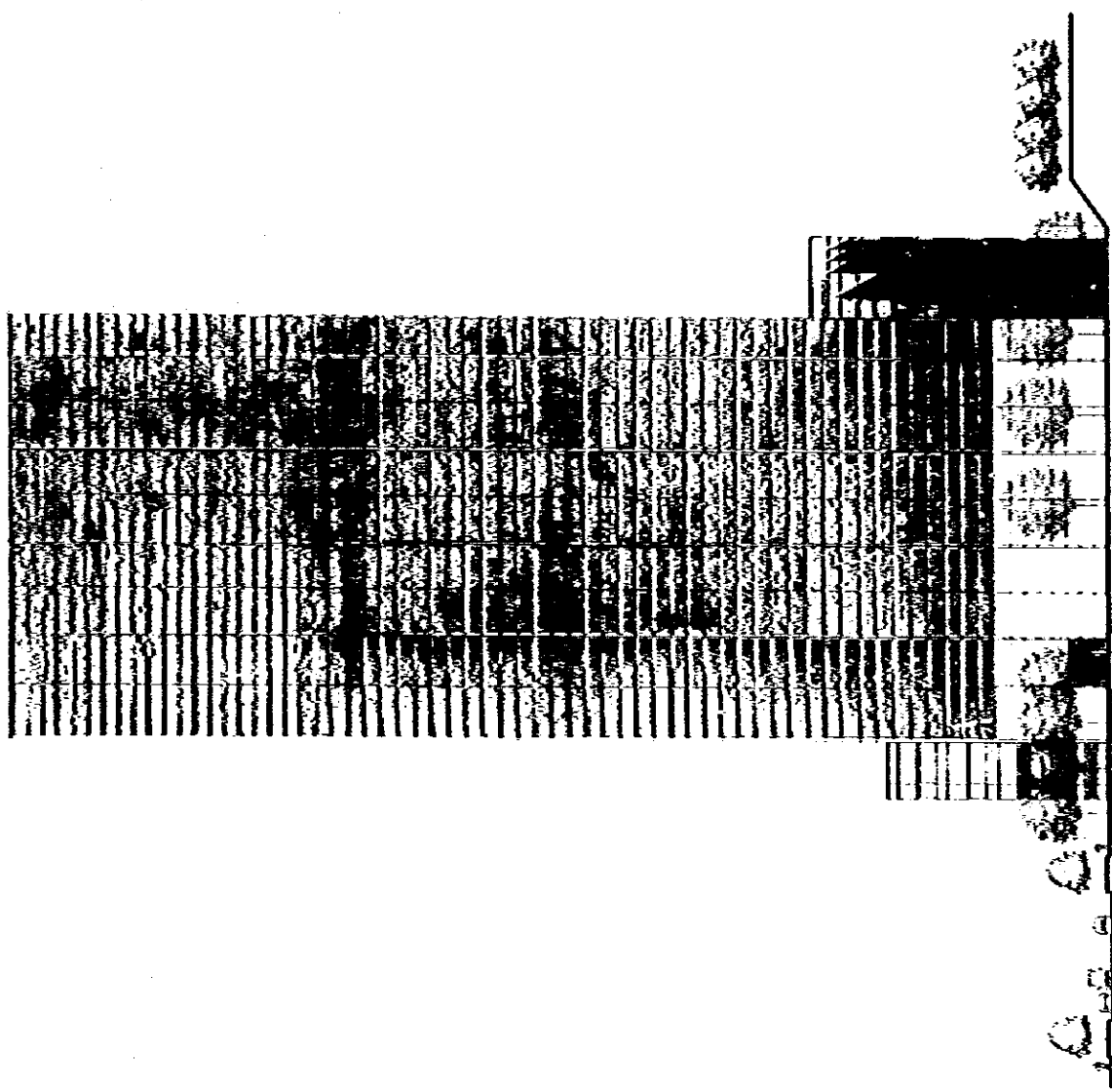




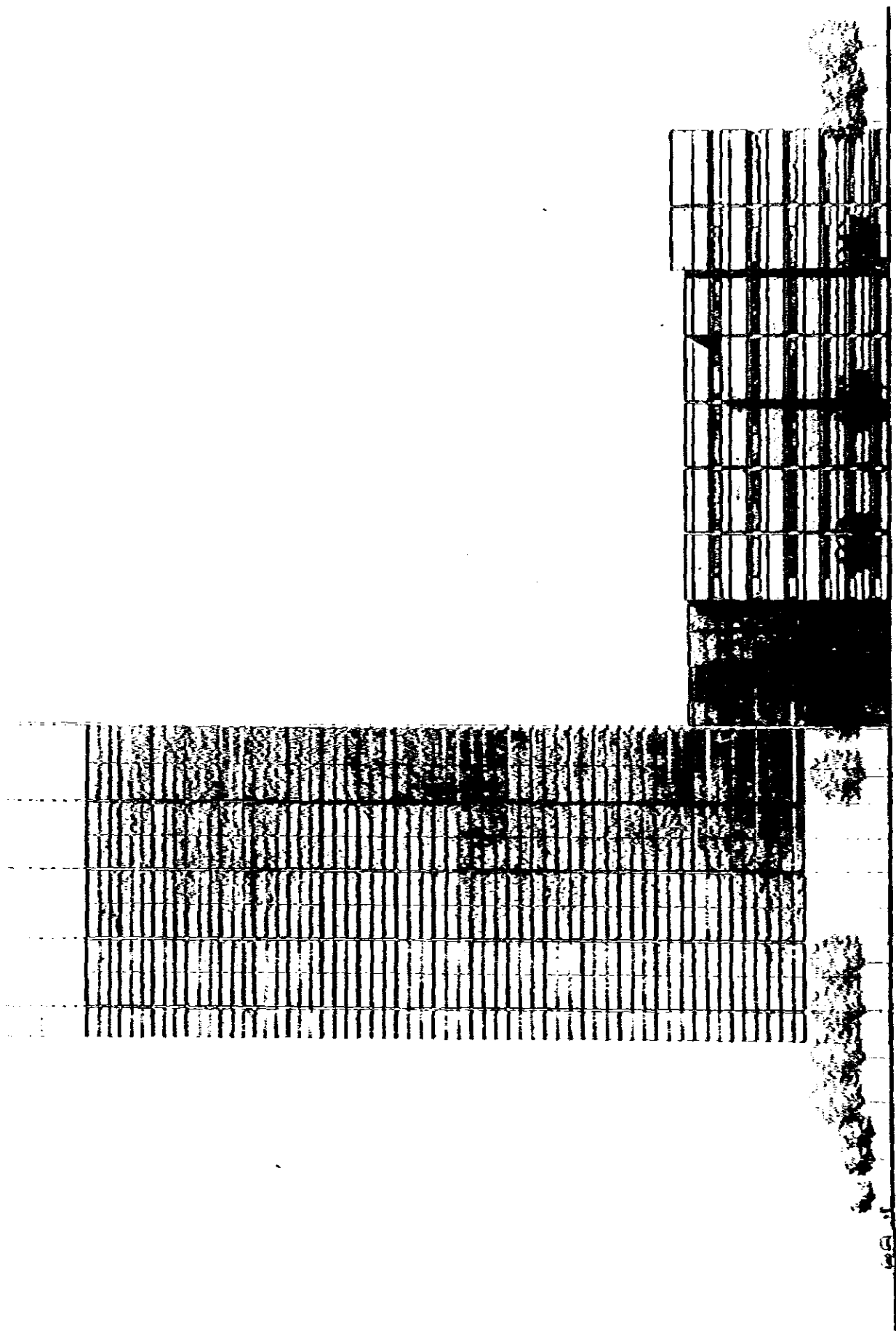
EAST ELEVATION

12

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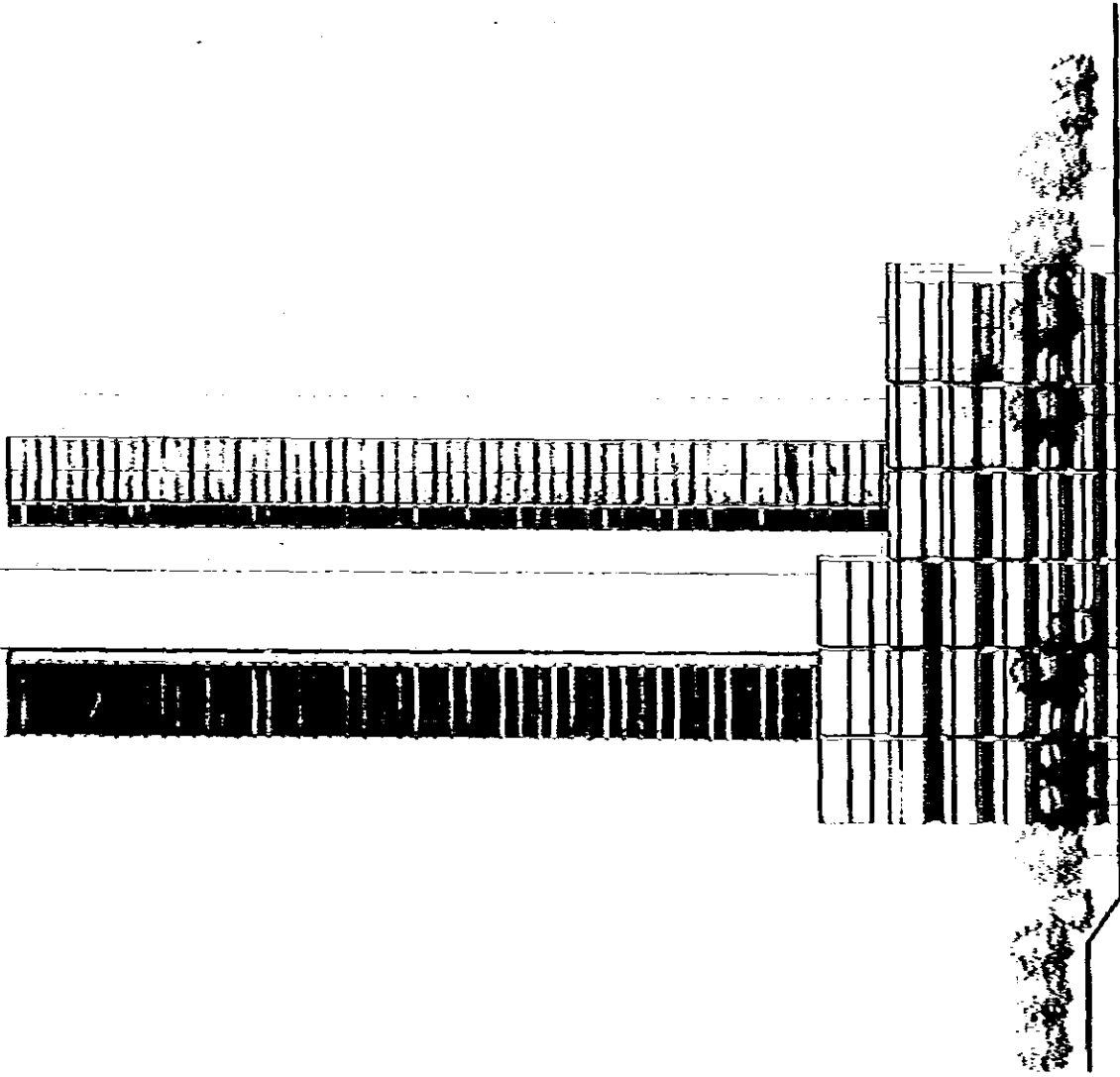


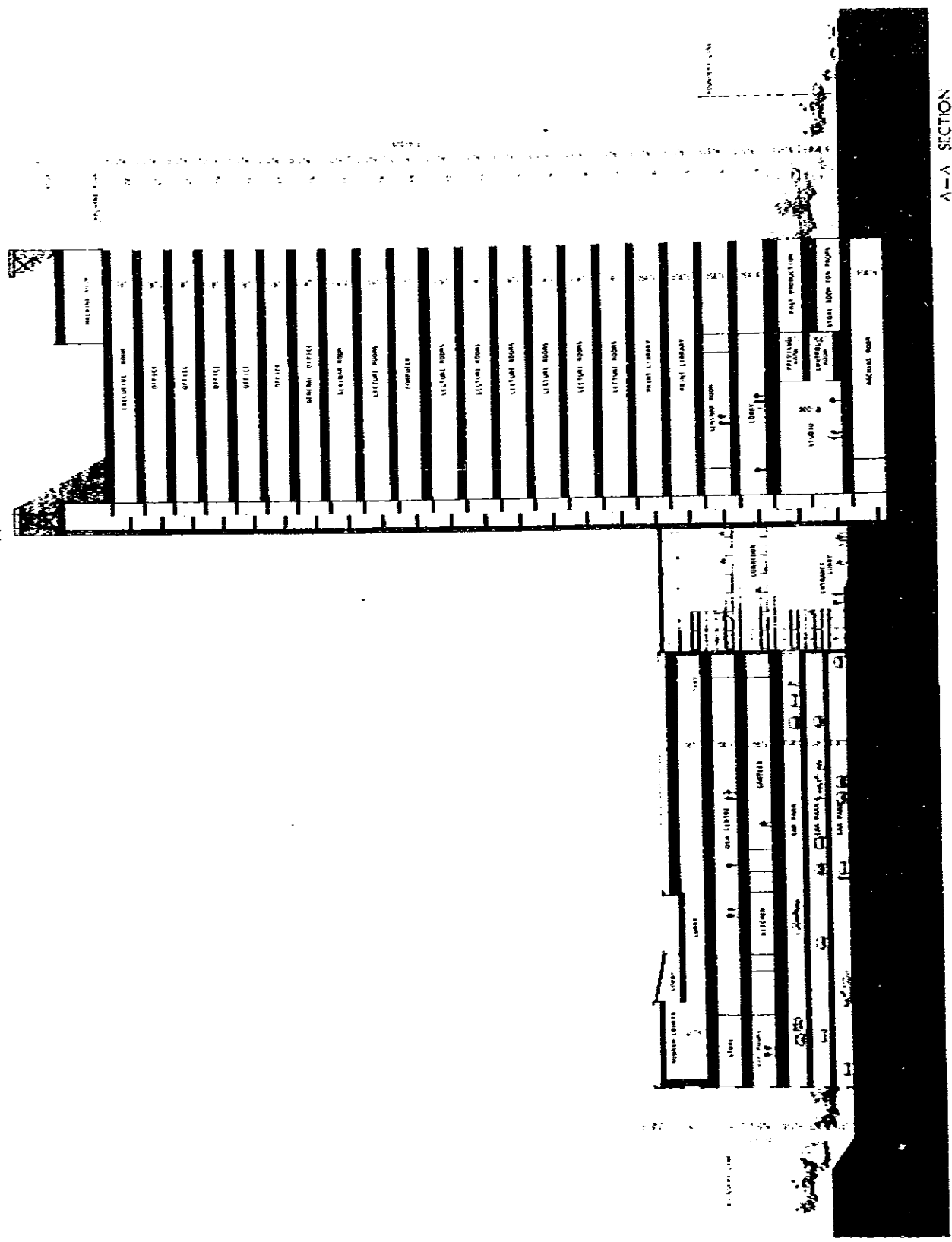
NORTH ELEVATION



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WEST ELEVATION





A-A SECTION