IV.6 Function/Services/Facilities/Equipment of Techno Centre

Here, maintained function, content of service of each center, and facilities and equipment are examined.

IV.6.1 **Mechatronics Testing Centre**

(1) Objective

This centre is implemented to promote upgrading of electric and electronic industry, leading industry in a Malaysian economy, to be able to adjust smoothly to a new international standard.

(2)Activities

Background

The centre will conduct various tests of adaptability to the standard, especially EMC, equipped with an Anechoic Chamber which it is difficult for each enterprise to equip and maintain on its own. And it has further business of certification the conforming to the standards, of being an agency of application to standards, of supplying information on standards, and of being a consultancy service for adaptation to standards.

It is necessary to obtain a guarantee that this centre is a proper laboratory for the standard form a proper organization in the case of providing testing or measurement services for adaptation to standard. For instance, it is preferable to conform to the EN45000 series when the centre is planning to conduct testing and measurement concerning CE marking. To certify the product which is exported to every country in the world, a proper person should test or measure the product by a proper method in facilities which have proper examination equipment: Namely, guarantee the centre has the proper facilities, people, and methods to conform to EN45000 series.

As the customers who commission the centre to test or measurement hope certification will show conformance to standard, the number of requests for testing and measurement depends on if it certifies this EN45000 series. It is necessary that this centre establish its position as a laboratory such as which certifies EN45000 series as soon as possible.

The EN45000 standard series nearly corresponds to the ISO/IEC guide. It provides standard for the testing facilities in detail by the following standard numbers.

EN45001	General criteria for the operation of testing laboratories.
EN45002	General criteria for the assessment of testing laboratories.
EN45003	General criteria for laboratory accreditation bodies.
EN45004	General criteria for the operation of various types of bodies performing inspection.
EN45011	General criteria for certification bodies operation product certification.
EN45012	General criteria for certification bodies operation quality system certification.
EN45013	General criteria for certification bodies operating certification of personnel.
EN45014	General criteria for suppliers' declaration of conformity.
EN45020	General terms and their definitions concerning standardization and related activities.

Activities

1) The first phase

- The EMC is readied.

2) The second phase

- Endurance of semiconductor in addition to EMC is examined.

3) The third phase

- In the field of electronics, technical innovation is so drastic that it is necessary to investigate how the centre will proceed in the third phase following the second phase.

(3) Facility Plan

1) Facilities and Equipment

a) Electronics Testing

In the first phase only basic equipment, i.e. oscilloscope, digital multimeter, are introduced to the centre.

In the second phase High temp humidity burn-in test system (HHBT) will be introduced.

b) EMC engineering

-Instrumentation for Interference Test

Field Strength Meter
Spectrum Analyzer
Receiving Antenna
LISN
T-type Network
Network Analyzer
Standard Signal Generator
Variation Monitor
System AC Supply
AC Stabilizer Supply
High Frequency Amplifier
Transmission Antenna

- Instrumentation for Immunity Test

High Frequency Volt Meter
Reflection Meter
Standard Signal Generator
Fast Trans/Burst Generator
Capacity Coupled Clamp
High Power Attenuator
Coax Switch Equipment.
Field Probe
Field Probe Mover
Electrostatic Simulator
Lightning Surge Tester
High Frequency Probe
Programmable Attenuator
Disturbance Coupled Network
Hi Power Lowpass Filter
Directional Coupler
Helmholz Coil
TEM (Transmission Electron Microscope) Cell

2) Maintenance

It is necessary for equipment empirically to calibrate precision once a year and to fix or replace parts of instruments about twice a year.

3) Trend in other organizations

It is not confirmed that SIRIM has an anechoic chamber for EMC testing. But we recognize that SIRIM does not supply the EMC service as well as the request from each enterprise.
As for the commercial site, Tokin Electronics Malaysia Sdn. Bhd. has an anechoic chamber (3m Method) and provides services in KL. In Singapore, SISIR or private organization

measure EMI in the open field test site and EMS in the anechoic chamber (3m method).

(4) Organization system

1) Recruiting and Training

The researcher is required to have a knowledge as a specialist for testing, not to mention be able to take advice about the measure of the product which has a defect, to be familiar with the standard and to have ideas how to pass the standard, especially in the EMC field.

To gain expertise, it is hoped to gain some experience by the on-the-job training about 2-3 years under the guidance of an expert after receiving higher education in the sciences. Therefore, as soon as the plan of Techno Centre is concrete, personnel should be recruited from throughout the country and be sent to the nation which has advanced technology in the field for a long term.

2) Organization system

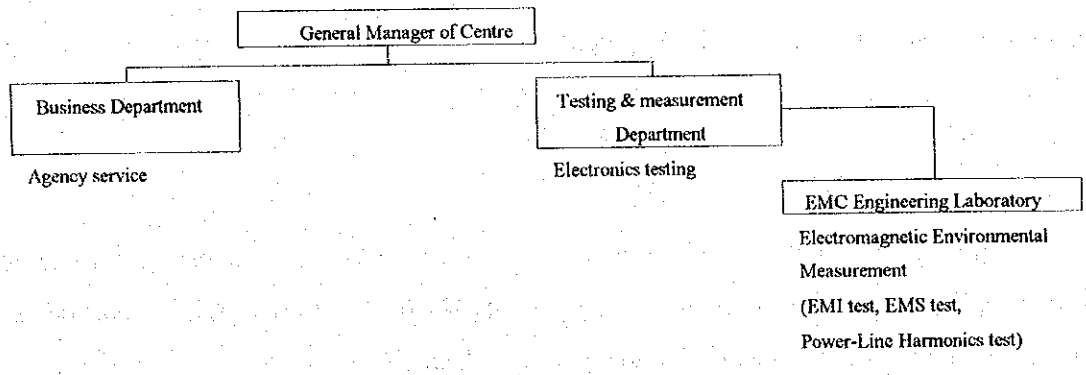
Organization structure

The business department provides the consultancy service, the agency service of application to various standards , and the certification service. Two employees are proposed.

The testing and measurement department provides various testing and measurement services related to electronics , and gives advice regarding a defective product. EMC testing and measurement is independently conducted by an EMC engineering laboratory which comes under the testing and measurement department. The numbers of employees is 3 for EMC and 1 for the other examinations in the first phase. These number of employees are increasing in proportion to the number of requested testing and measurement in each phase.

Manpower Plan

	1st phase	2nd phase	3rd phase
Business department	2	2	2
Testing & measurement department	4	6	6
(EMC)	(3)	(4)	(4)
Total	6	8	8



Management structure

EMC engineering laboratory is thought to be entrusted to the private sector. Since the laboratory has the necessity to gain the guarantee of the standard, considerable demand is expected, there is an enterprise which wants to manage this laboratory, and the business of this laboratory can be separated from the other business of the Mechatoronics Testing Centre. Of course it is necessary to acquire the proper experts as soon as possible.

The contract with the private sector is that the private sector pays a lease fee for the facilities and the commission of a certain percent of profit. The centre should, keeping its identity, choose an excellent partner and transfer the know-how of technological operation.

IV.6.2 **Material & Surface Analysis Centre**

(1) Objective

The Material & Surface Analysis Centre will be the central organization within the Techno Centre which supports the development of high-tech industries such as semiconductor and hard disk drive industry. Initially, the centre will enhance the quality control of high-tech industries, and gradually supplement the R & D capabilities in process design and product development.

(2) Activities

The centre will provide the analysis and measurement services of materials, parts and products for the industries in the KHTP and its surrounding areas with a particular focus on the hard disk drive and semiconductor industries.
The centre will also provide consulting services on production methods and quality control through failure analysis based on advanced micro-area analysis.

1) 1st Phase
In the first phase, the goal of the centre is to build foundations for basic analyses and research for semiconductor, metal, and ceramics. The major areas of analyses are;

- Composition Analysis
- Surface Analysis
- Structure Analysis
- 3D Composition Analysis

The life of a semiconductor depends on the control of electronic properties which are governed by the addition of impurities. Therefore, the identification and quantification of elements on the surface and inside are important research capabilities. High density of hard disks and semiconductors makes it necessary to maintain a high level of clarity; thus surface analysis is indispensable for failure analysis. The flatness of disks and chips and the shape of the head defines the quality of the product. Micro-mechanical testing and micro-observation become important tools for such analyses.

2) 2nd Phase

Based on the basic capabilities developed during the first phase, in the second phase the centre will be expanded to conduct analyses in further micro-areas and to offer more comprehensive analytical services for semiconductor and hard disk producers.

3) 3rd Phase

In accordance with the development of the KHTP, the revision of target industries are carried out, and the centre re-equipped to meet changing needs.

(3) Facility Plan

1) The first phase

Electron probe x-ray microanalyser is a type of scanning electron microscope which employs a more focused electron beam, achieving higher resolution. It is suitable for bulk test pieces. Coupled with EDX,WDX it is also capable of quantifying elements on the surface.

i Material & Surface Analysis

- Electron probe x-ray microanalyser / EDS / WDS
- Transmission Electron microscope (TEM)
- Secondary Ion Mass spectrometer (SIMS)
- Fourier transform infrared spectrophotometer
- X-ray fluorescence spectrometer
- X-ray diffractometer
- Optical microscope
- Scanning ultrasonic microscope

ii Test Piece Preparation

- Ion milling machine
- Dimpling machine
- Disk cutter
- Focused Ion Beam Equipment

iii Mechanical Testing

- Universal material testing machine
- Impact testing machine
- Torque testing machine
- Dynamic micro hardness tester
- Brinnel hardness tester
- Surface roughness tester
- Three-dimensional profiler
- True circle tester

iv Thermal Analysis

- Differential scanning calorimeter
- Differential thermal analyzer
- Constant temperature/humidity chamber

Electron microscope (TEM) is the most versatile electron microscope with a very high resolution. However, a thin polished test piece has to be prepared prior to analysis, and preparation requires extensive skills and specialized equipment such as Ion Milling Machine, Dimpling Machine and Focused Ion Beam Equipment. Secondary Ion Mass-spectrometer is capable of analyzing the test piece vertically -- indispensable in the semiconductor industry. Fourier transform infrared spectrophotometer is capable of identifying organic matters. X-ray fluorescence spectrometer is capable of quantifying compounds on the surface without destruction.

2) The second phase

- Photoelectron Spectrometer (ESCA)
- Scanning Auger microprobe
- Laser Raman Spectrometer
- Scanning Tunnel Microscope

A facility for magnetic property analysis will be investigated.

3) The third phase

The facility depends on the selection of target industries and their technical needs.

(4) Organization

1) Recruitment and Training

Researchers, qualifications are degrees in physics or chemistry, and experience with actual analysis. It is known to take more than three years of on-the-job training with proper guidance, and without experienced leaders it sometimes take 5-10 years to build competitive expertise. Judging from the urgency of the services required, it is recommended to affiliate with a well-established private laboratory for smooth start-up.

2) Manpower Plan

	1st Phase	2nd Phase	3rd Phase
Researcher	9	13	15
Administrator	1	1	2
Total	10	14	17

IV. 6.3. **Environmental Analysis Centre**

(1) Objective

Background

KHTP is a complex which has environmental management features in the way of an intermediate processing center for solid waste generated from manufacturing industries located in the complex. First of all, an analysis is performed to see whether toxic substances are mixed in the solid wastes when performing intermediate processing. Because of this, KSDC and KTPC are planning to locate the facility for analyzing the solid waste near the intermediate processing center. In this manner, facilities as well as adequate equipment will be needed for analyzing operations. The analysis of solid waste is normally performed by melting the solids in a fluid (mainly pure water) before testing them in an analyzer. Therefore, test equipment is mainly designed to analyze not only the waste solids but also the fluids themselves. At present, KHTP is aggressively promoting high-tech enterprises for the complex. But inviting high-tech enterprises entails being prepared to deal with extraction of high-tech substances. In the past there was an example in Silicon Valley where the area was polluted by high-tech substances. Thus, in the manufacturing process of high-tech products, it is anticipated that the solid or liquid wastes discharge would be high-tech substances (substances that require high-tech for treatment). Notably, a high degree of know-how, technology, and facilities and equipment will be needed for analyzing the density of the substances and for treatment of them because there will be an increased frequency of using organic solvents. Therefore, it will be necessary to prepare a monitoring system for wastes in the complex itself.

This is the reason and the significance of having the Techno Centre to become not only a regional high-tech centre but also the core for regional industrialization for the transferring of technology needed to promote high tech industries on a wider area.

It is essential for high-tech enterprises to have a high degree of inspection and measuring systems for products and production systems. This type of demand is growing in line with the increased sophistication of production systems and high-tech application of products. For example, as represented in silicon wafers, water plays an important role in the process of enhancing the degree of integration of a product. There

is a trend where there is a growing need for higher purity water. In other words, the conditions for the materials to be used and for the infrastructure do not depend on whether or not they existed as in the past, but that a conspicuously higher degree of quality is demanded. The higher the technology used, the higher the level of quality will be demanded.

In other words, without these preparations, it will be impossible to invite high-tech enterprises in this field to the complex. Moreover, because such facilities in Kulim can be used, it becomes possible to prevent the enterprises which already launched into other industrial complexes from transferring out to countries other than Malaysia.

The technology and know-how for inspection, analysis and measurement of solid wastes can be applied in fields related to the earth environment including water, air, and soil. If the field of application can be expanded, the expansion of service demand can also be anticipated. Also, since analyzing equipment for solid and fluid wastes can be commonly used in the analysis of air and soil, it is believed that the expansion of any given business area does not necessarily mean that investments for larger facilities will be necessary.

At present, the regulations concerning ISO14000 (known as Environmental ISO) are being promoted in developed nations. While the ISO9000 Series is one of the most famous ISO standards, this is a regulation for quality management, while ISO14000 is a regulation standard for environmental management. Specifically, it consists of environmental management system (EMS), environmental audit (EA), environmental performance evaluation (EPE), environmental label (EL) and life cycle assessment (LCA). At present, there is a growing trend among enterprises to use the acquisition of ISO9000 as the basic conditions for doing business with any given enterprise. The same could happen in the future with ISO14000. In other words, unless an enterprises has an ISO14000 license, this could have a major impact on exporting products or doing business with other enterprises. In Malaysia, SIRIM primarily enforces these undertakings. However, it is believed that SIRIM alone will be unable to respond to service demand sufficiently. Therefore, it is important to form a tie-up with SIRIM at present and respond to the service demand for ISO14000 in the future.

In Malaysia, while this country has one of the most stringent environmental standards in the world, its management and monitoring systems for pollution are not necessarily adequate. KHTP has devised many innovations in this aspect and has a temporary

storage facility for solid waste products. Thus, it is necessary to create a structure to clear all of the environmental standards from the viewpoint of giving consideration to the peripheral environment. Therefore, by using these characteristics, it is important to make KHTP into an industrial development region that utilizes high technology for both industrial purposes and preserving the environment in order to promote industrial development in the whole of Malaysia. Moreover, environmental problem is not just an issue for developing plants but for the entire region. For Techno Centre's service to heighten the measures to preserve environment for the group of industrial complexes throughout the nation would automatically mean that the centre will lead various regions for protecting the environment.

Objective:

1. Through the services offered in inspecting water quality and offering measurement services to enterprises established in the Techno Centre and to related regional enterprises, assistance is provided for managing environmental preservation. Also, with high-tech enterprises located at the complex and the high-tech technology available, the industrial complex will be made into one with a fully equipped environmental management system.
2. By expanding this service to other industrial complexes by using this service as the model case, this facility will become a pilot facility that allows Malaysian industry to adapt to the times by making the industrial structure of Malaysian industries adaptable to the environment.
3. The environment-adaptable high-tech service facilities at the complex will be accessible to all related enterprises in the region. Therefore, the complex will contribute to preparing high-tech facilities not only for the complex but for peripheral enterprises.
4. The facility will be used as a comprehensive service organization for offering water-related inspection, measurement and consultation (pollution prevention, installing environmental equipment and adding improvements) for the peripheral regions and all Malaysia.

(2) Activities

Policy

This target field of this centre is inspection and measurement of liquids. And at the next step, the centre aims toward inspection and measurement of air.

Activities

1) The first phase

Inspecting and analyzing water, particularly pure water, and soil quality of water and soil used by enterprises.

Analyzing waste water, sludge, and fluids in intermediary state.

-Inspection and measuring toxic materials:

Inspecting and analyzing organic toxic substances

Inspecting and analyzing inorganic toxic substances

-Inspecting and measuring non-toxic substances: Measuring BOD, COD, SS, etc.

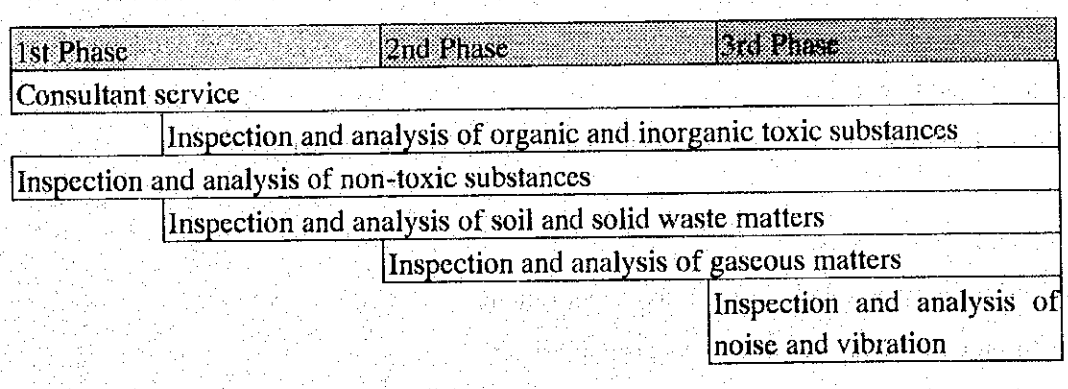
Consultation services for waste water disposal facility and other facilities

2) The second phase

-To unfold area of expertise into gaseous substances in addition to water quality

3) The third phase

-While the third phase might include noise and vibration, a full study will be made at the second phase level since many new facilities might be needed.



(3)Facility Plan

1) The first phase

a) General analyser for liquid

- O.D meter
- pH meter
- Spectrophotometer
- Constant Temperature humidity chamber
- Thermogravimeter
- Water purifier

b) Material analyser

- Atomic absorption spectrophotometer
- Atomic absorption spectrophotometer (Flameless)
- Ion chromato analyser
- Gas chromatograph
- Gas chromatograph mass spectrometer
- High performance liquid chromatograph
- Total organic carbon analyser
- Total nitrogen analyser
- Silica meter

c) Emission and waste fluid processing system

This is a system for processing gaseous substances and liquid wastes generated during analysis. (The premise is that the processing of organic solvents will be handled by outside sources)

Note): Gas chromatograph mass spectrometer must be equipped in a clean room.

2) The second phase

- Inductively coupled plasma mass spectrometer
- Inductively coupled plasma spectrometer
- Ultrasonic nebulyser

3) The third phase

Improvement and renewal of the equipment used in the first and second phases.

Note): The equipment described above can be utilized in the analysis of various substances covered under Malaysia's environmental standards. Also, this equipment can, to a certain degree, be used in the analysis of agricultural chemicals, industrial waste, and toxic substances.

4) Facilities used in other organizations

At SIRIM, many of the environment-related facilities were equipped through grants from Japan. Some of the equipment include gas chromatographic mass analysis system (GC/MS) and high frequency plasma emission spectrometer (ICP) which are some of the latest equipment being regarded with high interest in recent years. However, since it is believed that there is considerable demand for the use of such equipment, and the fact that environment-adaptable services are recognized to be strongly oriented to the immediate needs of the region, the facilities at SIRIM are being promoted primarily in the Kuala Lumpur area. Thus, it is believed that even if this equipment is installed at the Environmental Analysis Centre, there will be sufficient demand for the services of this equipment.

(4) Organization

1) Recruiting and Training

When the centre launches, it will be difficult to line up professionals for inspection and measurement required by the centre. Therefore, such personnel will be recruited form private corporations that handle similar work. It is important to build the business organization by involving enterprises that can form joint ventures from the planning stage. By utilizing the know-how of these enterprises, the technological level of the Environmental Analysis centre will be enhanced. On this point, this will be the same at other technological centres.

When the organizational structure of the subject centre is prepared, recruiting for personnel will be conducted. At the same time, the recruited personnel will undergo training at private enterprises and other external organs to prepare them before the Environmental Analysis Centre's project goes fully on-stream. Like the material centre,

it is important to foster and use personnel through cooperative exchange programmes with the environmental centres for other regions (states) for operating the centre instead of securing personnel from overseas.

2) Organizational Structure

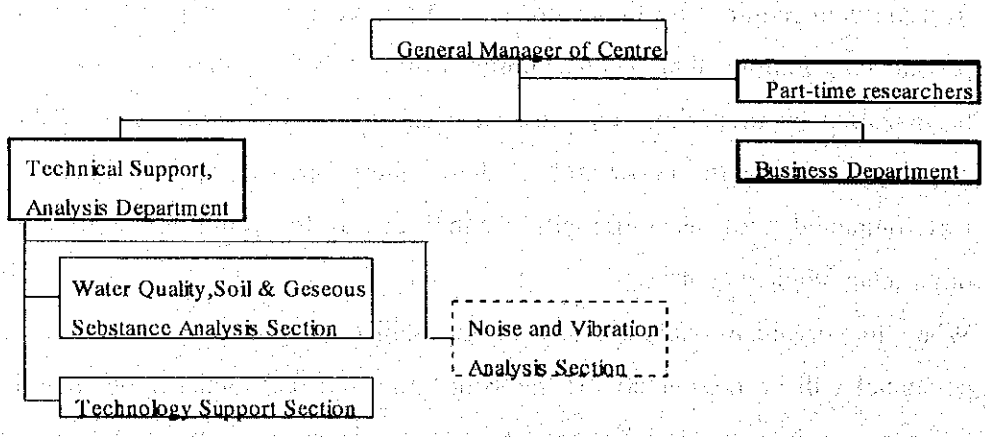
The Environmental Analysis Centre consists of two departments, Technical Support and Analysis Department, and Business Department. The activities of the former are to analyze and inspect water and air, to offer consultancy services for installing environmental facilities, to analyze the needs for new environmental analysis, and to submit management plan.

The activities of the latter are to train employees, to dispatch employees outside, and to promote technological exchange with universities, along with personnel exchange.

A part-time researcher system will be inaugurated to supplement any shortfall of researchers. (For various analyses, supporting analytical work, training centre employees primarily with university professors and corporate researchers).

Manpower Plan

	1st Phase	2nd Phase	3rd Phase
Researchers	7	9	11
Management accounting	1	2	2
Total	8	11	13



*Dotted lines indicate future expansion.

IV. 6.4 **Industrial Network Centre**

(1) Objective

Background

The industrialization of Malaysia depends on the accumulation of export-oriented foreign assemblers. Through the accumulation of these assemblers, there has been progress in unifying the industry in terms of its back stream and the nurturing of parts industries and engineering industries. However, the accumulation of these assemblers still lacks depth. The technical level of present supporting industries, except foreign companies, is not necessarily satisfactory from the viewpoint of the assembler side who trades with international markets. (There are few enterprises that could match the required technical level).

In fact, when the electronics industry in Malaysia is examined, one can easily speculate that many will be pressed to switch to producing products with high value added and high-tech contents. However, there are a few enterprises that have the technology to cope with production of precision equipment or high-tech products. There appears to be a slowdown in the advancement of enterprises with more advanced technology, and there is even a trend among enterprises aspiring for higher technology to transfer production to other places. It is extremely important for Malaysian industry how it secures and fosters such enterprises.

Malaysian assembly industries in general import parts and materials and process and assemble them into products for export, as explained previously. On the other hand, enterprises like Japanese-affiliated firms are being forced to revise their vertical transaction forms (many of these include importing goods from enterprises in Japan) because of the high yen. They are no longer questioning the source of goods as long as the products they acquire match their specifications. This trend suggests that the industry is at a turning point whether to continue relying on imported parts and materials or to go to ethnic Malaysian capital for the goods.

Meanwhile, the Malaysian economy at this juncture is in extremely good health. The country also has abundant funds. Therefore, there are enterprises that are producing

high-tech products or are forced to rely on high technology. When considering that there is a visible change in the procurement of parts and materials, it is no exaggeration to say that the golden opportunity has arrived to foster domestic enterprises with true technological expertise by channeling investment funds into leading edge sectors. Unlike the traditional single-product production enterprises, these new enterprises are involved in assembly networks of parts. The decisive issue for starting a new business is in the method used for forming an industrial assembly networks within and outside the country.

Objective:

The objective is to enhance the technological level of existing enterprises in the northern region of Malaysia, to create assembly networks, and to create and foster new enterprises within the network.

(2) Activities

Basic Policy

Of the functions of the Techno Centre explained earlier, the improvements made in the conditions for the organizational formation of product innovation and assembly (information centre and associations) support the creation of investment opportunities, and also provide support for start-up, growth, exchange, R & D and information to businessmen who wish to turn their investments into business projects.

Of the incubation projects in the start-up support function, many of these will be consigned to scheduled joint ventures with MTDC, and the service offered will be limited to front-stage operations that dot not include incubation projects like technical assembly, product assembly, market network and other business planning services and the creation of investment opportunities. The growth assistance offered by main supporting industries for product plans will be implemented, for the time being, on technical assembly information services that include technical information on industrial standards and technical journals. For the future, the aim will be on fostering prototype production enterprises that support R & D projects.

Exchange programmes to be executed will include seminars and salons for high-tech business management and study groups, and exchange meetings for electronics and related industries. The aim here is not only to emphasize technology, but also to encourage regional capital to accept high-tech projects for the network era in terms of management. For example, the aim is to assist in organizing planning meetings for parts and components enterprises scheduled to participate when setting up product planning, or to introduce or recommend enterprises to parts and components assemblers who meet a certain standard. In other words, offering services that create basic demand.

The support for R & D will primarily consist of operating rental laboratories.

As for offering information, consideration will be given to cooperative undertakings with the IT Centre. For example, engineering transactions that utilize such computer networks as the Internet are expected to grow considerably in the future. It will most likely be in the domain of the IT Centre to play the role of the common carrier or software manufacturing for these networks. On top of this, the roles of this centre explained above will be established.

As for industrial standards, technical texts and journals, the primary stage will only include printed matter. Eventually, however, offering multi-media services through the centre's activities will be considered. Through these functions, customers will be able to obtain the aforementioned procurement, and vendor information at all times.

Activities

-The following functions will be available as facilities for start-up and growth support.

Start-up support: Operating rental laboratories

Growth support: Operating open laboratories.

Support prototype production industries.

-Exchange Programmes

In order to pursue the objectives described above, it will be necessary to start from whatever is close at hand. The centre will schedule the following plans.

- Opening Kulim High-tech Salon

This will be a membership salon held about once a month. An attempt will be made to promote the exchange of information among the members in a free atmosphere. If requested, the centre will invite guest lecturers to hold discussions on management, technology, and sales. Target members will primarily be corporate proprietors. There are many cases where opportunities to exchange opinions led to new businesses.

- Opening general workshops

A three-day workshop to be held twice or three times a year, including meetings announcing research results on electronics. The target audience will be corporate and university researchers. The results of each workshop will be published as workshop proceedings by the centre's executive office. The centre will also consider creating a database to record the proceedings. In terms of the organizational set up, it will be close to the organization used by an academy.

- Opening special workshop (private)

This will be a workshop held about once a month. A separately organized officer's meeting will determine the topics to be discussed and the lecturer to be invited. The audience will be researchers and the like of member enterprises.

Investment opportunities are created through the extension of special workshops that lead to product planning meetings or assembly planning meetings, meetings to cope with standards, and to develop demand.

-Offering Information

Library service--> Data bank retrieval service --> Multi-media service.

The media will be gradually upgraded. This service section will begin by promoting information exchange service for the following information required by businessmen.

Text retrieval service for technical text, journals and other technical information.

Proceedings of workshops held in business exchange programmes.

- Corporate Information Service

Service to offer information on parts and parts materials via databases.

Information service on vendors.

For these services, the project will be started by creating a database.

-Networking

Promote networking by groups of enterprises that use the technology centre's services.

1) The networking will start by creating a loose organization or organizing information exchange meetings or to stage exhibitions, and gradually transform the organization into a more specialized and solid setup.

In any event, it is important that the organization be flexible to accept change.

2) The next stage is to form various unions, associations or federations from industrial groups or groups sharing common interests when the time comes for establishing and forming larger groups that encompass entire groups.

3) These will be important infrastructures for people and society for the industrial networking era as "element pools" that flexibly interchange networkings. This centre will also have the function to improve and maintain the infrastructure, that is, to solicit members, or to offer the services of the executive office or to operate to maintain the organization. Moreover, to maintain the high-tech quality of the centre is to create investment opportunities and product knowledge through technical communication conducted within the infrastructure.

(4) Organizational Structure

A major objective of this centre is to create a wide human network rather than to possess technical quality. For this, the centre will aggressively utilize personnel from the private sector for securing human resources. For example, it is necessary to assign people with unique background such as those who are involved in projects to develop businesses on an international scale, or those who are knowledgeable about the industries in the northern region.

Moreover, since these people are not nurtured through training activities, it is necessary to organize training schemes based on OJT to have them aggressively participate in exchange programmes. The following shows the personnel makeup. The employees of

this centre also serve as employees who operate the main KTC body. Moreover, the employees of the human resource training centre also serve as employees to operate the entire KTC organization.

Manpower Plan

	1st Phase	2nd Phase	3rd Phase
Exchange Department	4	4	4
Planning Department	2	3	3
Business Management Department	2	2	2
Total	8	9	9

IV. 6.5 **Information Technology Centre**

(1) Objective

The IT Centre led by USM was planned as a facility to promote the development of computer software and particularly educational projects in the field of information technology. The purpose of the centre is explained below. In February 1995 the Kedah State Government and USM signed a MOU on developing the IT Centre within KHTP and on its management. The ground-breaking ceremony was held in June, 1995.

- To facilitate the exchange and transfer of information technology knowledge and applications
- To encourage the use of information technology in industries
- To act as a resource centre for IT development
- To act as a reference centre for IT
- To function as a communication hub
- To attract industries to locate at the Kulim Park
- To become the focal point of an IT or Software Park

(2) Activities

The IT Centre is an organization (public research organization) operated by USM, and its scope of business covers information technology (IT). Its main business content is shown below. Work stations, CAD/CAM and other high-tech equipment are scheduled to be installed.

- Training Courses
- Seminars and Workshops
- Consultancy
- Provision of Computing Facilities
- Reference Centre
- Communication Centre

(3) Facilities

The facilities consist of the IT Centre building and software park. Each will have the following facilities.

Table IV.6.1 Office space of IT Centre

Item		(m2)
Administrative office, director's office		1,000
Central Computer room		1,000
Training Laboratory (PCs)		1,000
Training Laboratory (Workstations)		1,000
Training Laboratory (Macintosh Computer)		1,000
Five Private Laboratory (Rental Labo)	5*300	1,500
Rental Office Space	20*140	2,800
General Laboratory		1,000
Library / documentation room		1,000
Total		11,300

Table IV.6.2 Major facilities and equipment of IT Centre

1. Data communication facilities linked to USM' wide area Network (INTERNET, JARING)
2. Fibre optic backbone connecting the entire Hi-Tech park
3. A powerful central computer system
4. 20 units of PC's for training Laboratory
5. 15 units of PC's for the 5 private Laboratories and 10 offices
6. 10 units of workstations for training Laboratory
7. 5 units workstations and 10 units of PC's in general Laboratory
8. Equipment for administration office

(4) Organizational Structure

Staff for training, consultation and research are basically provided from USM on a part-time basis. However, it is necessary to fill these positions with full-time staff. The following are personnel requied:

Administration Staff : Secretary, clerk / typist, attendant

Technical Staff : computer system administrator, technician, computer applications specialists / programmers

(5) Cooperation with Other Centres

The IT Centre is to conduct training projects in the field of IT with various laboratories. There is a need to have intimate cooperative ties with the Human Resource Development Center and various business areas (notably in the CAD/CAM area) to effectively use personal computers and work stations which will be installed for the training courses.

The field of IT is an important area today because of the increase in numerical control machinery. Therefore, the IT Centre shall promote exchange of information with enterprises locate in the software park and to jointly develop the programmes for CNC machinery and automation systems for testing and measurement.

At the same time, the IT Centre will aggressively promote close personnel exchange and joint usage of equipment and facilities with other centres.

Moreover, if it becomes possible for the users of various centres to simultaneously view all of the documents showing common problems and issues shared (need to share documents), demand for each centre can be expected to increase dramatically. In this sense, offering support in such aspect is an important role of the IT Centre.

IV. 6.6 **Human Resource Development Centre**

(1) Objective

Background

The function of developing human resources is one of the most basic fields for regional development and promoting industries. It is an important element to ensure continuous growth of regional economy.

At present, Malaysian Industries are faced with a labour shortage problem in all levels of technology and management fields. Notably, there is a conspicuous shortage of technicians. The reason for this is that there are very few organizations that appreciated such personnel. However, Malaysian engineers have now emerged from the realm being of a school teacher. And, the biggest reason why there is still a shortage is because these status-conscious engineers do not prefer the working environment of a plant. In contrast, manufacturers, corporate engineers and technicians maintain their identity only if they are able to manage their work at the work sites. These factors are the bottleneck now, and this is the reason why there is a strong demand for industrial proprietors, manages and technicians. These people are regarded as the foundation for industrial and regional development, and are greatly responsible for the promotion of the supporting industries. For example, while engineers primarily engage in R & D activities, it is technicians who work with the engineers to realize the R & D projects (prototype productions). It is not Malaysia alone that urgently needs to train technicians as industrial proprietors and technical foremen.

Moreover, there is an active movement afoot in the world for standardization. Unless an industry responds to such trends, export activities and corporate transactions could be affected markedly.

At present, UTM, USM (Information Technology Centre) and KISMEC are scheduled to be established in KHTP. Japan-Malaysia Technical Institute (JMTI) is also being planned. (The candidate sites are KHTP and other locations in Penang). Excluding KISMEC, others will not be able to perform assembly operations without knowing the standards. Therefore, these organizations' main objectives are to offer long-term training and education.

Objective:

The objective is to nurture industrialists, engineers and technicians in the northern region of Malaysia who will be directly involved in production and R & D activities and work within the plants, as well as to foster personnel who are capable of responding to the global movement on standardization.

(2) Activities

Basic Policy

The training and education for nurturing personnel requires a high degree of know-how. At the same time, an important point in making this a success is whether there is a wide ranging human network.

Notably, it is impossible to acquire high degree of know-how in a short period. As for utilizing foreigners, while other centres might be able to accommodate them to a certain degree, it will be difficult to invite them from overseas because contacts with Malaysian industries and government circles are regarded as important.

For these reasons, this centre is to primarily engage in operating and managing facilities. The actual activities themselves will be consigned to other organizations.

Also, the training of these personnel starts from the realm of general education to education in basic technologies which are in the domain of the Ministry of Education. There is a limit to what one can do to educate an adult. Therefore, these long-term education programmes are not within the realm of the centre. This centre, through its original operation, offer information on the necessity of new basic education to many educational organizations with the given field. This centre educates personnel by directly hooking up with work sites. The results from education do not involve personnel alone, but also information that is disseminated through the Industrial Network Centre and IT Centre that are jointly established. This in turn contributes to the totality of Malaysia' science and technology education and for industrialization as a whole.

Activities

The training contents are selected from the following perspective:

1) Training on production activities and quality control

Training on quality control and production process management

Example:Total Quality Management

Quality Control

2) Training on standardization of product and production.

Example: ISO9000 related matters

CE mark, IEC, ISO14000 related matters

3) Training on automation and efficiency

Example:Training on programming for CNC, MC

On site-training on factory automation and production efficiency

Training System

The training system shall not be a long-term training system that lasts for years like higher education institutions, nor are they the short-term programmes that finish within one week as those offered by KISMEC. It is something in between (two to four weeks). Therefore, the training centre shall have lodging facilities (scheduled to be constructed in the second phase).

(3) Facilities Plan

While it is desirable to have an AV Room and a simultaneous interpreting system as basic facilities and equipment, the construction for the time being shall be limited to building the rooms that will be able to accommodate these equipment because partners may have their own desires.

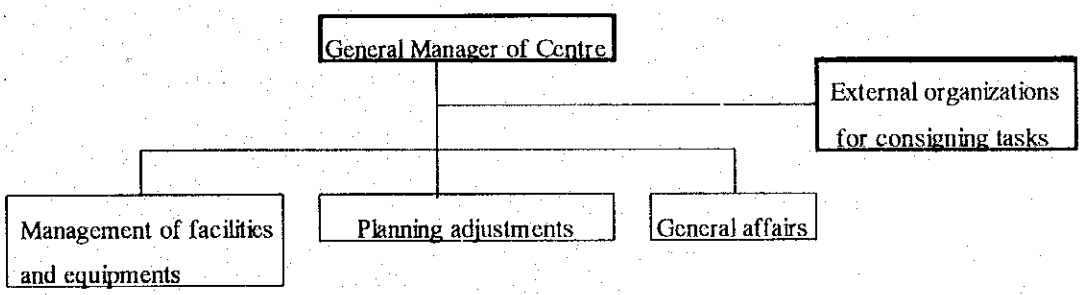
As for specific equipment and facilities, these will be decided after consulting with business owners.

(4) Organization Structure

The main duties of this centre are to manage the facilities for human resource development and engage in public relations activities to expand training activities. Since actual operations are entrusted to external organizations, the number of employees at the centre is held to a minimum.

The head of the centre primarily performs mutual adjustment activities with other centres in human resource development programmes, and develops demand. The management of facilities is performed on the facilities for human resource development, which is a part of KTC. However, the centre may entrust this task to the building management firm of KTC.

The task of planning adjustment involves promoting training projects while establishing cooperative links with external organizations for task consignments, and to conduct publicity activities on the importance of these training projects, and to utilize administrative support measures for the training projects (usage of HRDF).



Manpower Plan

	1st Phase	2nd Phase	3rd Phase
General manager of centre	(1)	(1)	(1)
Management of facilities and equipments	(1)	(1)	(1)
Planning	1	2	2
Business management	1	1	1
Total	2-4	3-5	3-5

*Regarding the possibility of entrusting training projects to external organizations.

At present, the JMTI is one of the training organizations scheduled to be newly established. We have also received information during the process of this survey concerning the plan of Japan-Malaysia Technology Centre (JMTC). This centre is being planned by Persatuan Alumni AOTS (The Association for Overseas Technical Scholarship) Malaysia. As known, AOTS has an office in KL and is already engaged in training activities. This is a large-scale training center that incorporates the AOTS office.

At present, AOTS is still searching for a site, and Shar Alam is one site that is being considered. One of the conditions for site selection is that there must be a heavy concentration of companies within the vicinity of the training centre because it anticipates demand for training.

From this aspect, we feel that it is important to adjust projects with these organizations when advancing into the technical centre because it anticipates sufficient demand when considering the accumulation of industries in Penang.

Table IV. 6.3. Summary of JMTC

Contents of Training Projects

- Translation of technical documents (Japanese to English (Malaysian))
- Publishing technical magazines
- Implementing plant, manufacturing and productivity management seminars
- Training on Total Quality Management of ISO9000 and others
- Training on computers (CAD/CAM)
- Training on use of industrial equipment and measuring systems

Object personnel for training

	Mechanical	Electronics	Mechatronic	Computer
Profesional			X	X
Sub-Professional(College Graduate)			X	X
Sub-Professional(Rank-file)	X	X	X	X
Supervisory(Vocational School)	X	X	X	
Technician	X	X	X	
Workers	X	X		

Artificial Design

Main Complex	Ground Floor	1,487.24
	(Meeting Room , etc)	
	1st Floor	963.50
	(Lecture Room., etc)	
Men's Hostel	Ground Floor	439.50
	1st Floor	2,520.00
Ladies' Hostel	Ground Floor	277.50
	1st Floor	1,442.50
Total Floor Area		7,130.25
Total Building Area		2,204.24
(including Parking Area, Tennis Court, Basketball., etc)		12,140.70

IV.6.7 **Sales and Promotion Company**

(1) Objective

The Techno Centre has plans to conduct tests on mechatronics, electronics, inspection and analysis on properties and surfaces, pure water and waste water through three independent specialized centres (Material & Surface Analysis Centre, Electronics Testing Centre, Environmental Analysis Centre).

While the operations at the three centres are separate in terms of the method of analysis and the materials, from the users (manufacturers) viewpoint, these tests and analysis, in many cases, are interrelated. Because of this, instead of assigning individual marketing staff at each centre to take orders, it will be more effective to offer higher quality services to users, and expand business by establishing an organization and sections that perform the comprehensive order taking duties for the three centres.

Also, by unifying marketing departments, it would be easier to get a comprehensive grasp of the state of usage of the three centres or for expanding or modifying the operational fields of the three centres. Moreover, it will be possible to jointly own study data for future possibilities in renewing facilities or to select the field of plant and equipment investments because of the availability of information on the needs of the corporations relating to the three centres. On the other hand, if the three centres each have their own marketing department, it will be difficult to collect customer-related information, and there will arise the possibility of making judgment errors on business matters through the loss of opportunities for receiving service orders.

If each centre is to have its own marketing staff, they will have to secure a certain number of personnel, which could result in deteriorating the earning power of the centre itself. On the other hand, a were few members might not suffice to carry out full-scale order-taking activities.

Thus, a unified organization, or "sector" separate from the three centres should primarily perform marketing and such organization will cultivate demand for the services in common for all of the three centres.

(2) Activities

The major contents of operations are as follows:

- To promote demand for testing, inspection, and analysis for the three centres.
- To in corporate all three centres.
- To offer services as intermediary or for introducing persons and organizations to solve problems within companies.
- To study and research future inspection and analytical functions for the three centres.

Scope of Business

The business territory basically will involve companies located within KHTP to which priority will be given to meet their demands first. However, it will be difficult to run a profitable operation on these companies alone. Therefore, the territory shall cover the regions of KL and Johor where there are heavy concentrations of industries, centering around the northern states of Kedah, Penang and Perak.

(3) Organizational Structure

Organization

The most important operation for this organization is to develop demand for the services offered by the three centres. In order to promote these businesses, it is necessary to assign personnel who are knowledgeable about the three centres, those who are familiar with the respective fields and those who have specialized knowledge. In order to promote marketing efforts, the best means would be privatization.

Notably, for managerial personnel, it is necessary to use persons who have specialized knowledge and detailed knowledge of industries. The staff working under the managers must have specialized knowledge and business sense.

As for marketing, public organizations are generally involved in promoting demand also, and in most cases, the salaries of public servants remain unchanged regardless of their performance in order taking.

Therefore, it is believed that private organizations system will have better effect of motivating marketing personnel in order taking activities. For managers, it is important to select persons who have good contacts within industry. Thus, from the standpoint of business, it is preferable to hire private citizens. It is also desirable to offer incentives to marketing personnel to reflect their performance in their salaries.

Manpower Plan

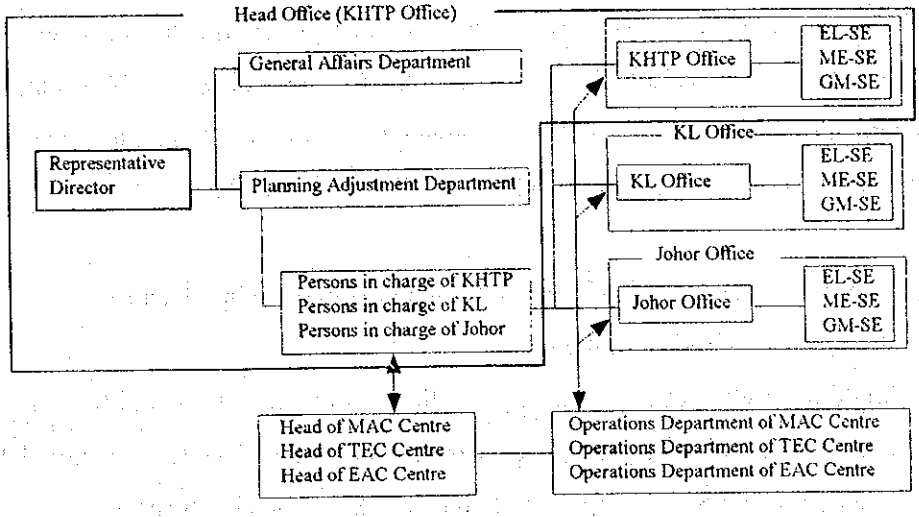
1) Manpower plan is based on the following policy.

- Assigning sales persons by each industrial category
- Assigning liaison personnel to link the centres with industries and government
- Assigning personnel on regional basis
- Assigning liaison personnel to overseas markets.

Among these, the most important would be the business efforts on industry basis because the most important item is to develop individual market channels.

2) Organization

Organizational Structure Roles of Each Department



	First Phase	Second Phase	Third Phase	Role and Business Content
Representative Director	1	1	1	Channel to business and government circles Sales activity by top management
Planning Adjustment Department	1	1	1	Formulate order taking activity plan, marketing strategy etc Mutual adjustment of three dispersed offices
Persons in charge of KHTP		1	1	
Persons in carge of KL		1	1	
Persons in charge of Johor				
Persons in charge of Overseas markets	1	1	2	Develop overseas markets
General Affairs Department	2	2	3	Accounting etc.for all
Head of KHTP Office	1	1	1	Operational base for kedah,Penang,and Perak states
EL-SE	3	9+1	10+1	
ME-SE	3	(One manager still undecided)	(One manager still undecided)	Operational base for overseas territories including Thailand,Singapore and Indonesia
GM-SE	3			
Head of KL Office	1	(1)	(1)	Marketing base for the territory of KL, Selangor and Malacca states
EL-SE		1	3+1	
ME-SE		1	(One manager still undecided)	
GM-SE		1		
Head of Johor Office			1	Marketing base for the territory of Johor state and Singapore
EL-SE				
ME-SE				
GM-SE				
Total	15	19	24	

* The post is taken by the one selected from among the Sales Engineers of these fields
EL-SE (Electronics fields Sales Engineers)
ME-SE (Micro-Electronics field Sales Engineers)
GM-SE (General Manufacturing field Sales Engineers)

IV. 7 Selection of Facilities and Equipment

Based on the management strategies of the Techno Centre, the facilities and equipment to be introduced will be sophisticated from the initial phase. The outline plan of each centre describes the list of the equipment to be procured. In this section, the general principles for selection and procurement will be described.

For the technical appeal and financial stability of the Techno Centre
-The selection of the equipment
-Should be based on the sound needs of the users in the KHTP and the surrounding areas,
-Should be advanced and unique to make the Centre an excellent research laboratory,
-Should promote R & D capabilities and shift to high-tech industries.

For the sound management of the Techno Centre,

(Human Resources)
The centre should employ staff well experienced in the operation of equipment and capable of conducting analyses with that equipment, and continue to train the staff to upgrade their skills and knowledge.

(Operation/Maintenance)

-Maintenance Contract

The items to be checked for maintenance should be as follows;

-interval, and items of maintenance
-guarantee of parts supply and stock
-ease of maintenance
-inexpensive maintenance cost
-prompt response in maintenance services
-qualification in standards and certification
-availability of consumable materials, gases, standardized test piece etc.

Table IV.7.1 List of Equipment

Unit(RM '000')

	1st phase	2nd phase	3rd phase	Total
A. MECHATRONICS TESTING CENTRE				
(1) EMC Engineering				
-Anechonic Chamber	8,600			8,600
-Instruments	4,300			4,300
sub Total	12,900			12,900
(2) Electronics Testing				
-High Temp & humidity burn-inn test system		860		860
-Electronic voltmeter	5 × 5 = 25			25
-Digital multimeter	10 × 5 = 50			50
-Oscilloscope	11 × 5 = 55			55
sub Total	130	860		990
B. MATERIAL & SURFACE ANALYSIS CENTRE				
(1) Material Analysis				
-Dynamic micro hardness tester	110			110
-Brinnel hardness tester	30			30
-Surface roughness tester	120			120
-Three dimensional profiler	1,370			1,370
-Torque testing machine	80			80
-Impact testing machine	50			50
-True circle tester	160			160
-Universal material testing machine	550			550
-Scanning ultrasonic microscope(SUM/SAM)	860			860
-Differential scanning calorimeter	100			100
-Differential thermal analyser	75			75
sub Total	3,505			3,505
(2) Material Surface Analysis				
-Electron probe X-ray microanalyser (EPMA/EDS)	3,480			3,480
-Transmission electron microscope (TEM)	2,140			2,140
-X-ray photoelectron spectrometer (ESCA)		2,570		2,570
-Secondary ion mass spectrometer (SIMS)	3,430			3,430
-Scanning auger electron spectrometer (AES)		3,140		3,140
-Scanning probe microscope (SPM)		720		720
-Scanning Tunneling microscope (STM)		2,000		2,000
-Focused ion beam system	2,000			2,000
-FE-Scanning electron microscope (FE-SEM)			1,500	1,500
-Raman spectrophotometer		1,060		1,060
-Microscopic picture storage unit	220			220
-Fourier transform infrared spectrophotometer	110			110
-X-ray fluorescence spectrometer	1,290			1,290
-X-ray diffractometer	400			400
-Optical microscope	85			85
-Specimen making equipment	1,140			1,140
sub Total	14,295			25,285
C. ENVIRONMENTAL ANALYSIS CENTRE				
-Atomic absorption spectrophotometer	190			190
--do-(Flameless)	250 × 2 = 500			500
-Ion chromato analyser	100 × 2 = 200			200
-Gas chromatograph	70			70
-Gas chromatograph mass spectrometer	320			320
-High performance liquid chromatograph	170			170
-Inductively coupled plasma mass spectrometer	1,030			1,030
-Inductively coupled plasma spectrometer		460		460
-Ultrasonic nebulyser		140		140
-O.D meter	7 × 3 = 21			21
-pH meter	10 × 3 = 30			30
-Spectrophotometer	20			20
-Constant Temperature humidity chamber	92			92
-Thermogravimeter	72			72
-Water purifier	30			30
-Total organic carbon analyser	125 × 2 = 250			250
-Total nitrogen analyser	285			285
-Silica analyser	170			170
-Fume and waste fluid Treatment equipment	2,860			2,860
sub Total	6,310	600		6,910

Unit(RM '000')

	1st phase	2nd phase	3rd phase	Total
D. PROTOTYPE PRODUCTION				
- CNC precision lathe			570	570
- Lathe			200	200
- Drilling machine			70	70
- Universal tool grinder			80	80
- CNC vertical milling machine			630	630
- Precision surface planar			630	630
- Bench grinder			12	12
- Bench drilling machine			10	10
- Jig plate			60	60
- Metal band saw			200	200
- Plate bending machine (Brake press)			140	140
- shearing machine			140	140
- Electric welding equipment			23	23
- Oxi-acetylene welding apparatus			5	5
sub Total			2,770	2,770
E. LABORATORY EQUIPMENT				
- Drying oven	12 × 5 = 60		12 × 5 = 60	120
- Centrifuge	20 × 5 = 100		20 × 5 = 100	200
- Autoclave	20 × 5 = 100		20 × 5 = 100	200
- Water distilling unit	15 × 5 = 75		15 × 5 = 75	150
- Refrigerator	26 × 5 = 130		26 × 5 = 130	260
- Draft chamber	52 × 5 = 260		52 × 5 = 260	520
- Center table	20 × 10 = 200		20 × 10 = 200	400
- Side table	10 × 90 = 900		10 × 90 = 900	1,800
- Side sink	10 × 20 = 200		10 × 20 = 200	400
- Cabinet	12 × 20 = 240		12 × 20 = 240	480
- Shelf	10 × 20 = 200		10 × 20 = 200	400
- Glass ware & utensils	75		75	150
sub Total	2,540		2,540	5,080
F. OTHERS				
- Work station	30 × 4 = 120			120
- Server	90			90
- Personal computer	6 × 60 = 360			360
sub Total	570			570
Total	40,250	10,950	6,810	58,010

CHAPTER V

SPATIAL DESIGN OF TECHNO CENTRE

V SPATIAL DESIGN OF TECHNO CENTRE

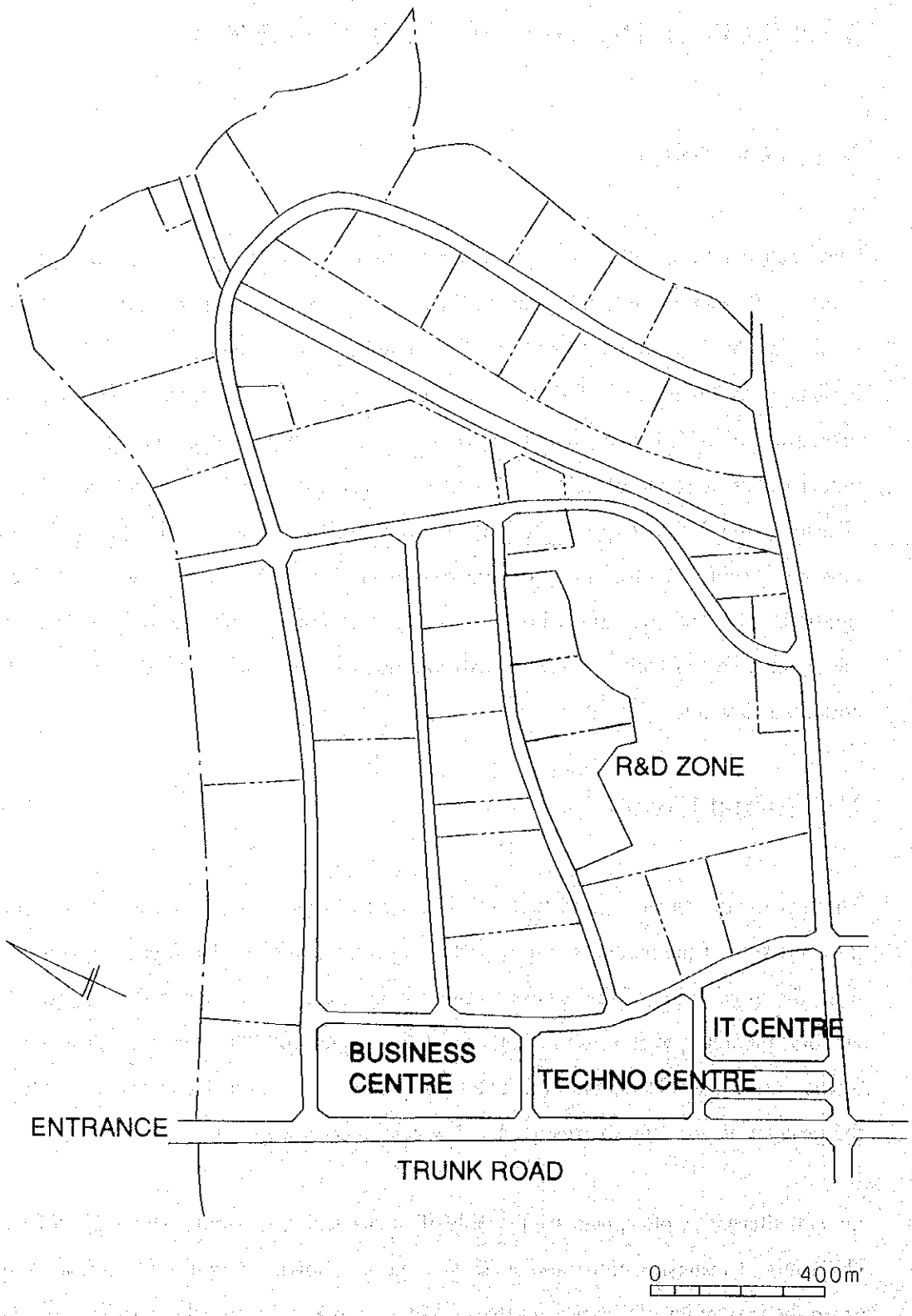
V.1 Basic Policy

The Techno Centre will be located in one of the lots along the trunk road running north-south. In its vicinity, lots are planned for Business Centre and Information Technology Centre in a linear layout, and a little off to the east a lot for the government R & D zone is planned as illustrated in FigureV.1.1. These institutions are intended to conduct sales promotion of KHTP land, and support the research and development activities of the industries in and out of KHTP. Therefore, these lots can be collectively called the "Business and R & D Core" of KHTP. It will be the basic policy of this Study Report to have the Techno Centre play a central role in the Business and R & D Core. This can rightly be claimed given the wide range of R & D support services and the long range perspective vested with the Centre toward industrial development of the region and the country as a whole.

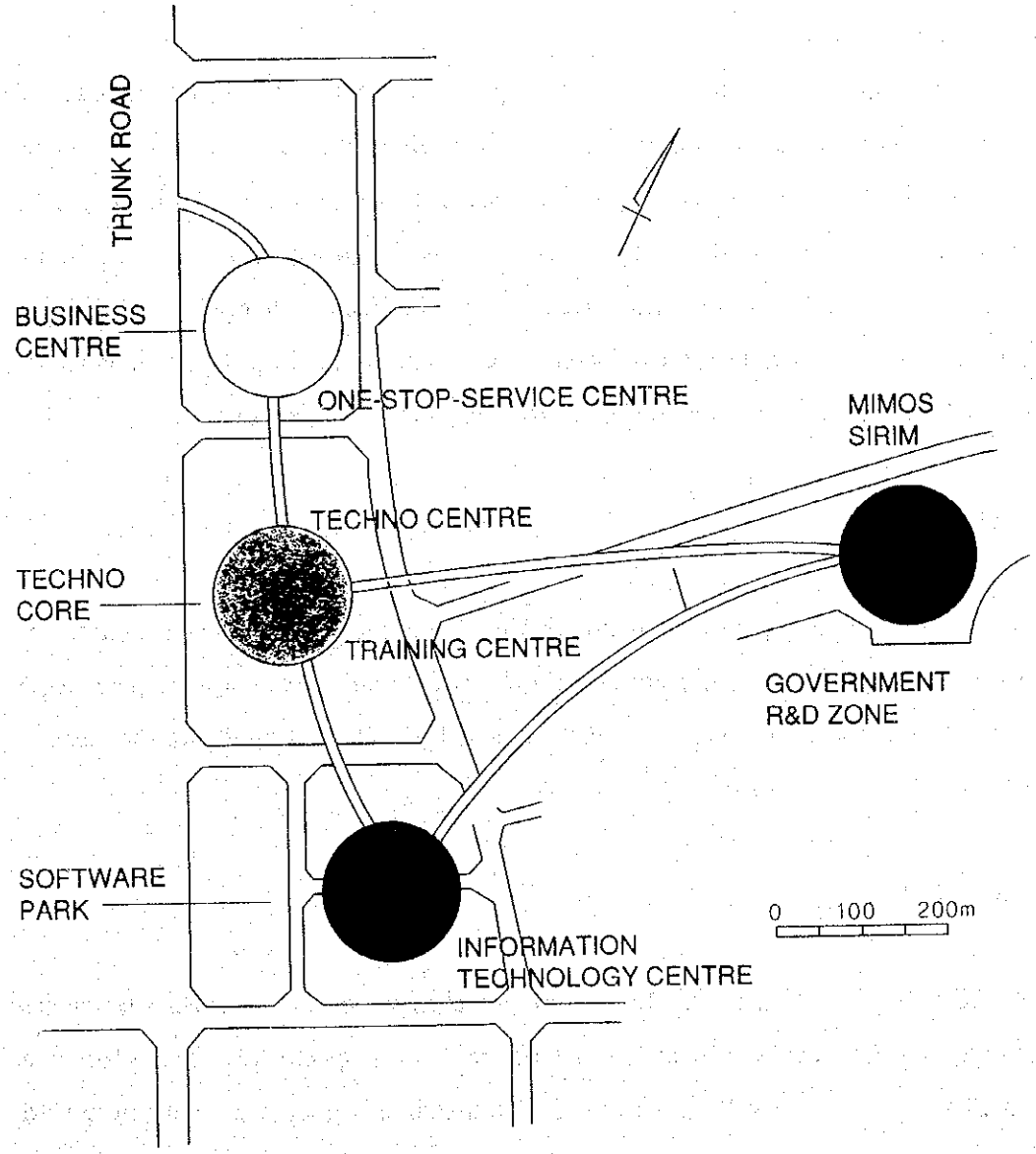
V.2 Spatial Layout

The lots for the Business and R & D Core are laid down encircling the factory lots on the west side of the industrial estate and along the trunk road. The layout is dually ideal from the view point of the access to these from the factories and of the approach for visitors. Incoming visitors would on their left see one building after another as they go further into the KHTP compound. The layout would also put a clean separation between the production area and the research and development activity area.

Several alternative plot plans are possible, if theoretically, to arrange the Techno Centre, IT Centre, Business Centre and R & D zone as shown in Figure 5.1 in the Annex. From the viewpoint of connecting these Centres and Zone physically and functionally as well as of the Techno Centre's central role, evidently, the one illustrated in Figure V.2.1 seems the best.



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) ECONOMIC PLANNING UNIT, THE GOVERNMENT OF MALAYSIA STUDY ON MANAGEMENT AND PLANNING OF R&D SUPPORTING FACILITIES (TECHNO CENTRE) FOR KULIM HI-TECH INDUSTRIAL PARK	Figure V.1.1 1st Phase Layout Plan Japan Industrial Location Centre Nippon Koei Co., Ltd.



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) ECONOMIC PLANNING UNIT, THE GOVERNMENT OF MALAYSIA STUDY ON MANAGEMENT AND PLANNING OF R&D SUPPORTING FACILITIES (TECHNO CENTRE) FOR KULIM HI-TECH INDUSTRIAL PARK	Figure V.2.1 Spatial Relationship of Business and R&D Core Japan Industrial Location Centre Nippon Koei Co., Ltd.

V.3 Spatial Design

V.3.1 Business Centre

Here, a one-stopservice centre will be set up for marketing, legal and commercial advisory services to customers, operation and maintenance of common or public facilities in KHTP along with administration activities. Approach to the lot could be taken on the west side from the trunk road and another from the sub-road on the south for a smooth traffic flow from the trunk road toward the Techno Centre lot. An idea is suggested to use the bottom of the adjacent flood retention pond on the north as sports courts such as a tennis court which will be usable during the dry seasons.

V.3.2 IT Centre

The IT Centre building is placed in the centre of the site, is surrounded by lots for software development firms, constituting the Software Park. Accesses are also taken both on the east and north sides for connection with the R & D zone and the Techno Centre lot.

V.3.3 R & D Zone

Here, MIMOS and SIRIM plan to set up branches to engage in microelectronics technology development and advanced material research respectively. This place is a little higher in ground level than the others, commanding a good view with preserved forest on the background, something a research organization and central government institutes could possibly enjoy.

V.3.4 Techno Core

This lot will accommodate skill upgrading training centres in addition to the Techno Centre. The entire lot could be collectively called the Techno Core and will be designed as a complex; in between the Techno Centre on the north and the training

centres on the south, a plaza will be placed as a gathering spot for the entire Business and R & D community.

V.3.5 Plaza

It is recommended to have the plaza play a very significant role in the Business and R & D community, creating a very pleasant space with greenery landscaping and artificial structures and furnishings. People will get together, mill about, relax, chat, eat, exchange ideas, engage in sports activities etc. Pergola frames, which will render a transitional space between outdoor and interior, will be erected to connect the various buildings and to provide shaded or non-shaded promenade and pocket sitting corners. Open food court, an artificial pond in a shape of Kedah State perhaps, a symbol tower reminiscent of a minaret of mosque, or even tennis courts or swimming pool could be provided for comfort and pleasure. The plaza might as well be provided with access roads for vehicles connecting with such places as R & D Zone or Town Centre by a ramp or an overbridge as illustrated in Figure V.3.1

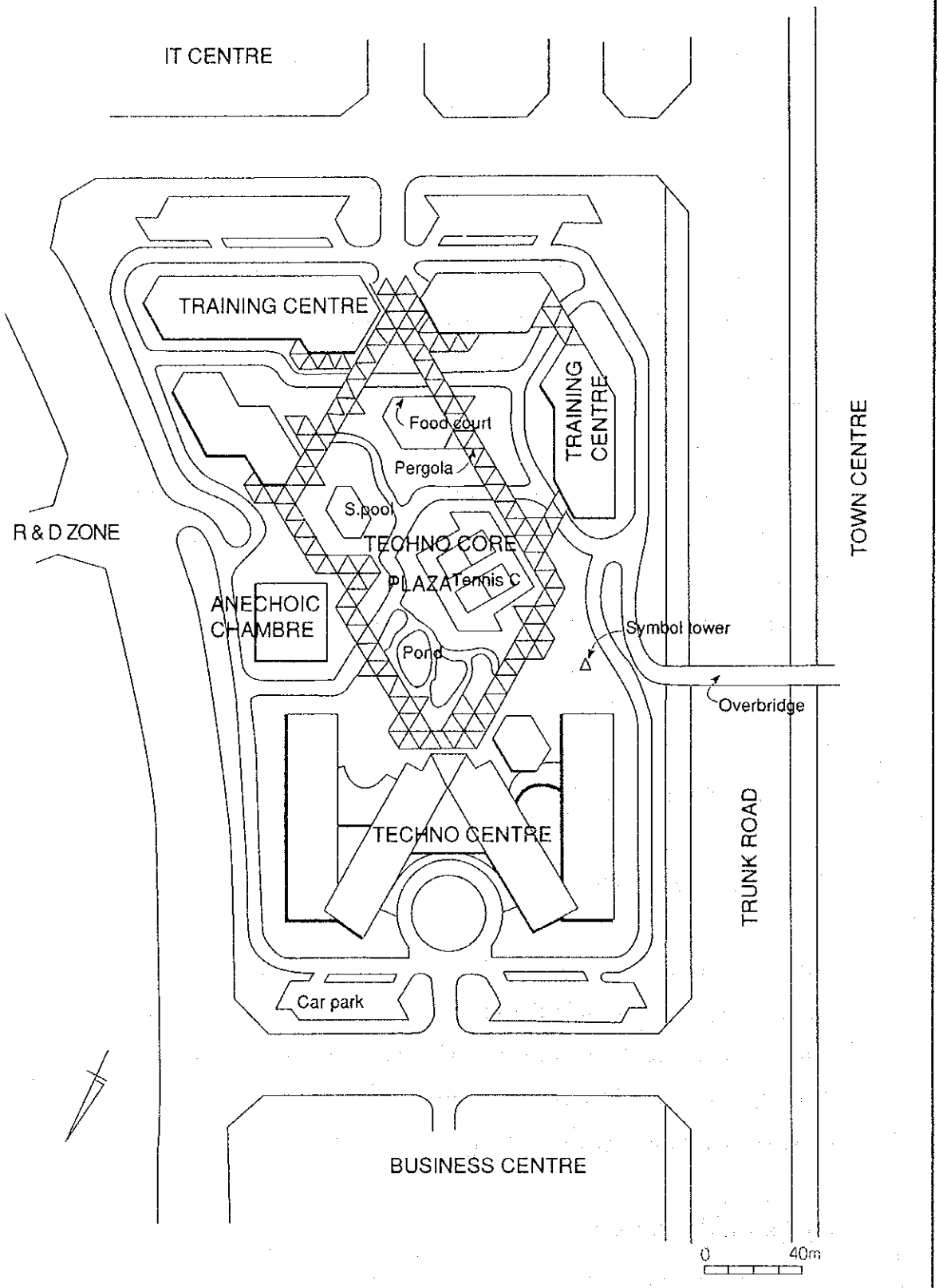
V.3.6 Overall Architectural Profile

(1) Existing Land Conditions

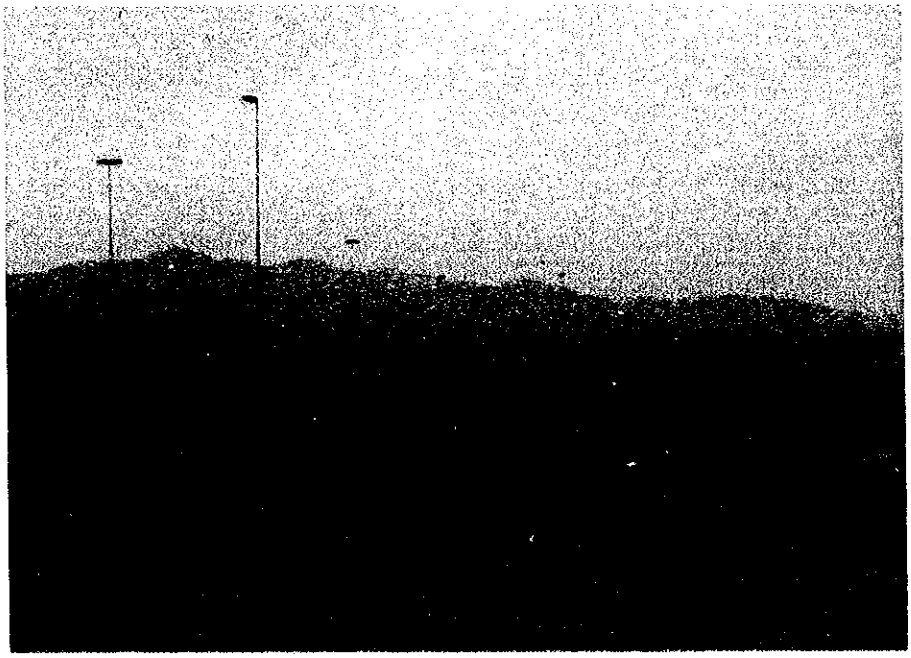
The proposed land for Business and R & D Core are all flat and level, free of obstacles for construction as shown in Figure V.3.2. As the land has been reclaimed from rather hilly terrain, terraces are inevitably in existence as illustrated in Figure 5.2 in the Annex. Although the level differences are small, this condition might better be taken into consideration in planning access to each site.

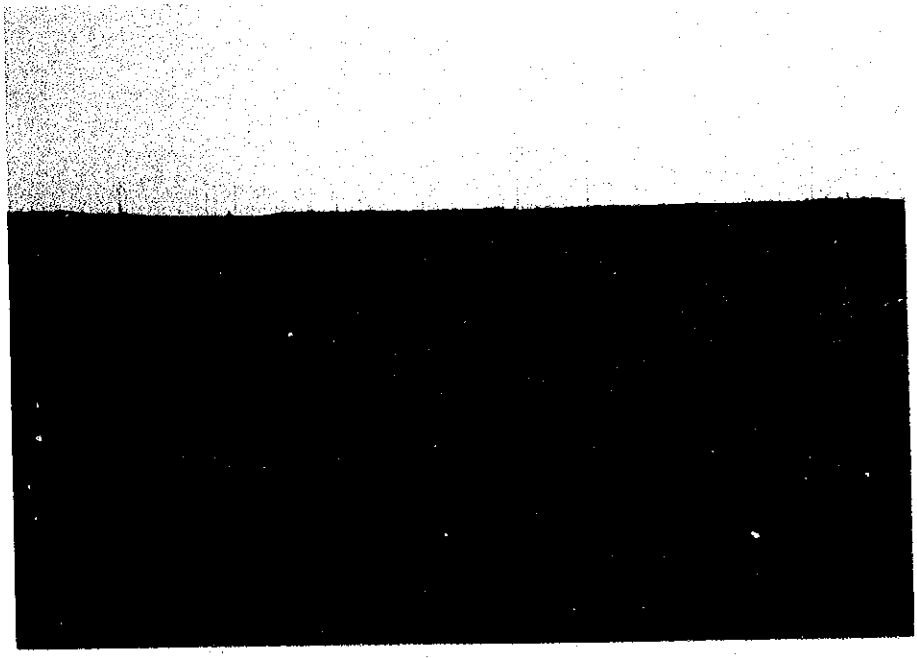
(2) Triangle and Hexagon

Taking a cue to the hexagonal shape of the IT Centre building (refer to Figures 5.13 and 5.14 in Annex), of which construction will start soon, and to the fact that triangle and hexagon is one of the underlying architectural consciousness in Malaysia, diagonal lines



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) ECONOMIC PLANNING UNIT, THE GOVERNMENT OF MALAYSIA STUDY ON MANAGEMENT AND PLANNING OF R&D SUPPORTING FACILITIES (TECHNO CENTRE) FOR KULIM HI-TECH INDUSTRIAL PARK	Figure V.3.1 Techno Centre Layout Plan Japan Industrial Location Centre Nippon Koei Co., Ltd.





JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) ECONOMIC PLANNING UNIT, THE GOVERNMENT OF MALAYSIA STUDY ON MANAGEMENT AND PLANNING OF R&D SUPPORTING FACILITIES (TECHNO CENTRE) FOR KULIM HI-TECH INDUSTRIAL PARK	Figure V.3.2 Site Condition for Techno Centre Japan Industrial Location Centre Nippon Koei Co., Ltd.

could be employed to configure various structures in the Business and R & D Core. This will maintain a consistent design concept throughout and help create a distinctive feature of the Business and R & D Core. An example is given in Figure 5.3 in the Annex.

V.4 Architectural Design

V.4.1 Architectural Design

(1) Design Procedure

Architectural design of the Techno Centre will be carried out in the following sequence:

- Architectural design concept
- Scope of services rendered at the Centre
- Space requirement for each service
- Functional relationship of each space
- Movement lines of people and goods
- Safety and security

(2) Architectural Concept

One would start the architectural design by bearing some basic image which he wants to embody in the building feature or use as the basis to elaborate on. In view of the discussions so far made in section IV, the following concept will be laid down:

- Malaysia's aspiration toward industrial advancement
- Symbolic identity as the centre for high-tech drive
- Modern technology
- Subtlety of the minds of the people of Malaysia

Several key words will be employed as media to represent the above notion as given below:

- Colonnade reminiscent of a Mosque

- Courtyard and plaza, where minds of people meet
- Atrium, also the same as above
- Metal and glass representing modern technology
- Water or pond, representing serenity and purity

(3) Services Rendered at the Centre

Following the discussion in Section IV, scope of services will be summarized as given in Table V.4.1.

Table V.4.1 Scope of Services at Techno Centre

FUNCTION	SERVICES	
R&D SUPPORT FUNCTION	Testing and analysis	Surface analysis Condition analysis Microspic observation
	Electronics testing	Electromagnetic interference test Electromagnetic susceptibility test
	Environmental monitoring	Industrial waste and effluent test
	Product and material testing	Electronic test Material test Environmental impact test
INCUBATION FUNCTION	Incubation room rental Prototype production Secretary service (copy, type, fax, accounting etc.) Venture capital advisory Market survey Office furniture and equipment rental Patent and legal advisory Technical advisory Debt guarantee advisory Start-up advisory	
SUPPORTING INDUSTRIES FUNCTION	Laboratory rental	
HUMAN RESOURCES DEVELOPMENT	Seminar & training	Managing seminar Technical seminar Upgrading seminar Advanced technology seminar Skill training (hi-class, mid-class, lo-class)
	Advanced technology inspection tour	At private industry At research institute (incl. overseas trip)
	On-job special training	At selected industry
INFORMATION SERVICE FUNCTION	Database reference Linkage with information network through IT Centre Library (technical books, journals, industrial standards, etc.) Information on regional industries Computer workstation rental	
EXCHANGE FUNCTION	Intra-industry exchange forum Joint research promotion forum Academic forum Industrial exhibition, fair Membership research society	
COMMON SERVICE	Office automation equipment rental Restaurant, coffee shop Shop Bank, insurance company, post office Recreational facilities (indoor gym, swimming poor, tennis court) Patent application Clinic, health check	

(4) Space Requirement for Each Service

Various rooms and spaces corresponding to the foregoing services will then be run down as given in Table V.4.2.

Table V.4.2 Space Requirement and Priorities

No.		Priority		
		I	II	III
1	R&D SUPPORT SERVICES			
	Analysis laboratory	0		
	Environmental monitoring centre	0		
	Electronics testing laboratory	0		
	Material/product testing laboratory	0		
2	INCUBATION SERVICES			
	Incubation room	0		
	Secretary service room	0		
	Consulting room	0		
	Prototype production shop		0	
3	SUPPORTING INDUSTRIES SERVICES			
	Rental laboratory	0		
	Open laboratory	0		
	Special laboratory (industrial clean room)		0	
4	HUMAN RESOURCES DEV. SERVICES			
	Seminar room		0	
	Training room	0		
5	INFORMATION SERVICES			
	Library	0		
	Information service room	0		
6	EXCHANGE SERVICES			
	Conference room	0		
	Exhibition hall			0
	Multipurpose hall			0
	Lounge	0		
7	COMMON SERVICES			
	Bank, insurance company		0	
	Restaurant, coffee shop, shop	0		
	Post office		0	
	Clinic		0	
	Patent office	0		
	Supply depot	0		
	Indoor gym		0	

(5) Functional Analysis of Spaces

Hereafter, the functional relationship between the foregoing rooms will be analysed to achieve horizontally and vertically efficient arrangement. The result is illustrated in Figure V.4.1.

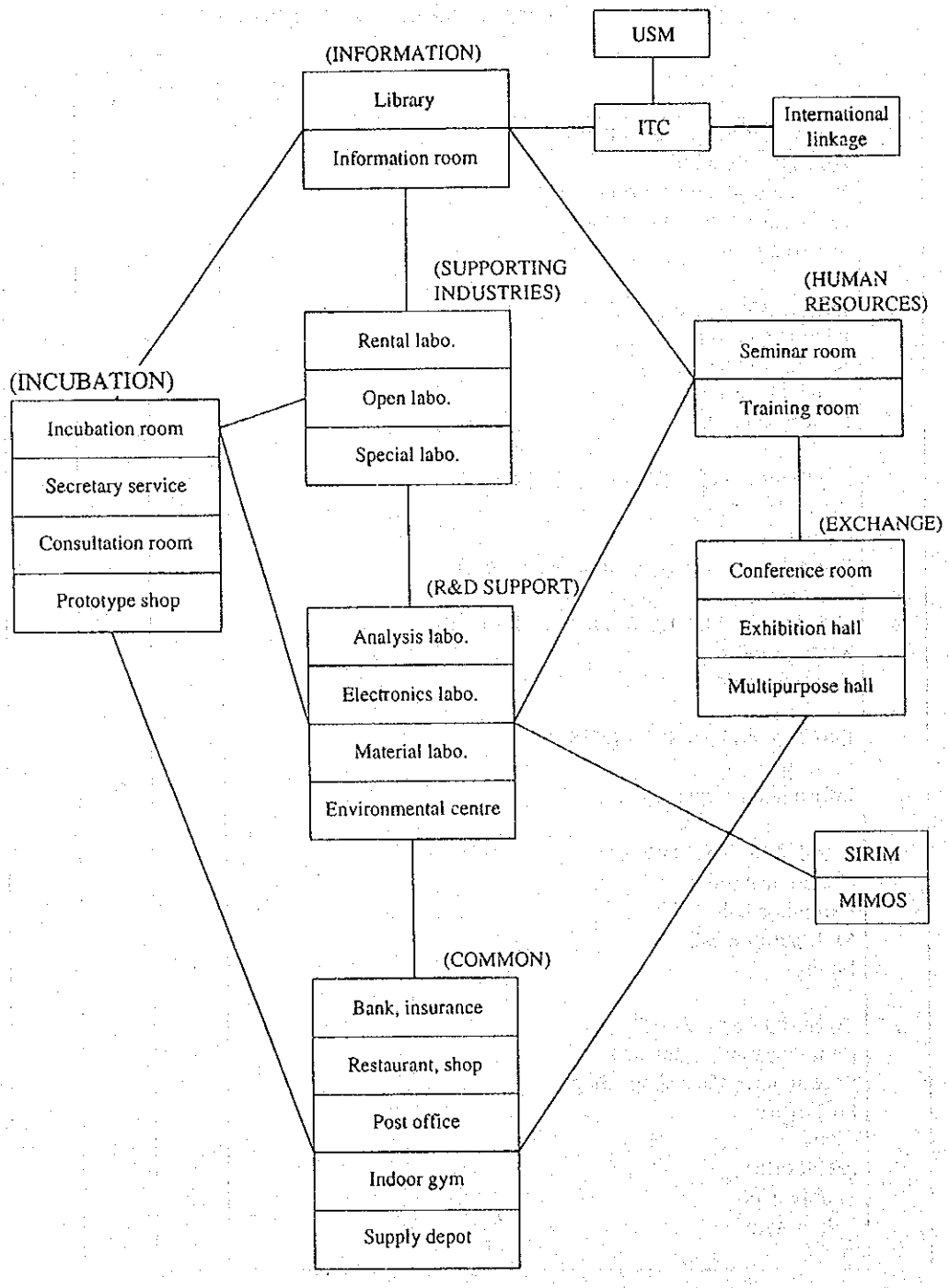


Figure V.4.1 Function & Spatial Relationship

(6) Configuration of the Building

Thought will be given to the following aspects in shaping the overall features of the building.

- Symbolic identity
- Close relation with the Plaza
- Inviting feature of approachway for visitors

The first idea is to have a clustered building as illustrated in Figure 5.4 in the Annex on its upper left. This shape is good in relating the building with the Plaza on the south but poor in inviting visitors on the approach side; bedsides, it is increasingly poor in giving an identity to the building. A solid shape may be better in giving a distinctive feature, but again poor in relation with the Plaza and the approach side. Train of thought would in the end lead to the M-letter shaped winged building as shown on the right bottom.

(7) Blocking Plan

The winged shape of the building would enable the assignment of functions wing by wing. A clear separation of functions eliminates the conflict of movement lines of people and goods. This feature is illustrated in Figure 5.5 in Annex, where central wings will stand higher than the others to secure a feeling of stability and to draw the eyes of people toward the centre.

(8) Atrium

An atrium will be placed in the centre of the building, and the upper space of it will be voided up to the roof which will be entirely covered with glass on steel. The glazed roof will be sloped up toward the junction of the wings constituting a triangle roof. The atrium will be provided with see-through caged elevators, artificial pond with a fountain or cascade and surrounded with shops, coffee shop, restaurant etc. for comfort and enjoyment. The pergola frames are encroaching into the atrium on the Plaza side for easy access for the outside community on this side.

(9) Expandability

If necessary, the building could be expanded wing by wing as illustrated in Figure 5.6 in Annex. To put a floor on top of the other is practically a little hazardous if not too difficult. Steel structures instead of reinforced concrete can be used for this purpose using dry-construction method, minimizing the chance of disrupting ongoing operations. Horizontal expansion on the other hand is rather easy on the ground floor at the east and west wings in north-south direction.

(10) Unit Module

Upon examination of the sizes of laboratory for various purposes, a column line grid of 6.5 m (bay) and 8 m (span) accompanied with 4 m intermediate central span is found to be very flexible and versatile in use. This grid will snugly accommodate various types of laboratories and incubation rooms as illustrated in Figure 5.7 and 5.8 in Annex in addition to seminar rooms, offices etc. This grid will be used as the unit module throughout the building.

(11) Flexibility of Space Use

Because of the flexibility of the unit module as introduced in the above paragraph, conversion of a room from one purpose to another can be done as illustrated in Figure 5.8 in Annex, where with the provision for a utility shaft for piping, cabling and air ducting, an incubation room can be converted to a laboratory quite easily, and vice versa.

(12) Architectural Finishes

Exterior finishes of the building will be either of aluminum curtain wall which, though a little expensive, would imply the shifting from concrete age to metal age in the construction industry giving a hi-tech sort of feeling, or ceramic wall tile which will give the building a sedate and neat impression if properly done, something desirable for a research laboratory. Another point is that the IT Centre is going to be clad with

aluminum panels. If the consistency of the exterior finishes is considered desirable, aluminum panels will be used for the Centre as well.

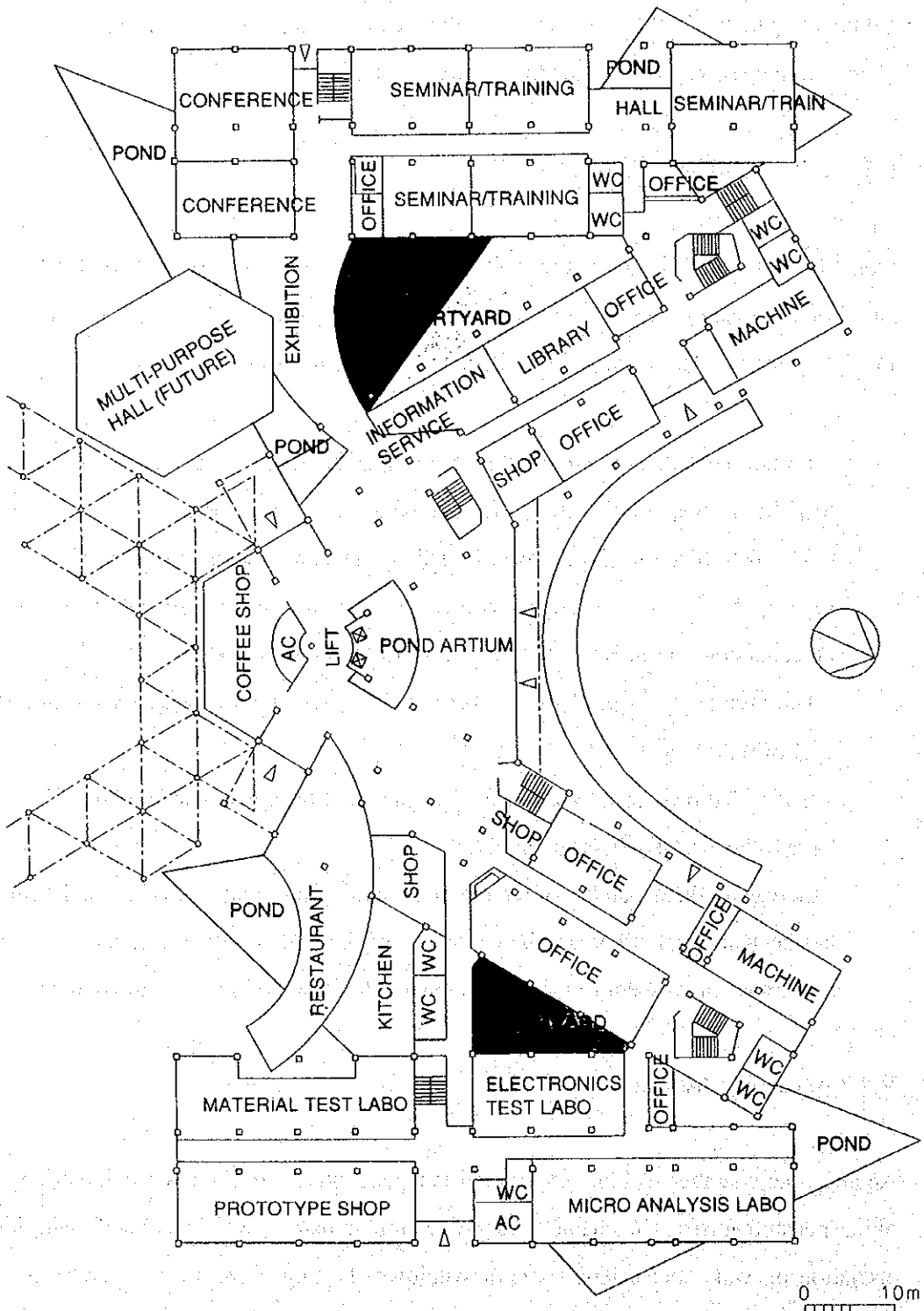
(13) Scale of Building

Plans, sections and elevation given in Figure V.4.2 thru FigureV.4.5 are worked out based on the result of the survey and analyses as discussed previously in Sections III and IV. The design is also examined for adequacy by the following relevant facts:

- Techno centres on prefectural level in Japan have on average about 8,000 m^2 of total floor area; possibly the bottom line for the Techno Centre
- The fact that the Centre was initially planned to mainly serve KHTP. In this regard, the Centre can be considered as an additional investment to the overall investment of about RM100 million for the 1st phase of KHTP.
- The preliminary plan of the Centre in the Master Plan of KHTP has a total floor area of 9,200 m^2.
- If the Centre is to play a more important role than just a local centre, it would have to be a relatively large building.
- Increasing the capability of testing and measurement will be easy once the finance has been secured; whereas, the expansion of the building is time consuming, hence it is a wise investment to have a little extra allowance of space to the building.

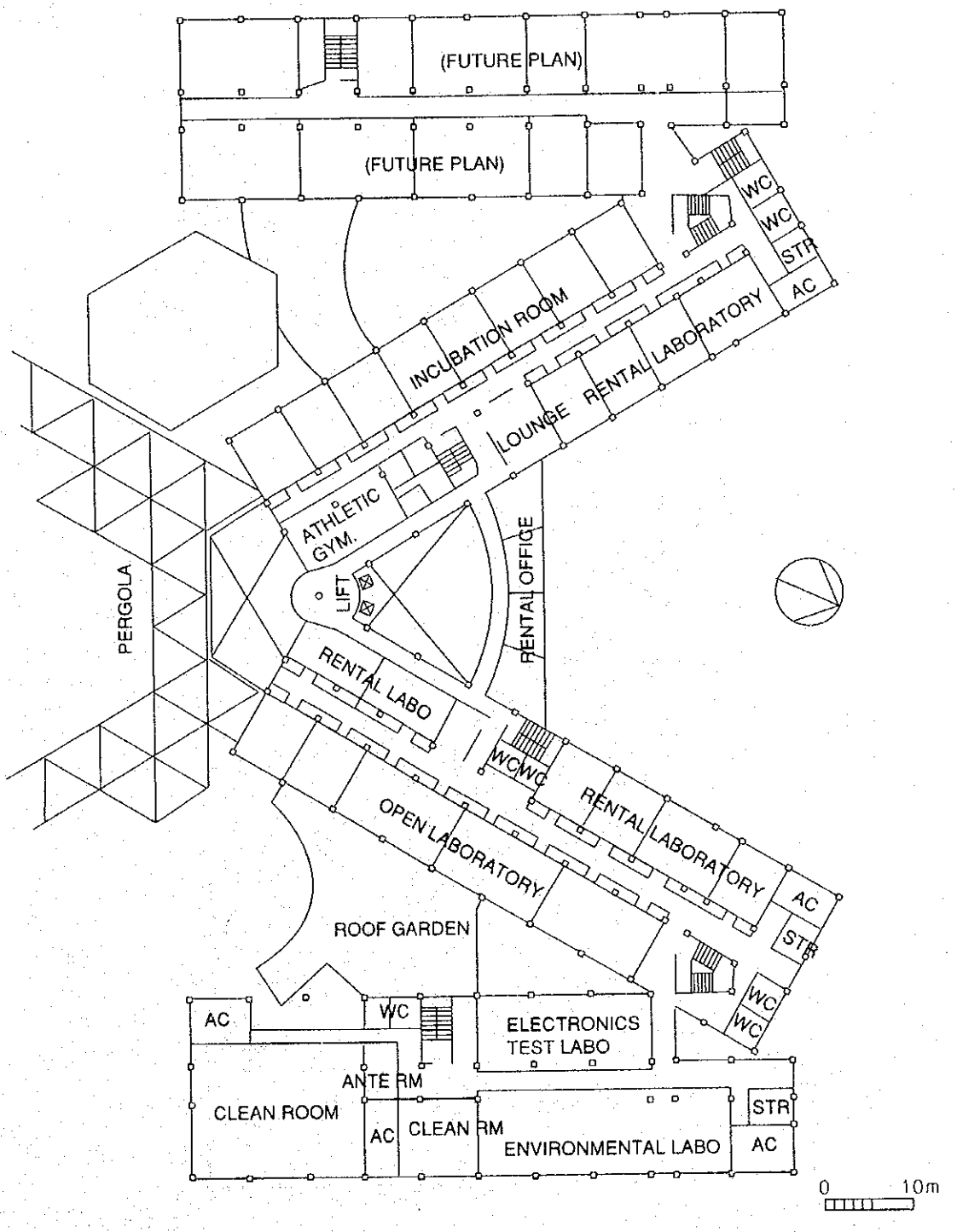
V.4.2 Anechoic Chamber

An anechoic chamber will be constructed independently from the main building because of its special features. The chamber has to be large in plan as well as in height with heavy insulation on walls and ceiling without windows. Testing objects may vary from small electronic gadget to large driving engine, the fact that requires easy access from outside. A test will last for hours or days, so even a bedroom will be needed for testing personnel. An example of an anechoic chamber is given in Figure V.4.6; however, consultation with a specialist company is called for to work out practical design.



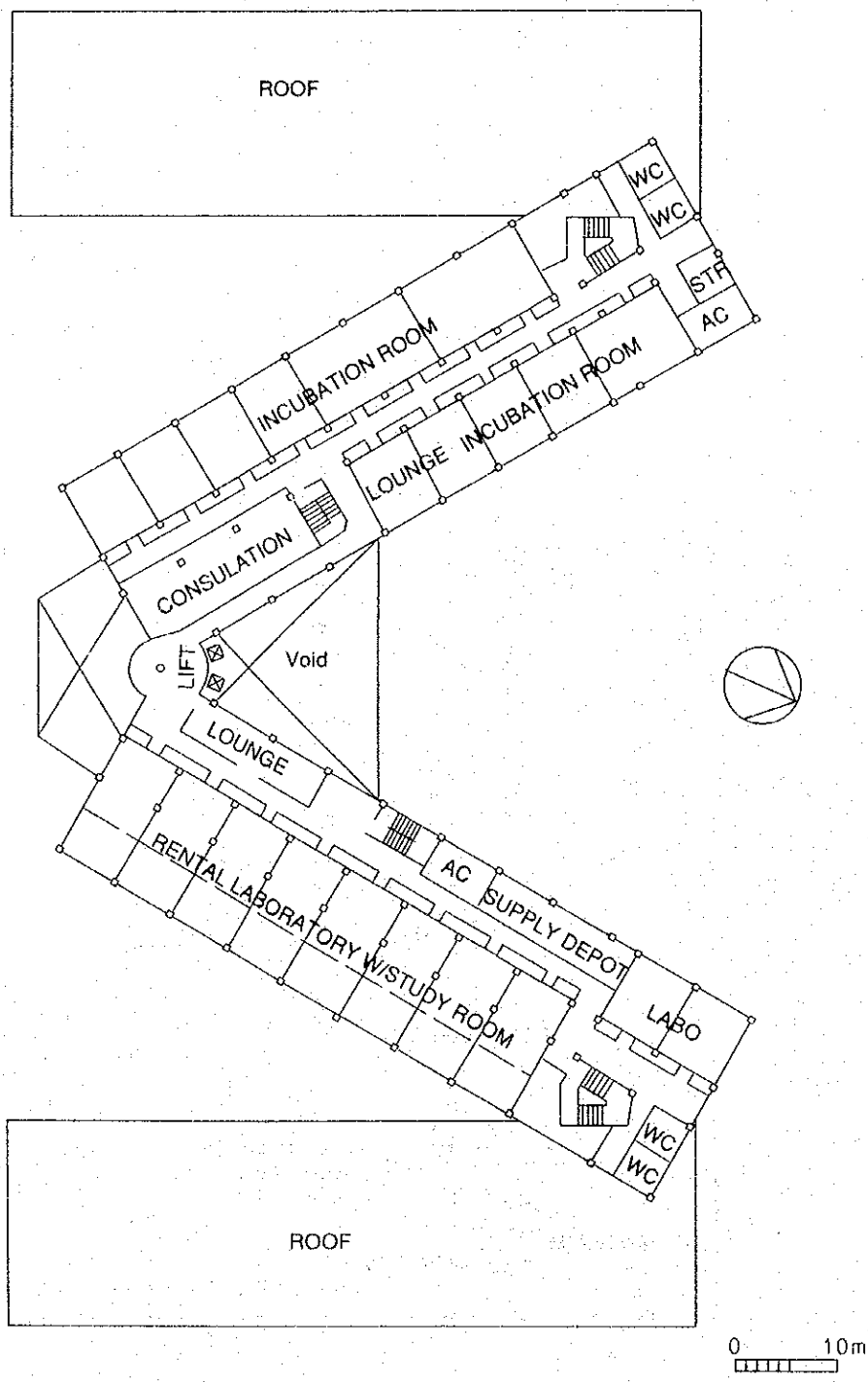
FLOOR AREA : 6,200m²

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) ECONOMIC PLANNING UNIT, THE GOVERNMENT OF MALAYSIA STUDY ON MANAGEMENT AND PLANNING OF R&D SUPPORTING FACILITIES (TECHNO CENTRE) FOR KULIM HI-TECH INDUSTRIAL PARK	Figure V.4.2 Techno Centre Ground Floor Plan Japan Industrial Location Centre Nippon Koei Co., Ltd.



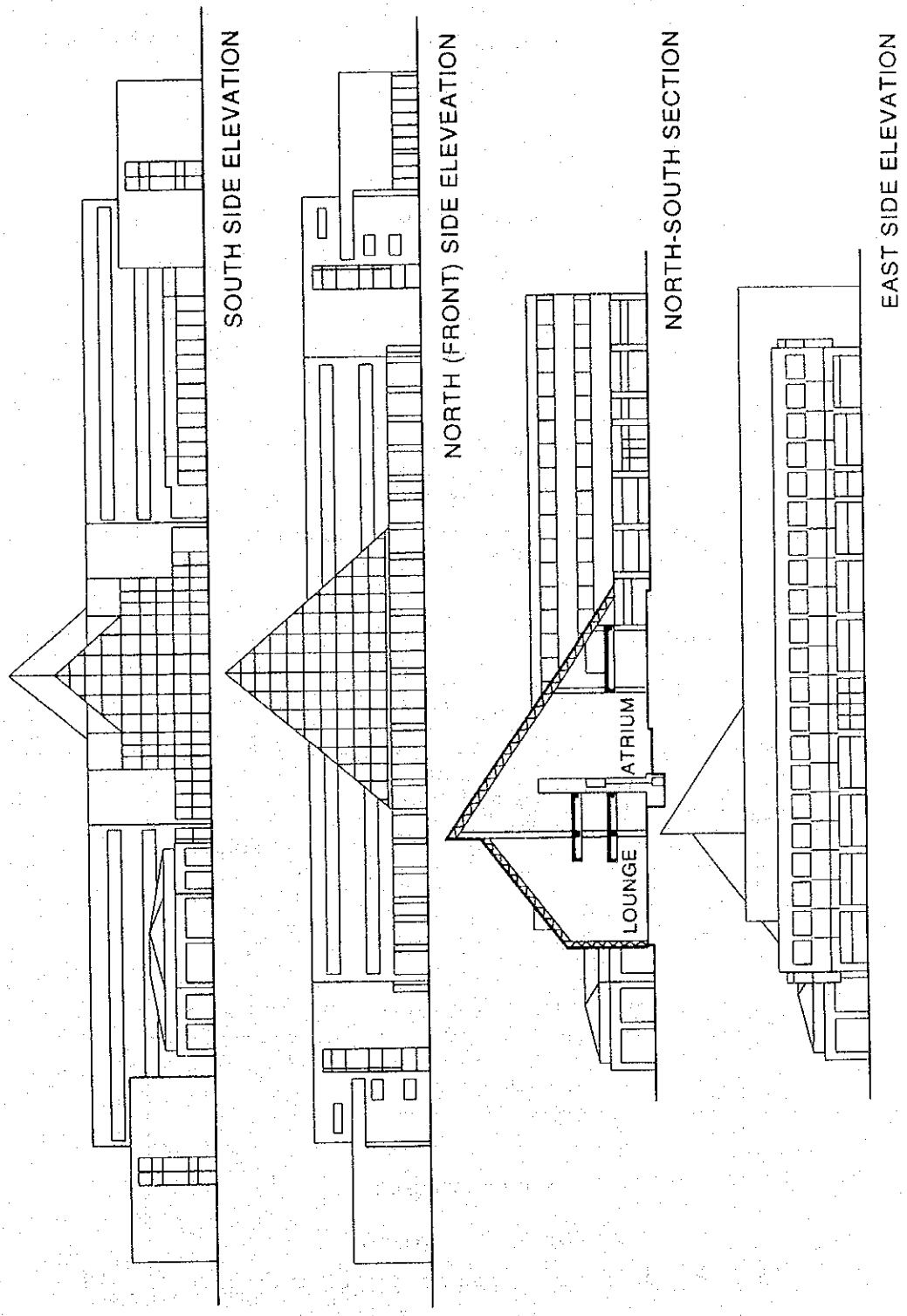
FLOOR AREA : 5,370 m^2

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) ECONOMIC PLANNING UNIT, THE GOVERNMENT OF MALAYSIA STUDY ON MANAGEMENT AND PLANNING OF R&D SUPPORTING FACILITIES (TECHNO CENTRE) FOR KULIM HI-TECH INDUSTRIAL PARK	Figure V.4.3 Techno Centre 1st Floor Plan Japan Industrial Location Centre Nippon Koei Co., Ltd.

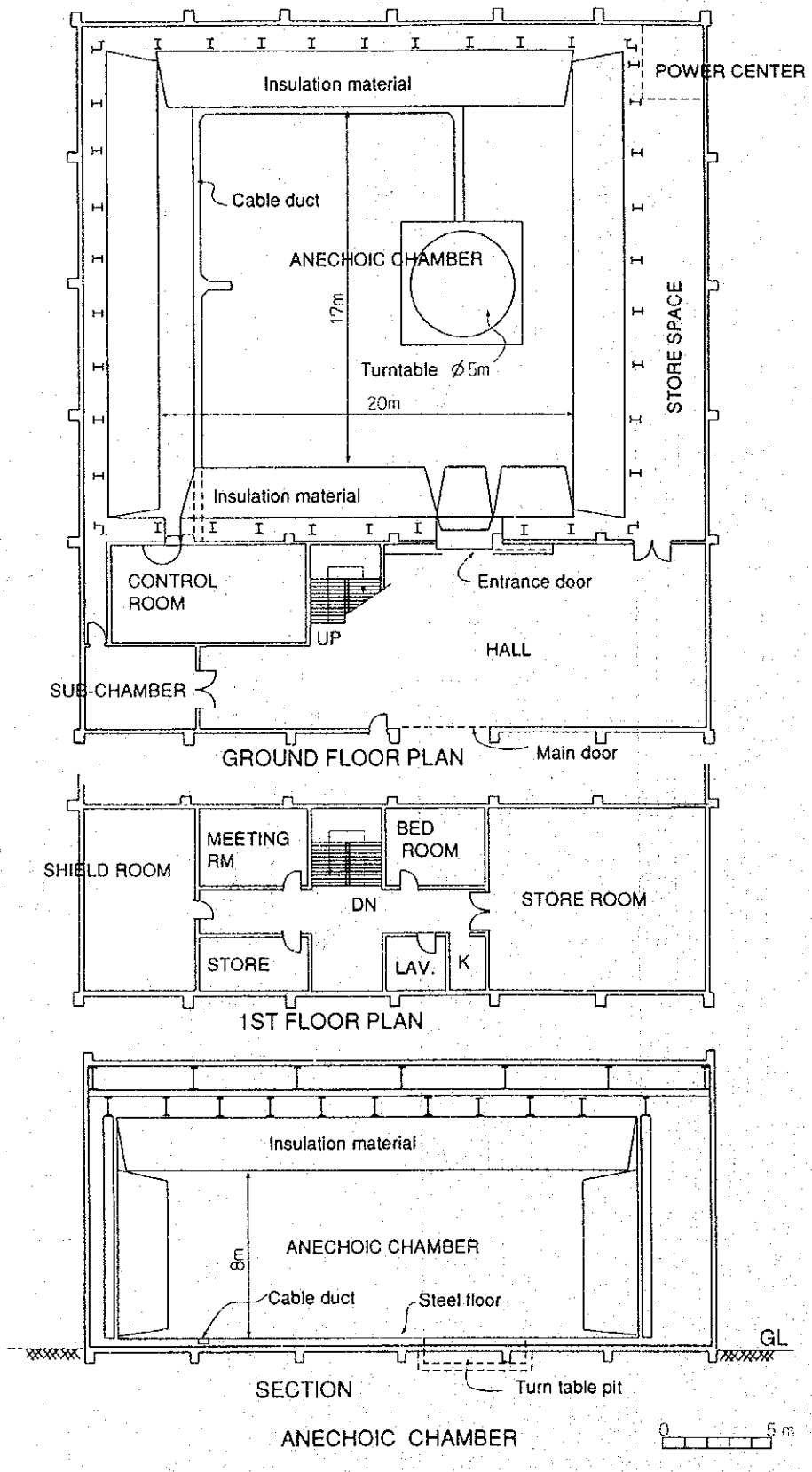


FLOOR AREA : 2,730 m²

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) ECONOMIC PLANNING UNIT, THE GOVERNMENT OF MALAYSIA STUDY ON MANAGEMENT AND PLANNING OF R&D SUPPORTING FACILITIES (TECHNO CENTRE) FOR KULIM HI-TECH INDUSTRIAL PARK	Figure V.4.4 Techno Centre 2nd Floor Plan Japan Industrial Location Centre Nippon Koei Co., Ltd.



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) ECONOMIC PLANNING UNIT, THE GOVERNMENT OF MALAYSIA STUDY ON MANAGEMENT AND PLANNING OF R&D SUPPORTING FACILITIES (TECHNO CENTRE) FOR KULIM HI-TECH INDUSTRIAL PARK	Figure V.4.5 Techno Centre Elevations & Section Japan Industrial Location Centre Nippon Koei Co., Ltd.



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) ECONOMIC PLANNING UNIT, THE GOVERNMENT OF MALAYSIA STUDY ON MANAGEMENT AND PLANNING OF R&D SUPPORTING FACILITIES (TECHNO CENTRE) FOR KULIM HI-TECH INDUSTRIAL PARK	Figure V.4.6 Anechoic Chamber Japan Industrial Location Centre Nippon Koei Co., Ltd.

V.4.3 Building Services Systems

(1) Water Supply System

Domestic water will be tapped from the water main running along the sub-road, of which demand is estimated at about 40 t/day (200 l/day/person x 200 persons). In addition, specially pure water will be required for the tests and analyses at the laboratories. For this purpose, water purifying equipment will be provided individually at each laboratory. Should KHTP decide to supply pure water to some of the microelectronics industries inside KHTP from a central water purifying plant, then the pure water supply for Techno Centre will also be taken care of by this plant.

(2) Waste Water Drainage System

House waste water from lavatories, kitchens and the like will be discharged into the waste water pipes running nearby. On the other hand, waste water from the laboratory sink and gas scrubbers for draft chambers will have to be handled separately from the house waste water on account of toxic substances. Laboratory waste water will be treated by a laboratory waste water treatment plant as illustrated in Figure 5.11 in Annex before being discharged into drainage ditches.

(3) Solid Waste Disposal

Solid toxic waste coming out of the laboratories will be collected in special containers and taken to the toxic waste depot of KHTP.

(4) Electric Power Supply

Total power demand at the Centre is estimated at about 2,300 kVA (15,000 m^2 x 150 VA/m^2). Power will be taken from the power distribution line 11 kV running nearby. Power will be received at the power receiving room where voltage will be stepped down to 415/240 V, in a three-phase, four-wire supply system. An emergency power generator

will not be considered owing to the highly reliable power supply system in the entire KHTP.

(5) Pure Gas Supply

For material and surface analysis and environmental analyses at the laboratories, pure gas such as N_2, H_2, and Ar will be used. These gases will be supplied individually to each requirement by gas cylinders as a central supply station can not be justified due to the small demand as a whole.

(6) Air Conditioning and Ventilation Systems

The air conditioning system will consist of inverter controlled self-contained room air conditioners and self-contained packaged air conditioners with air duct system both accompanying air cooled condensing units. The former will mainly be used for offices, laboratories and the like, while the latter is for public or common spaces such as corridors, halls, etc.

Fume exhaust systems will be provided individually to such laboratory equipment and analysers as draft chambers, atomic absorption spectrometers, gas chromatographs, etc. An air exhaust duct for fumes will be connected to scrubbers to remove toxic substances as required, and the scrubbing water will be conducted to the laboratory waste water disposal plant as previously discussed.

(7) Fire Protection System

The fire protection system will be provided in compliance with the applicable fire code of the region. Particular attention will be paid to that for the anechoic chamber for its special feature; non-windowed, heavily insulated building.

(8) Security System

Entry to some analysing laboratories, research laboratories, incubation rooms etc. by unauthorized persons will be restricted. Security control in this regard will basically be carried out by security guards posted at critical spots. If deemed appropriate, an ID card system will be introduced, providing electrical locking system to the required doors.

(9) Intelligent Building System

If deemed appropriate, all building services systems will be monitored and controlled centrally by electronic computers. A control room will be set up with control console and all indicator panels. An example is schematically illustrated in Figure 5.12 in Annex.