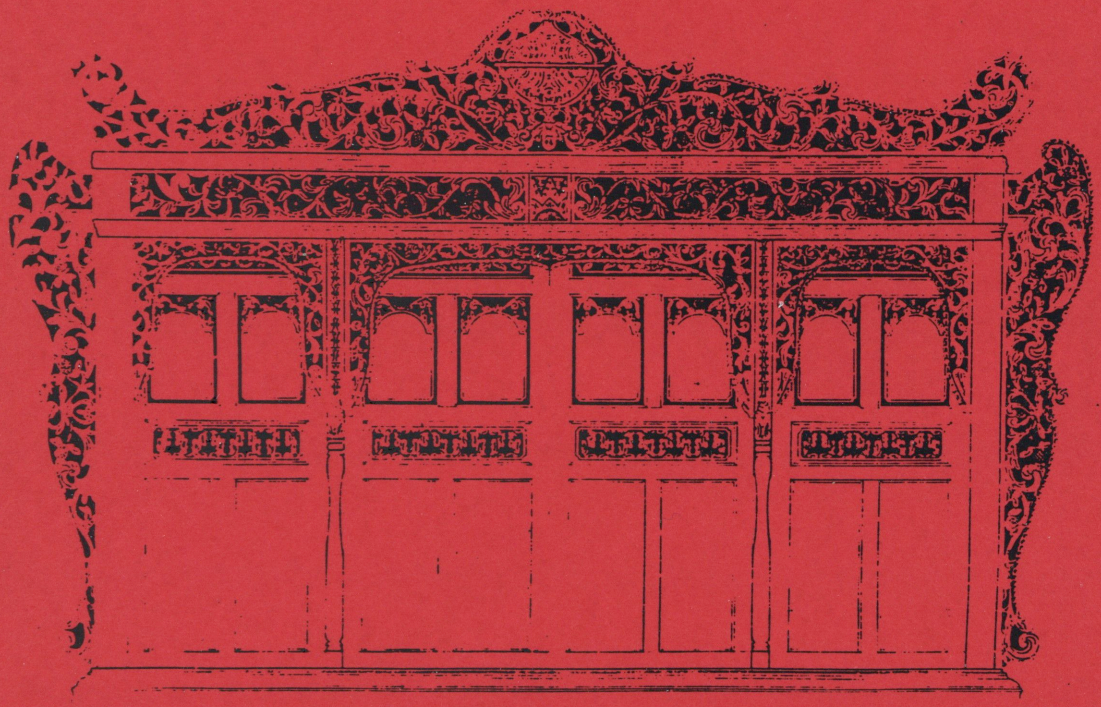
MULTI PURPOSE BUILDING



P378
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Bandar Seri Manjong
Perak Malaysia

Montana State University Library, Bozeman

A Multi-Purpose Building

by

Zamhuri Ramli

A Professional Paper Submitted in Partial Fulfillment

of the Requirements for the Degree

of

BACHELOR OF ARCHITECTURE

Approved:

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Bob Utzinger

MONTANA STATE UNIVERSITY

Bozeman, Montana

March 11, 1988

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Acknowledgements

To my father -

Thank you my Graceful God, Allah. My mom, brothers and sisters, friends and those who helped me throughout my past five school years here at MSU. Thank you so much for your support and encouragement.

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INTRODUCTION



"WORLD MAP

!LLUSTRATION !



ILLUSTRATION 2

Malaysia:

Location: Malaysia is situated in the central part of Southeast Asia, in the square bordered by longitudes 100 and 120 East, and latitudes formed by the Equator and 7 North. To the north of Malaysia are Burma, Thailand, Laos, Kampuchen,and Vietnam. Singapore and Indonesia are south and to the East are the islands of the Philippines.

Area: The land mass of Malaysia is made up of two parts: the Malay Peninsula and (on the island of Borneo)* the states of Sabah and Sarawak. The total land area is 330,434 square kilometers in Peninsula Malaysia and 198,847 square kilometers in Sabah and Sarawak.*

Population: Malaysia is a multiracial country with a population of 14.4 million. Peninsular Malaysia has 12 million people while Sabah and Sarawak have 2.4 million. Malays, Chinese, Indians and the indigenous people of Sabah and Sarawak form the majority of the population.*

* see map of Malaysia, illustration 2

* reference from Malaysia travel planner 1986, by Tourist Development Center

* source from Malaysia Yearly Book 1986, by Tourist Development Center

Climate: Malaysia is a country of incomparable and exciting beauty with a balmy tropical climate. The warm, tropical temperatures are varied only by the fresh, cool air hanging over the occasional hills and highlands. Rainfall can be expected at any time. Heavy downpours lasting just a few minutes accumulate over a year to total an average of between 200 - 260 centimeters. The relative humidity is high, generally between 80 - 95 percent.

Federal Capital: Kuala Lumpur is the federal capital.

States and Capitals: There are 13 states, 11 in Peninsular Malaysia and two on the island of Borneo The states and their capitals (in parenthesis) are:

Perlis (Kangar)

Kedah (Alor Setar)

Penang (Georgetown)

Perak (Ipoh)

Selangor (Shah Alam)

Negeri Sembilan (Seremban)

Malacca (Malacca)

Johor (Johor Bahru)

Pahang (Kuantan)

Trengganu (Kuala Trengganu)

Kelantan (Kota Bahru)

Sabah (Kota Kinabalu)

Sarawak (Kucing)

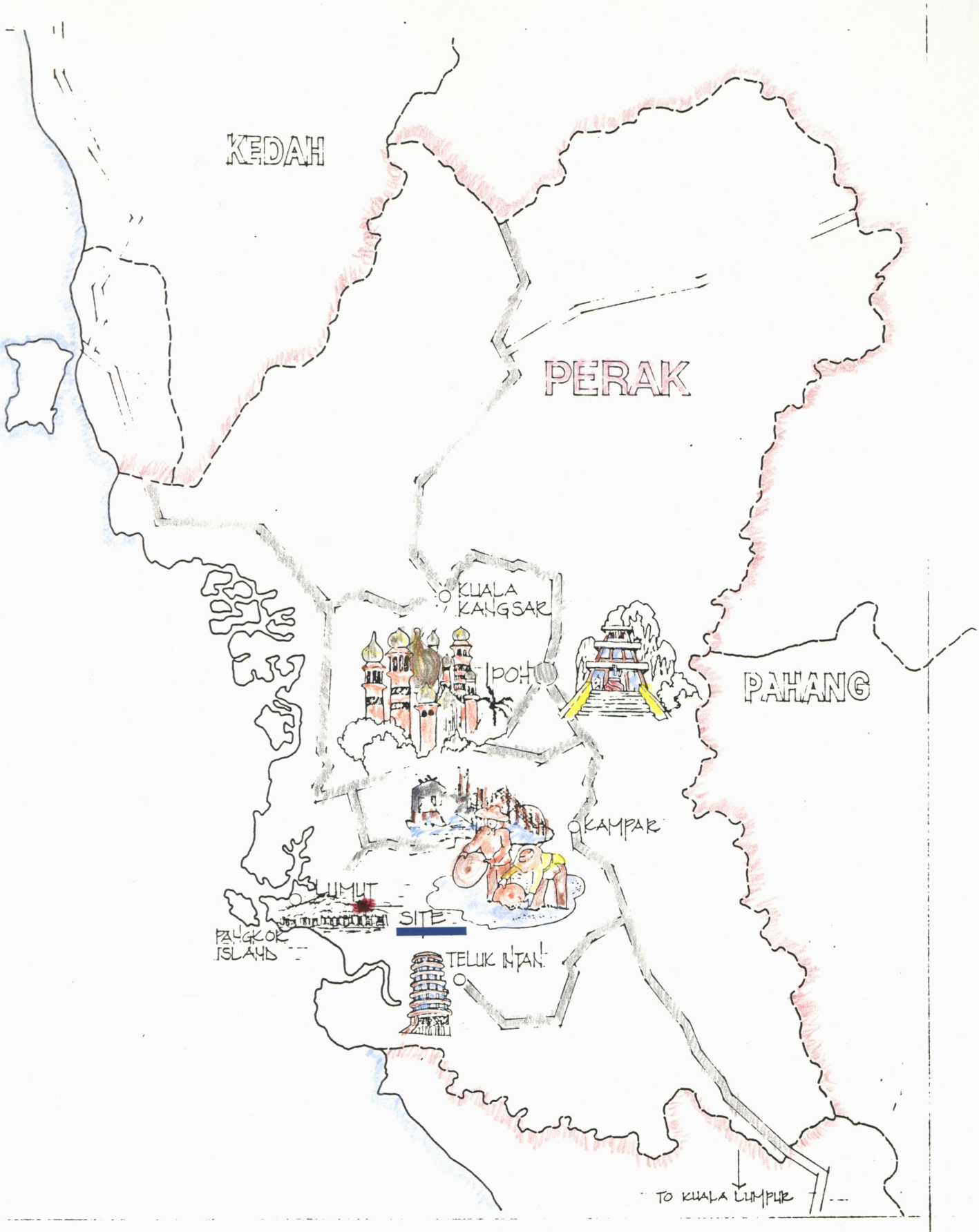


ILLUSTRATION 3

Perak

Location: Perak is bordered by the states of Kedah and Kelantan on the north, Pahang on the east, and Selangor on the south.

Area: Of all the sizes of states in Malaysia, Perak is the fourth largest after Sarawak, Pahang and Sabah.

Population: Perak has the highest Chinese population, especially at Ipoh (state capital).*
The total population of Perak is 1.2 million. There are Malays, Chinese, Indians and indigenous people or Orang Asli.

State Capital: Ipoh is the state capital.

Interesting Places:
- Istana Kengangan, (a very fine and ornate example of Malay Architecture; see illustration 4)
- Cave Temple (see illustrations(5 and 6)
- 'Kota Belanda' (an historical site from the Holland occupation in Malaysia; see illustration 7)
- Tin mines (see illustration 8)
- Mosque Ubudiah (see illustration 9)
- Leaning Tower (see illustration 10)

* Reference from magazine 'Welcome to Malaysia', edition 1986/87

Istana Kenangan (illustration 4) is located in Kuala Kangsar, 30 miles from Ipoh. This building is a very fine and ornate example of Malay Architecture with woodcraft detailing on the facade and on the eaves.

It functions as a ceremonial hall for the Sultan of Perak and his royal family. The building is raised on stilts because of the hot humid climate of Perak.



ILLUSTRATION 4

Cave Temple and Buddha Statues

Buddhism devotees believe that spirits live in the small caves near Ipoh, so they built temples in the caves. The material form of the structure is mostly concrete because the concrete matches (mixes with) the natural surroundings. The front facade is usually very elegant and ornamental to welcome devotees or worshippers and to impress the holy spirit of the cave.



ILLUSTRATION 5

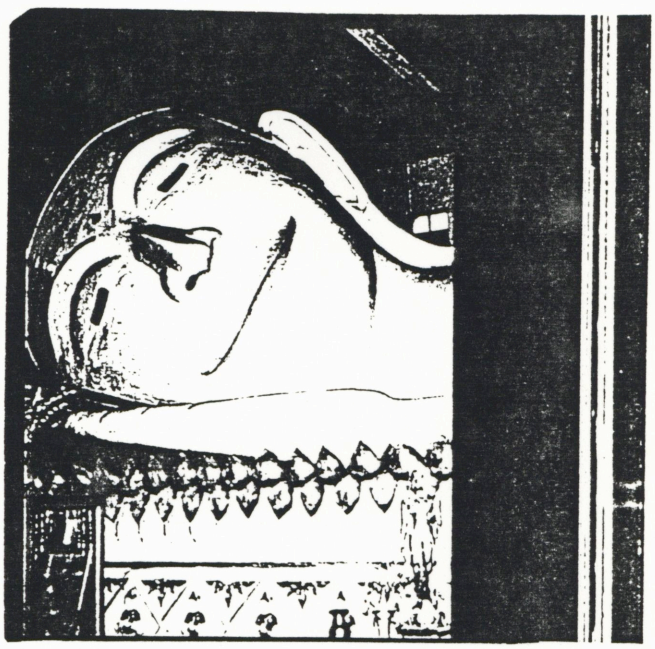


ILLUSTRATION 6

Kota Belanda (illustration 7) is located in Teluk Gedung, Pulau Pangkor. The stone wall was constructed by the Dutch in 1680.* The wall was constructed for defense from sea pirates and Malay people. By 1748 the stone wall was left by the Dutch, and now the place is declared as an historical site.

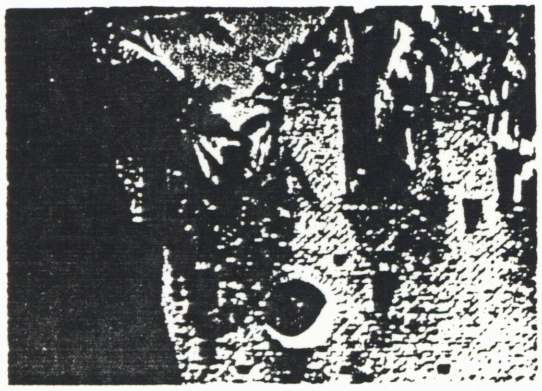


ILLUSTRATION 7

* Source from Parak Pamphlet by Tourist Development Center of Malaysia.

'Palong' and 'Mendulang' (illustration 8)

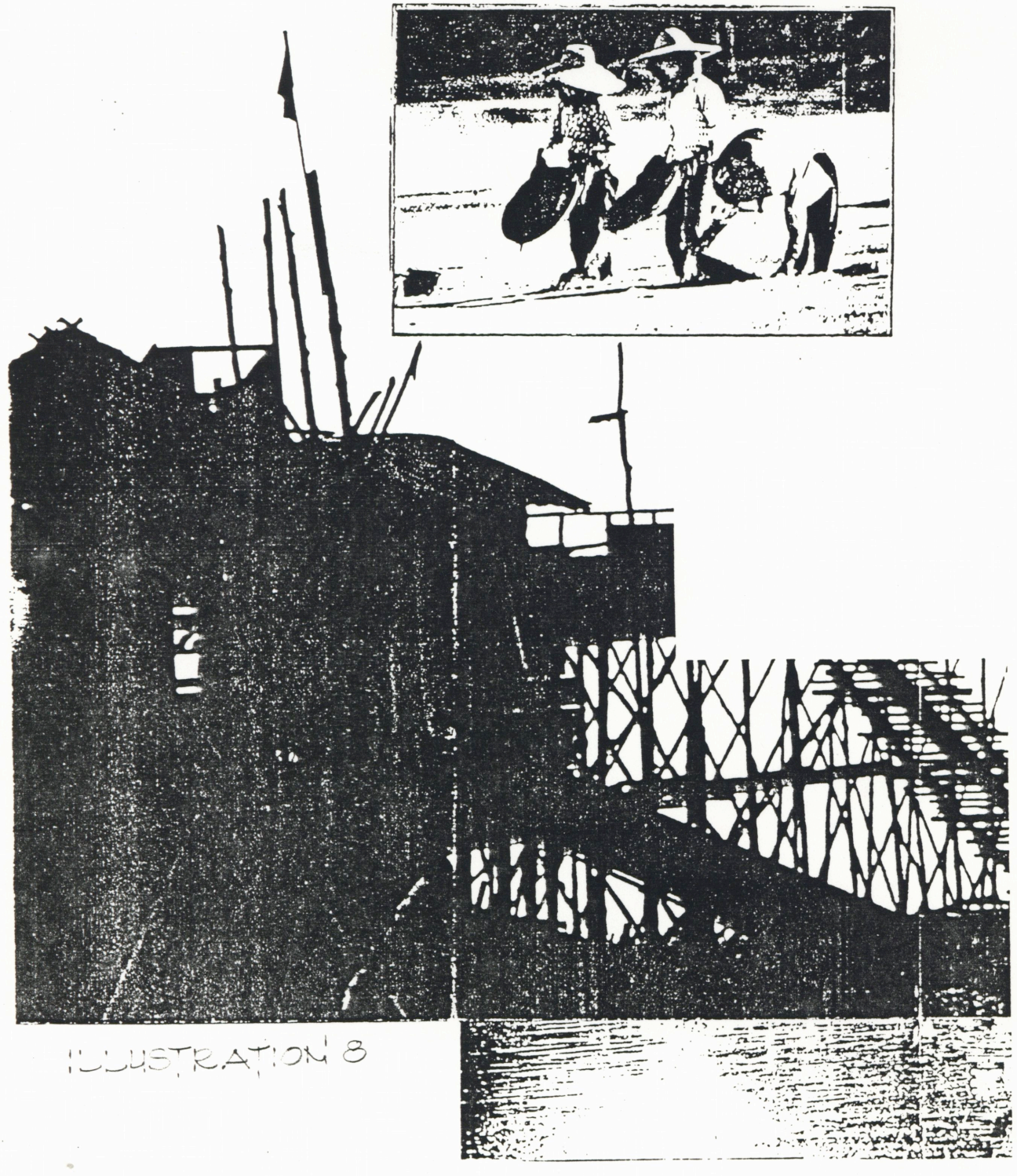
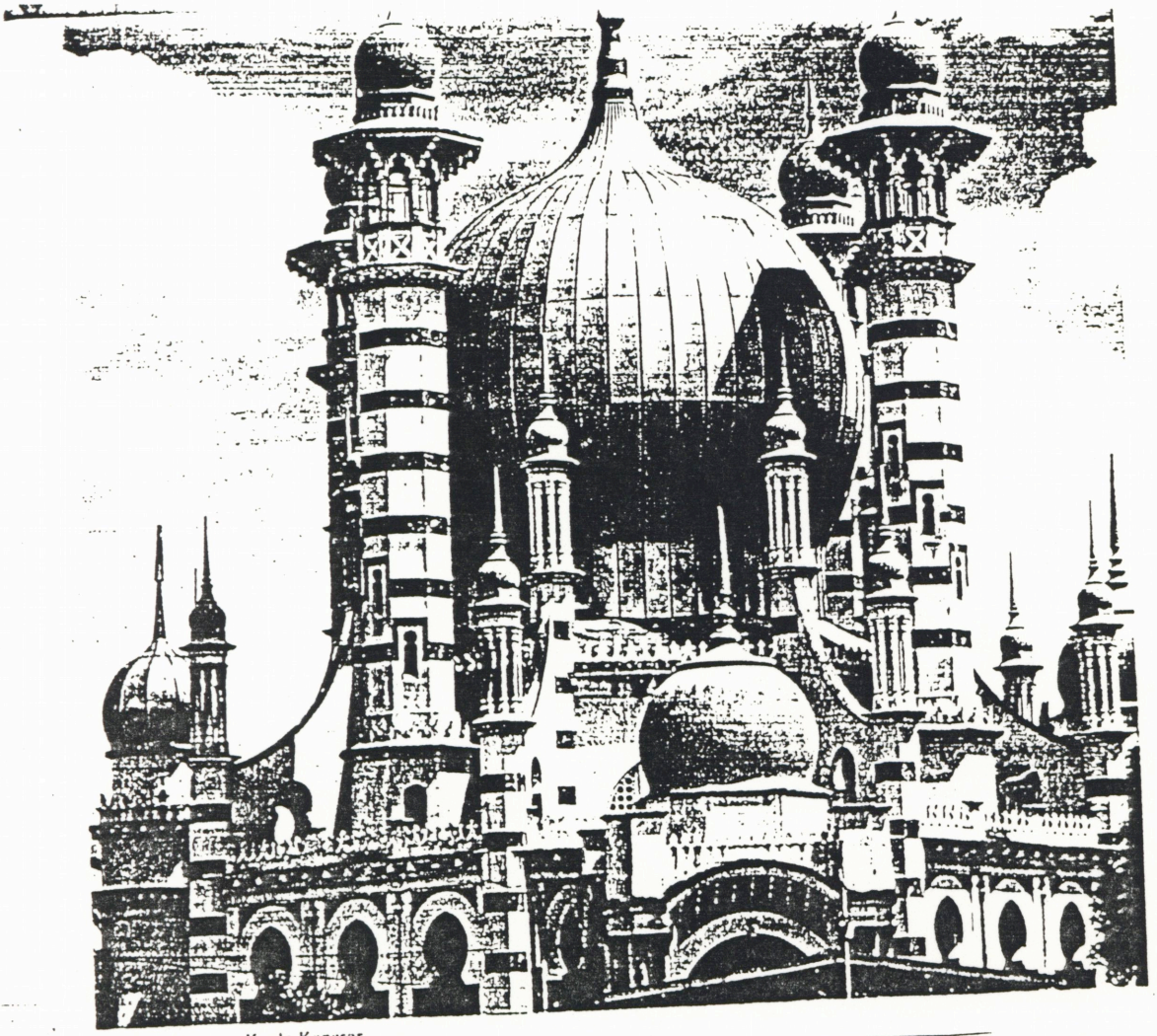


ILLUSTRATION 8

Tin Mines are located in the Kinta Valley which contains the world's richest deposits of tin, accounting for 60% of Malaysia's total output. There are three different methods of tin mining: 'Kapal Korek', 'Palong' and 'Mendulang'. Only two types are shown here. The Palong method usually uses wood materials because wood is easy to get and cheap. Other materials such as concrete are more expensive. In addition, tin mining operations do not stay in one place. They are moved from one place to another, so wood construction is most preferable.

Mosque 'Ubudiah' (illustration 9) is located in Kerala Kangsar, the royal town of the Perak. This mosque was built during the British occupation in Malaysia in the 1940's. It is one example of the colonial influences in Malaysian Architecture. There are four minarets bordering the building at the four corners, and at the center is the Dome. The Dome structure is common on most of Malaysia's mosques because it creates a bigger interior space for praying purposes.



Ubudiah Mosque, Kuala Kangsar.

ILLUSTRATION 9

The Leaning Tower is located in Teluk Intan. The Chinese built this town during the British occupation during the 1940's. The eight story building has leaned towards the left since it was constructed. In the early days the tower was meant for storing water, but today it is the landmark of Teluk Intan.

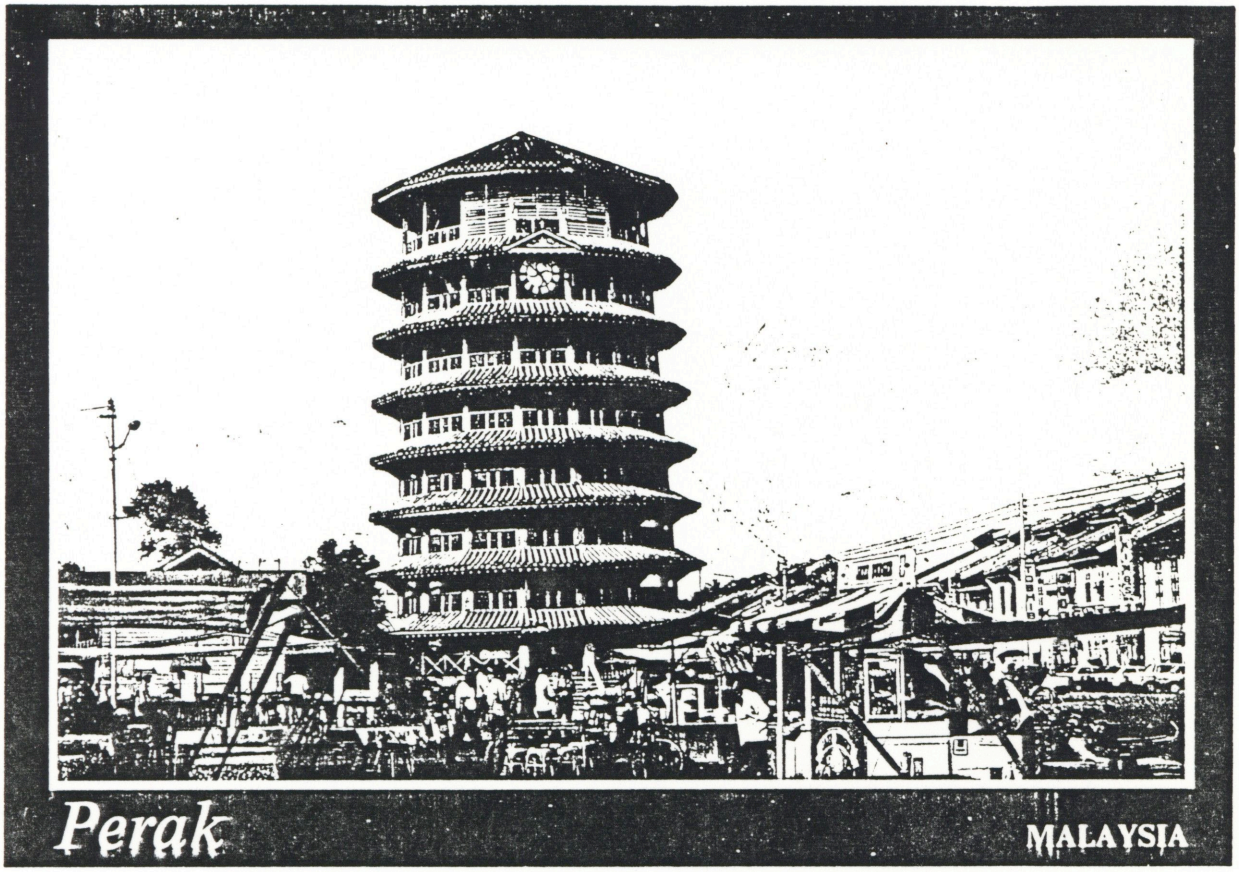
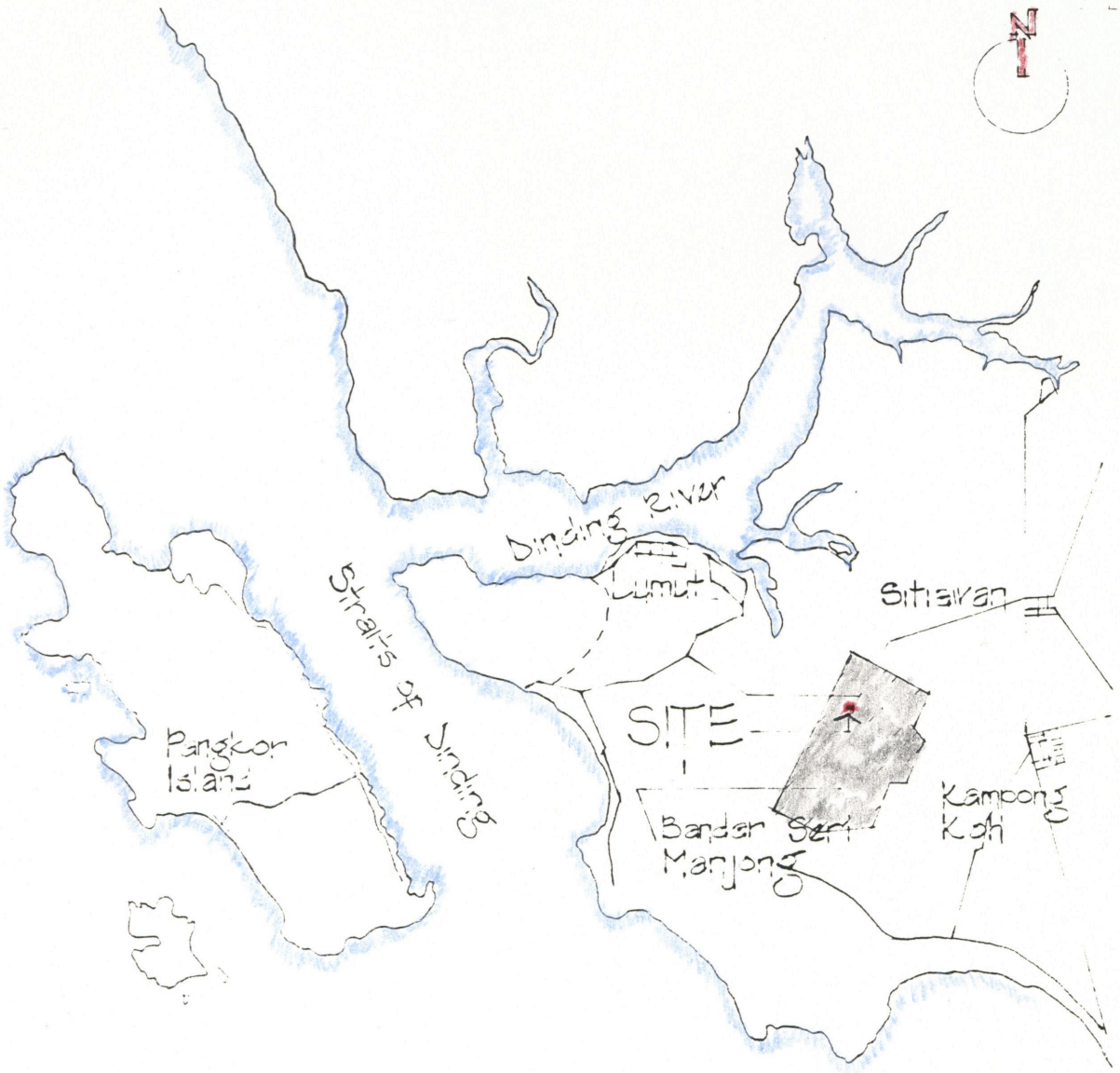


ILLUSTRATION 10



BANDAR SERI MANJONG

ILLUSTRATION II

Bandar Seri Manjong (illustration 11)

During the British occupation in the 1940's, the Malaya Naval base had a site at Woodland, Singapore.* At that time, Singapore was part of Malaya Federation. Later, in 1963, Singapore got its own independence from Malaysia and became the Republic of Singapore.

The site at Woodland had been on a lease agreement, where every year the Government of Malaysia had to spend much money to pay the rent of the site.

Thus, during the Third Malaysian Plan (1975 - 1980) the Malaysian Government called upon the City Planning Department to do research on having a Naval base site in Malaysia. By the end of 1980, a proposal was completed and submitted to the Government of Malaysia, Defense Department. The proposal suggested Lumut and Kuantan as the sites.

Lumut is located on the West-Coast, so that it controls the Western Side. Having a base in Kuantan on the East-Coast provides security on the Eastern part, the South China Sea.

Moving the Navy personnel was carried out in the Fourth Malaysian Plan (1981-1985). Now the Navy occupies

*

prefabricated 11 story buildings (see illustration 12). Lumut is a small town, and it is surrounded by many green, tropical hills. The town, Lumut, is occupied by about 1,000 people who mostly work in government departments and businesses. On the weekend, Lumut provides boat accommodations for tourists who want to visit the many beautiful beaches in Pangkor Island which is separated from Lumut by a 30 minute boat ride. Sitiawan is an old town which only provides minimum services. Bandar Seri Manjong is a new town that accommodates all of the needs of the surrounding towns of Sitiawan and Lumut.

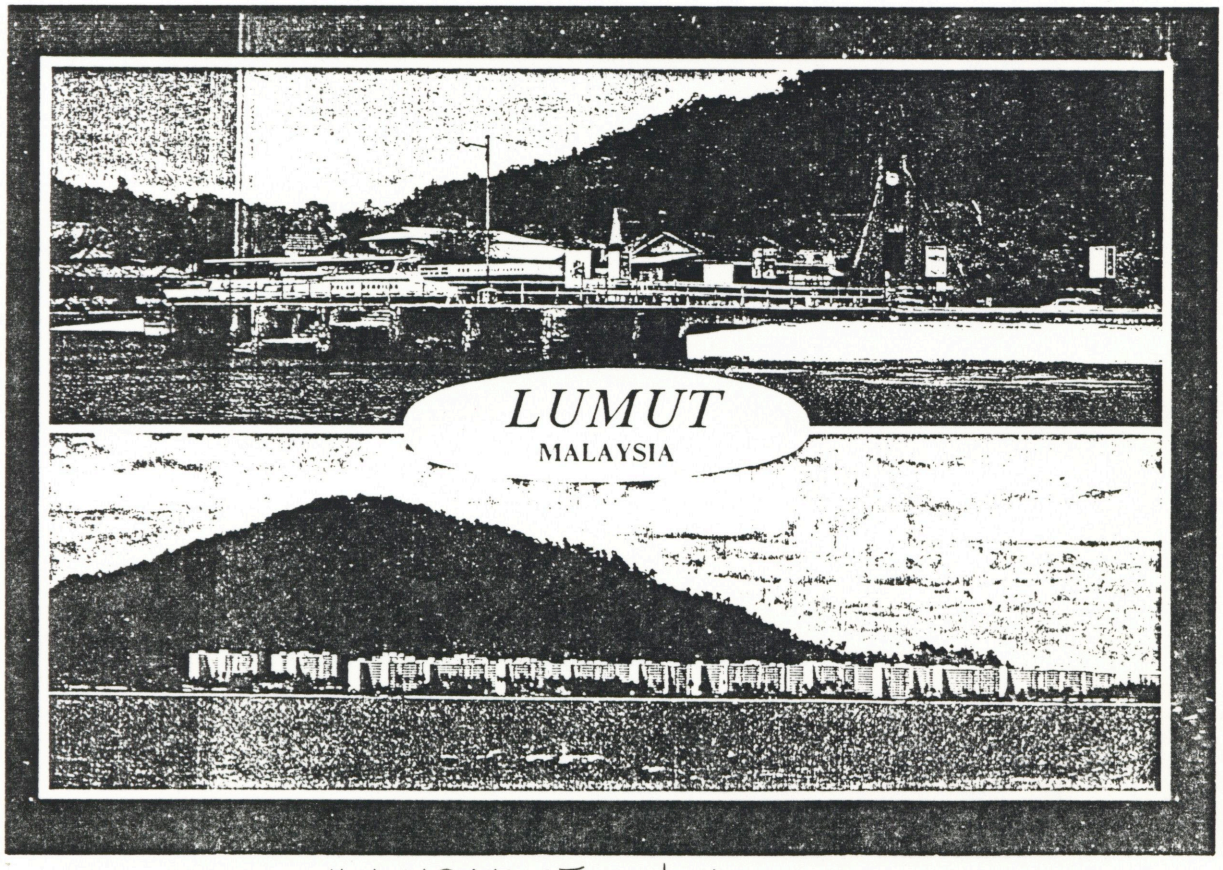


ILLUSTRATION 12

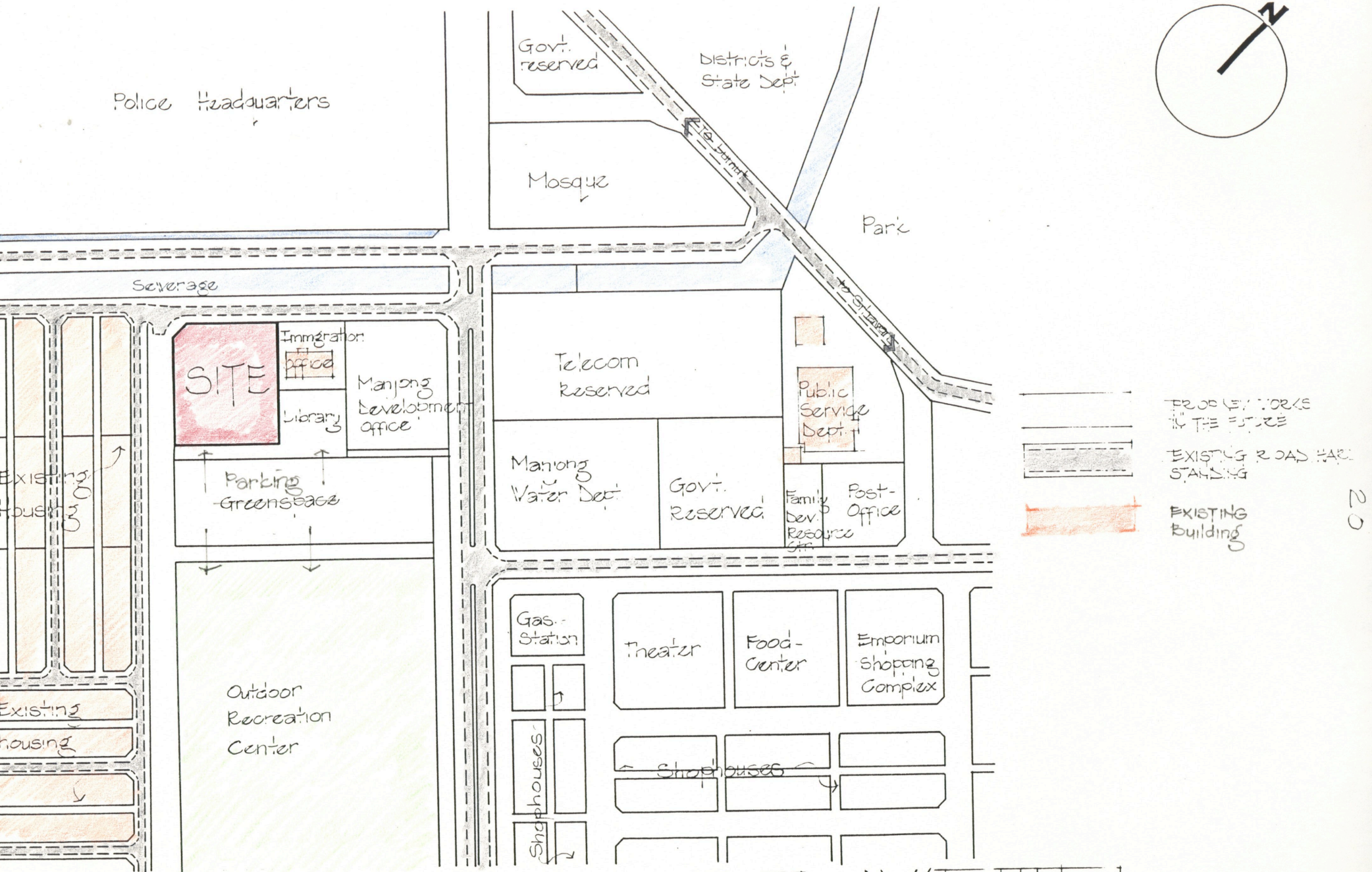
RATIONALE

(Scenario and Project Goal Statement)



BANDAR SERI MANJONG

ILLUSTRATION 14



SITE ANALYSIS

ILLUSTRATION 13

Thesis Statement

My thesis project is to design a Multi-purpose Building (Dewan Bandaran) at Bandar Seri Manjong, Perak, Malaysia. The multi-purpose building will provide to the Bandar Seri Manjong community a variety of facilities, either in indoor sports programs or in public functions wuch as weddings, concerts and conferences.

Indoor sports such as badminton, sepale-raga*, martial arts, table tennis, volleyball and basketball are becoming popular only recently in Malaysia. The only indoor sport that has achieved an international level of competition is badminton. The badminton tournament, the Malaysian Open, is held once a year, attracting many international players to compete. The tournament is usually held at Kuala Lampur, the capital city of Malaysia. The international players come from China, Denmark, Indonesia, South Korea, Britain and other countries in the world.

The other indoor sports are just coming up to establish their level. Currently, the level of competition is Asian only. For example, the Sea Games, which are held once every two years, will hold events such as those sports mentioned above. The Sea Games began 25 years ago. Now the Asian countries; Indonesia, Bronei, Singapore, Phillipines, Thailand, Burma and Malaysia, participate in this sporting event. In the Asian countries we have few opportunities for athletes to establish themselves before competing at the International level. Currently, most sports are dominated by countries like the United States, East Germany, and the U.S.S.R. It concerns us, the Asian countries, that we develop our athletes to reach the international level.

Therefore, my project, the Multi-purpose Building, will be a part of the project to develop our athletics. This multi-purpose building will be designed to adequately meet more of the basic needs and priorities of the Seri Manjong Community.

Project Goal

I will design a Malaysian type form that needs to meet my two major goals:

- climatic considerations
- a future model for Malaysian multi-purpose buildings

Knowing Malaysia is located near the equator, climatic considerations need to be well addressed. Hot and humid temperatures exist throughout the year, and ventilation needs to be well studied.

In my project, I will raise the whole structure so that underneath it will allow ventilation. This is a fine example, following the traditional Malaysian house style.

Since there is a disadvantage in the traditional Malaysian house, the material (wood) which does not last long, I will have my structure based on concrete and steel. The concrete and steel structure is not just longer lasting, but they are also permitted a longer span. As in the case of my gymnasium, I need to have a longer spanned structure.

Lastly, since most of our buildings in Malaysia are not well designed, I am taking this advantage to establish a new basic model for multi-purpose buildings. This multi-purpose building will not only better serve a need in any community in Malaysia, but will also achieve a better climatic environment. Evidently, the concrete and steel structure will last longer than the wood structure.

Site Description

The project, a Multi-Purpose building, is located at Bandar Seri Manjong, Perak, Malaysia. The Bandar Seri Manjong is located (at 44 degrees 13' North latitude and 100 degrees 42'E longitude) in between Sitiawan and Lumut (see illustration 13). The height above mean sea level is seven meters, or 22.75 feet.

The size of the site is 1.814 acres or 79,000 square feet. It is located at the west side of Bandar Seri Manjong (see illustration ~~below~~ 13).

Project Goals Statement

What is the Project?	-Multi-Purpose Building
Where is the Site?	-Bandar Seri Manjong, Perak, Malaysia
Who is the Project For?	-Community of Bandar Seri Manjong -Sports Clubs in Manjong District -Other communities in Manjong District
Why are they Building it?	-Lack of sports facility in Manjong District -Common need of a place for every new community
What type of building is it?	-In reference to the Malaysian Uniform Building Law, this multi-purpose building is categorized in Type III of recreation buildings (for further reference, refer to Appendix A.)
How big is it?	-Big enough to provide a gymnasium (one basketball court), two meeting rooms and other spaces that are suitable and required.
What is the scope of the project?	-A multipurpose center for cultural, youth, and sports activities.

Facts:

- -interviews of Sports Club Committee (see schedule A)
- -interview with Jur Manjong/Pajabal Paerah Manjong (see schedule B)
- -newspaper cut-outs (see schedule C)
- -magazines/articles (see schedule D)

Functional Requirements of Project

* Serving the maximum number of people

  wedding - maximum 400 people
  banquet - maximum 400 people
  meeting - maximum 600 people
  concert - maximum 2,000 people

* Major spaces linked by pathway

  Lobby ⟷ Walkway ⟷ Gymnasium
  Kitchen ⟷ Walkway path ⟷ Gymnasium
  Meeting Room ⟷ Walkway path ⟷ Gymnasium
  Women's Changing Room ⟷ Walkway path ⟷ Men's Changing Room

* Segregation

  Gymnasium separate into two parts with a screen between for men and women

  Meeting hall can hold two separate meetings at one time

* Progression and approach

  Walkway progression from outside of building to inside developed in hierarchy manner--height increases as one passes through the roof structure

* Security

  Public entrance into the building controlled by mechanical and manual. Security guard on both entrances and membership card required

* Economical--efficiency

  Using natural ventilation to reduce HVAC costs
  Using long lasting materials such as concrete work will minimize maintenance cost in the future

* Hierarchy of values and feelings

  Changing of moods from inviting mood inside the main lobby to the exciting mood in the gymnasium
  Using different colors could maintain this value--bright colors for excitement, such as inside the gymnasium
  Private type of mood inside the meeting hall--plain color which is not too bright will reflect privacy

Organizational Relationship of Project

* Site elements surrounding
    - trees line, existing buildings, fences, etc.
* Efficient land use
* Neighbors
* Entry

My design organization principle will develop from a central type organization. A major space at the center will be the focal point either to the viewers from outside of the building or to the other spaces surrounding the focal point. For instance, the gymnasium spaces will be the central area and the rest of the program areas will surround it. Since the site is located at the heart of the Manjong City, the building will have a unique identity in such a way that it will catch our eye. This unique identity will be explained by the roof form and the detailing on the wall surrounding it.

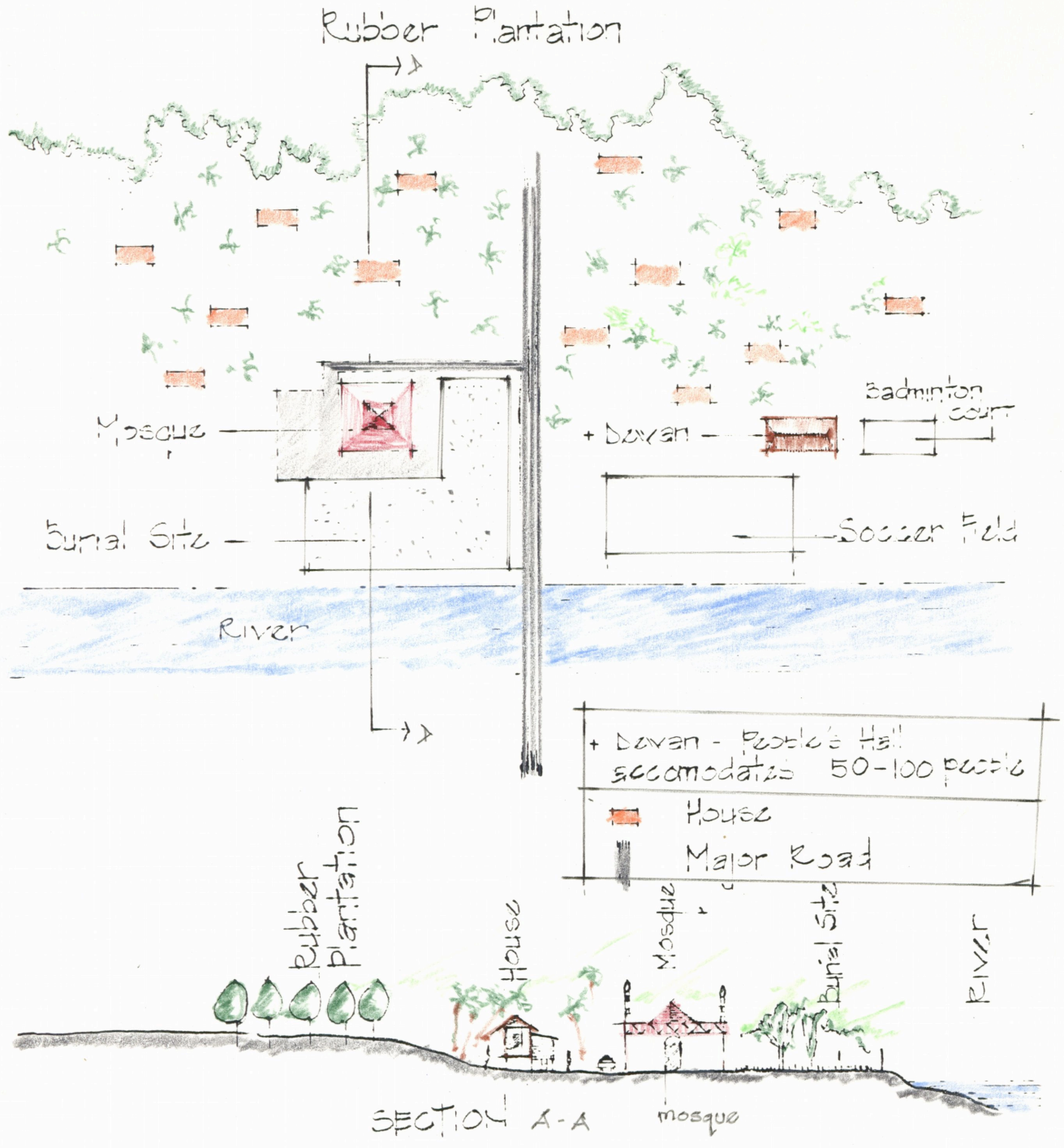
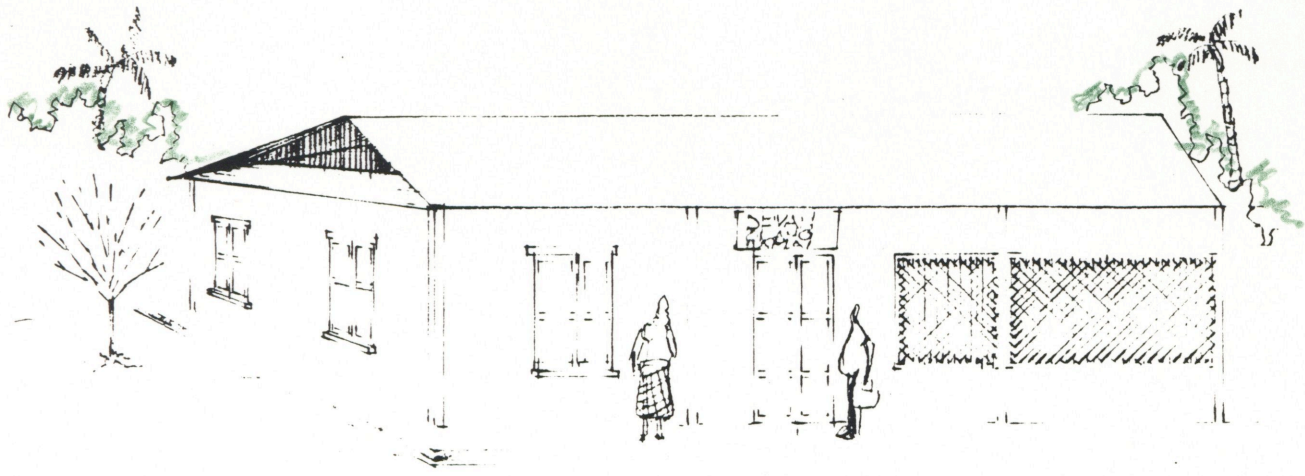
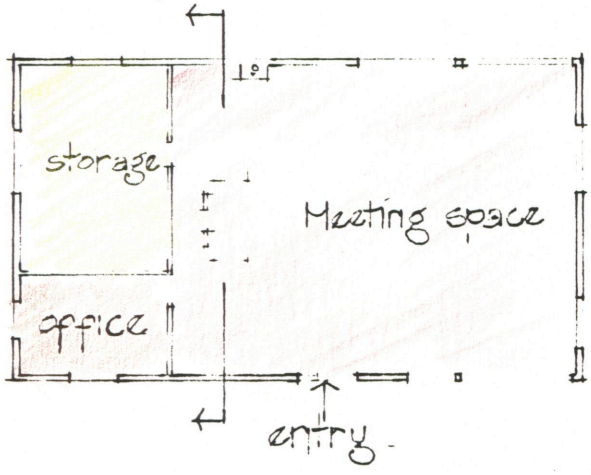
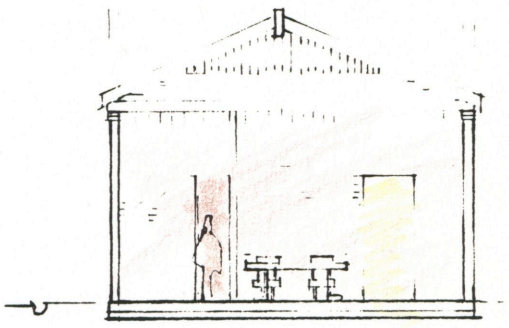


ILLUSTRATION OF DEWAN & VILLAGE





Floor Plan



Section

not to scale

DEWAN ORANG RAMAI

People's Hall

Case Study 1

There are three different types of buildings that already exist as Multi-purpose buildings in Malaysia. In a kampung, or village, such a building is called 'Dewan Orang Ramai' or 'people's hall'. The building's size is determined by the total population of the village. The 'Dewan Orang Ramai' usually accommodates 50 to 100 people. The building either serves as a community center for political conferences or village leaders' election hall, or it serves as an indoor sports facility. Next to the 'Dewan Orang Kamai' is usually a badminton or sepale-raga court.

TYPE III RECREATION BUILDINGS

-These buildings are used in a community of less than 200 people

-Facilities that are usually provided:

- -social hall/meeting hall
- -offices
- -storage
- -outdoor courts, two separate takraw courts or one badminton court

-Form orientation usually east-west because:

- -follows traditional Malay house orientation
- -influence of Pak Tukang', based on his experience
- -minimize solar radiation

-Material usually wood construction because:

- -easy to get/most available
- -very economical

-Openings usually on north and south side because:

- -breezes usually from north-east and south-west

-Roof form usually pitch-roof type because:

- -better and faster drainage of heavy downpours
- -ventilation from not using ceiling



not to scale

DEWAN IDRIS SHAH II
TOWN HALL

STAGE ELEVATION

not to scale

FIRST FLOOR PLAN SECOND FLOOR PLAN

TOWN HALL IN LIMIT

Case Study 2

As the population increases, there is demand for a bigger space. This happens to a Pekan (town) community. In a Pekan a multi-purpose building is called the Town hall or 'Dewan'. Normally, a royal nick-name follows the Dewan name, for example Dewan Idris Shah II. The Idris Shah II is a name of the Sultan of Perak. It is named after him to commemorate the kindness of the Sultan to his own 'rakyat' or people. The function is still the same; the purpose being either as an indoor sports center or a center for the community.

TYPE II RECREATION BUILDINGS

-These buildings are used in the community of 1000-5000 people

-Facilities that are provided:

- -social hall
- -two indoor badminton courts
- -stage
- -storage
- -upper fixed seating area for 40-50 people
- -projector room
- -office(s)
- -lobby and lounge
- -restrooms
- -reception and security

-Orientation of east-west is preferable because:

- -minimizes solar radiation

-Materials usually reinforced concrete because:

- -it has greater span
- -lasts longer

-Color preference is a light color for reflecting sunlight

-Roof form is generally a flat type

-Access is usually on the north and south sides because:

- -they open larger than major entrance
- -major entrance is usually for higher ranking personnel
- -easy access

Goals to Achieve

-East-west orientation

-Have main access on north and south sides

-Use of materials such as reinforced concrete

-Provide more facilities

-Provide maximum seating capacity

Case Study 3

In a city or 'Bandar', a multi-purpose building is called 'Dewan Serbaguna' or multi-purpose building. So, this is where the term derived from. The 'Dewan Serbaguna' usually accommodates 150-200 people. Here the building provides a larger space for indoor sports programs. For example, the gymnasium generally has one basketball court which can be turned into four badminton courts or one volleyball court.

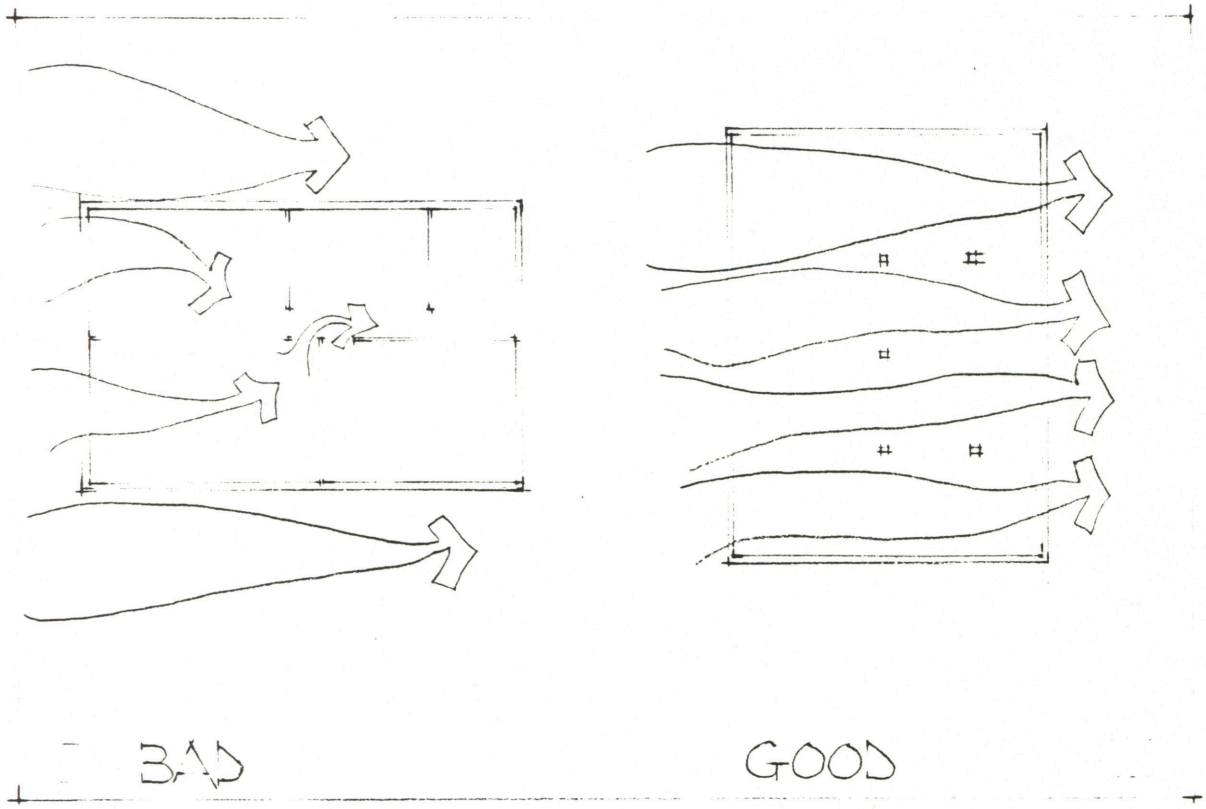
Case Study

Traditional Malay House vs. Contemporary Housing

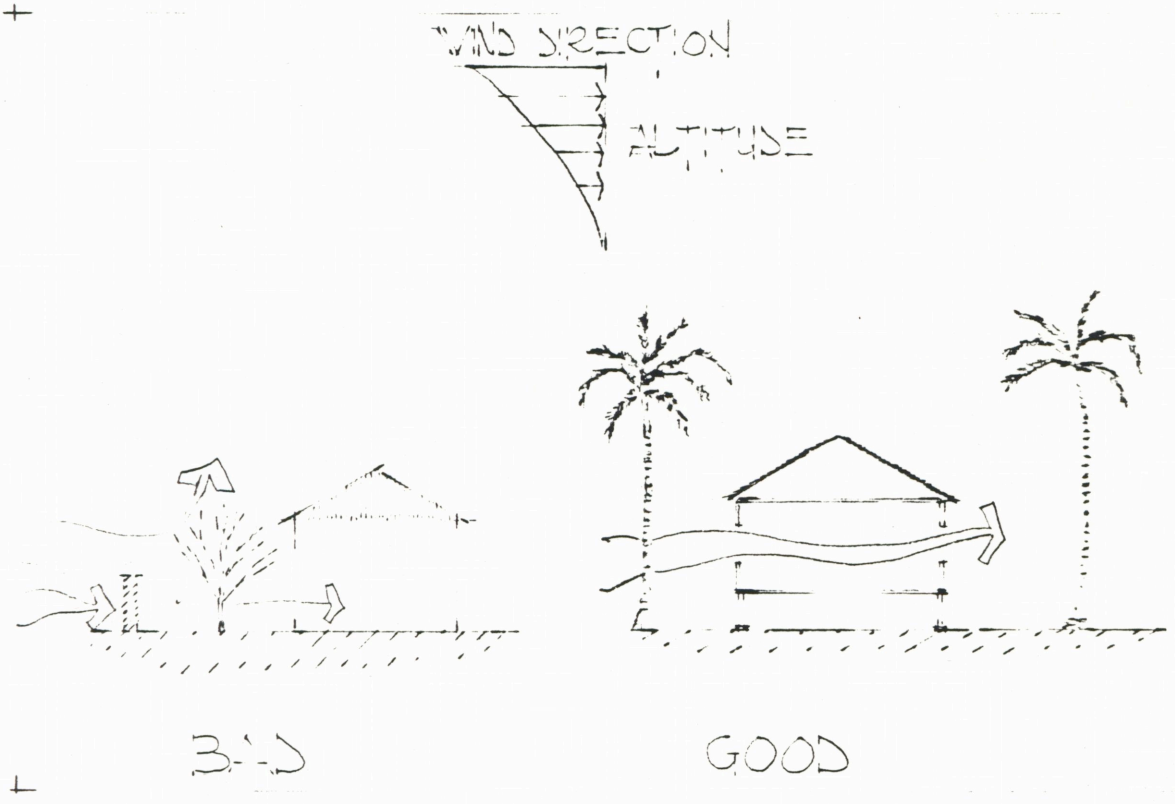
Some of the climatic factors that are effectively taken into account in a traditional Malay house are:

1. Ventilation Properties

   a) Cross Ventilation - minimal interior partitions and elongated plans allow easy passage of air and good cross ventilation.



b) Wind Velocity Gradient - The velocity of wind increases with altitude. Structure on lower level receives wind of lower velocity. Edges and solid fences that provide privacy deviate the passage of winds and reduces speed considerably.



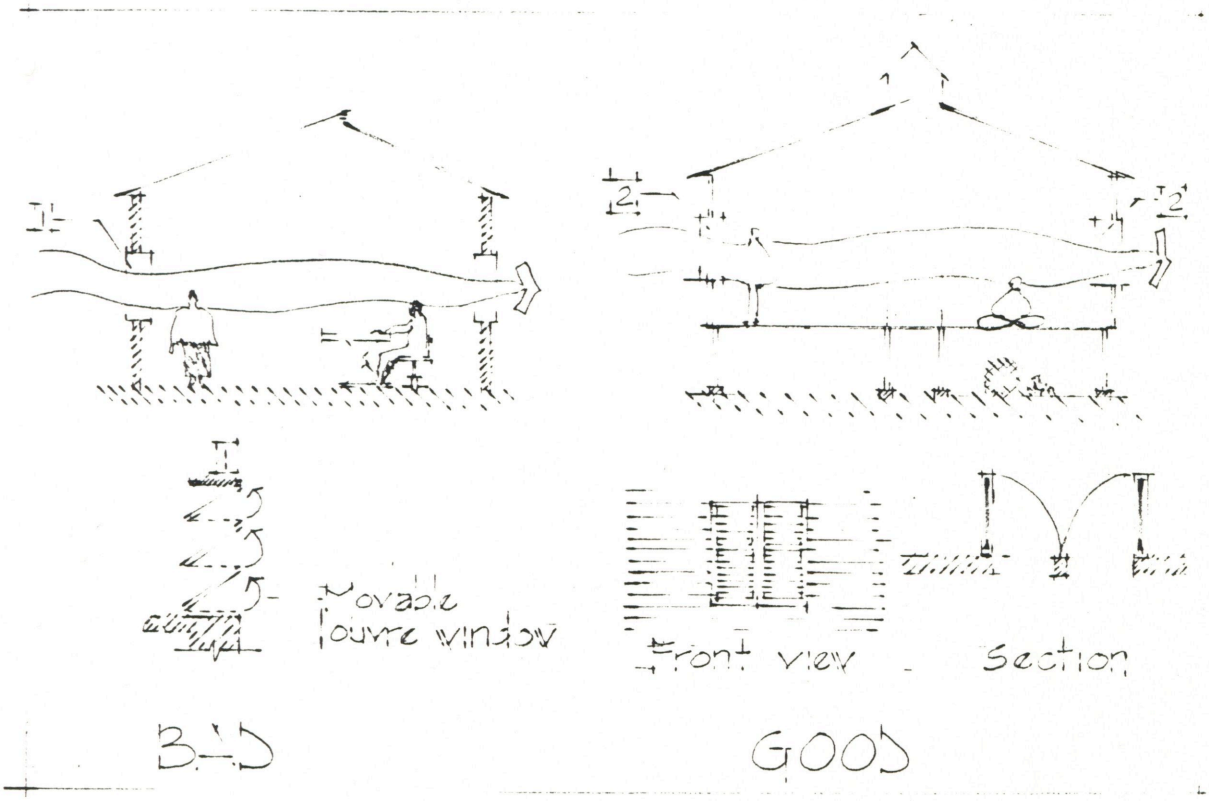
c) Ventilation of Body Level - The body level is the most important area for ventilation for comfort. Ventilation at the upper part of the body is not good. When choosing a window system such as grilles and glass doors (in contemporary housing):

Filter out what is undesired -- solar radiation

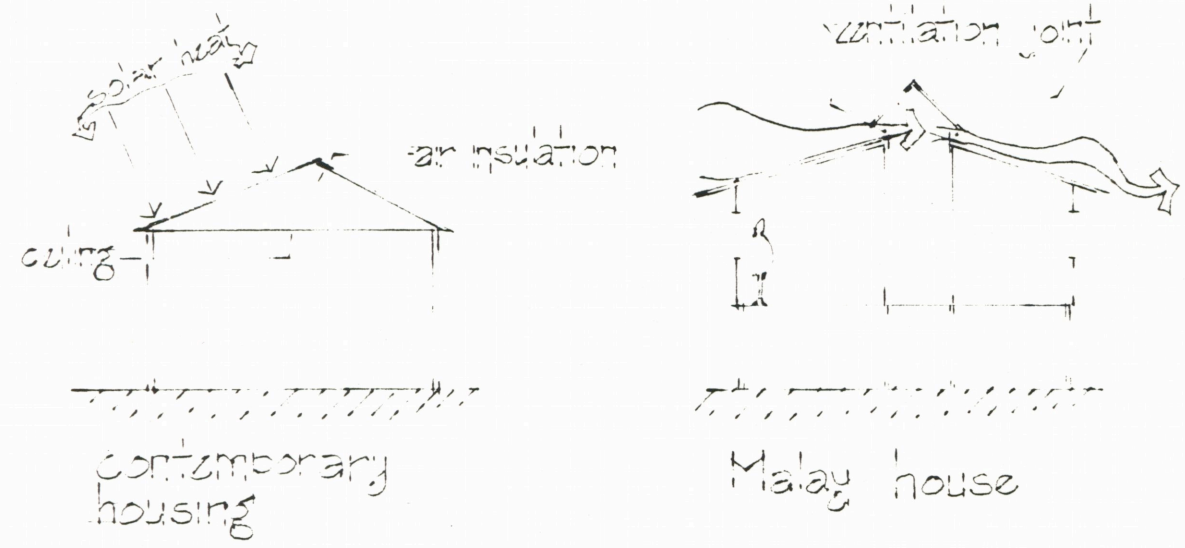
Filter in what is desired -- ventilation

The adjustment of both of the above will allow for:

- privacy
- ventilation
- natural lighting
- anti-burglary

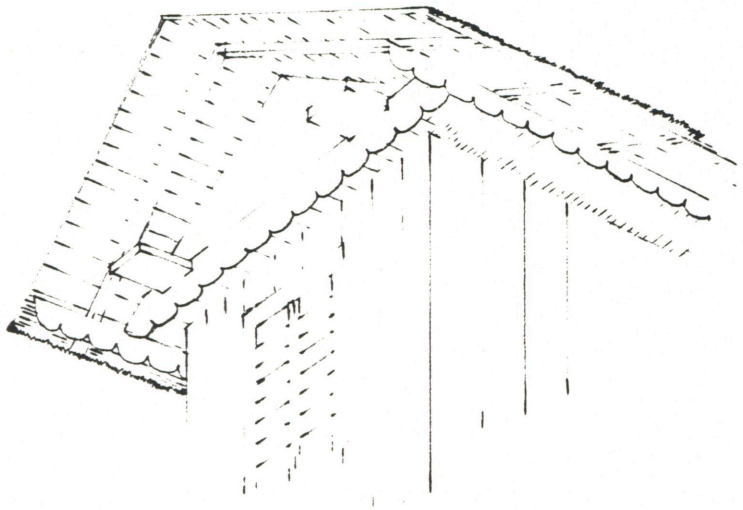


d) Ventilation of Roof Spaces - Using ceilings such as in contemporary housing roof spaces, will create an insulation of trapped air instead of being ventilated. It needs more materials rather than just ceiling which is less effective. In Malay houses, they have an open system where you can see the roof structure.



2) Solar Radiation

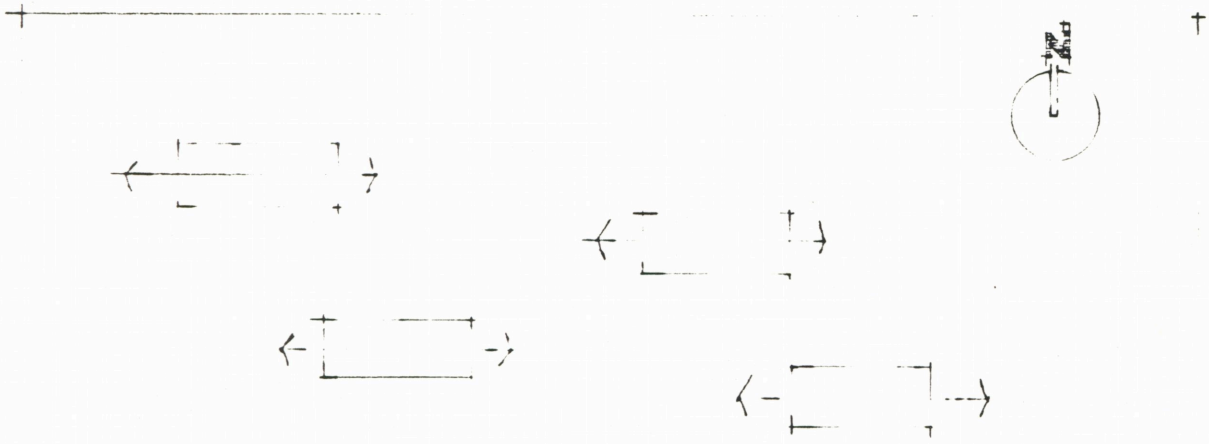
a) Overhangs and Exposed Vertical Areas - Large overhangs (eaves) and the low exposed vertical areas (windowless and walls) are good protection for rain and shading. The larger and higher vertical areas will make sunshading a more difficult task. The exposed vertical areas of windows will be penetrated by direct sunlight and cause considerable discomfort and the walls which act as direct sunshading devices get heated up and radiate heat into interior areas.



Looking up at eaves (projecting ridge)

3) Orientation

a) East-West Orientation - This is always preferable either for special reasons, such as Malay houses face Mecca for religious reasons, or to minimize solar radiation exposed areas. This is for heat gains to the building.



East - West Orientation

Footprint Malay House

4) Materials

a) Use of Materials - Using bricks, tiles, concrete and other materials of high thermal capacity such as in contemporary housing will store heat and radiate it at night. On the other hand, materials in Malay houses are of lightweight construction, especially wood and other natural materials, which ~~has~~ have lower thermal capacity. It holds little heat and cools adequately at night.

5) Conclusion

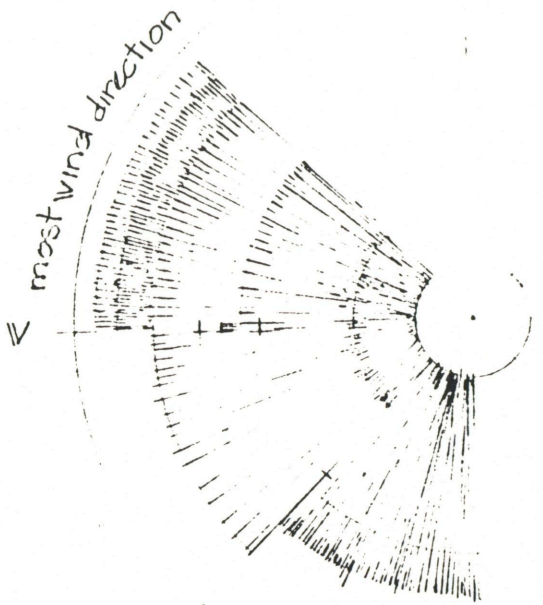
Goals - Climatic factors should have been effectively taken into account when designing any building in Malaysia. Thus, three major elements that are going to be considered in my designs are:

* north - south orientation for protecting major spaces for direct solar heating
* wind direction from south - east to north - west (refer to chart 1)
* rainfall (refer to chart 2)

CHARTS

Month	Jan	Feb	Mar	Apri.	May	June	July	Aug.	Sept.	Oct	Nov	Dec
Direction	W-NW S-SW	West	N. West	West	S-SW	S-SW	SW-W	W-NW	W-NW	W-NW	West	S. West
Wind Mean (m/s)	0.6	1.3	1.2	1.1	1.4	1.2	1.6	1.6	1.9	1.8	1.4	1.1

N



WIND DIRECTION

CHART 1

MONTH	JAN	FEB	MAC	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MM.	192.3	30.6	186.7	166.5	153.8	47.7	92.2	44.0	106.9	97.9	213.9	250.9

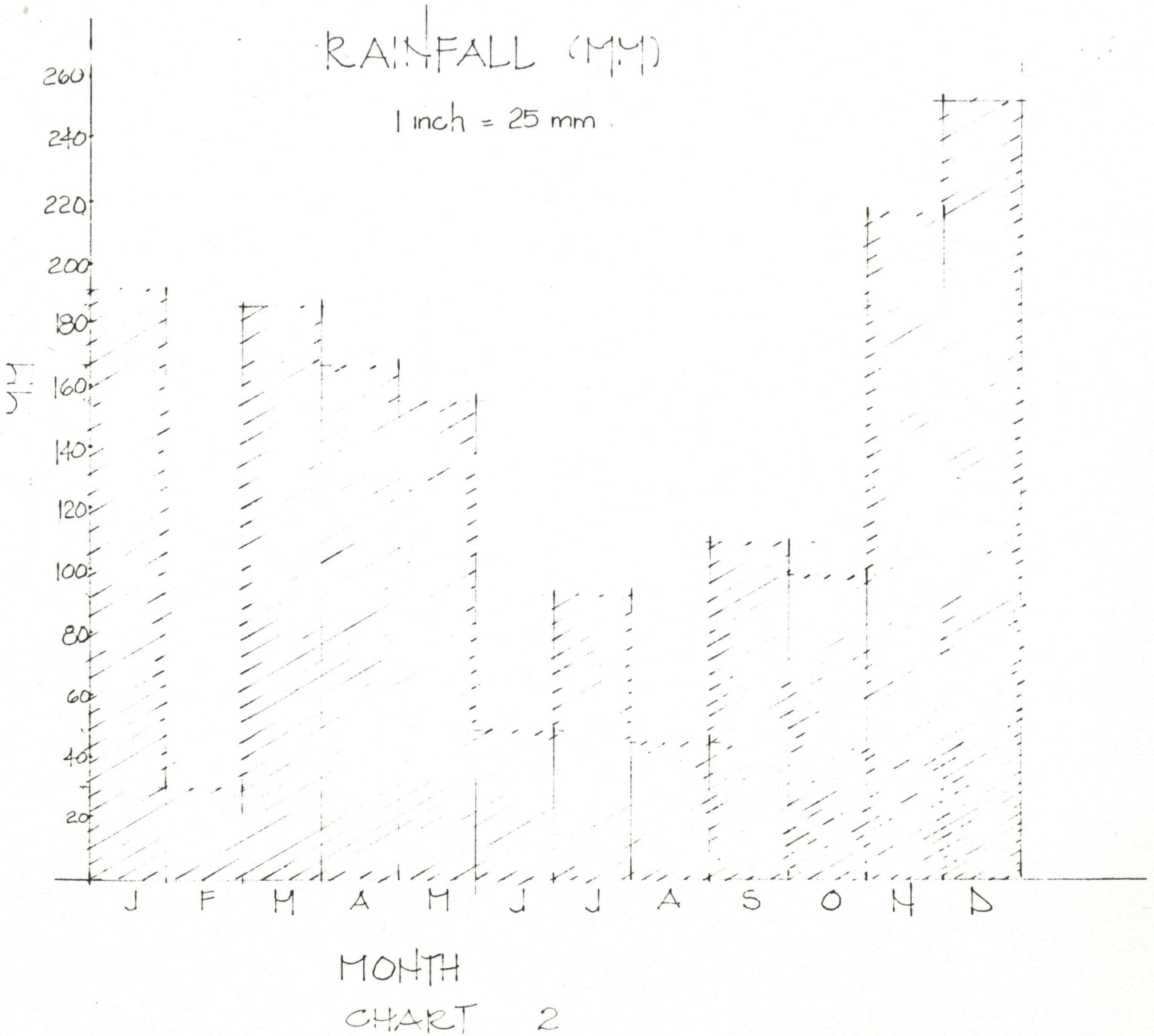
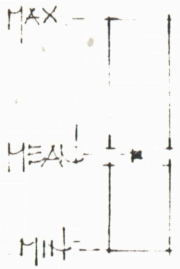
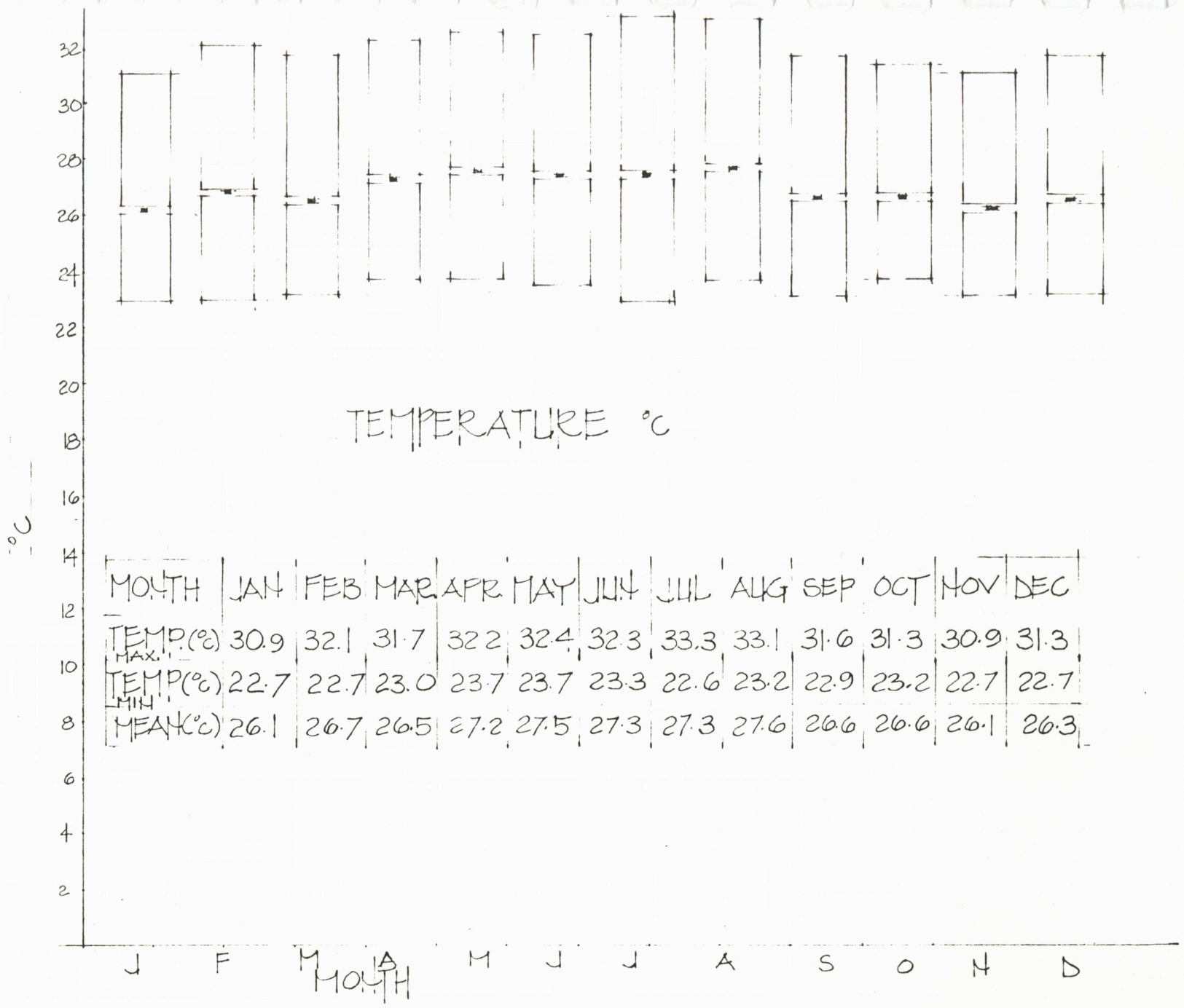


CHART 2





TEMPERATURE °C

MOUTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TEMP.(°C) MAX.	30.9	32.1	31.7	32.2	32.4	32.3	33.3	33.1	31.6	31.3	30.9	31.3
TEMP(°C) MIN	22.7	22.7	23.0	23.7	23.7	23.3	22.6	23.2	22.9	23.2	22.7	22.7
MEAN(°C)	26.1	26.7	26.5	27.2	27.5	27.3	27.3	27.6	26.6	26.6	26.1	26.3

CHART 3

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
%	85·7	81·9	86·1	85·9	83·0	83·7	80·4	79·5	84·0	85·0	86·9	85·7

RELATIVE HUMIDITY

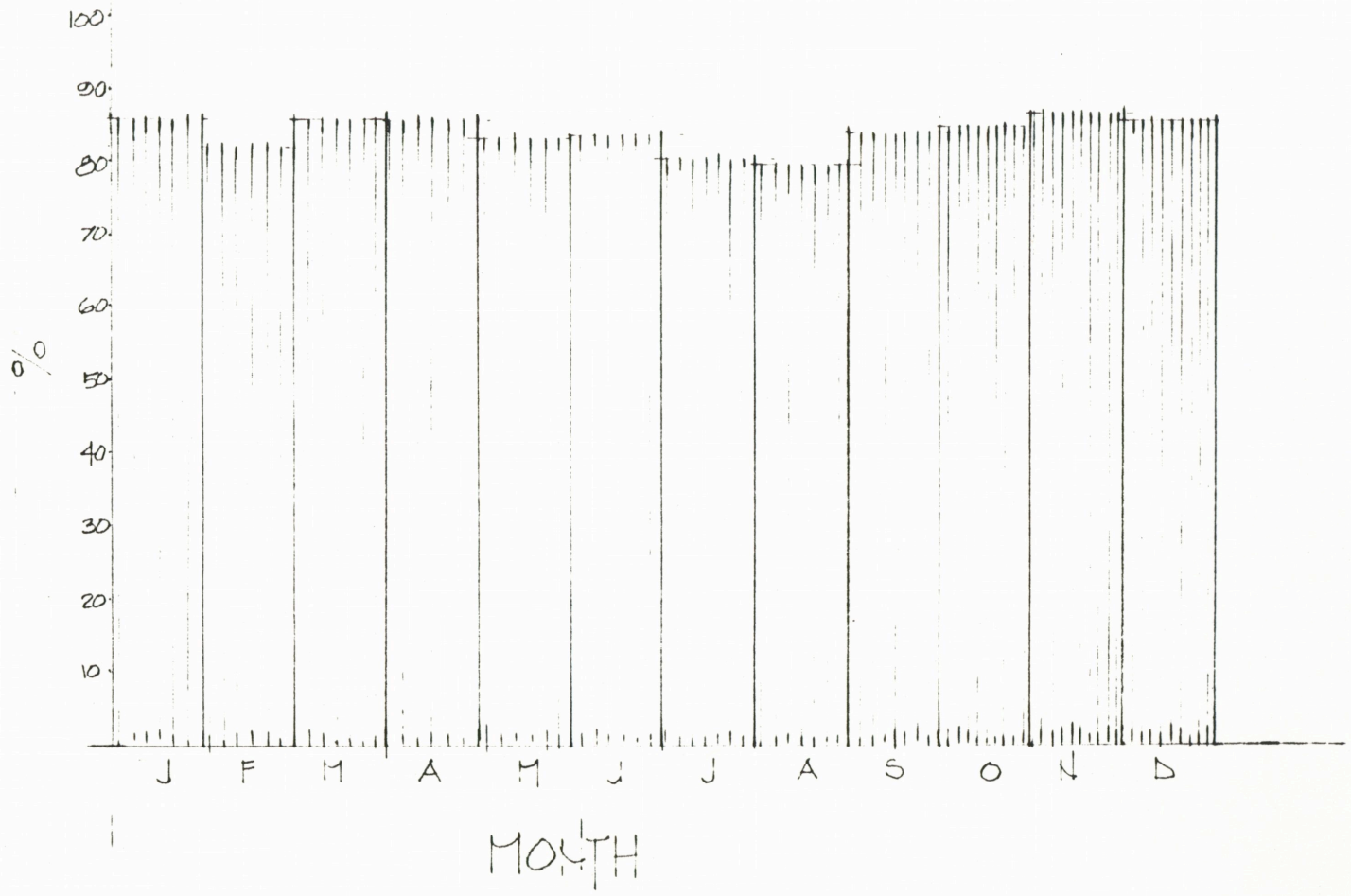


CHART 4

Lighting

Lighting in Malaysia's climate is a more complex matter because daylight is accompanied by thermal radiation. Daylight sources in our climate should not be direct sunlight, but rather indirect sources like reflected light (internal and external) and diffused or skylight. Internally reflected light is the best lighting as the heat is excluded and glare is minimized.

Slight under-lighting rather than over-lighting is recommended for our climate, because over-lighting is likely to cause overheating from the accompanying thermal radiation. Overheating would case greater discomfort than underlighting. Furthermore, a slightly underlit room is psychologically more acceptable, as light is often associated with warmth and reduced lighting with coolness.

Glare and 'gloominess' are other aspects of lighting which need to be addressed (besides lighting levels, which is more specific according to the different visual tasks). 'Gloominess' is a subjective effect created by excessive lighting contrast between the bright exterior and dimly lit interiors. Glare is caused by excessivley bright surfaces in the visual field.

DESIGN PROGRAM

Gymnasium/Social Hall

-The overall size of a social hall/gymnasium is 180 by 64 feet

-The size of a gymnasium/social hall should be at least 90 by 100 feet, with a minimum ceiling height of 22 feet.

-The gymnasium/social hall is used for social activities such as weddings, banquets, and meetings. In addition, it is used for indoor games such as basketball, volleyball, badminton, etc.

-The size for a basketball court is 50 by 94 feet

-The size for a badminton court is 20 by 44 feet

-The size for a volleyball court is 42 by 72 feet

-provision should be made for a mechanical ventilating system (forced air). The wainscotting should provide clear, unobstructed wall space from the floor to a height or 12 feet.

-There should be no windows at either end of the social hall/ gymnasium

-The floor should have a non-skid surface to prevent accidents. The floor should also be level in order to permit multiple uses of dancing, meetings, sports, games, etc.

-Maple flooring is commonly used

-The standard used for determining the size requirements of a recreation building is based upon a square-footage -to-population ratio. This may be determined by allowing one to two square feet per person to be served.

-There is no fixed seating in this social hall/gymnasium. The types of chairs used are; plastic stacking chair, plia chair, and tubular steel folding chairs.

Type of Activity	Number of Occupants
Wedding	350-400
Banquet	400 maximum
Meeting	600-650
Tournament with Spectators	150-200
Culture Shows	600-650
Concert	2000 maximum

-A lighting system which provides a variation of illuminance is used here. Thus a circuit system with independent and combination is used to provide a range of illuminance

value, depending on the type of activity.

-For special activities, such as dances, where the creation of a mood or atmosphere is the primary lighting objective, and low luminance is desired, the most satisfactory results can often be achieved through the use of portable or temporary supplemental lighting equipment. For example, small flood lights, reflectorized lamps or colored filters could be used.

-A simple acoustic treatment can be achieved by treating part of the ceiling with sound-absorbing material, for noise and reverberation control, leaving the central portion hard for sound-reinforcing reflection. The opposite end of a stage can be treated with a sound-absorbing material to reduce echo (see illustration) and sometimes a sound reflecting panel can be arranged at the platform end of the room, to give additional sound-reinforcing reflections.

Stage

-and related facilities are frequently included in a community center

-they may be built in conjunction with the multi-purpose area, or preferably, as a separate unit.

-Size:

-the stage proper should be about 200 feet in depth, and the proscenium opening should be at least two thirds the width of the room.

-it is desirable that the approach to the stage from the floor of the main room be by way of inclined ramp with a non-skid surface to facilitate the physically disabled and aging, and to accommodate the movement of equipment.

-all stage lighting should be controlled from a dimmer-control cabinet equipped with a rheostat. Provisions should also be made for television installation.

-spotlights are used in the house area to cover the downstage (close to the audience) area. These spotlights should be mounted and may be adjusted vertically and horizontally. Consideration should be given to the ease with which the shape and definition of the light beam can be controlled, since this is of prime importance in preventing light spill on the curtains and walls around the stage.

-spotlights are also used over the whole stage to light the various acting areas. Borderlights and footlights of the individual reflector or compartment type provide a convenient source of general lighting and add an over-all blending to the light picture. Auxiliary striplights, floodlights and spotlights may be required to light various areas and backings. In addition to circuits necessary for overhead lighting, groups of stage type receptacles are required on or near the stage floor around the acting area for additional lighting units which may be plugged in from time to time. Separate work lights are also necessary for the stage.

-it is desirable for all stage lighting branch circuits to be brought into a central interconnecting panel. The panel provides a switching or interplugging system, whereby any stage branch circuit can be connected to any dimming circuit.

Drinking Fountain and Cuspidor

-Recessed drinking fountains and cuspidors should be provided and should be located in areas where they will cause minimum interference.

-Water fountains should be hand or hand-foot operated, with upfront spouts and controls.

-Protective floor covering or drainage at the base of the fountain should be considered to avoid floor damage

Dressing-Locker Room

-A room for the purpose of changing clothes is necessary and should be in close proximity to the social hall-gymnasium.

-There are two accepted plans for checking personal apparel:

1) The use of locker rooms with metal lockers

2) The use of dressing rooms with check rooms for checking clothes in wire baskets or nylon bags

Locker Room

-Should be located near the gymnasium
-The suggested requirements for the locker room in a community recreation building are as follows:

1) for men and boys, 200 lockers

2) for women and girls, 150 lockers

-The placement of lockers should take into account the space requirements of the disabled.

-The floor of the locker room should pitch to a central drain or drains to facilitate cleaning and washing. The junction of the wall and floor should be coved.

-In the women's locker room, dressing booths should be supplied in the ration of 10 percent of the total number of lockers.

-Hair dryers and nonbreakable liquid soap dispensers are also recommended.

Dressing Room with Checkroom

-This system will accommodate the same number of users in

about one fourth of the space required for metal lockers.

Conclusion

-Type of locker room that is going to be used is a dressing room with locker room.

-The size for boys/mens locker room is at least 600 square feet

-The size for girls/womens locker room is at least 500 square feet

Shower Room

-The size of shower rooms is dependent on two things:

1) the extent of the facilities

2) the number of persons to be served at one time

-For men and boys, it is suggested that approximately 12 shower heads be provided, spaced a minimum of four feet apart and six feet above the floor level.

-For women and girls, it is recommended that a minimum of six group shower heads and three individual shower and dressing booths be provided. Shower heads should be 4 1/2 feet above the floor level.

-For drainage mean in construction of shower room floors, drainage gutters 4 inches deep and 8 - 10 inches wide should be placed around the perimeter of the shower room.

-The central portion of the shower floor, raised above the depressed area, should drain toward shower drains.

-A carborundum-impregnated ceramic tile, it its equal, will provide a nonslip surface.

-The temperature of water feeding into the shower heads should be 120 degrees F, controlled by means of a mixing chamber rather than by individual control.

Meeting Room

-A minimum of 500 square feet of floor space is needed per meeting room.

-Provide at least three to five small meeting rooms for multiple use.

-At least one large meeting room should be located adjoining the kitchen.

-When windows are placed high on the wall, they provide more

space for furniture, bulletin boards, pegboards, chalkboards and exhibits.

-There are three meeting rooms that are going to be provided here. Two of those meeting rooms are for club purposes. In between the two rooms is a folding wall. Each of these two rooms is 700 square feet.

-Another meeting room size is 500 square feet. This meeting room is for the board members purposes.

-Base and wall plugs should be provided in all meeting rooms for the operation of movie projectors, etc.

Director's Office

-An approximate size of 120 square feet is suggested, with sufficient window space to provide maximum supervision of the lobby, lounge, club rooms, and social hall/gymnasium. At least three walls should have windows. If there is a window connected to the social hall/gymnasium, a non-breakable type of glass is preferrable.

-It is often recommended that t there be an adjoining shower-dressing unit with a floor surface area of not less than 100 square feet. This unit should contain a shower, toilet and lavatory, clothes closet, and first-aid supply cabinet.

-Opening off the director's office should be a large storage closet with a burglar-proof door for storing valuable supplies and equipment, such as the motion picture projector and public address system.

Rest Rooms

-Facilities should include multipurpose units/combining automatic towel and soap dispensers, mirror and shelf, and a combination paper-towel dispenser and waste receptacle. These units should be recessed into the wall.

-Mirrors should have metal frames and be recessed into the wall so they cannot be torn off.

-Dressing room benches should be of a permanent type and should be securly anchored to the floor or against the wall so they cannot be turned over, broken or removed from the building.

-Toilet fixtures should be hung from the wall for ease in cleaning and should be push-valve operated, with a valve of 24 inches above the top of the fixture, or three feet above the floor.

-Lavatories should be of enamel-coated iron or other

unbreakable material rather than vitreous china.

-Restroom facilities should be made accessible to the disabled.

Lounge and Lobby

-The lobby is the space just inside the entrance.

-The lounge should open off the lobby, and if possible, should be close to the central office and to the meeting rooms and/or social hall/gymnasium.

-Lobby and lounge are often combined into one room.

-When they are combined, the total size should be from 600-800 square feet. This facility should be attractively lighted, should contain a wall-mounted, recessed drinking-fountain, and a built-in electrically lighted trophy case and bulletin board.

-An area of at least 100 square feet is provided for a receptionist area in the lounge. There is also some space provided for vending machines.

-Appropriate space should be allowed for public telephones, and at least one telephone should be installed to accommodate a person in a wheelchair.

-The offices and restrooms should be adjacent to the lounge/lobby.

-The entrance doors of the lobby should consider problems of aesthetics, safety, security and vandalism.

-Glass doors and panels can be easily broken, so good aluminum doors with a minimum of glass are preferrable.

-One of the main causes of damage to floors is the habit people have of dropping cigarettes on the floor and stepping on them. This habit causes definite damage to asphalt, disfiguring and discoloring light colors, and to some extent, even marring darker colors. Therefore, terrazzo, quarry tile, and patio tiles are preferrable.

Kitchen

-The pullman or kitchenette type kitchen is usually sufficient for most community recreation buildings. An area of 250 square feet is needed here. Usually the size ranges from 250 to 500 square feet, depending on what type of banquets need to be served.

-The kitchen should be located near the social hall/

gymnasium and meeting rooms. This will make the kitchen available to small gatherings or large banquet gatherings.

-Adequate storage space, cabinet space, and electrical outlets for such appliances as the refrigerator, the range, the dishwasher, and can opener should be provided.

-Exhaust fans should also be installed.

Storage Areas

-Sufficient storage space for equipment, maintenance and custodial purposes.

Equipment Storage Room

-Provisions should be made for storing apparatus and equipment.

-There should be an opening six feet wide with louvered flush doors between the social hall/gymnasium and the storage room. This will permit passage of the most bulky equipment. There should be no raised threshold.

-The minimum size of the storage room should be 250 square feet.

-Provision should be made for storage of inflated balls, bats, table tennis, shuttle cocks and other supplies, either in separate cabinets or a special closet.

-Appropriate bins, shelves, and racks are suggested.

-In addition, a recessed alcove for the storage of a piano is desirable.

Maintenance Storage Room

-This room will vary in size, depending upon the size of outdoor sports facilities and the size of the building.

-This facility is used as a headquarters for all outdoor maintenance, thus the room is ordinarily located on ground level and adjacent to the outdoor areas.

-The facility may have to house rakes, shovels, hoses, marking equipment and supplies, hand tools, power tools, and other equipment.

-Recessed wall shelving and cabinet storage should be provided for tools, supplies and equipment. This space should also contain hot and cold water, a slop sink, a lavatory, a water closet, and a clothes closet.

-The floor should be concrete and should be pitched to a

central drain. The junction of the walls and floor should be coved.

Custodial Storage Room

-A supply closet equipped with a slop sink and space for mops, pails, brooms, and cleaning supplies should be centrally located on each floor level.

Projector Room

-A soundproof broadcasting and television booth is provided for attractions of considerable public interest.

-The projector is located on the second level, so that it is away from the heavy traffic of audiences.

Fixed Seating Area

-An area of 200 - 250 square feet of fixed seating is provided on the second level adjoining the projector room.

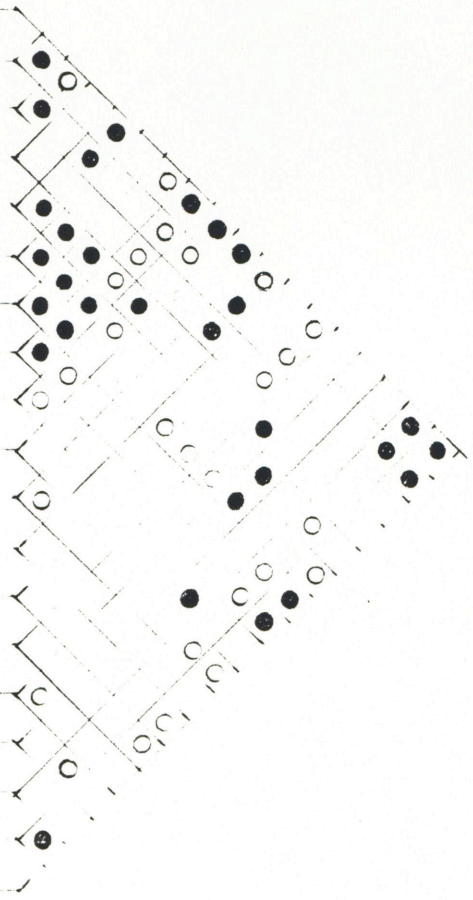
-The type of seating is the auditorium seating unit.

-Access to the second level is provided by stairs and an elevator for handicapped persons.

PROGRAM

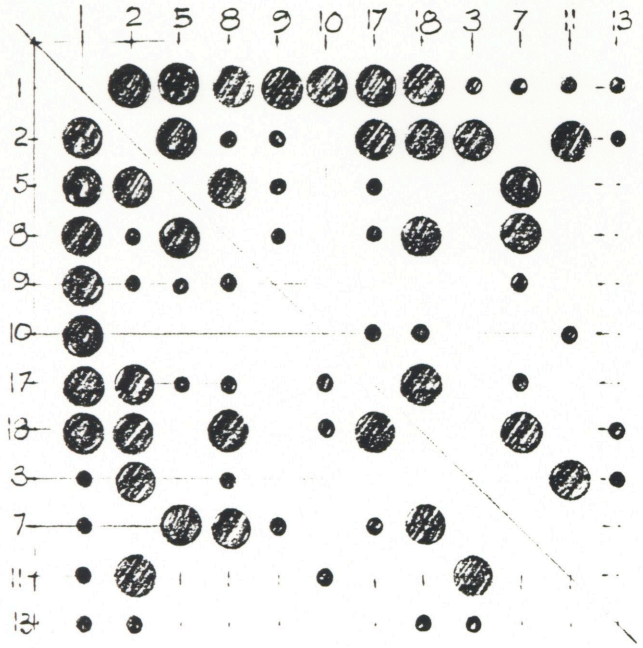
Program	Sq. Ft.
1. Social Hall, Gymnasium	9400
2. Stage	1200
3. Dressing Rooms	
- Boys, Men	660
- Girls, Women	440
4. Meeting Rooms	
: 2 @ 500 sq. ft.	1000
5. Director's Office	120
6. Receptionist	120
7. Rest Rooms	
: Men	150
- Women	150
8. Lounge & Lobby	1000
9. Kitchen	250
10. Equipment Storage	220
11. Stage "	250
12. Maintenance "	250
13. Custodial "	110
14. Meeting Rm. Storage	110
15. Offices "	110
16. Kitchens "	110
17. Audio / Projector Rm.	350
18. Fixed Seating Area @ 150 people	600
Total	16 820
: Circulation 15% x total =	2523
. Mech., Elect. & etc 15 x total =	2523
Total Area	21866

1 Social Hall/Gymasium
2 Stage
3 Dressing Rooms
4 Meeting Rooms
5 Director's Office
6 Receptionist
7 Rest Rooms
8 Lounge & Lobby
9 Kitchen
10 Equipt. Storage
11 Stage Stor.
12 Maintenance Stor.
13 Custodial Stor.
14 Meeting Rm. Stor.
15 Office & Stor
16 Kitchen & Stor
17 Audio Rm.
18 Fixed Seating Area

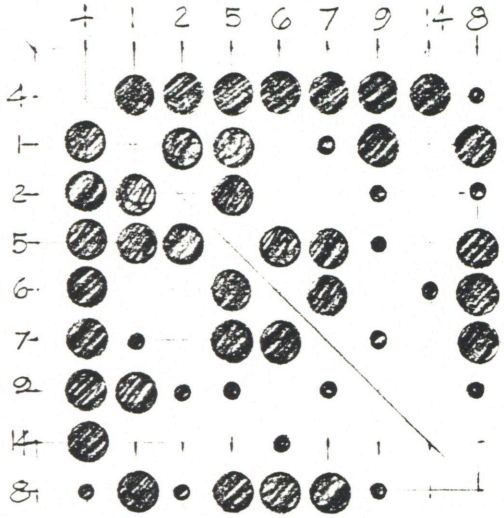


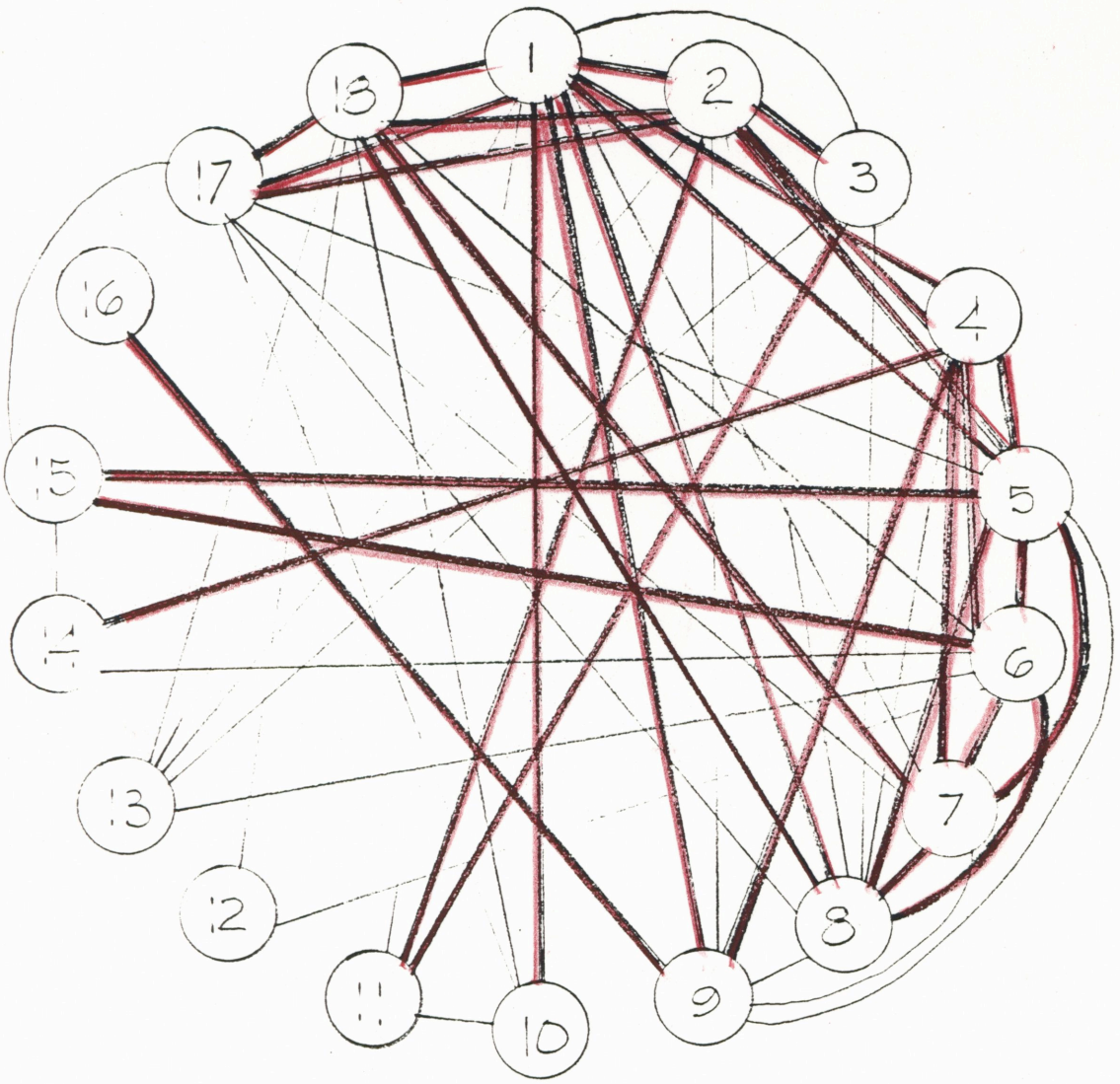
Adjacency Requirement:

Essential ◈ Desirable ◇ Nonessential ×



Adjacency Required ● Separation Desirable •



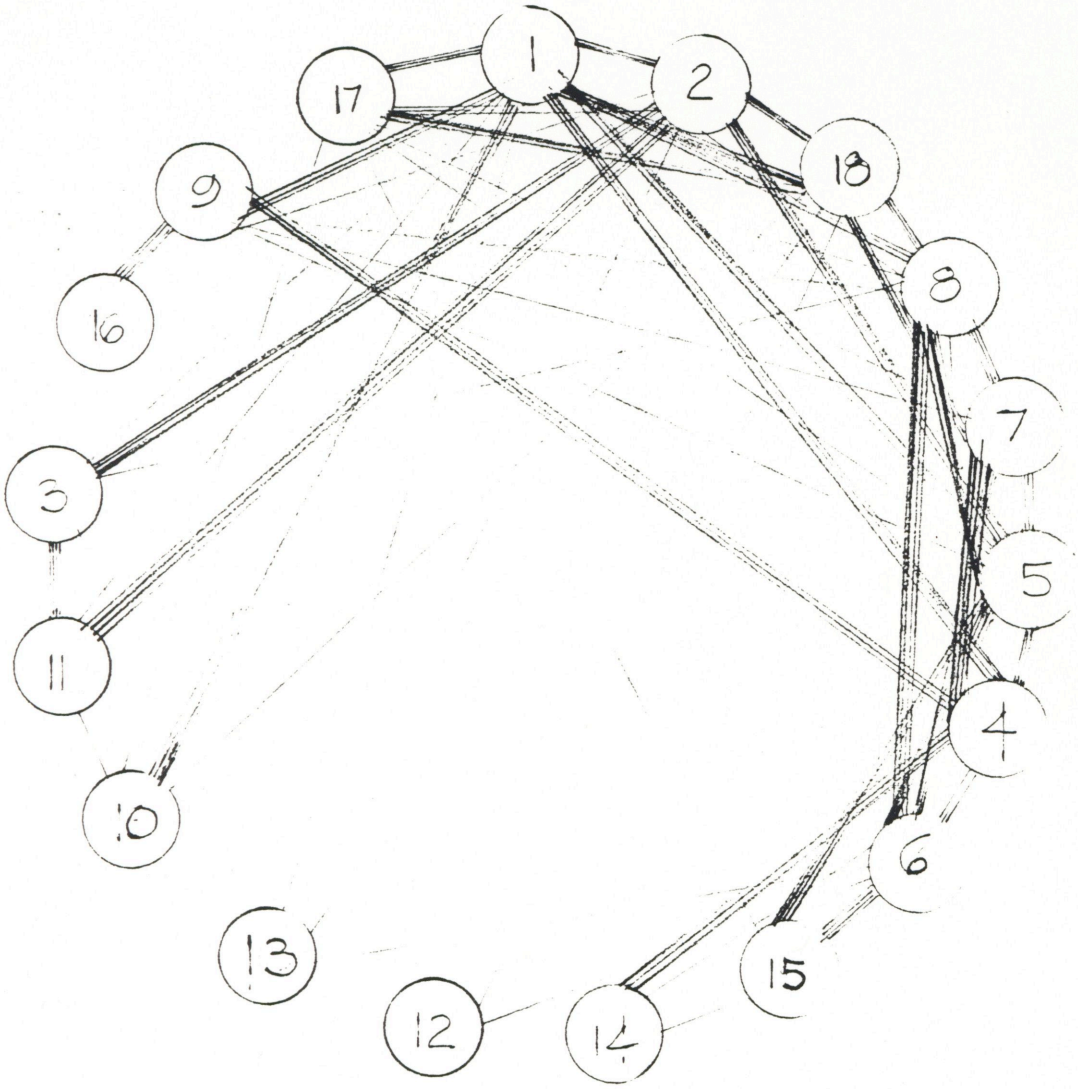


INTENSITY OF RELATIONSHIPS

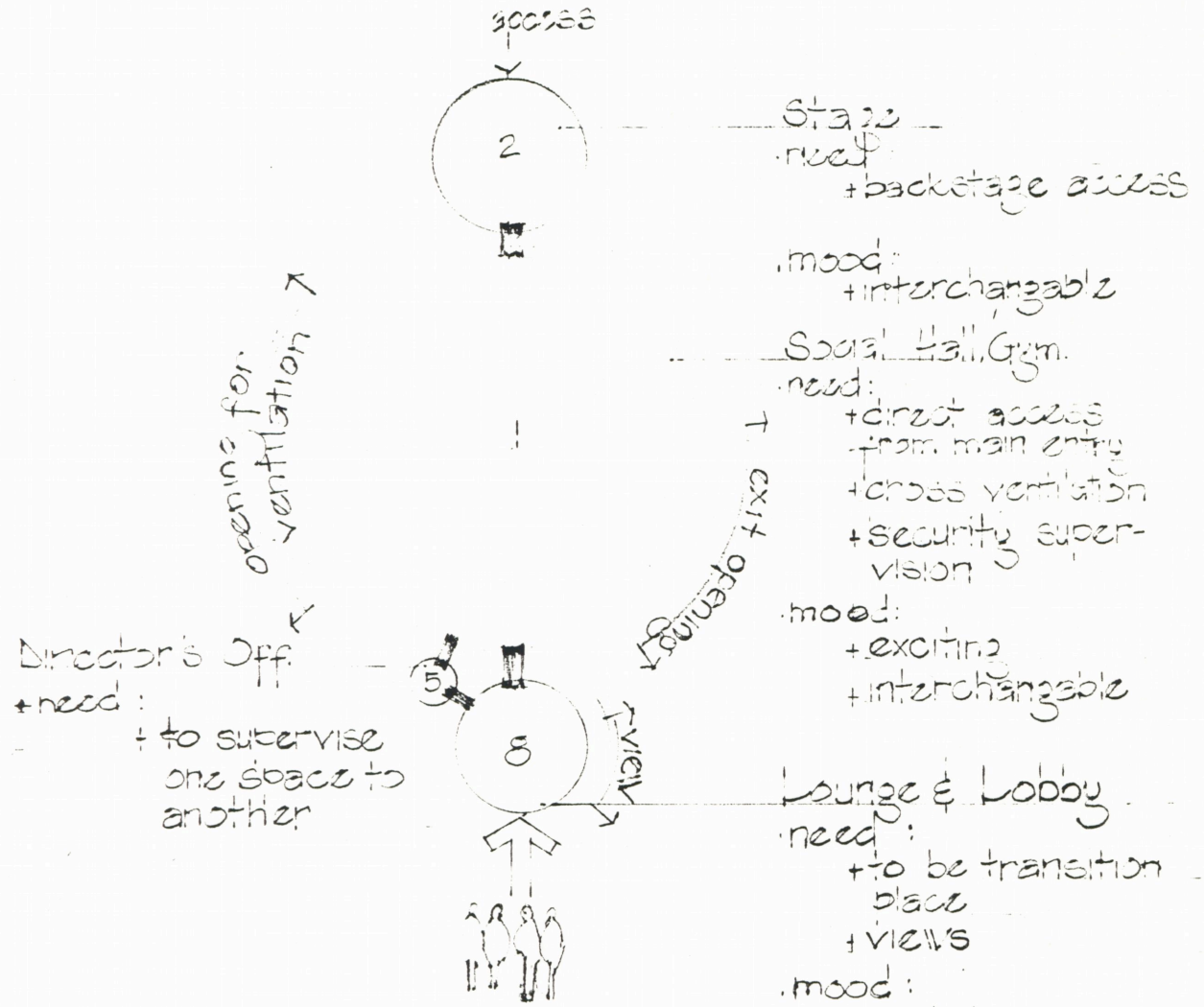
Intensity Required

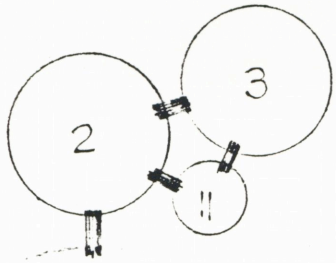
" Desirable

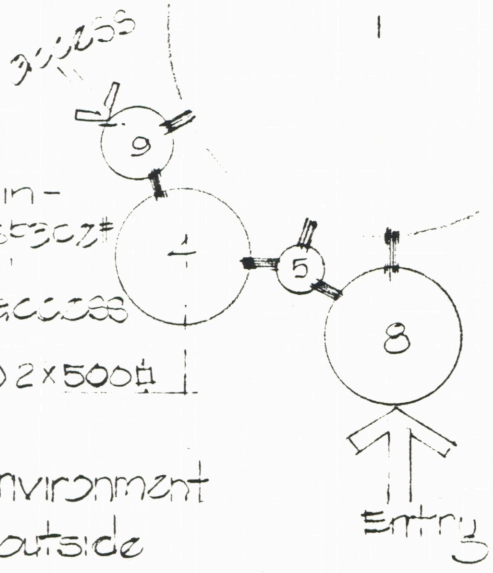
need more description



same


access
2
Stage
need
+backstage access
mood:
+interchangable
Social Hall, Gym.
need:
+direct access from main entry
+cross ventilation
+security supervision
mood:
+exciting
+interchangable
openings for ventilation
exit openings
Director's Off.
+need:
+to supervise one space to another
5
8
view
Lounge & Lobby
need:
+to be transition place
+views
mood:
+invitating
adjacency required





Kitchen

·need:

+buffer zone in-between to separate one

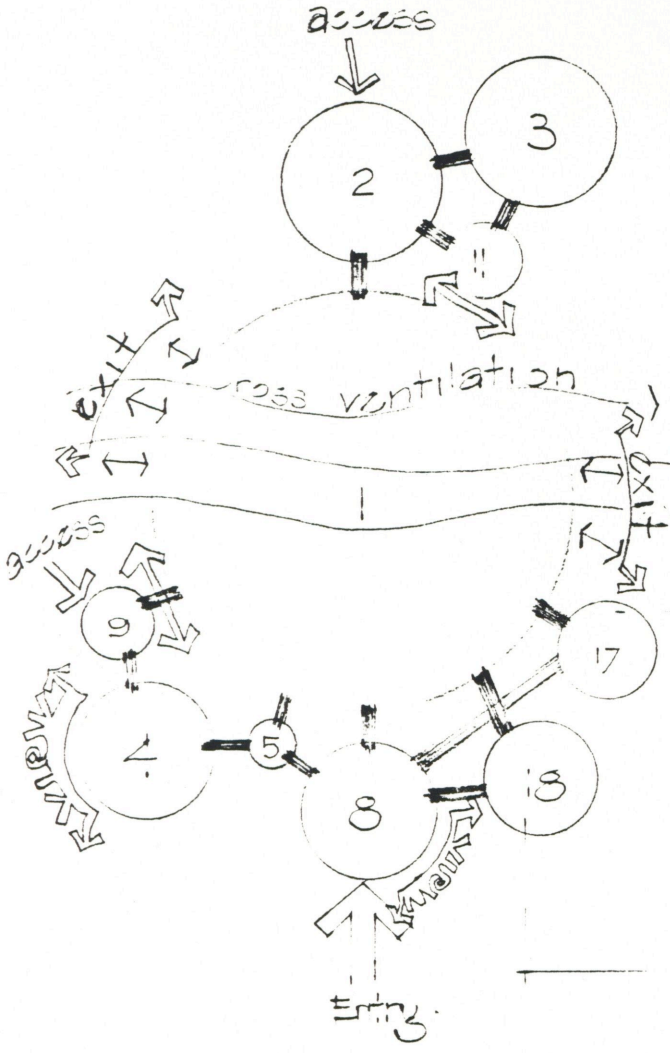
+separate access

Meeting Rms. @ 2x500ft

·need:

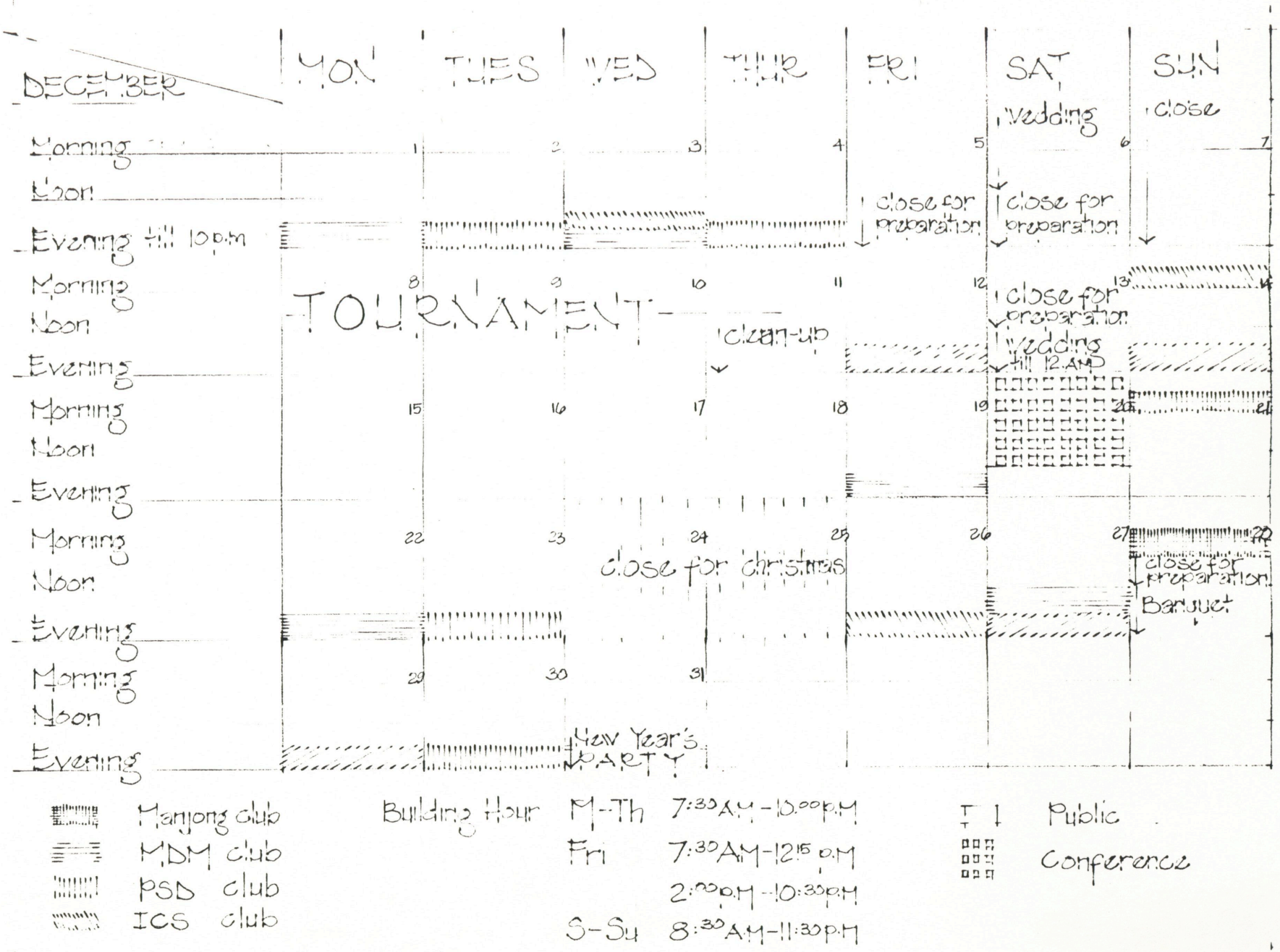
+privacy environment

+views to outside



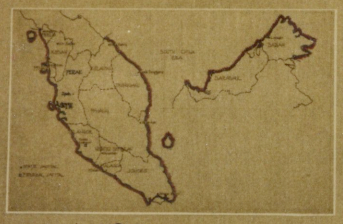
Audio Projector Room need:
+ directly opposite to the stage
+ to be on higher level than seating one.

Fixed Seating need:
+ direct access from the lobby
+ to provide good views to all the spectators.


DECEMBER
MON
TUES
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Morning
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Evening
Morning
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close for preparation
close for preparation
close
-TOURNAMENT-
clean-up
close for preparation
wedding till 12 AM
close for christmas
close for preparation
Banquet
New Year's PARTY
Mahjong club
MDM club
PSD club
ICS club
Building Hour
M-Th 7:30 A.M - 10.00 p.M
Fri 7:30 A.M - 12:15 p.M
2:00 p.M - 10:30 p.M
S-Su 8:30 A.M - 11:30 p.M
Public
Conference



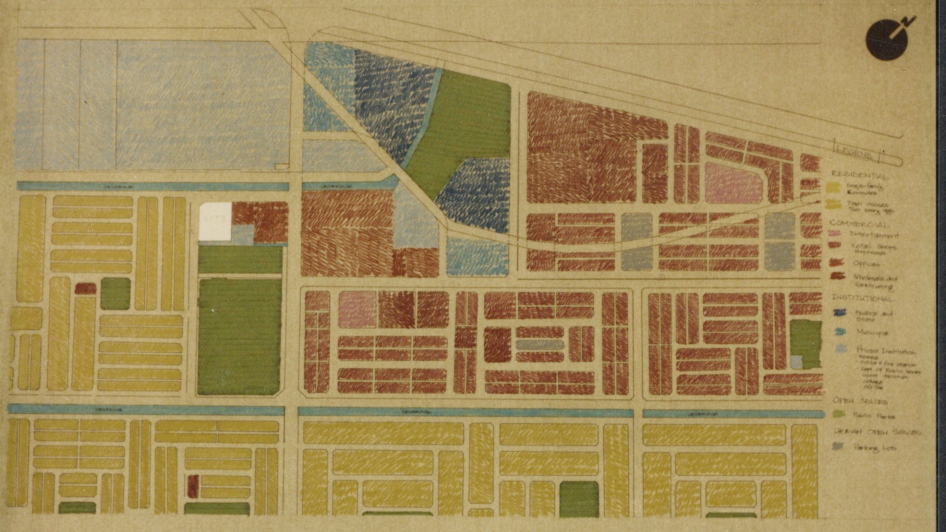
WORLD MAP



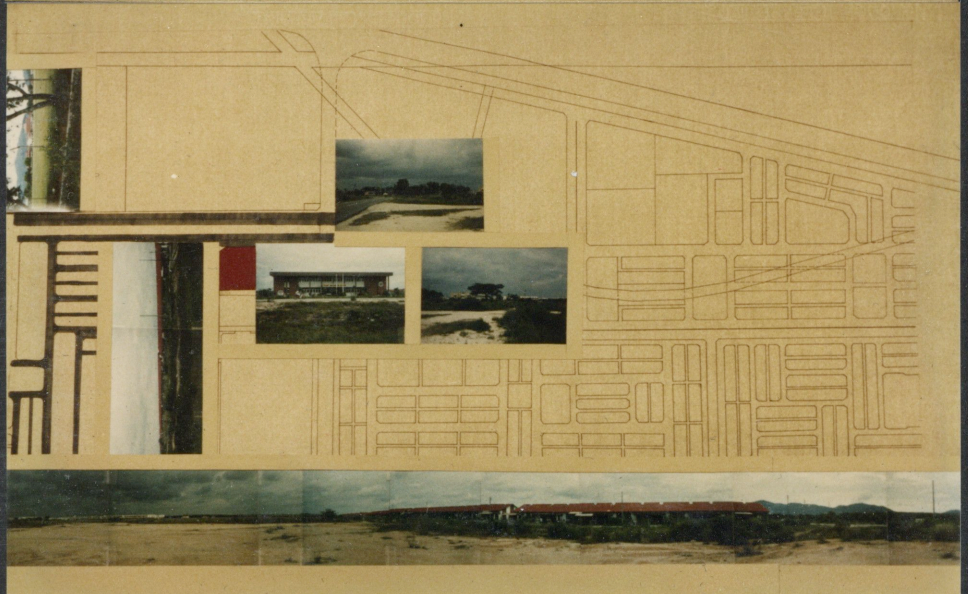
MALAYSIA

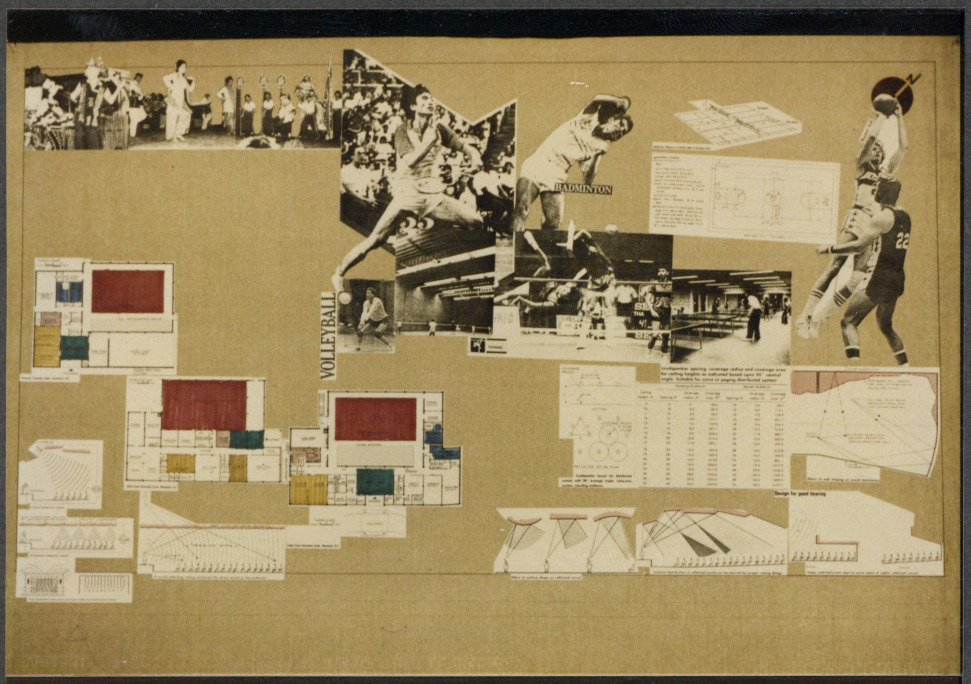


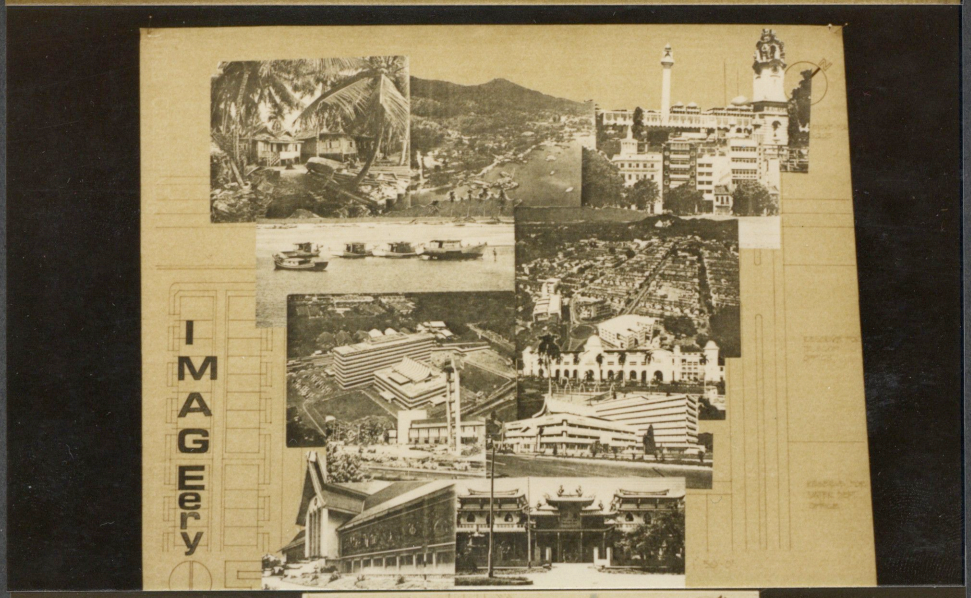
Map of PERAK

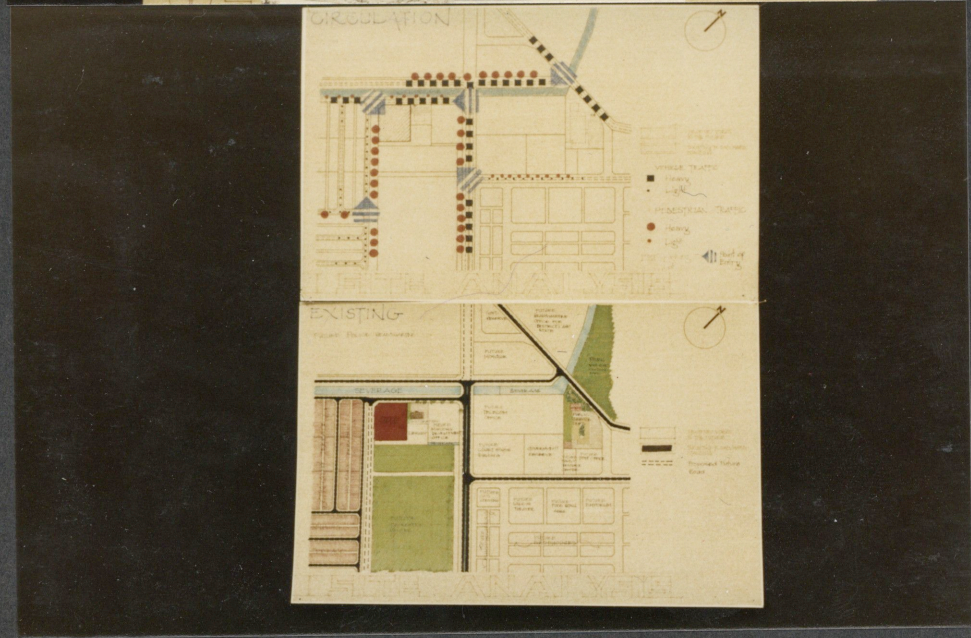


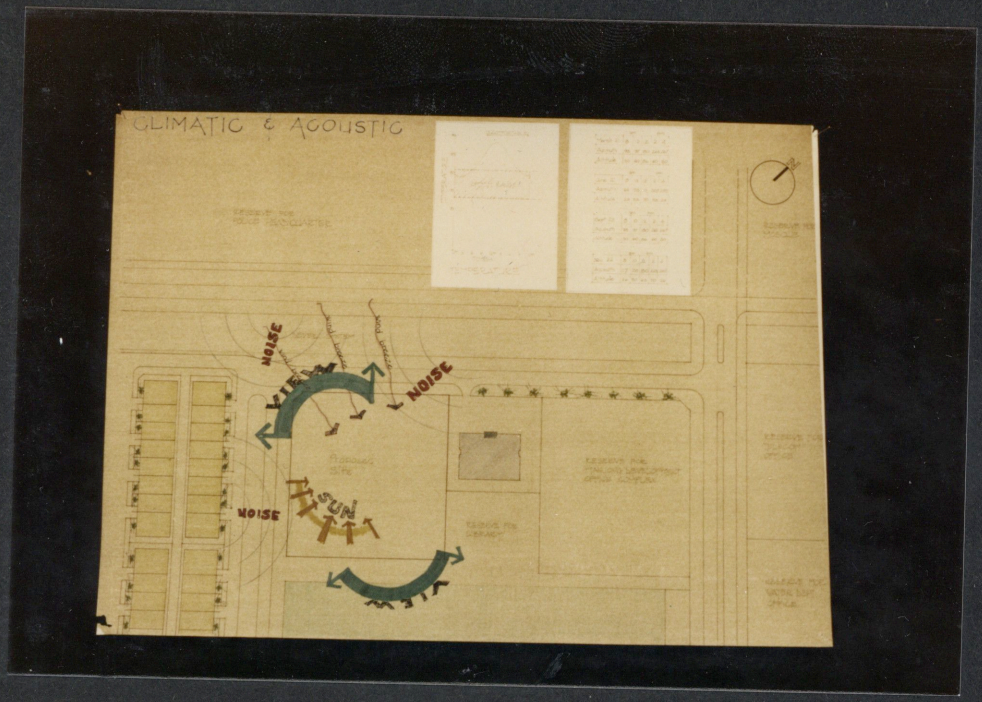
MULTI-PURPOSE BUILDING

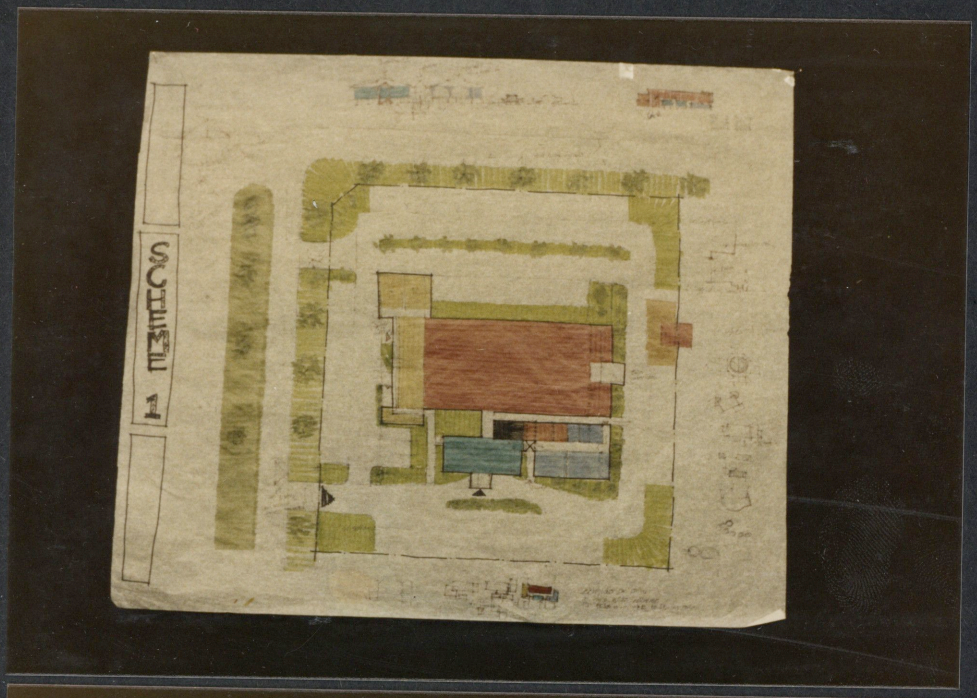


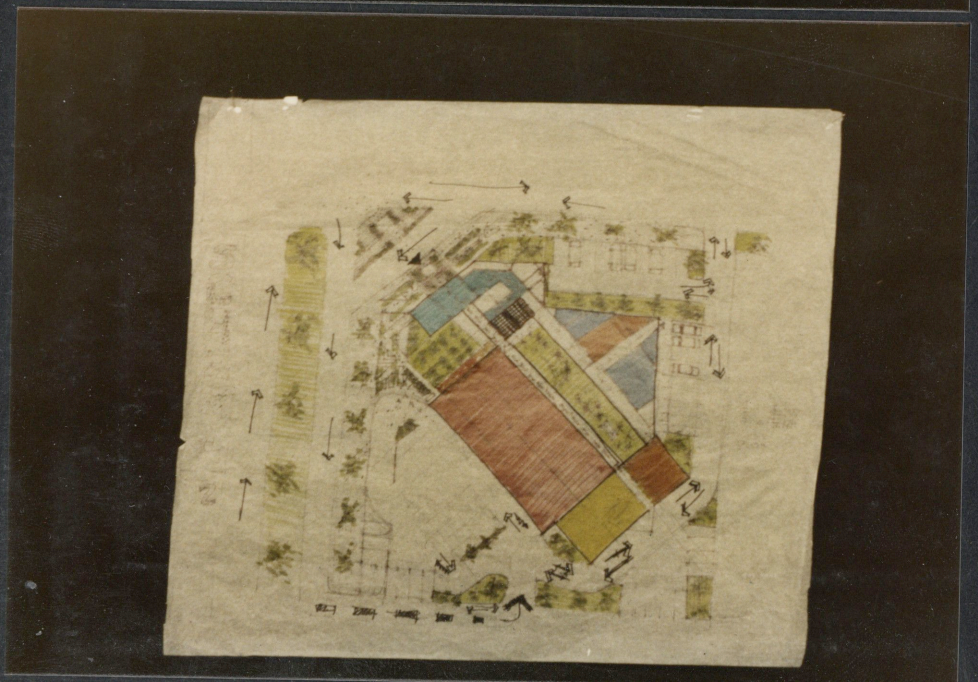

VOLLEYBALL
BADMINTON

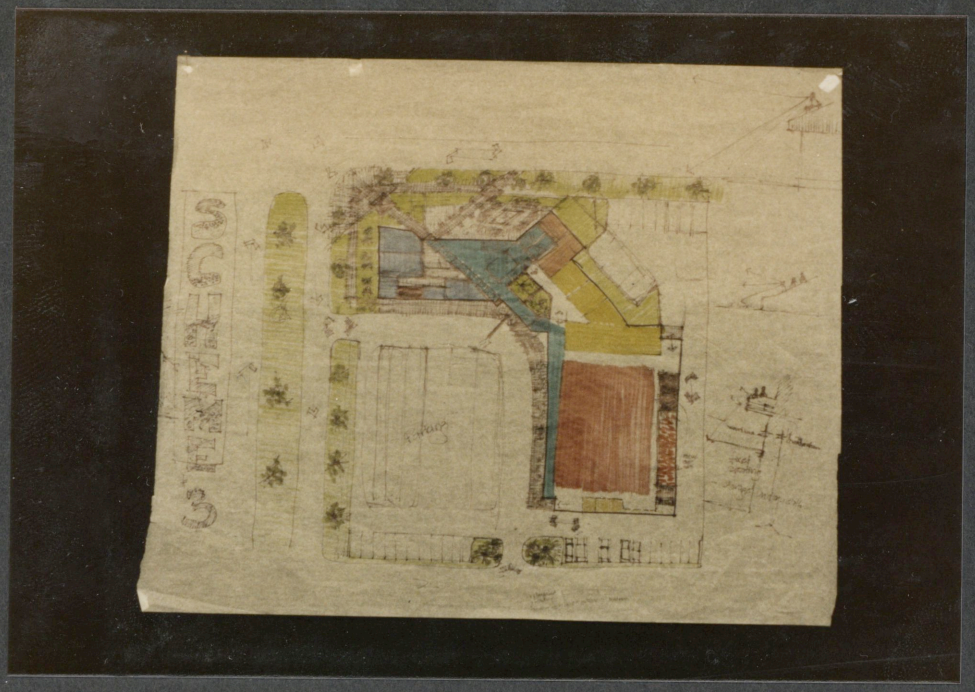

IMAGEery


CIRCULATION
EXISTING


CLIMATIC & ACOUSTIC
NOISE
NOISE
NOISE
SUN

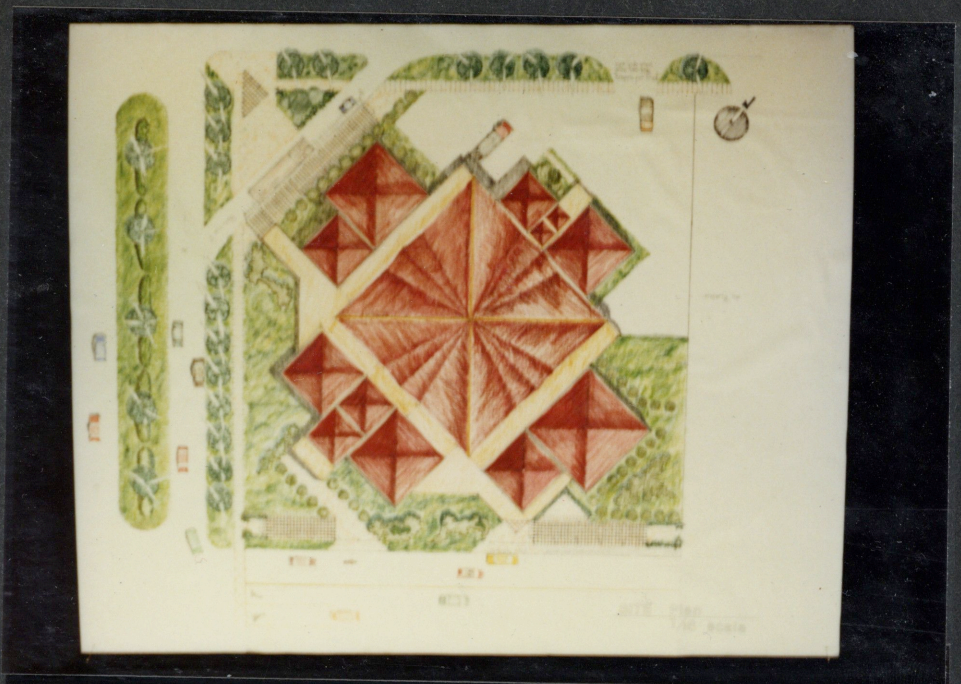

SCHEME 1

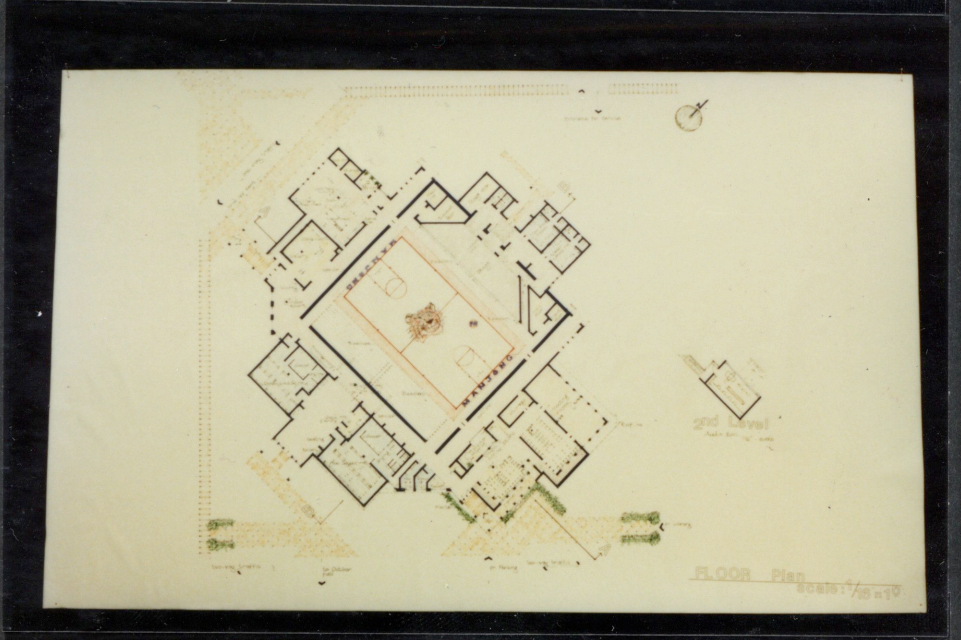




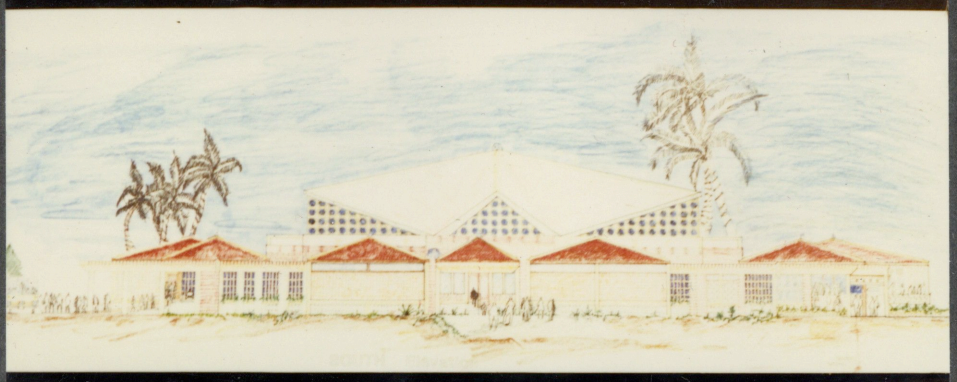


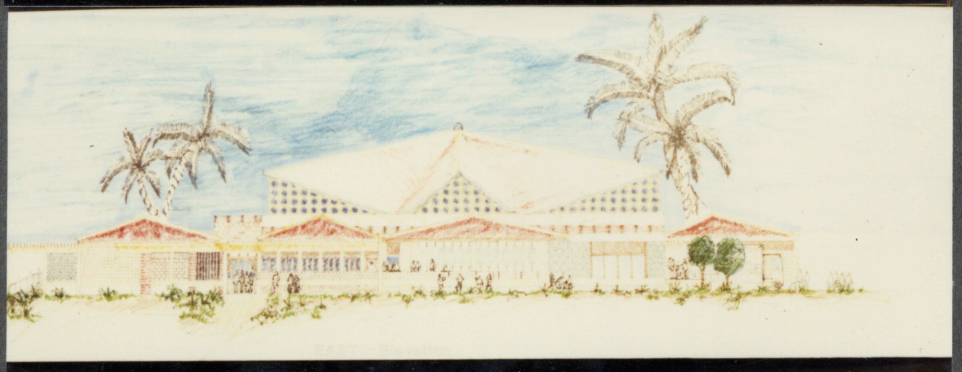
Thesis I




2nd Level
FLOOR Plan

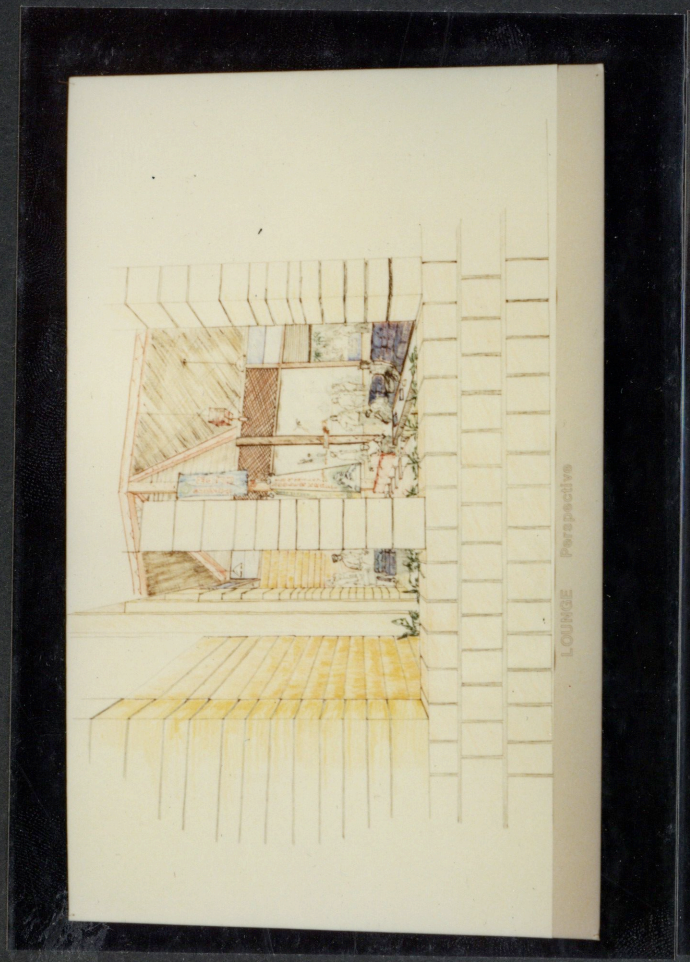


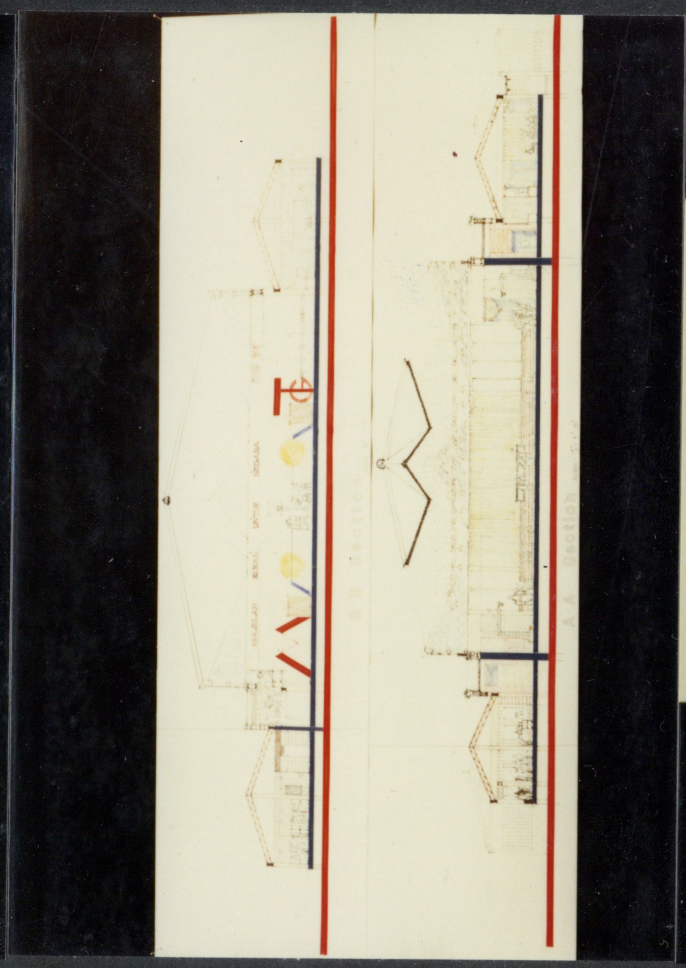


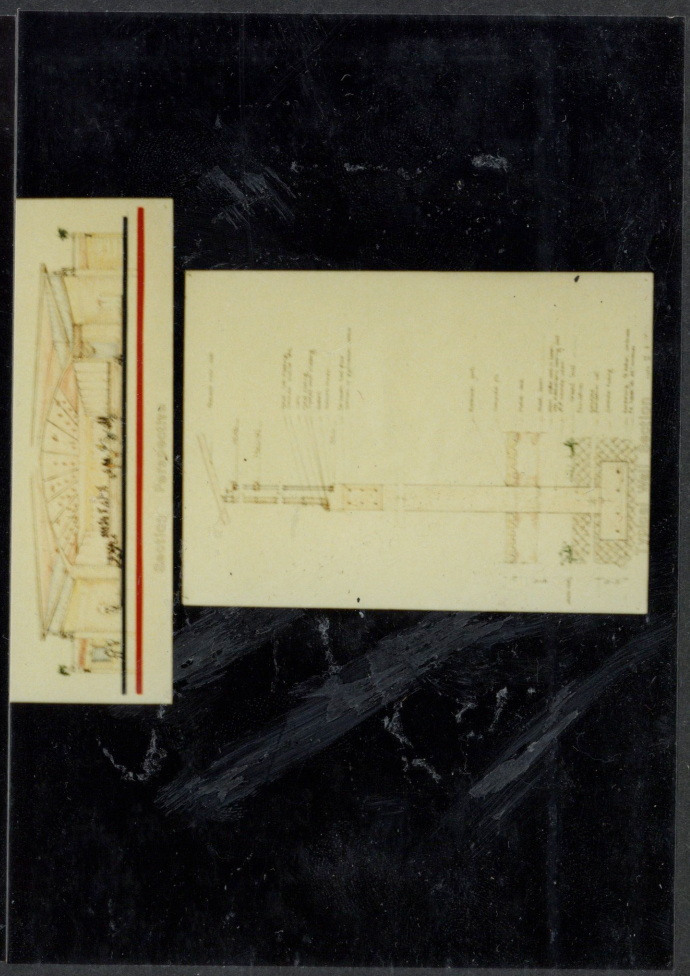




Thesis II







APPENDIX

- Schedule A - Interviews

- Uniform Building By-Laws 1984

INTERVIEW WITH MR. AMIR AHMAD FROM THE PUBLIC SERVICE DEPARTMENT, MANJONG, PERAK

Zam: You said that a project of Dewan Bandaran will be built pretty soon. That is quite interesting to me, so I am doing a thesis on that project which is related to our unique community here in the Manjong District. I would like to ask, straight to the point of the program, since you are the one responsible for making the design of this particular project. Why do we need this facility here?

En. Amir: There are not enough facilities in the Manjong area to meet the international standard. In order to meet the international standard, we need four badminton courts at least, and a minimum ceiling height of 25 to 30 feet.

Zam: Who is the facility for?

En. Amir: We will design this for the public, especially for the Bandar Seri Manjong community. It is intended to serve as a tournament space for either basketball or badminton. This facility will also serve other indoor sports programs.

Zam: What type of building are we talking about here?

En. Amir: A brickwork and reinforced concrete building. Using wood is not a good idea because it cannot have a large span interior space.

Zam: What type of soil is this area?

En. Amir: The type of soil is sands. The reinforced concrete piling is suitable as the foundation because sands will tend to close up the gap when pilings are in the

ground, and move tension too.

Zam: What type of flooring system is good here?

En. Amir: A parquet flooring system is best, or rubber type of form which can absorb tension.

Zam: How is the facility going to be maintained?

En. Amir: This facility is normally for public interest and will be maintained by Majlis Daerah Dinding (Dinding Development Department).

Zam: How do you refer to a historical point of view?

En. Amir: Before, the Dewan was used as a town hall, which provided a place for parties. Now we have a different name for it, Dewn Serbaguna, which means multi-purpose, and serves either as a place for community functions such as weddings, or as an indoor sports area. Sports is just recently well known to us, before this we did not have this kind of facility. Sports interest rose after we got independence in 1957. The only Asian level sports that we know are the South-East Asia Games. This tournament was introduced in 1960. Now, it is only the 14th anniversary, which was just held in Jakarta last August. But there are new games that have been introduced such as snooker, pencak silat and squash. So we hope in the future, starting now, to consider to provide some space for these new sports when designing any sports facility.

Zam: Well, En. Amir, you really have good ideas and I hope you will be successful in your future works. Thank you

very much for your help.

En. Amir: I hope you will have a great time on the thesis, and I am hoping to see you soon on this architecture area.

Zam: Thank you.

INTERVIEW WITH MR. ZABIDI ISMAIL FROM (INFOCRAFT DEPARTMENT, SITIAWAN, PERAK)

Zam: There are not many building constructions lately in our town. Even the development of the new town, Bandar Seri Manjong, is also in economic trouble. What do you say about that?

Zabidi: Our economics is really in a depression, and most of our government projects are stopped for now. Mostly, the projects over in Bandar Seri Manjong need government funding, and are really in trouble. The government tries not to fund any buildings that need a big budget. They are trying to save some money. But most of the small scale projects will be getting funding from the government. This type of funding is also going to Bandar Seri Manjong small scale projects such as the Dewan Bandaran, Mosque, post office, and Manjong District Development Office.

Zam: That is true, I found out from the officers in the Public Service Department in Bandar Seri Manjong that they are going to develop a Dewan Bandaran in November 1987. So I am taking this problem too as my project for my thesis this fall of 1987. Therefore, I need some information in terms of how well the facility is going to meet the needs of our community. As far as I know, you are a member of the Infocraft Sports Club.

Zabidi: Well, building up a facility such as that will really be helpful to our club and also to the others in our community. Our club runs many competitions around

this town, especially indoor sports. We have 20 very active members. Presently only one facility exists that provides an indoor sports program. That facility is in Kampong Koh and belongs to the Anglo Chinese School. The facility only provides two badminton courts. Our club members need a bigger place for training and for evening non-casual exercises. If we are going to run a tournament in badminton, we need at least four or more courts. This will permit 16 people to participate at one time; because if they play double in one court it will take four players to play. The four courts will cover 2/3's of our 20 members at one time.

Zam: But what about the Dewan Idris Shah in Lumut?

Zabidi: That is too far to reach, and our gas bill has to be considered too. We need a facility that is easy to reach and not too far away from this town, Sitiawan.

Zam: What about the other clubs in town? Do they also face the same problems as your club?

Zabidi: I know some of my friends in other departments who also have joined their own clubs. They have basically the same programs like us, are involved in indoor games such as badminton, sepak-raga and ping-pong. They sometimes have trouble finding a place to play, either for training or for evening exercise. The only facility at Kampon Koh is not enough for us. The facility is also very poor in supervision. They do not

have a schedule where we can know when space is available. Even the kids who go to that school are using that facility. So, we hope in the future there will be a better facility that will serve our community in a better way than at present.

Zam: Well, I hope the one in Bandar Seri Manjong will provide an answer to the needs of our community. Thank you for your time in this conversation, I really appreciate it.

* based on the interview with Mr. Zabidi Ismail. Some of the statements are from the facts that he gave to me during the interview

UNIFORM BUILDING BY-LAWS 1984

Malaysia

STREET, DRAINAGE AND BUILDING ACT 1974

UNIFORM BUILDING BY-LAWS 1984

In exercise of the powers conferred by section 133 of the Street, Drainage and Building Act 1974, the Minister/State Authority makes the following by-laws: *Act 133.*

PART I

PRELIMINARY

1. These By-laws may be cited as the **Uniform Building By-laws 1984.** Citation.

2. In these By-laws, unless the context otherwise requires— Interpretation.

"Act" means the Street, Drainage and Building Act 1974;

"advertisement hoarding" means any frame, hoarding, board, wall, bar, pillar, post, wire, or any combination of these, or any erection of any kind, or any surface or space used for the display of trade, business or professional advertisements;

"aggregate" means any material other than cement and water used in the making of concrete which does not contain additions or admixtures;

"alterations" includes additions and extensions;

"approved" means approved by the local authority;

"approved plan" means a plan for a building approved by the local authority in accordance with these By-laws;

"architect" means any person who is registered as an architect under any law relating to the registration of architects and who under that law is allowed to practise or carry on business as an architect;

"ASHARE" means the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.;

"balcony" means any stage, platform, oriel window or other similar structure projecting outwards from the wall of a building and supported by brackets or cantilevered;

"base" in relation to a wall or pier means—

(a) the underside of the course immediately above the footings, if any, or in the case of wall carried by a beam, above the beam; and

(b) in any other case the bottom of such wall or pier;

"basement" means any storey or storeys of a building which is or are at a level lower than the ground storey;

"building line" means the line prescribed by either the competent planning authority or the local authority beyond which no part of a building may project, except as otherwise permitted by these By-laws;

"BS" means the latest published edition of the British Standard Specification;

"BSCP" means the latest published edition of the British Standard Code of Practice;

"ceiling" means the covering to the underside of floor joists or ceiling joists or floor slabs excluding in all cases any supporting beams, and where no such covering exists means the underside of floor joists or roof cellars or ties excluding any supporting beams;

"column", in relation to structural steel, timber or reinforced concrete, means any part of construction which will by its resistance to compression in the direction of its length and to the bending actions induced by such compression, support and transmit loading;

"dead load" means that static weight of all walls, partitions, floors, roofs and finishes, including all other permanent construction;

"depth", in respect of a building, means the measured distance between the front line of the building and the back line of the rear main wall which separates the main building from the open space;

"detached building" means any building not attached to any other buildings;

"engineer" means a person who is registered as a professional engineer under any law relating to the registration of engineers and who under the law is allowed to practise or carry on the business of a professional engineer;

"external wall" means an outer wall of a building not being a party wall notwithstanding that it may immediately adjoin a wall of another building;

"factory" means any building or part thereof designed, adapted or used for—

(a) the making of any article or part of any article, commodity or product; or

(b) the altering, repairing, ornamenting, finishing, cleaning, washing or the breaking up or demolition of any article, commodity or product; or

(c) the adapting for sale or assembly of any article, commodity or product; and

(d) any other building as defined in the Factories and Machinery Act 1967; *Act 139.*

"fire wall" means any wall, not being a party wall or external wall, of materials having the fire resistance as required under Part VII of these By-laws and either used or constructed to be used for the separation of adjoining buildings or the separation of parts of a building in such manner as to prevent or reduce the spreading of fire from one building to another or from one part of a building to another part of that building and includes a proscenium wall, compartment wall, separating wall and a protecting structure;

"flat" means any separate dwelling used or constructed or adapted to be used wholly or principally for human habitation for a single family, where the kitchen, lavatory and bathroom or water-closet are contained within the separate dwelling and that dwelling is contained in a building comprising two or more such dwellings joined vertically;

"flat roof" means any roof having no inclination or having an inclination of not more than seven and one-half degrees with the horizontal;

"flood level" means such flood level as may be prescribed for any area by the local authority;

"floor" includes any horizontal platform forming the surface of any storey and any joist, board, timber, stone, concrete, steel or other substance connected with or froming part of such platform;

"footing" means the construction whereby the weight of the structure of building is transferred from the base structure to the foundations;

"foundation" means a system or arrangement of foundation units such as footing, raft or pile through which the loads from a building or structure are transferred to the supporting soil or rock;

"garage", for purposes of these By-laws, means a building or part thereof designed, adapted or used for the housing of motor vehicles;

"godown" means any building or part thereof designed, adapted or used for storage purposes but does not include any garage ancillary to a residential building;

"ground storey" means the lowest storey of a building to which there is an entrance from the outside on or above the level of the ground at the front of the building;

"habitable room" means any room not less than 6.5 square metres in area but does not include any bathroom, water-closet, open verandah, terrace or garage;

"hardwood timber" for the purpose of these By-laws includes Cengal Batu, Balau, Resak, Tempenis, Jati, Cengal, Merbau, Kapur, Belian, Tembusu, Damar Laut Merah, Keruing, Teak or any similar natural durable heavy timber classified as such by the Forestry Department;

"headroom" means the clear vertical distance between the finished floor level and the soffit of the lowest projecting member or surface above that point;

"height" in relation to—

(a) a room means the vertical distance measured between the finished floor level and the underside of the ceiling excluding the thickness of the plaster;

(b) any storey means the vertical distance measured between the upper surfaces of its floor to the upper surface of the floor immediately above it;

(c) a wall means the vertical distance measured from the base of the wall to its highest part or, in the case of a gable, to half the height of the gable;

"hospital" means any building or part thereof designed, adapted or used for the care, accommodation or treatment of the sick, infirm, aged, convalescent or pregnant;

"hotel" means any building specifically designed and constructed or substantially adapted to be used to accommodate persons for the purpose of gain or profit, with or without arrangements for communal feeding, and includes a boarding house, lodging house or guest house;

"imposed load" means the load assumed to be produced by the intended occupancy or use including distributed, concentrated impact and inertia loads but excluding win loads;

"lateral support", in relation to a wall or pier, means such support in the direction of the thickness, length or breadth of the wall or pier which prevents movement thereof at the level and in line of direction of such support;

"layout plan" means a plan approved by the competent planning authority;

"lintel" means a beam supporting walling over an opening or recess;

"load bearing", in relation to any part of a building its foundations, means that part of the building which bears a load other than that due to its own weight and to wind pressure on its own surface;

"low lying land" means any land of which the surface is below flood level or which is so situated that it cannot at all times be efficiently drained by gravitation into an existing public surface water drain or water course;

"mesh" in relation to the measurement of materials, means the mesh of a sieve complying with BS 410—Test Sieves;

"mezzanine floor" means any floor interposed between the main floors of a building and includes any platform or landing of greater than 2.5 metres width;

"MS" means the latest published edition of the Malaysian Standard;

"MSCP" means the latest published edition of the Malaysian Standard Code of Practice;

"panel wall" means a non-load bearing wall set within a structural frame;

"partition" means any internal wall not being a party or an external wall;

"party wall" means a wall forming part of a building and used or constructed to be used for separation of adjoining buildings belonging to different owners or occupied or constructed or adapted to be occupied by different persons either constructed over or abutting a common boundary;

"pitched roof" means a roof having an inclination of more than seven and a-half degrees with the horizontal;

"prestressed concrete" means concrete in which predetermined stresses are induced to counteract the stresses due to dead and superimposed loading for the purpose of eliminating or decreasing the tensile stresses due to bending and sheer;

"qualified person" means any architect, registered building draughtsman or engineer;

"registered building draughtsman" for the purpose of these By-laws means any building draughtsman who is registered under the relevant Act;

"residential building" means a building of part thereof designed, adapted or used for human habitation;

"room" means any portion of a building enclosed by walls or partitions;

"school" means any building or part thereof designed, adapted or used for the dissemination of knowledge and includes a creche;

"self-closing door" means a door fitted with a device which is free from any means of holding it in an open position and which will close automatically unless held open by other approved means;

"semi-detached building" means any building designed to be built as one pair having a party wall as one of its walls;

"shophouse" means any building, part of which is designed, adapted or used for business purposes;

"smoke stop door" means a door or pair of doors which when fitted in a frame satisfies the requirements of section 7 of BS 476: Part 8: 1972 as to freedom from collapse for not less than thirty minutes and is resistant to the passage of flame and hot gases for not less than twenty minutes and which is fitted with minimum practicable clearances between the leaf and frame;

"storey" means the space between the upper surface of every floor and the surface of the floor next above it, or if there be no such floor then the underside of the tie or collar beam of the roof or other covering or if there be neither tie nor collar beam then the level of half the vertical height of the underside of the rafters or other support of the roof;

"submitting person" means a qualified person who submits plans to the relevant authority for approval;

"swimming pool" means any pool or bath for the purpose of swimming;

"temporary building" includes any building constructed wholly or in part of materials which are, in the absence of special care, liable to rapid deterioration, or are otherwise unsuitable for use in the construction of permanent buildings, and may include any house or building the erection of which is permitted under licence issued by the local authority for a limited period to be specified upon the expiration of which the building shall be demolished;

"terrace house" means any residential building designed as a single dwelling unit and forming part of a row or terrace of not less than three such residential buildings;

"verandah-way" means a covered footway fronting a street;

"wind load" means all loads due to the effect of wind pressure or suction.

PART II

SUBMISSION OF PLANS FOR APPROVAL

Submission of plans for approval.

3. (1) All plans for buildings submitted to the local authority for approval in addition to the requirements of section 70 of the Act shall—

(a) be deposited at the office of the local authority together with the fees prescribed for the submission of such plans in accordance with the First Schedule to these By-laws;

(b) bear upon them a statement showing for what purpose the building for which the plans are submitted is to be erected and used;

(c) bear the certification of the qualified persons on these plans together with Form A as set out in the Second Schedule to these By-laws for which they are respectively responsible; and

(d) have attached thereto a stamped copy of the relevant site plan approved by the competent planning authority and certified within twelve calendar months preceding the date on which the building plans are deposited unless otherwise exempted under any law relating to planning.

(2) Every plan, drawing or calculation in respect of any building shall be submitted by a qualified person.

Return of plan.

4. (1) A local authority may if it is of the view that any plan, drawing or calculation is beyond the competence of such qualified person submitting the same, return such plan, drawing or calculation.

(2) A local authority shall accept any returned plan, drawing or calculation if the same were re-submitted together with a certificate from the relevant competent authority responsible for registering such qualified person, certifying that such plan, drawing or calculation is within the competence of such qualified person submitting the same.

Supervision of work.

5. Where under these By-laws any plan, drawing or calculation in relation to any building is required to be submitted by qualified person, no erection or continued erection of that building shall take place unless that qualified person or any person duly authorised by him undertakes the supervision of the erection and the setting out, where applicable, of that building.

Plans to be signed.

6. (1) All plans submitted shall be signed by the qualified person and by the owner or his agent and shall bear the full address of the owner.

(2) The local authority may, if satisfied that the owner of the premises has refused to or has failed to execute any work which is required under the Act to be executed by him, direct the owner of the premises in writing to execute such work.

Withdrawal or change of qualified person.

7. (1) The qualified person submitting the plans shall be responsible for the proper execution of the works and shall continue to be so responsible until the completion of the works unless—

(a) with the agreement of the local authority another qualified person is appointed to take over; or

(b) the local authority agrees to accept his withdrawal or replacement at the request of the owner provided that the erection of a building has not commenced.

(2) Where the local authority agrees to accept a qualified persons's withdrawal or replacement under paragraph (1) *(b)* of by-law 7 the works shall not commence until another qualified person is appointed to take over.

(3) Where any qualified person who has submitted any plan, drawing or calculation in respect of any building has died or become bankrupt or cannot be found or has been deregistered from the register or for any other reason ceased to practise, the owner or occupier shall as soon as practicable appoint another qualified person to act for him and to submit adequate evidence to the local authority of the circumstances.

(2) Where the certificate under paragraph (1) is issued and the owner or the occupier of the building does not fully comply with the requirements as imposed, the local authority may make use of the deposit for the purpose of complying with the said requirements.

Partial certificate of fitness for occupation.

27. (1) The local authority may in its discretion grant a partial certificate of fitness for the occupation of any part of a building partially completed and may impose any conditions that it deems necessary in the public interest:

Provided that no such permit shall be granted if—

(a) no application for partial certificate of fitness for occupation has been made within the period of construction;

(b) all essential services, including access road, landscape, car parks, drains, sanitary, water and electricity installations, fire lifts, fire hydrant and others where required, sewerage and refuse disposal requirements have not been provided; and

(c) the occupation of such part or parts of a partially completed building will prejudice public health or safety.

(2) A partial certificate of fitness for occupation once issued shall remain effective until the whole of the building is completed and a certificate of fitness for occupation is issued.

Offence under the Act.

28. No person shall occupy or permit to be occupied any building or any part thereof unless a certificate of fitness for occupation, a partial certificate of fitness for occupation or a temporary certificate of fitness for occupation has been issued under these By-laws for such building and any failure to comply with this by-law shall render such person liable to prosecution under the Act.

Fees for consideration of plans and for permits.

29. Fees in accordance with the First schedule to these By-laws shall be paid by persons who submit plans and specifications for approval in respect of buildings to be constructed or altered or for the issue of permits or temporary permits in accordance with these By-laws.

PART III

SPACE, LIGHT AND VENTILATION

Open spaces to be provided.

30. Every building which is erected shall, unless the local authority is of the opinion that in any particular case air space is otherwise sufficiently and permanently provided for, have directly attached thereto an open space exclusively belonging thereto of such dimensions as may be prescribed hereafter.

Open spaces not to be altered or roofed.

31. (1) Whenever any open space has been provided in connection with any building in pursuance of these By-laws, no person shall, without the approval in writing of the local authority—

(a) make or maintain or permit to be made or maintained any alteration in such open space; or

(b) construct or maintain or permit to be constructed or maintained a roof over any portion thereof so as to diminish the area of such open space:

Provided that the local authority in its discretion may issue such a permit if it is satisfied that the free movement of air is not impeded or hindered.

(2) The local authority may by notice in writing require the owner or any person acting in contravention of this Part to remove any such alteration or roof or otherwise to do such works as will restore such open space.

Space about buildings abutting a street and a backlane.

32. (1) The open space for buildings abutting a street and backlane shall be—

(a) in respect of residential buildings, not less than one-third of the built-on area of the building lot; and

(b) in respect of other buildings used for non-residential purposes, not less than one-tenth of the built-on area of the building lot.

(2) For the purpose of calculating the open space required by paragraph (1) of by-law 32—

(a) in a two-storeyed shophouse the space occupied by any single-storeyed annexe not being a habitable room which does not exceed the height of the ceiling of the ground floor shall be considered as neutral and shall not be counted as built-on area or as open space;

(b) half the width of the backlane abutting a building shall be counted as open space;

(c) balconies, passage-ways and sun-shades may project over any open space provided they do not project more than 1 metre and such projection shall be counted as open space and not as built up area;

(d) the open space provided between the street and the set back for a building line of a terrace house shall not be counted as open space.

(3) Where open space not abutting a backlane is provided for, such open space shall have a minimum clear dimension of not less than 2.5 metres and such open space shall exclude projections of hoods, sun-shades or balconies.

Space about buildings on lots abutting a street and having no backlane.

33. For a building on a lot abutting a street and having no backlane, the open space shall be situated at the rear of the building and shall extend across the full width of the lot.

Space about detached buildings.

34. (1) Subject to the specific requirement of Part VII, for a detached building there shall be not less than 2 metres clear space measured between the extreme projections of the building and boundaries of its lot and 4 metres clear space between such building and any other building unless they are within the same building lot.

(2) For the purpose of this by-law a pair of semi-detached buildings shall be deemed to be one building on a single lot.

Access from a street.

35. Every building to be erected on a site which does not front a street shall have access from a street and the means, nature and extent of the access shall be in accordance with a layout plan approved by the competent planning authority or the local authority.

Splayed corner.

36. Where a building is erected at the junction of two streets and in cases where the degree of splay or rounding off is not shown on the layout plan or any statutory amendment, modification or replacement thereof maintained by the competent planning authority, the corner of such building shall be splayed or rounded off to a height of not less than 5 metres above the street level at the point of intersection of the street lines so that no part of the building below this height shall project beyond the straight line drawn across the corner of the building plot joining each street line at a point 3 metres from the point of intersection of the street lines.

Projections over the street and over the building line.

37. (1) Where buildings abut on a street, projection over the street for open, verandahs, balconies, sun-shades or similar projections may be permitted on the following basis:

$$\text{Projection} = \frac{\text{Width of street in metres minus 10 metres}}{2}$$

Provided that the maximum projection which may be permitted under this formula is 1.25 metres clear of the approved line of street.

(2) Projections in the nature of canopies over entrances in axcess of 1.25 metres may be permitted at the discretion of the local authority.

(3) All such projections shall be at least 5 metres above the level of the road. Between the levels of 2.5 metres and 5 metres, projections not exceeding 500 millimetres may be permitted.

(4) Where a building line is prescribed for a street set back from the regular line of street, projections above the ground floor over such building line may be permitted provided that such projection shall not exceed 1.83 metres and shall not exceed one half of the building frontage to the building line.

Width of footway.

38. (1) The width of any verandah-way or uncovered footway shall not be less than 2.25 metres but piers or columns to a maximum depth of 600 millimetres from the boundary of the street may be permitted on such verandah-way or footway.

(2) The width of the verandah-way or uncovered footway shall be measured from the boundary of the street to the wall or other part (not being an outside verandah pier) of the building nearest the street, and all dimensions referred to in this by-law shall be measured at the pavement level of the verandah or uncovered footway.

(3) For the purpose of this by-law any step, threshold or other structure appurtenant to a building shall be deemed to be part of the building though not directly connected therewith.

(4) Where there is a change in levels along the footway between adjoining lots there shall be provided steps with risers not exceeding 150 millimetres and treads not less than 275 millimetres or a pedestrian ramp of gradient not exceeding one in ten.

(5) Where a service road is provided the footway required to be provided and constructed shall follow the line of the street.

Natural lighting and ventilation.

39. (1) Every room designed, adapted or used for residential, business or other purposes except hospitals and schools shall be provided with natural lighting and natural ventilation by means of one or more windows having a total area of not less than 10% of the clear floor area of such room and shall have openings capable of allowing a free uninterrupted passage of air of not less than 5% of such floor area.

(2) Every room used for the accommodation of patients in a hospital shall be provided with natural lighting and natural ventilation by means of one or more windows having a total area of not less than 15 of clear floor area of such room and shall have openings capable of allowing a free uninterrupted passage of air or not less than 10% of such floor area.

(3) Every room used for the purpose of conducting classes in a school shall be provided with natural lighting and natural ventilation by means of one or more windows having a total area of not less than 20% of clear floor area of such rooms and shall have openings capable of allowing a free uninterrupted passage of air of not less than 10% of such floor area.

(4) Every water-closet, latrine, urinal or bathroom shall be provided with natural lighting and natural ventiiation by means of one or more openings having a total area of not less than 0.2 square metre per water-closet, urinal latrine or bathroom and such openings shall be capable of allowing a free uninterrupted passage of air.

Air-wells.

40. (1) *(a)* The minimum size of each air-well where provided in all buildings shall be as follows:

(i) for buildings up to 2 storeys in height, 7 square metres;

(ii) for buildings up to 4 storeys in height, 9 square metres;

(iii) for buildings up to 6 storeys in height, 11 square metres;

(iv) for buildings up to 8 storeys in height, 13 square metres;

(v) for buildings more than 8 storeys in height, 15 square metres;

(b) The minimum width of such air-wells in any direction shall be 2.5 metres.

(2) *(a)* The minimum size of each air-well for lavatories, water-closets and bathrooms shall be as follows:

(i) for buildings up to 2 storeys in height, 3.5 square metres;

(ii) for buildings up to 4 storeys in height, 4 square metres;

(iii) for buildings up to 6 storeys in height, 4.5 square metres;

(iv) for buildings up to 8 storeys in height, 5 square metres;

(v) for buildings more than 8 storeys in height, 5.5 square metres;

(b) The minimum width of such air-wells in any direction shall be 2 metres.

Mechanical ventilation and air-conditioning.

41. (1) Where permanent mechanical ventilation or air-conditioning is intended, the relevant building by-laws relating to natural ventilation, natural lighting and heights of rooms may be waived at the discretion of the local authority.

(2) Any application for the waiver of the relevant by-laws shall only be considered if in addition to the permanent air-conditioning system there is provided alternative approved means of ventilating the air-conditioned enclosure, such that within half an hour of the air-conditioning system failing, not less than the stipulated volume of fresh air specified hereinafter shall be introduced into the enclosure during the period when the air-conditioning system is not functioning.

(3) The provisions of the Third Schedule to these By-laws shall apply to buildings which are mechanically ventilated or air-conditioned.

(4) Where permanent mechanical ventilation in respect of lavatories, water-closets, bathrooms or corridors is provided for and maintained in accordance with the requirements of the Third Schedule to these By-laws, the provisions of these By-laws relating to natural ventilation and natural lighting shall not apply to such lavatories, water-closets, bathrooms or corridors.

Minimum areas of rooms in residential buildings.

42. (1) The area of the first habitable room in a residential building shall be not less than 11 square metres, the second habitable room be not less than 9.3 square metres and all other rooms be not less than 6.5 square metres in area.

(2) The width of every habitable room in a residential building shall be not less than 2 metres.

(3) The area and width of a kitchen in a residential building shall be not less than 4.5 square metres and 1.5 metres respectively.

Minimum dimensions of latrines, water-closets and bathrooms.

43. In all buildings, the sizes of latrines, water-closets and bathrooms shall be—

(a) in the case of latrines or water-closets with pedestal-type closet fittings, not less than 1.5 metres by 0.75 metre;

(b) in the case of water-closets with fittings other than pedestal-type closet fittings, not less than 1.25 metres by 0.75 metre;

(c) in the case of bathrooms, not less than 1.5 square metres with a width of not less than 0.75 metre; and

(d) in the case of bathrooms with closet fittings, not less than 2 square metres with a width of not less than 0.75 metre.

Height of rooms in residential buildings, shophouses, schools, etc.

44. (1) The height of rooms in residential buildings other than shophouses shall be—

(a) for living rooms and bedrooms, not less than 2.5 metres;

(b) for kitchens, not less than 2.25 metres;

(c) for bathrooms, water-closets, latrines, porches, balconies, verandahs, garages and like, not less than 2 metres.

(2) The average height of rooms with sloping ceilings in residential buildings other than shophouses shall be—

(a) for living rooms and bedrooms, not less than 2.5 metres;

(b) for kitchens, not less than 2.25 metres;

(c) for bathrooms, water-closets, latrines, porches, balconies, verandahs, garages and the like, not less than 2 metres.

Provided that not part of any room shall be less than 2 metres in height.

(3) In shophouses the height of ground floor rooms shall be not less than 3 metres and the height of upper floor rooms shall be not less than 2.5 metres. Where the depth of such shophouse at any upper floor level is greater than 10.5 metres the height of rooms on every such upper floor shall be not less than 2.55 metres.

(4) In schools, the height of rooms used for the dissemination of knowledge shall be not less than 3 metres headroom.

(5) In hospitals the height of rooms used for the accommodation of patients shall be not less than 3 metres.

(6) The height of any room in a factory in which any person works shall be not less than 3 metres headroom.

Height of rooms in places of public resort.

45. (1) The height of rooms, other than water-closets, lavatories, cloakrooms, corridors and rooms to which the public do not have access in places of public resort shall be not less than 3.5 metres. Where a balcony is provided for in places of public resort, the heights between the level of the topmost tier of the balcony and the ceiling over such topmost tier, and between the floor immediately under the balcony and the underside of the balcony, shall be not less than 3 metres in each case.

(2) In places of public resort the provisions of paragraph (1) of by-law 46 shall apply to water-closets, lavatories, cloakrooms, corridors and rooms to which the public do not have access.

Height of rooms in other buildings.

46. (1) In buildings other than those specified in the preceding provisions of by-laws 44 and 45 the height of rooms on the ground floor shall not be less than 3 metres and on any floor above the ground floor shall not be less than 2.75 metres.

(2) The height of any basement shall be not less than 2.5 metres.

(3) Where the greater part of the ground floors is left open for use as car-park or covered garden or similar purpose, the height of such ground floor shall be not less than 2.5 metres.

(4) The minimum headroom of any habitable room or space inside any building shall be 2 metres.

(5) The height of any verandah-way shall be not less than 3 metres.

Projections over a verandah-way.

47. Projections in the nature of—

(a) beams;

(b) stairways and landings;

(c) screens;

(d) blinds; and

(e) signboards or advertisements;

which are not less than 2.5 metres above the verandah-way paving may be permitted.

PART IV

TEMPORARY WORKS IN CONNECTION WITH BUILDING OPERATIONS

Commencement of building operation.

48. (1) When any building operation is commenced, the person responsible for the erection shall display a board giving the names, addresses and telephone numbers of the submitting person and building contractor.

(2) Construction of any building shall not commence unless a protective hoarding to the requirements of the local authority is erected to separate the building from the public street or footway.

(3) Where a protective hoarding is required, a temporary permit shall be obtained in accordance with by-law 19 and the protective hoarding shall be constructed according to the approved protective hoarding plan and shall during the demolition or erection of any building be maintained in good condition to the satisfaction of the local authority.

Responsibility of person granted temporary permits.

49. The person to whom the temporary permit is granted shall be responsible for—

(a) taking such measures as are necessary to keep the roadside drain clear of obstruction and to the satisfaction of the local authority;

(b) adjustments to existing cables, pipes and other service or utility or equipment and for their reinstatement on completion of the works in accordance with the requirements of the relevant authorities;

(c) painting the ends of the hoardings white and for having the ends of hoardings and railings suitably marked by red warning lights throughout the night;

(d) any accident and damage to property or persons, directly attributable to the hoardings or railings;

(e) ensuring that hydrant points and any other existing utility service installations are not obstructed by such hoardings or materials;

For roof slopes between 30° and 75°, the imposed load to be allowed for may be obtained by linear interpolation between 0.25 kN/m² (25.5 kgf/m²) for a 30° roof slope and nil for a 75° roof slope.

Curved roofs.

64. The imposed load on a curved roof shall be calculated by dividing the roof into not less than five equal segments and by then calculating the load of each, appropriate to its mean slope, in accordance with paragraphs (2) and (3) of by-law 63.

Roof coverings.

65. To provide for loads incidental to maintenance, all roof coverings, other than glazing, at a slope less than 45° shall be capable of carrying a load of 0.9 kN (91.8 kgf) concentrated on any square with a 125 millimetres side, measured in the plane of the roof.

Internal suspended loads on primary structural members.

66. Due allowance shall be made in the design of roof trusses or other primary structural members supporting roofs, for the weight of heating, lighting and ventilating equipment, service trunking, piping for liquids or gases, mechanical handling or production equipment and overhead walkways for inspection and maintenance, as applicable.

Amount of suspended load.

67. Any panel point of the lower chord of such roof trusses or any point of such other primary structural members supporting roofs over garages, manufacturing or storage floors shall be capable of carrying safely a suspended concentrated load of not less than 9.0 kN (918 kgf) in addition to the imposed loads on the roof.

Dynamic loading.

68. (1) Where loads arising from machinery, runways, cranes and other plant producing dynamic effects are supported by or communicated to the framework, allowance shall be made for these dynamic effects, including impact, by increasing the dead weight values by an adequate amount.

(2) In order to ensure due economy in design, the appropriate dynamic increase for all members affected shall be ascertained as accurately as possible.

(3) In the absence of sufficient data for such calculation, the increase in the imposed loads shall be as follows:

Structure	Increase in imposed load (per cent)
For frames supporting lifts and hoists	100
For foundation, footways and piers supporting lifts and hoistering apparatus	40
For light machinery, shaft or motor units	not less than 20
For reciprocating light machinery or power units	not less than 20

(4) Concentrated imposed loads including impact and vibrating effects which may arise due to installed machinery shall be considered and provided for in the design. In any event the increase in imposed loads shall not be less than 20%.

(5) Provisions shall also be made for carrying any concentrated equipment loads while the equipment is being installed or moved for servicing and repairing.

Crane gantry girders.

69. (1) In respect of crane gantry girders, the following allowances shall be deemed to cover all forces set up by vibration, shock from slipping of slings, kinetic action of acceleration and retardation and impact of wheel loads:

(a) for loads acting vertically, the maximum static wheel loads shall be increased by 25% for an electric overhead crane and 10% for a hand-operated crane;

(b) the horizontal force acting transverse to the rails shall be taken as the following percentage of the combined weight of the cab and the load lifted:

(i) 10% for an electric overhead crane; and

(ii) 5% for a hand-operated crane.

The horizontal force shall be taken into account when considering the lateral rigidity of the rails and their fastenings;

(c) horizontal forces acting along the rails shall be taken at the following percentages of the static wheel loads which can occur on the rails:

(i) 10% for an electric overhead crane; and

(ii) 5% for a hand-operated crane.

(2) The forces specified in paragraph (1) above shall be considered as acting at the rail level and being appropriately transmitted to the supporting system.

(3) Gantry girders and their vertical supports shall be designed on the assumption that either of the horizontal forces specified in paragraph 1 may act at the same time as the vertical load.

(4) The provisions of paragraphs (1), (2) and (3) shall apply only to a single crane operation and to simple forms of crane gantry construction and separate provisions shall be provided for in the calculation in respect of heavy cranes, high-speed operation or multiple cranes on a single gantry.

Parapets and balustrades.

70. Parapets and balustrades shall be designed for the minimum loads as provided in Table 2 below. The minimum loads are expressed as horizontal forces acting at handrail or coping level.

TABLE 2: HORIZONTAL LOADS ON PARAPETS AND BALUSTRADES

Use	Intensity of horizontal load	
	N/m run	*kgf/m run*
Light access stairs, gangways and the like not more than 600 mm wide ..	220	22.4
Light access stairs, gangways and the like not more than 600 mm wide, stairways, landings and balconies, private and domestic	360	36.7
All other stairways, landings and balconies and all parapets and handrails to roof	740	75.5
Panic barriers	3,000	306.0

Vehicle barriers for car-parks.

71. (1) Where a barrier to withstand the force of a vehicle is required for a car-park it shall be designed to withstand a force F uniformly distributed over any length of 1.5 metres where—

$$F = \frac{\frac{1}{2} mv^2 \text{ kN}}{\delta_c + \delta_b} \frac{(1000 (\frac{1}{2} mv^2)) \text{ kgf}}{(9.8 \ (\delta_c + \delta_b))}$$

m = mass of vehicle in kg
v = velocity in m/s
δ_c = deflexion of the vehicle in mm
δ_b = deflexion of the barrier in mm

(2) Where the car park has been designed on the basis that vehicles using it will not exceed 2500 kilograms the following values shall be used to determine the force F:

m = 1500 kg*
v = 4.47 m/s
δ_c = 100 mm unless better evidence is available.

For a rigid barrier the force appropriate to vehicles up to 2500 kilogrammes shall be taken as 150 kN.

*The mass of 1500 kg is taken as being more representative of the vehicle population than the extreme value of 2500 kg.

(3) Where the car park has been designed for a vehicle exceeding 2500 kilogrammes the following values shall be used to determine the force F:

m = the actual mass of the vehicle for which the car park is designed in kilograms.
v = 4.47 m/s.
δ_c = 100 mm unless better evidence is available.

(4) The impact force provided under paragraph (2) or (3) above shall be considered to act at bumper height. In the case of car parks intended for motor cars not exceeding 2500 kilogrammes this shall be taken as 375 millimetres above the floor level.

(5) Barriers to access ramps of car parks shall be designed to withstand one half* of the force determined in paragraph (2) or (3) above acting at a height of 610 milimetres above the ramp. Opposite the ends of straight ramps intended for downward travel which exceed 20 metres in length the barrier shall be designed to withstand twice †the force determined in paragraph (2) or (3) above acting at a height of 610 millimetres above the ramp.

(6) The recommendations in these By-laws may be used to form the basis of designs either within or beyond the usual serviceability limits of materials.

Basement walls and floors.

72. (1) In the design of basement walls and similar underground structures, provision shall be made for the lateral pressure of adjacent soil, due allowance being made for possible surcharge from fixed or moving loads.

(2) When a portion, or the whole, of the adjacent soil is below a free water surface, computations shall be based on the weight of the soil diminished by buoyancy plus full hydrostatic pressure.

(3) In the design of basement floors and similar structures underground, the upward pressure of water, if any, shall be taken as the full hydrostatic pressure applied over the entire area.

(4) The hydrostatic head shall be measured from the underside of the construction.

Foundations.

73. (1) The foundations of a building shall—

(a) safely sustain and transmit to the ground the combined dead load, imposed load and wind load in such a manner as not to cause any settlement beyond the limits designed for or other movement which would impair the stability of, or cause damage to, the whole or any part of the building or of any adjoining building or works;

(b) be taken down to such a depth, or be so constructed, as to safeguard the building against damage by swelling and shrinking of the subsoil; and

* The mass of 1500 kg is taken as being more representative of the vehicle population than the extreme value of 2500 kg.

† The force in paragraph (5) above is only half that of paragraph (2) or (3) because although the speed of vehicles may be greater the angle of impact is likely to be less. At the ends of straight ramps however not only is the speed likely to be greater but the angle of impact will also be greater so that the barrier must withstand a greater force is therefore double that given in paragraph (2) or (3).

(c) be capable of adequately resisting any attack by sulphates or any other deleterious matter present in the subsoil.

(2) The requirements of paragraph (1) shall be deemed to be satisfied if the foundations of a building are constructed in accordance with the relevant recommendations of the BSCP 2004—Foundations.

Foundations of buildings not exceeding four storeys.

74. If the foundations form part of a building other than a factory or storage building, having not more than four storeys the requirements of by-law 73 shall be deemed to be satisfied if such foundations are constructed in accordance with BSCP 101—Foundations and Substructures for Non-Industrial Buildings not more than Four Storeys.

Reinforced concrete foundations.

75. The requirements of by-law 73 shall be deemed to be satisfied as to such part of any foundations as is constructed of reinforced concrete if the work complies with BSCP 110—The Structural Use of Concrete, BSCP 114, BSCP 115 or BSCP 116, where applicable.

Strip foundations.

76. If the foundations of a building are constructed as strip foundations of plain concrete situated centrally under the walls, the requirements of by-law 74 shall be deemed to be satisfied if—

(a) there is no made ground or wide variation in the type of subsoil within the loaded area and no weaker type of soil exists below the soil on which the foundations rest within such a depth as may impair the stability of the structure;

(b) the width of the foundation is not less than the width specified in the Fourth Schedule to these By-laws;

(c) the concrete is composed of cement and fine and coarse aggregate conforming to BS 882 and is of a nominal mix not leaner than 50 kilogrammes cement: 0.3 cubic metre all-in aggregate;

(d) the thickness of the concrete is not less than its projection from the base of the wall or footing and is in no case less than 150 millimetres;

(e) where the foundations are laid at more than one level, at each change of level, the higher foundations extend over the unite with the lower foundations for a distance not less than the thickness of the foundations and in no case less than 300 millimetres; and

(f) where there is a pier, buttress or chimney forming part of a wall, the foundations project beyond the pier, buttress or chimney on all sides to at least the same extent as they project beyond the wall.

Brick footings.

77. (1) Where brick footings are provided in the foundations of a wall, they shall be in regular off-sets of 50 millimetres wide and the height from the bottom of such footings to the base of the wall shall be equal to at least two-thirds of the thickness of the wall at its base. Wherever possible, the bricks in the footings shall be laid as headers.

(2) Brick footings in the foundations of a wall may be omitted if allowance is made for such omission in the thickness of the concrete foundations for the wall.

(3) Where in the opinion of the submitting person ground conditions are favourable, the foundations for non-load bearing internal walls may be formed by increasing the depth of the concrete floor slabs under such internal walls.

Foundations below invert of drains.

78. (1) When a building or part of a building is erected at a distance from the centre of a drain less than the depth of the drain, except where the whole of such building is carried on piles other than timber piles, the bottom of the foundation of such building or part thereof shall be stepped down within an angle of 45° so that the bottom of the foundation of that part of the building situated within the aforesaid distance shall be at least 450 millimetres below the drain invert.

(2) For the purpose of paragraph (1) of by-law 77, in framed building, the foundations hall be deemed to be foundations under the load-bearing columns.

Foundations under external and party walls.

79. Where an external wall is built against another external wall or against a party wall, the widths of concrete foundations specified in the Fourth Schedule to these By-laws shall be modified accordingly.

Structure above foundations.

80. (1) The structure of a building above the foundations shall be designed and constructed to safely sustain and transmit to the foundations the combined dead and imposed loads and wind loads without such deflection or deformation as will impair the stability of, or cause damage to, the whole or any part of the building.

(2) The requirements of paragraph (1) shall be deemed to be satisfied if the design and construction of the structure or part of the structure complies with the following Codes of Practice of Standard Specifications:

BS 449	—	The Use of Structural Steel in Building;
BSCP 110	—	The Structural Use of Concrete;
BSCP 111	—	Structural Recommendations for Loard Bearing Walls;
BSCP 114	—	Structural Use of Reinforced Concrete in Building;

BSCP 115	—	The Structural Use of Prestressed Concrete in Buildings;
BSCP 116	—	The Structural Use of Precast Concrete;
BSCP 117	—	Composite Construction in Structural Steel and Concrete;
BSCP 118	—	The Structural Use of Aluminium;
BSCP 2007	—	Design and Construction of Reinforced and Prestressed Concrete Structure for the Storage of Water and other Aqueous Liquids;
BS 5337	—	The Structural Use of Concrete for Retaining Aqueous Liquids; and
MSCP	—	The Structural Use of Timbers.

PART VI

CONSTRUCTIONAL REQUIREMENTS

Building site.

81. (1) No building shall be erected on any site which has been filled up with any matter impregnated with faecal, animal or vegetable matter, until the whole ground surface or site of such building such has been rendered or become innocuous and has been covered with a layer of hill earth, hardcore, clinker or ash rammed solid to at least 0.305 metre thickness.

(2) The ground to be built upon by any building shall be effectively cleared of turf and other vegetable matter.

Drainage of subsoil.

82. (1) Wherever the dampness or position of the site of a building renders it necessary, the subsoil of the site shall be effectively drained or such other steps shall be taken as will effectively protect the building against damage from moisture.

(2) Where, during the making of an excavation for a building, existing subsoil drains are discovered, such drains shall either be diverted or replaced by pipes of approved material to ensure the continual passage of subsoil water through such drains in such a manner as to ensure that no subsoil water entering such drains causes dampness to the site of the building.

Protection against soil erosion, etc.

83. (1) All air-wells and open spaces in and around buildings shall be suitably protected against soil erosion.

(2) All ground under raised buildings shall be suitably finished and graded to prevent the accumulation of water or the growth of unwanted vegetation or for the breeding of vermin.

Prevention of dampness.

84. (1) Suitable measures shall be taken to prevent the penetration of dampness and moisture into a building.

(2) Damp proof courses where provided shall comply with BS 743 (materials for Horizontal D.P.C.).

(3) Every brick or masonry wall of a building founded on strip footings shall be provided with a damp proof course which shall be—

(a) at a height of not less than 150 millimetres above the surface of the ground adjoining the wall; and

(b) beneath the level of the underside of the lowest timbers of the ground floor resting on the wall, or where the ground floor is a solid floor, not higher than the level of the upper surface of the concrete or other similar solid material forming the structure of the floor.

(4) Where any part of a floor of the lowest or only storey of a building is below the surface of the adjoining ground and a wall or part of a wall of the storey is in contact with the ground—

(a) the wall or part of the wall shall be constructed or provided with a vertical damp proof course so as to be impervious to moisture from its base to a height of not less than 150 millimetres above the surface of the ground; and

(b) an additional damp proof course shall be inserted in the wall or part of the wall at its base.

(5) Where the floor or any part of the walls of a building is subject to water pressure, that portion of the floor or wall below ground level shall be waterproof.

Nominal thickness of walls.

85. For the purposes of this Part wherever references are made to the thickness of any brick wall, the maximum or minimum thickness of such wall shall not exceed the nominal thickness plus or minus the maximum tolerance permissible under any standard specification.

Party walls.

86. (1) All party walls shall generally be of not less than 200 millimetres total thickness of solid masonry or *insitu* concrete which may be made up of two separate skins each of not less than 100 millimetres thickness if constructed at different times:

Provided that in multi-storeyed flats and terrace houses of reinforced concrete or of protected steel framed construction having floors and roofs constructed to the requirements of these By-laws, the party wall thereof shall not be less than 100 millimetres total thickness.

(2) Party walls in single storeyed houses may be in load-bearing 100 millimetres solid masonry or *insitu* concrete provided the requirements of Part V, VI and VII of these By-laws are complied with.

(3) All party walls shall be carried above the upper surface of the roof to a distance of not less than 230 millimetres at right angles to such upper surface.

(4) Other non-combustible materials may be used for party walls provided the requirements of Part V, VI and VII of these By-laws are complied with.

Openings in party walls.

87. (1) Openings may be made or left in a party wall if—

(a) such openings are made with the consent of and in accordance with the requirements of the local authority; and

(b) the owners of the properties concerned give written permission.

(2) Every opening in a party wall shall be solidly built up with brick or stonework to the full thickness of the party wall and properly bonded therewith when the use of such opening is discontinued.

Recess.

88. Where a recess is made in an external wall or a party wall—

(a) the wall at the back of the recess shall be not less than 100 millimetres thick in an external wall and 200 millimetres thick in a party wall;

(b) a sufficient arch or lintel of incombustible material shall be built in every storey over the recess;

(c) in each storey the total area of recesses causing the wall at the back of the recesses to be of less thickness than that prescribed by these By-laws shall not exceed one-half of the superficial area of the wall; and

(d) the side of the recess nearest to the inner face of a return external wall, shall be not less than 300 millimetres therefrom.

Chases.

89. A chase made in a wall for pipes and other service facilities shall leave the wall at the back of the chase not less than 100 millimetres thick in external walls and not less than 100 millimetres thick in a party wall and shall be not wider than 200 millimetres.

Underpinning.

90. If underpinning is required the owner or his agent shall—

(a) give written notice to the local authority informing of the fact and stating the method of underpinning proposed to be used;

(b) obtain the written sanction of the local authority thereof before proceeding with the work; and

(c) comply with the requirements as set out in these By-laws.

Coping, etc., to be impervious.

91. (1) Every coping, cornice or other like projection shall be of brick, tile, stone concrete, cement render or other impervious material.

(2) Every parapet wall, free-standing wall or boundary wall shall be finished on top with an impervious material.

Projections in brickwork.

92. All projections in brickwork shall be corbelled but gradually and no projection shall extend more than 230 millimetres from the face of any wall unless built in strong cement mortar.

Measurement of the length of a wall.

93. For the purposes of these By-laws—

(a) walls shall be deemed to be divided into distinct lengths by return walls when bonded to each other;

(b) the length of a wall shall be measured from centre to centre of—

(i) cross walls bonded to it; or

(ii) piers therein having a dimension measured parallel to the length of the wall of not less than twice the thickness of the wall and a dimension measured at right angles to the wall of not less than three times the thickness of the wall.

Use of 100 millimetres brickwork and concrete blocks in load-bearing.

94. Walls built of burnt bricks or of cement bricks 100 millimetres in thickness and walls in concrete blocks of a thickness of not less than 100 millimetres may be used for both internal and external load-bearing walls provided they are designed in accordance with by-law 80.

External panel walls.

95. In all cases where 100 millimetres brickwork or 100 millimetres precast concrete blocks are used for external panel walls, such walls shall be properly secured to the reinforced concrete framework.

For the purpose of this by-law the expression "properly secured to the reinforced concrete framework" means bonding the wall panel to the reinforced concrete column with a metal tie of at least 14 gauge and 40 millimetres width, built at least 230 millimetres into the brickwork with vertical spacings of not more than 400 millimetres. All metal ties shall be securely fixed to the column.

Non load-bearing partition.

96. Every non load-bearing partition shall be adequately restrained or buttressed.

Timber built into party walls.

97. No timber such as joists, beams, wall plates, tile battens and ties shall be built into the thickness of any party wall unless there are not less than 100 millimetres of brickwork or cement between such timbers.

Fences and boundary walls.

98. Fences or walls to the boundaries of detached properties other than the boundary which abuts the street of backlane shall be constructed to a maximum height of 1.8 metres in the case of solid fences or walls and to a maximum height of 2.75 metres in the case of fences which are so constructed as to permit the passage of light and air.

Cooking facilities in residential buildings.

99. (1) Every residential building and every floor of a residential building which is or may be separately let for dwelling purposes shall be provided with a kitchen having a properly constructed fireplace with a flue and chimney as may be required by the local authority.

(2) The chimney and smoke flue shall be continued up above the roof and shall be of a thickness all round of not less than 100 millimetres of brick or concrete to a height of not less than 1.2 metres above the highest point in the line of junction with the roof.

(3) Flues shall be not less than 230 millimetres in diameter and a separate flue shall be provided for each fireplace.

Cooking facilities in quarters.

100. (1) In the case of one room or two room quarters for labourers, artisans or servants, a kitchen not less than 2.32 square metres in floor area may be provided. Such kitchen shall be provided with a properly constructed fireplace, flue and chimney, and shall be adequately lighted and ventilated.

(2) Where it is intended to instal in any residential building or floor in a residential building as specified in by-law 99 gas, electric or oil cookers for cooking purposes and the plan for such building is endorsed accordingly, fireplaces, flues and chimneys shall not be required.

(3) For the purposes of by-laws 99 and 100, the expression "properly constructed fireplaces" means a concrete slab not less than 80 millimetres thick supported on brick or concrete piers with a smoke hood over such concrete slab constructed of incombustible materials at a height of 1.91 metres from the floor to the lower edge of such smoke hood. The smoke hood shall project 230 millimetres on each side and in front of the slab and shall be constructed with an angle of inclination of not less than thirty degrees.

Boilers fireplaces, forges and incinerators in factories.

101. Boilers, fireplaces, furnaces, forges, incinerators and other similar heat generating appliances used in buildings other than residential buildings shall be provided with adequate means for conveying the heat and fumes generated by such appliances so as to discharge into the open by means of properly constructed flues or ducts of fire resisting material of at least two hours rating in accordance with BS 476 Part 3.

Combustible materials adjoining smoke flues.

102. Combustible materials used in the construction of the building shall be at least 80 millimetres clear of any casing to any flue required for the conveyance of smoke or other products of combustion.

Timber floors.

103. (1) Where structural timber floors are permissible under these By-laws they shall be designed of hardwood or of species of timber treated with a suitable wood preservative.

(2) All timber floors joists shall be designed in accordance with these By-laws.

(3) All timber trimming joists shall be at least 25 millimetres thicker than the joist of the adjoining floor.

Bearing for joints.

104. (1) All joists shall have at least 100 millimetres bearing on the walls and where supported on corbelled brickwork, such corbelling shall be continuous over-sailing courses. Separate corbels shall not be allowed.

(2) No joists shall be built into the thickness of any party wall unless there is at least 100 millimetres of fire resisting material between the sides and end of such timbers.

(3) All ends of joists built into walls shall be treated with wood preservative.

Space below floors to be ventilated.

105. Where the ground floor of any building is constructed with timber joists and flooring boards, the space below the floor shall be adequately ventilated.

Dimensions of staircases.

106. (1) In any staircase, the rise of any staircase shall be not more than 180 millimetres and the tread shall be not less than 255 millimetres and the dimensions of the rise and the tread of the staircase so chosen shall be uniform and consistent throughout.

(2) The widths of staircases shall be in accordance with by-law 168.

(3) The depths of landings shall be not less than the width of the staircases.

Handrails.

107. (1) Except for staircases of less than 4 risers, all staircases shall be provided with at least one handrail.

(2) Staircases exceeding 2225 millimetres in width shall be provided with intermediate handrail for each 2225 millimetres of required width spaced approximately equally.

(3) In building other than residential buildings, a handrail shall be provided on each side of the staircase when the width of the staircase is 1100 millimetres or more.

(4) All handrails shall project not more than 100 millimetres from the face of the finished wall surface and shall be located not less than 825 millimetres and not more than 900 millimetres measured from the nosing of the treads provided that handrails to landings shall not be less than 900 millimetres from the level of the landing.

Maximum flights.

108. (1) In residential buildings, a landing of not less than 1.80 metres in depth shall be provided in staircases at vertical intervals of not more than 4.25 metres and in staircases in all other buildings there shall be not more than sixteen risers between each such landing.

(2) No part in any flight of any staircase shall have less than two risers.

Winders.

109. (1) Subject to the provisions of Part VII and VIII of these By-laws spiral staircases may be permitted as a secondary staircase in buildings where the topmost floor does not exceed 12.2 metres in height.

(2) Winding staircase may be permitted where they are not used as a required means of egress.

No obstruction in staircases.

110. (1) There shall be no obstruction in any staircase between the topmost landing thereof and the exit discharge on the ground floor.

(2) There shall be no projection, other than handrails in staircases, in any corridor, passage or staircase at a level lower than 2 metres above the floor or above any stair.

Lighting and ventilation of staircases.

111. All staircases shall be properly lighted and ventilated according to the requirements of the local authority.

Enclosure of staircases in a shop.

112. In a shop, the flight of stairs which has access direct from the street shall be enclosed with walls in incombustible material.

Use of timber staircases.

113. (1) Timber staircases may be permitted for the following types of buildings which are not more than three storeys in height:

(a) detached residential buildings;

(b) semi-detached residential buildings;

(c) terrace houses;

(d) in the upper floors of shophouses other than from the ground floor to the first floor provided that it is located within the protected area for its full height; and

(e) other similar types of buildings of limited fire risk at the discretion of the local authority.

(2) All other staircases shall have a fire-resistance rating of not less than two hours.

Timber roofs.

114. (1) Structural timber for roof construction shall be designed and constructed of timbers of adequate sizes which shall either be in hardwood or, if in other species of timber, shall be treated by a suitable wood preservative.

(2) All built-in or concealed roof timbers shall be coated with wood preservative.

Roof coverings and drainage.

115. All roofs of buildings shall be so constructed as to drain effectually to suitable and sufficient channels, gutters, chutes or troughs which shall be provided in accordance with the requirements of these By-Laws for receiving and conveying all water which may fall on and from the roof.

Accessible flat roofs, balconies, etc.

116. Every flat roof, balcony or other elevated areas 1.8 metres or more above the adjacent area where normal access is provided shall be protected along the edges with suitable railings, parapets or similar devices not less than 1 metre in height or other suitable means.

Access to roof space.

117. (1) Where the space beneath a roof is enclosed by a ceiling, access to such space shall be provided by means of a trap door at least 0.75 metre in any direction.

(2) No verandah-way shall be constructed except to levels approved by the local authority and shall have a cross-fall of 25 millimetres towards the road or drain.

Refuse chutes and alternate means for disposal of refuse.

118. (1) All residential buildings which are four storeys and above shall be provided with refuse chutes unless alternate means for the disposal of refuse such as container-based systems, in-sink waste disposal units, Garchey system and one-site compression systems are installed.

(2) Where such alternative means of refuse disposal are installed, they are subject to the approval of the local authority.

(3) Where refuse chutes are to be provided, the number shall be determined by the local authority.

(4) For non-residential buildings, no refuse chutes will be permitted. The removal of refuse and trash in such buildings shall be by way of the service lift or other means to the satisfaction of the local authority.

(5) In multi-purpose buildings containing residential accommodation, refuse chutes shall be provided for the residential portions running through the building, but no openings will be permitted where such chutes pass through the non-residential portions of the building.

(6) Other alternate means for the disposal of refuse as stated in paragraph (1) to the approval of the local authority may be provided to serve the residential portions of the building.

Change of use of building.

119. (1) When the use of a building is changed from non-residential to residential, refuse chutes or other alternate means for the disposal of refuse shall be provided to the satisfaction of the local authority.

(2) Where the use of a building is changed from residential to non-residential, the openings into existing refuse chute serving the converted floors shall be sealed up.

Design and construction of refuse chutes.

120. The design and construction of all refuse chutes shall conform to the following requirements:

(a) the chute shall be vertical for the whole length and shall be constructed with a smooth-finished impervious inner surface;

(b) the internal diameter shall not be less than 400 millimetres;

(c) adequate ventilation at the top of the chute shall be provided;

(d) the chute shall discharge into a suitable metal receptacle or receptacles of not more than 0.95 cubic metre in capacity or as specified by the local authority;

(e) openings into any refuse chute shall be fitted with a self-closing and tight-fitting flap or hopper; and

(f) openings into refuse chutes shall not be located in any stairway enclosure or corridor, nor in a stairway protected lobby.

Requirements for refuse receptacle chambers.

121. All refuse receptacles shall be housed in a chamber which shall—

(a) be provided with concrete curbs for the refuse receptacles to stand on;

(b) be adequately fly and vermin proofed;

(c) be connected to and drained by a foul water drain;

(d) open to the external air;

(e) be lined throughout with glazed tiles; and

(f) be located near to a water point.

Access to refuse receptacle chambers.

122. The approach access to the loading point from refuse chute chambers for the removal of refuse by refuse vehicles shall be at gradient to enable the refuse vehicles to approach it and shall be to the approval of the local authority:

Provided that where direct access to refuse chutes for refuse vehicles is not possible, specific points for storing refuse receptacles shall be provided to the satisfaction of the local authority.

Pipes and service ducts.

123. (1) Where ducts or enclosures are provided in any building to accommodate pipes, cables or conduits the dimensions of such ducts or enclosures shall be—

(a) adequate for the accommodation of the pipes, cables or conduits and for crossings of branches and mains together with supports and fixing; and

(b) sufficiently large to permit access to cleaning eyes, stop cocks and other controls there to enable repairs, extensions and modifications to be made to each or all of the services accommodated.

(2) The access openings to ducts or enclosures shall be long enough and suitably placed to enable lengths of pipe to be installed and removed.

Lifts.

124. For all non-residential buildings exceeding 4 storeys above or below the main access level at least one lift shall be provided.

Swimming Pools.

125. (1) The floor and wall surfaces of swimming pools shall be smooth and free from cracks.

(2) Swimming pools shall be completely surrounded by an overflow channel constructed so that—

(a) the overflow and any matter floating therein cannot return directly to the swimming pool;

(b) the arms or legs of swimmers cannot be trapped by the overflow channel; and

(c) swimmers can take hold of the edge of the overflow channel but so that the depth of the overflow channel does not enable the bottom of the overflow channel to be touched with the fingers.

Steps and footway.

126. (1) Steps shall be situated at the side walls near the ends of the swimming pool and shall be so arranged that they are not higher than the internal facing of the walls of the swimming pool, such steps being constructed of non-ferrous materials with a non-slip surface and provided with a handrail.

(2) A footway with a non-slip surface shall be provided round every swimming pool.

Opening into swimming pool.

127. The openings by which the water enters a swimming pool shall be distributed in such a manner that circulation of the water in the swimming pool is uniform and dead points of stagnant place avoided.

Depth of water.

128. (1) Swimming pools shall have lines marked on the side walls of a swimming pool to indicate—

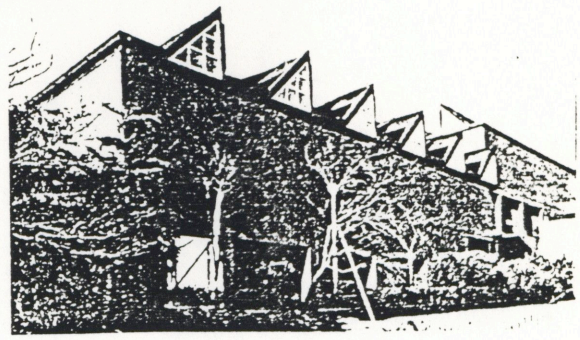
(a) the depth of the water at the shallow and deep ends of the swimming pool;

(b) the part of the swimming pool where the depth of the water is between 1.3 metres and 1.8 metres; and

(c) the depth of the water shown in figures over the lines marked on the side of the swimming pool above the overflow channel of the swimming pool.

KOBE MUNICIPAL OJI SPORTS CENTER

architects: Building Division of the Kobe Municipal Housing Bureau + Sakakura Associates, architects and engineers

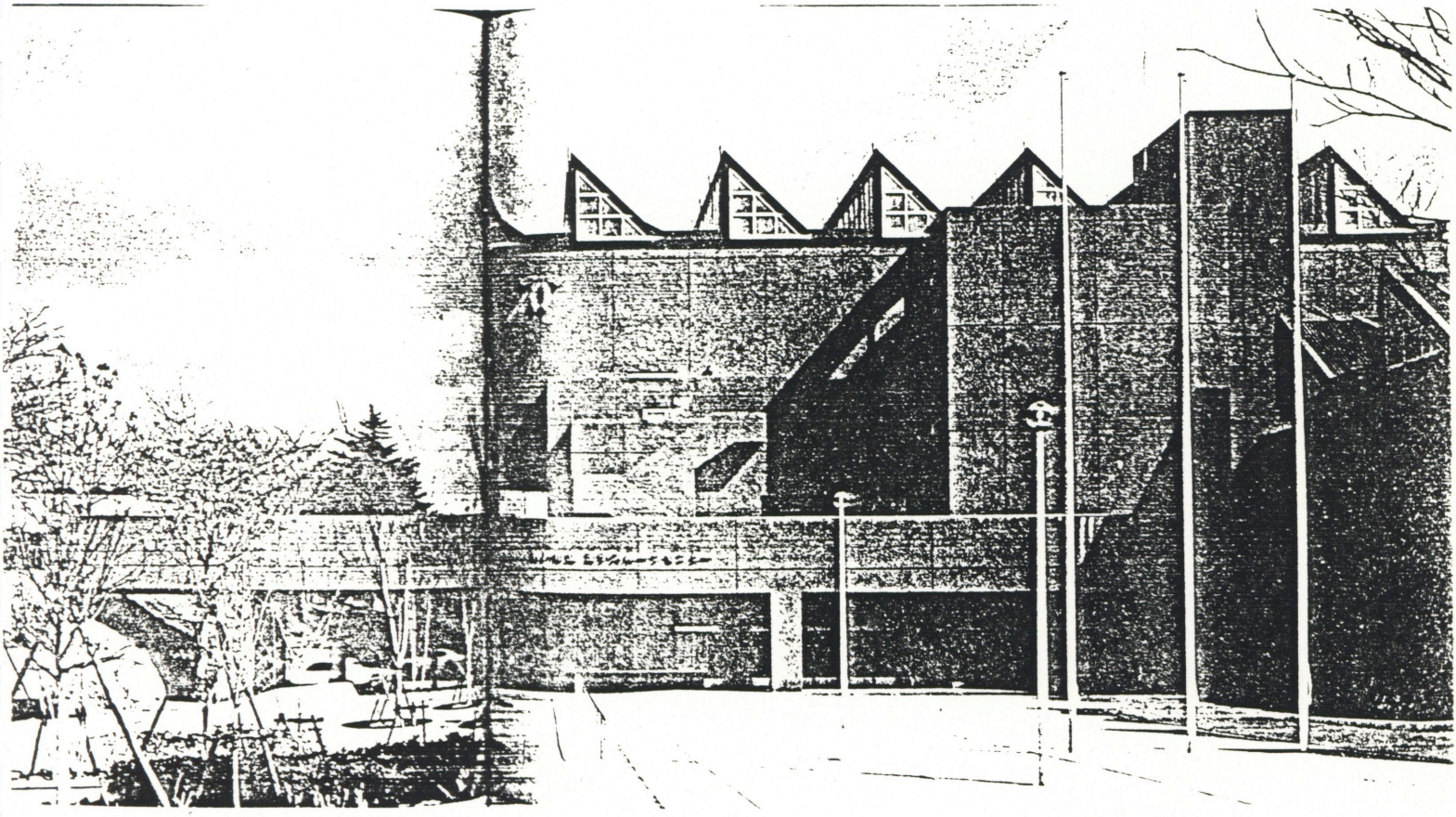


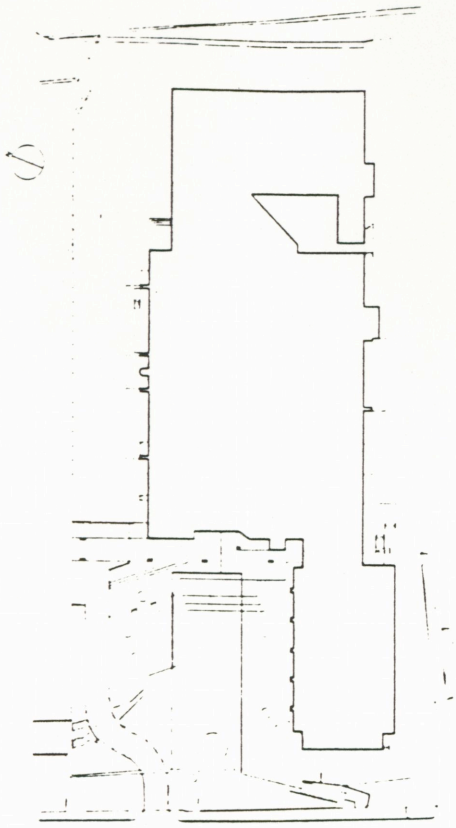
Data

KOBE MUNICIPAL OJI SPORTS CENTER/ ·· Kobe City, Hyogo Prefecture; architects: Building Division of The Kobe Municipal Housing Bureau and Sakakura Associates, architects and engineers; structural engineers; Hirata Architectural Institute; site area: 191,510.00m^2; building area: 3,937.94m^2; total floor area: 7,193.35m^2; structure: reinforced concrete, 4 stories and 1-story penthouse; general contractor: Takenaka Komuten Co., Ltd.; completion date: September, 1978.

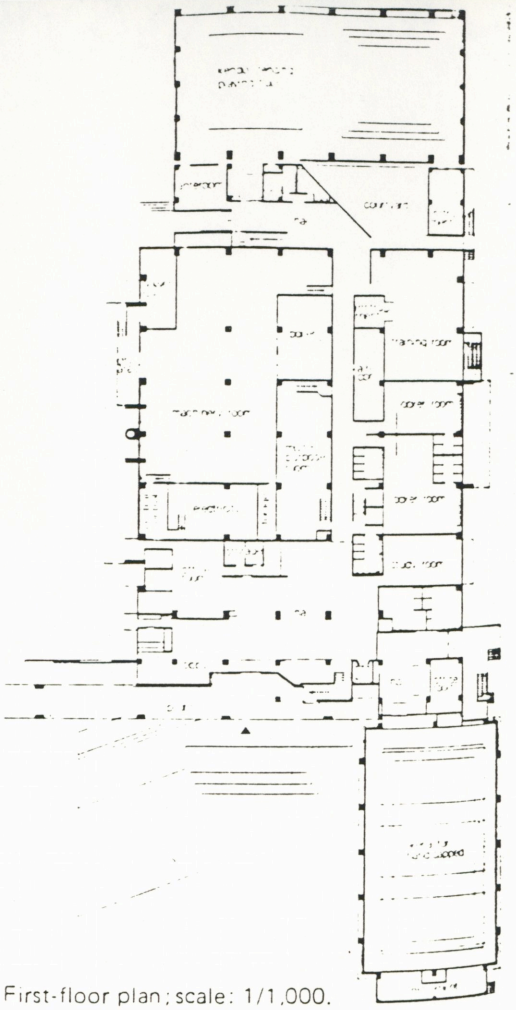
Photos: Photography Dept., JA.

(top) West side. The judo and Japanese fencing training rooms are behind the main gymnasium, in the central foreground. On the right is the special gymnasium for disabled persons. (bottom) South side of the gymnasium for disabled persons.

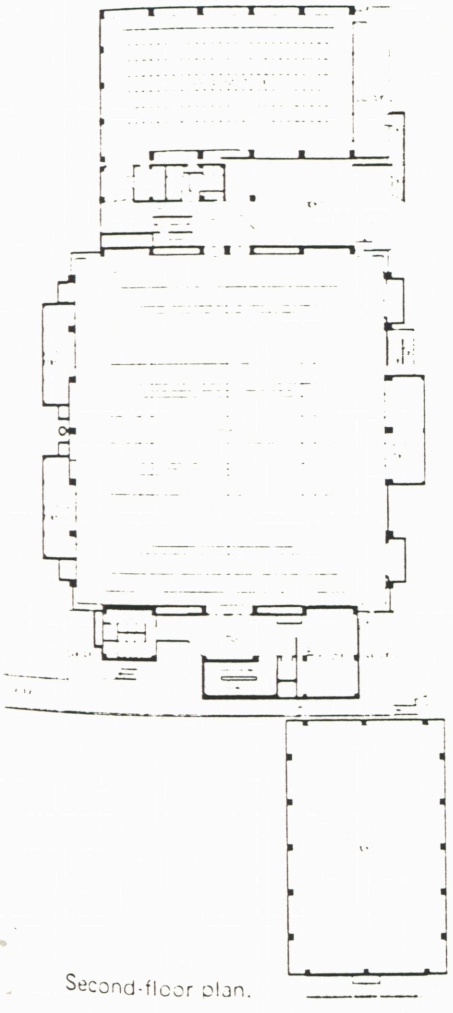




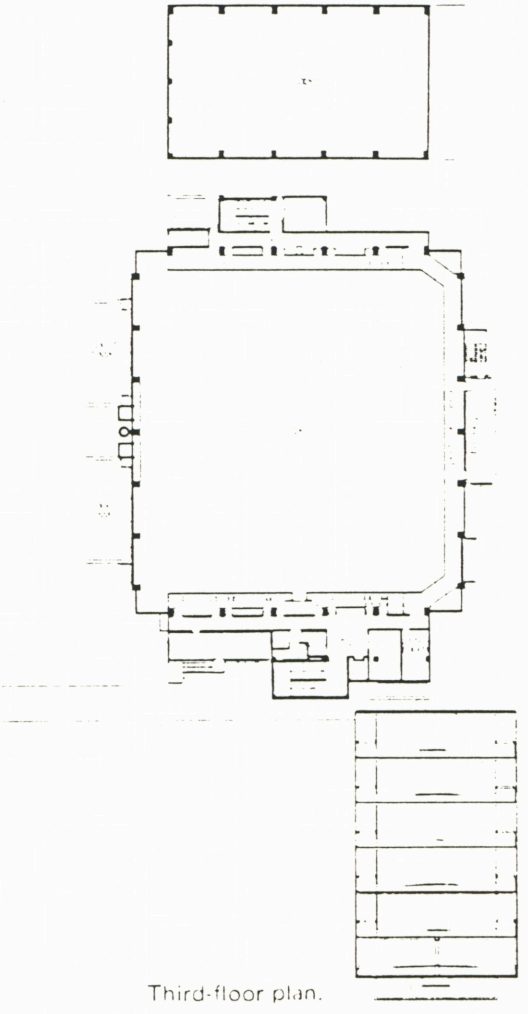
Plot plan; scale: 1/1,500.



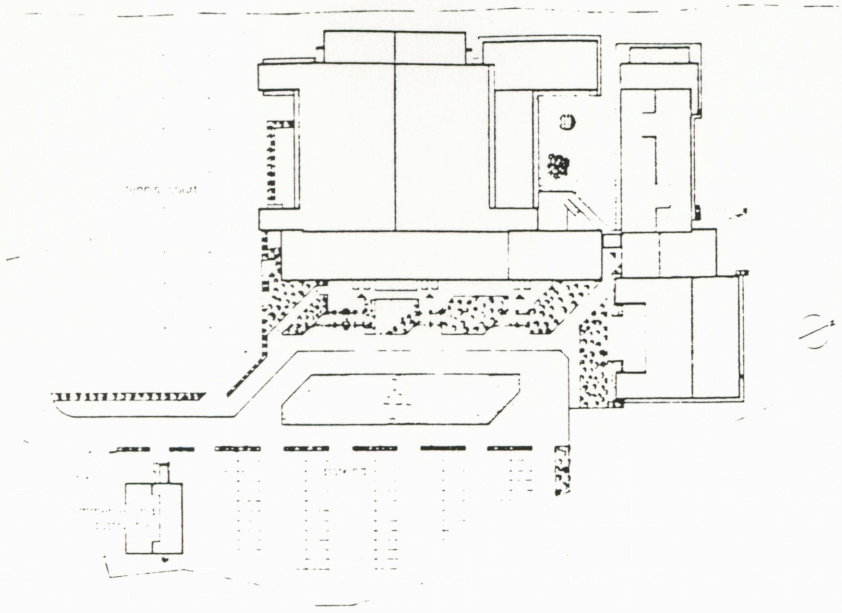
First-floor plan; scale: 1/1,000.



Second-floor plan.



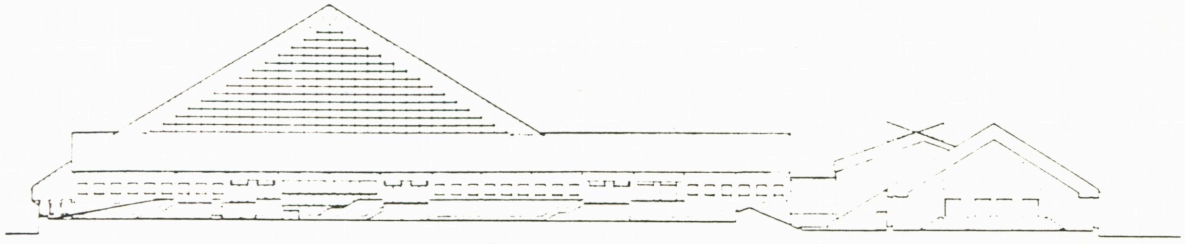
Third-floor plan.



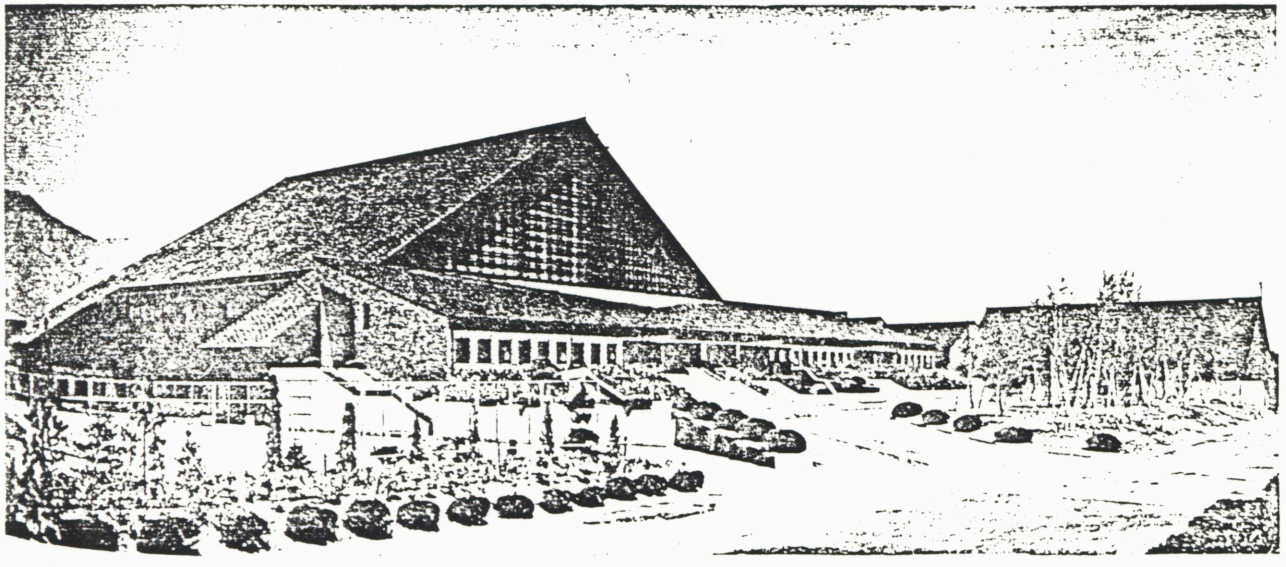
Plot plan; scale: 1/2,400.

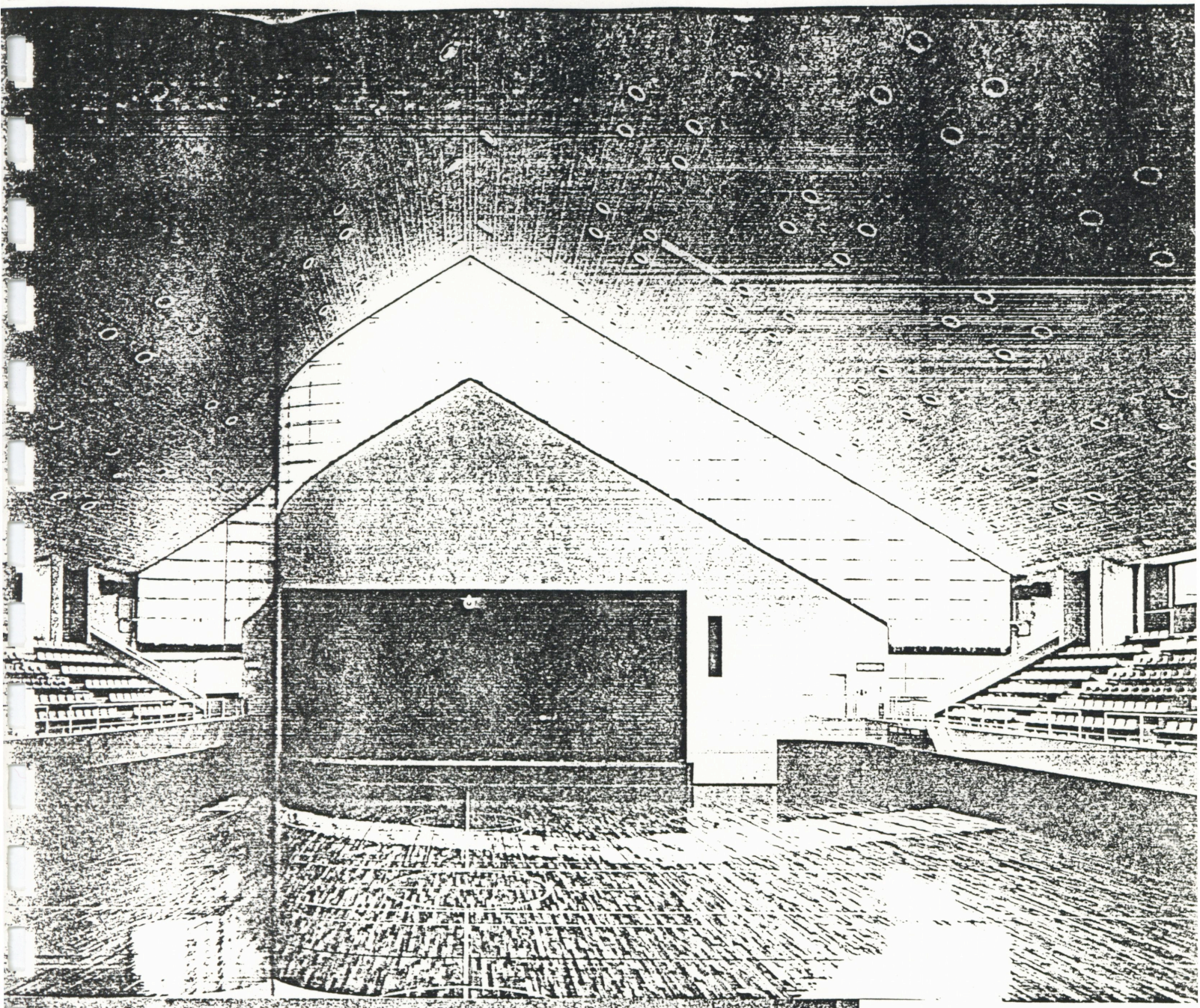
HODAKA CIVIC CENTER

architects: Tanaka · Nishino Sekkei Jimusho (Architects and Engineers)

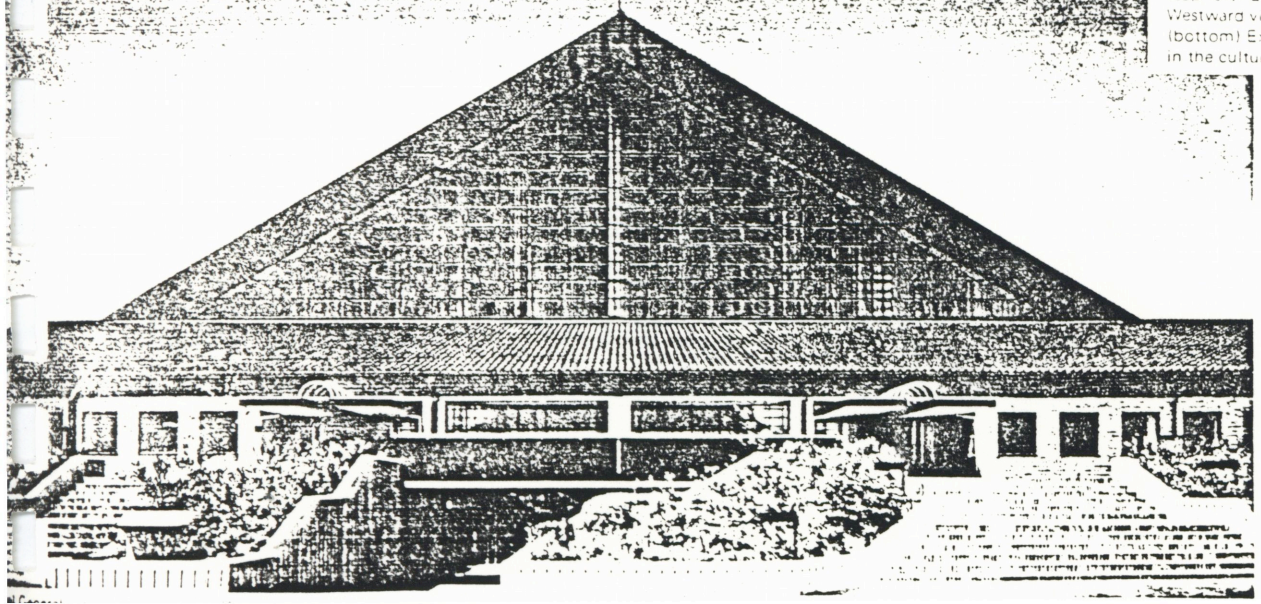


North-south elevation and section; scale: 1/800.



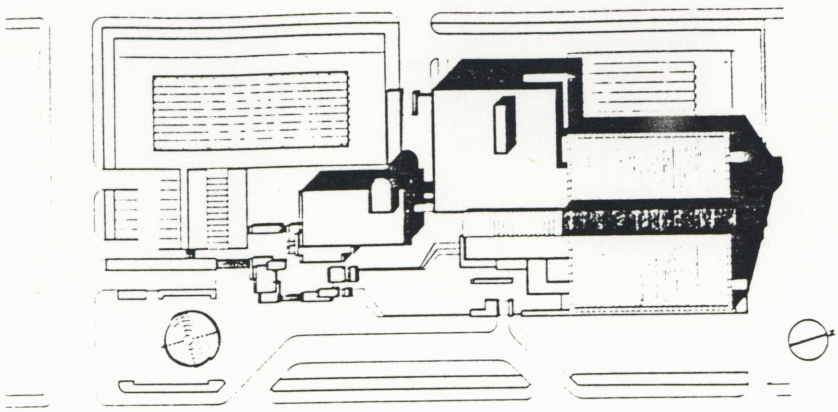


(top left) East side of the gymnasium. (top right) Westward view of the interior of the gymnasium. (bottom) Exhibition hall in front of the lecture hall in the cultural wing.

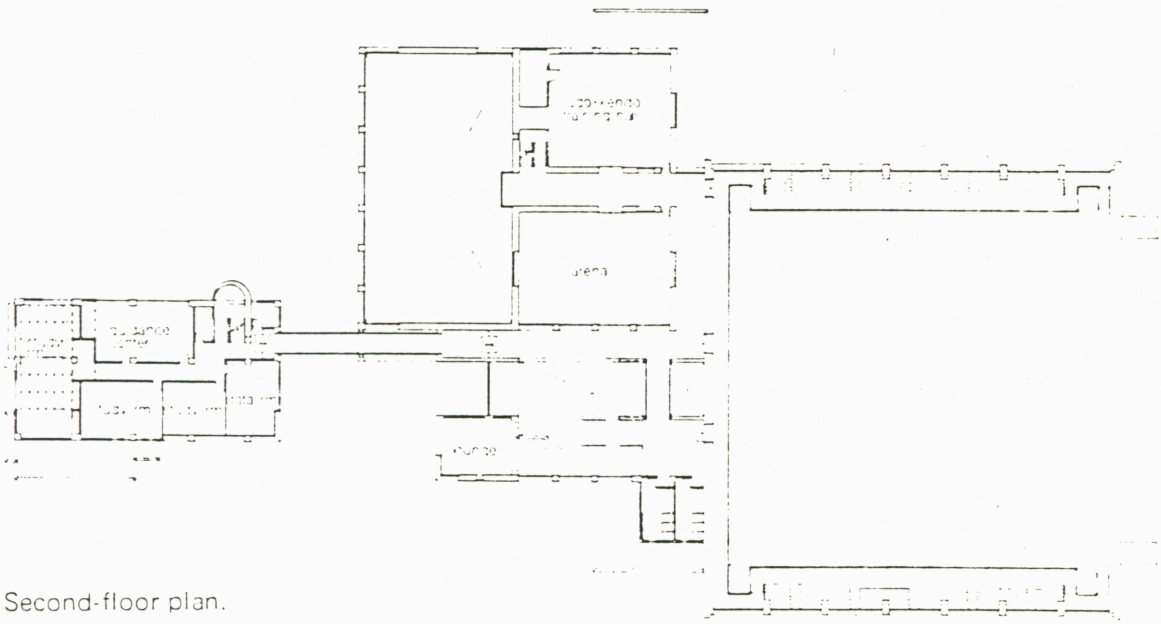


CIVIC GYMNASIUM AND
ROVEMENT CENTER/
ture, architects: Nishihara
, structural engineers:
Structure Design Institute
Kawahara Mechanical
Institute, site area:
area 3,817.98m2; total
m2, structure: reinforced
1-story penthouse; genera
tsu Kogyo Inc.; comple

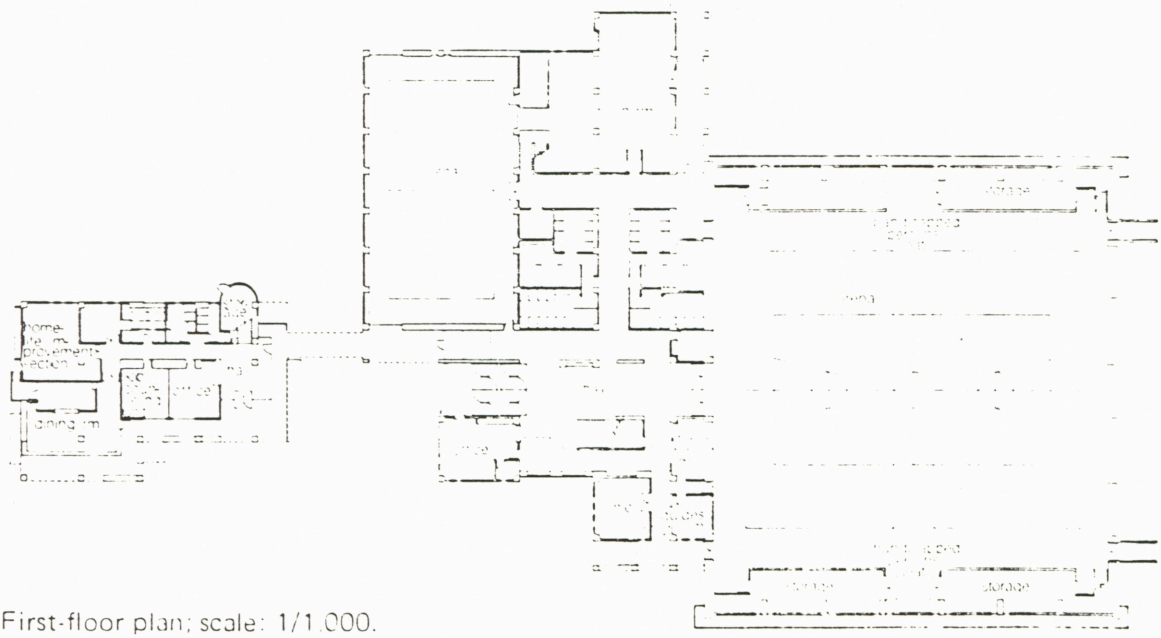
Dept., JA.



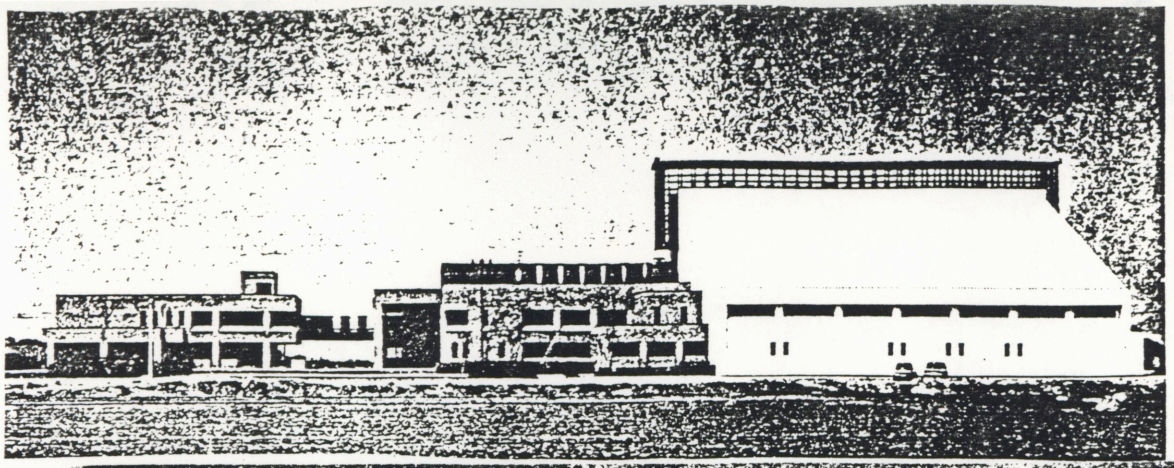
Plot plan; scale: 1/2,400.

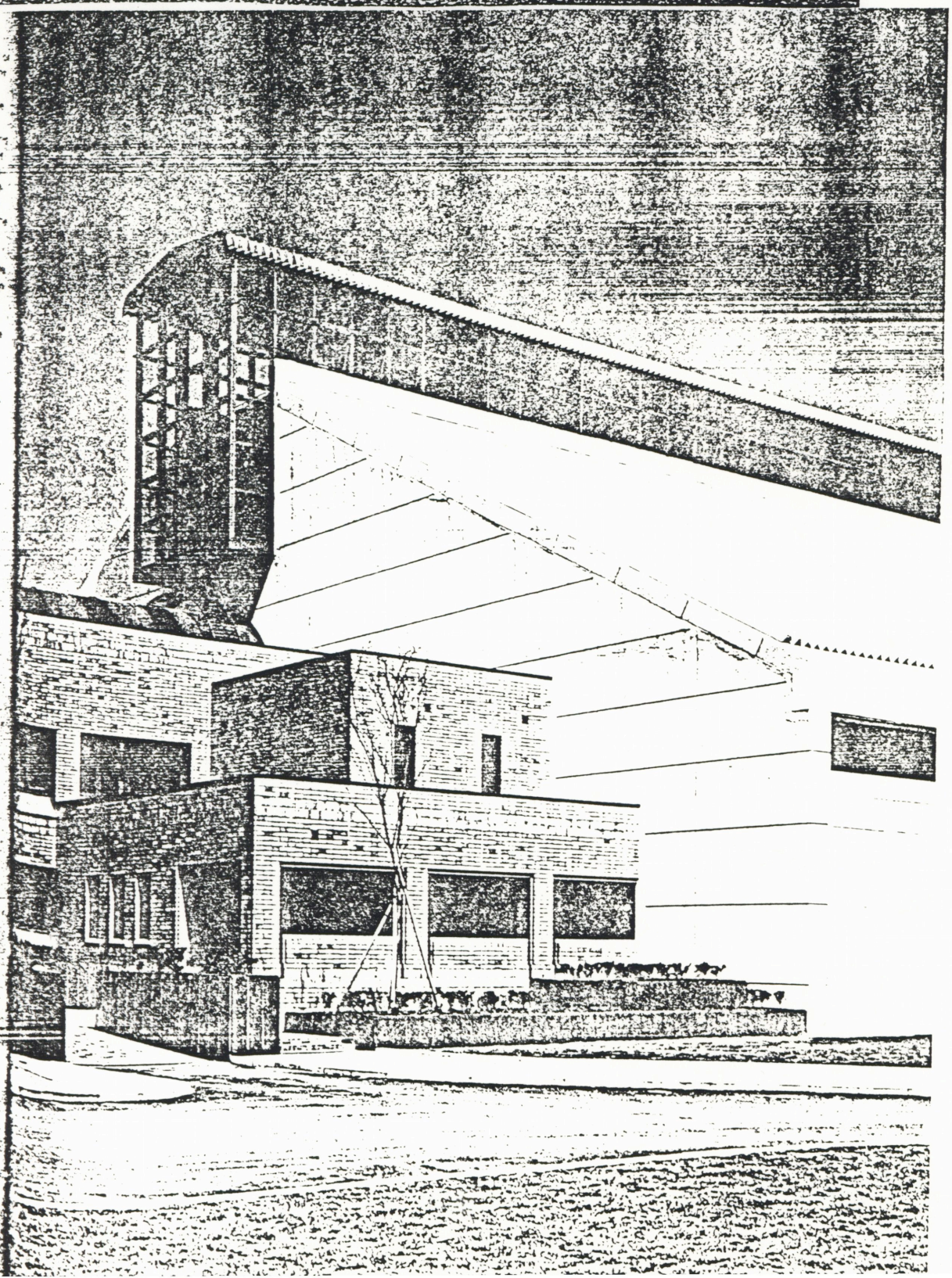


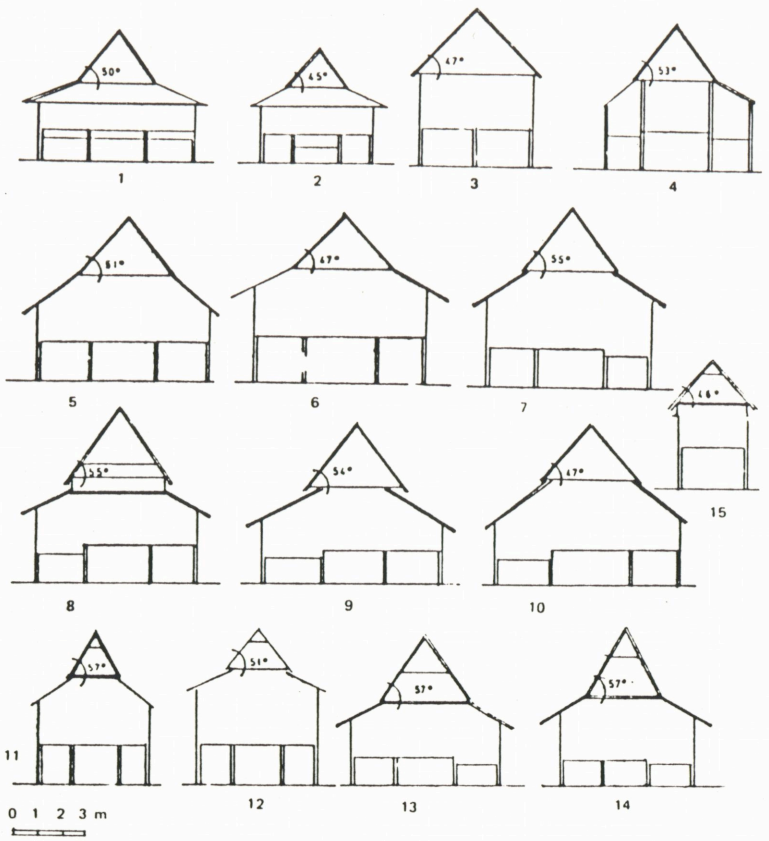
Second-floor plan.



First-floor plan; scale: 1/1,000.

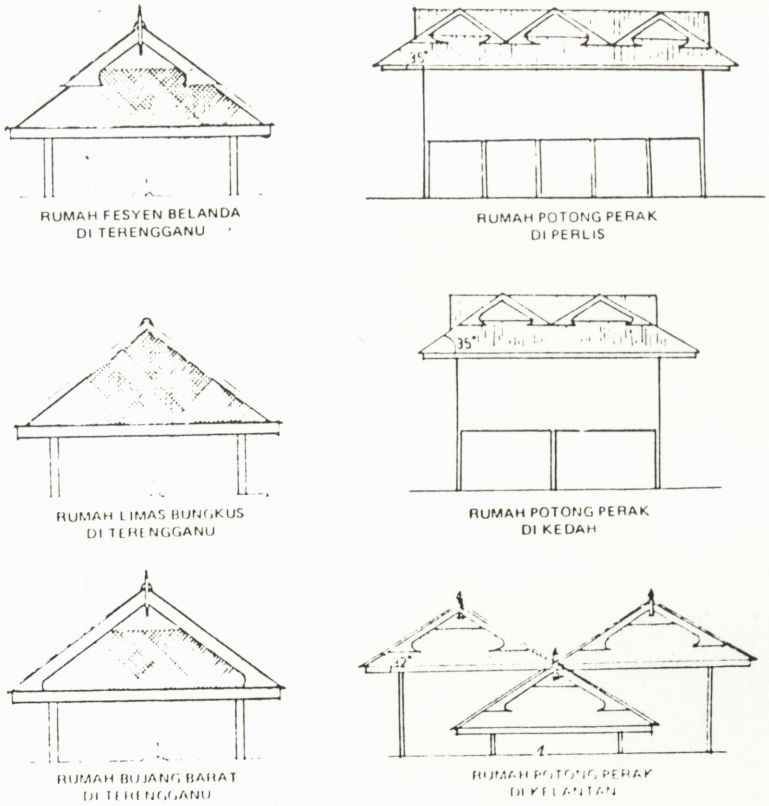






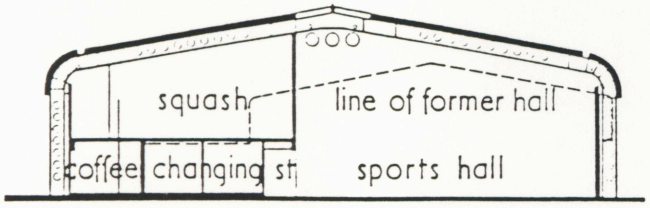
BUKAAN SUDUT BUMBUNG RUMAH-RUMAH BUMBUNG PANJANG

1. Rumah Bumbung Panjang Perlis
2. Rumah Panjang Kedah
3. Rumah Bujang Kedah
4. Rumah Serambi bergajah Menyusu, Pulau Pinang
5. Rumah Kutai di Perak jenis Tiang 12
6. Rumah Kutai Tiang 16
7. Bumbung Panjang Selangor
8. Bumbung Panjang Negeri Sembilan – berl oteng
9. Bumbung Panjang Negeri Sembilan – tidak berloteng
10. Bumbung Panjang Pahang
11. Rumah Tiang Dua Belas, Kelantan
12. Rumah Tiang Dua Belas, Terengganu
13. Rumah Bumbung Panjang Melaka Tiang 16
14. Rumah Bumbung Panjang Melaka Tiang 12
15. Rumah Bujang Terengganu

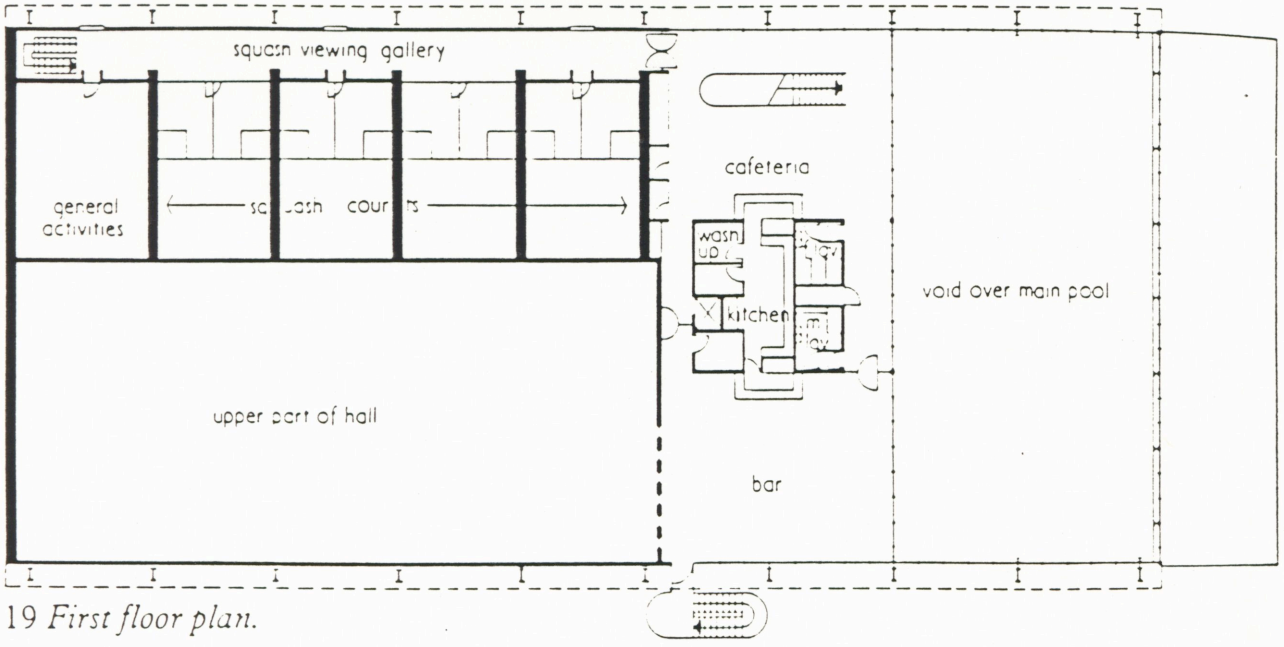


BUKAAN BUMBUNG RUMAH-RUMAH LIMAS

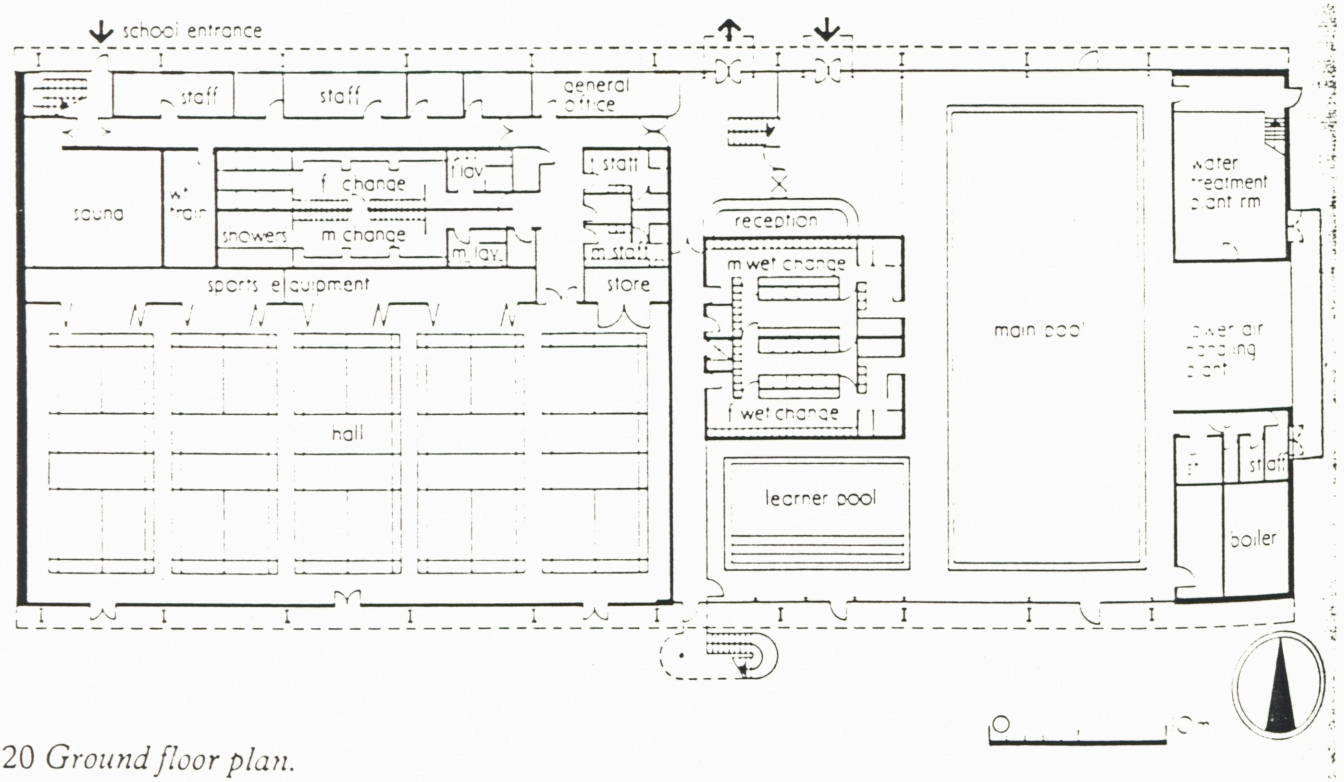
Ringwood Sports Hall - England



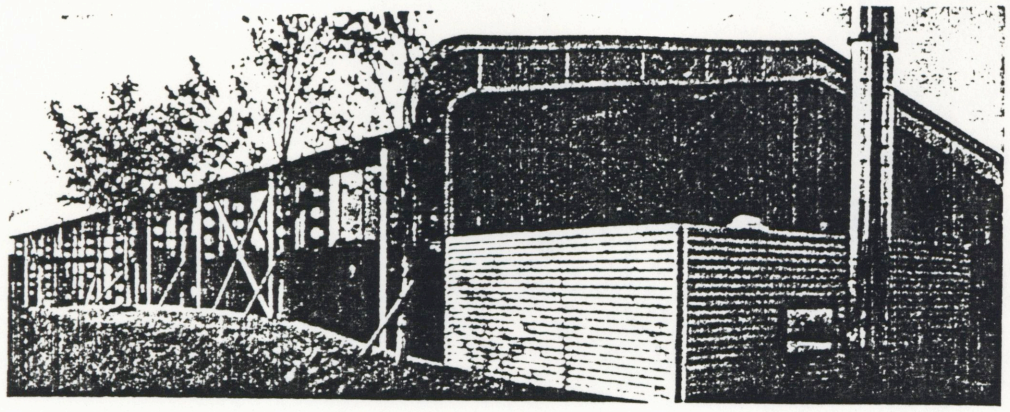
18 *Section.*

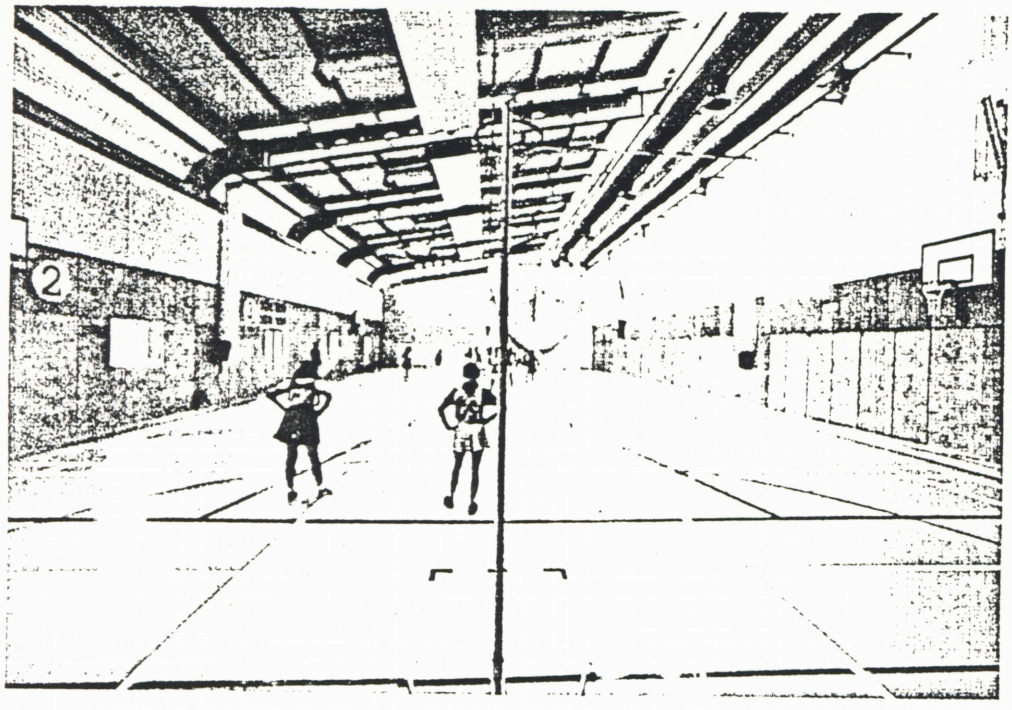


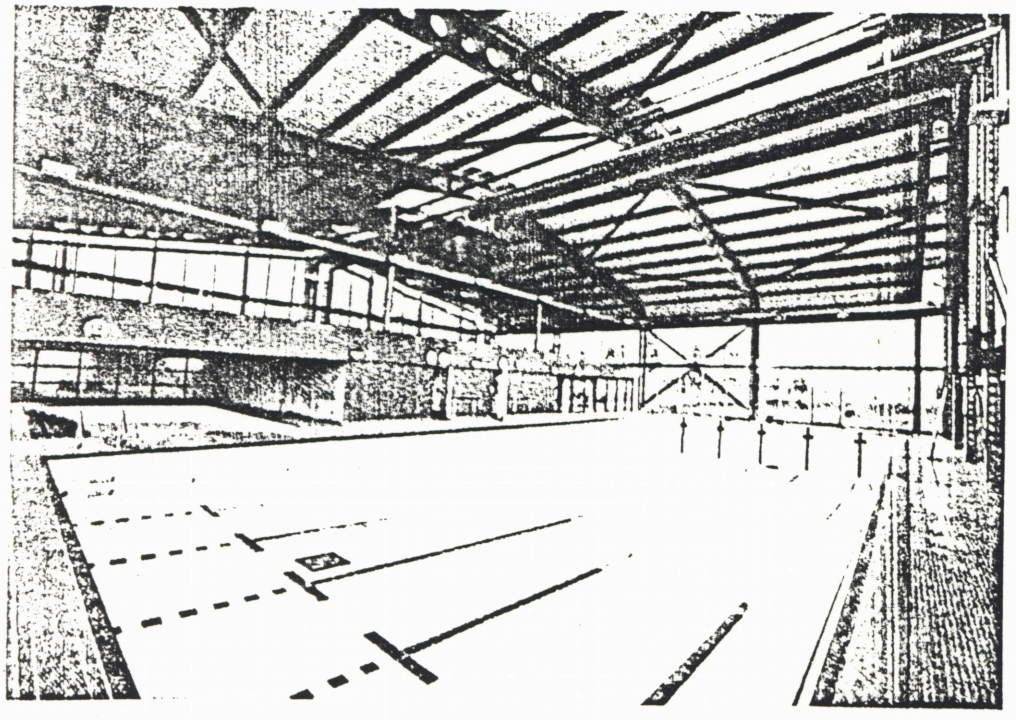
19 *First floor plan.*



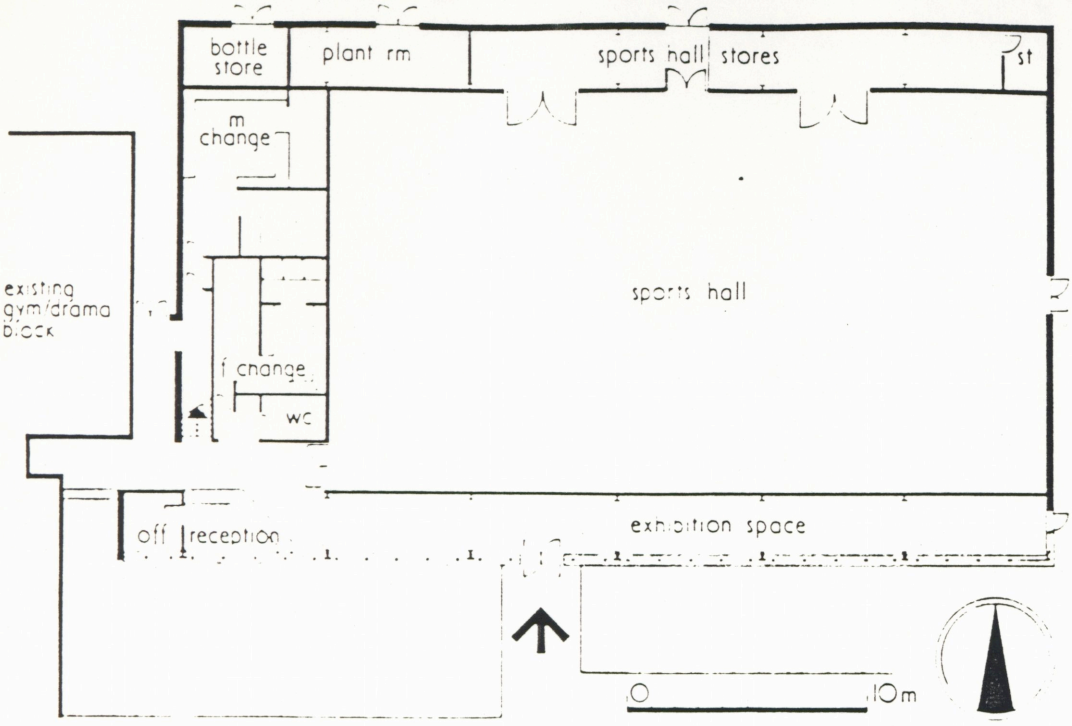
20 *Ground floor plan.*



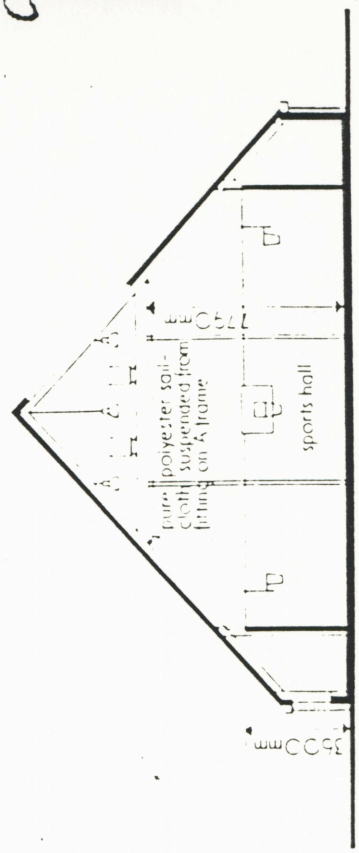

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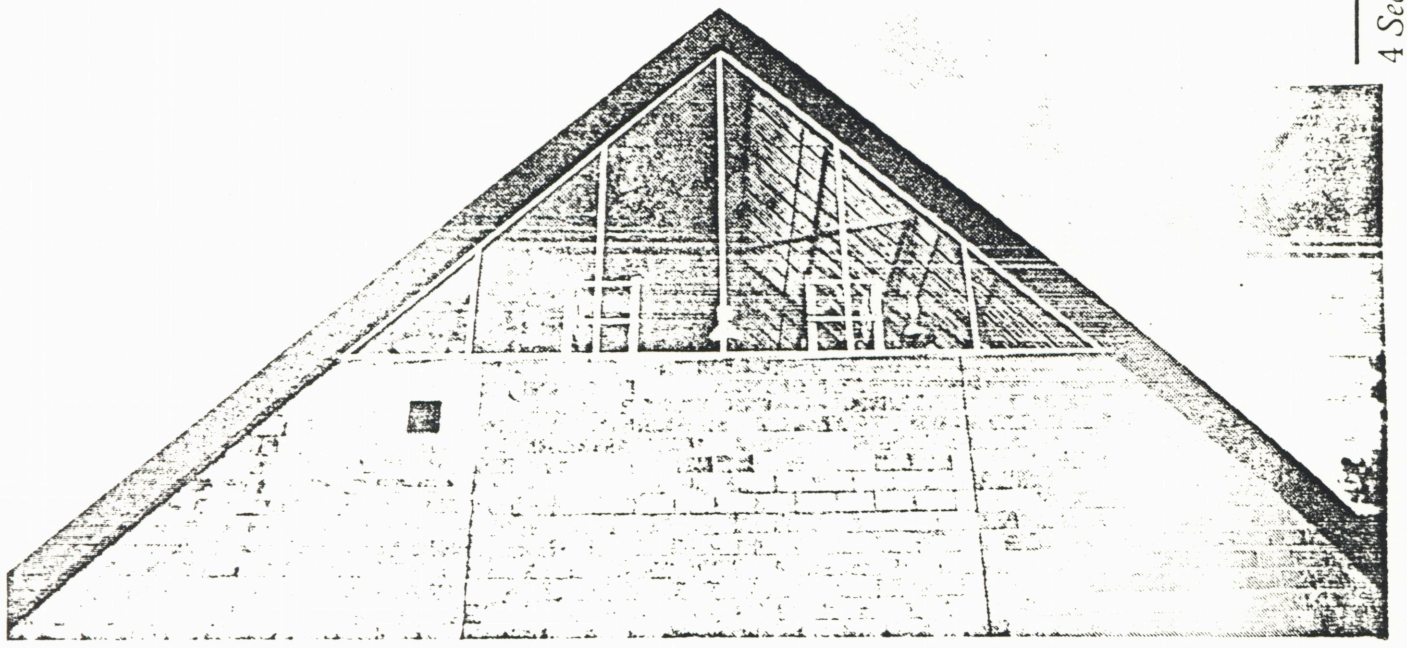
Fareham Park Sports Center - England

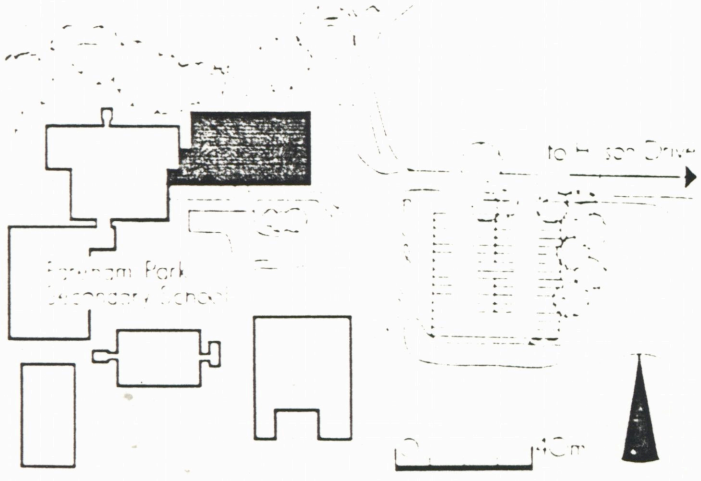


3 *Ground floor and balcony plans.*

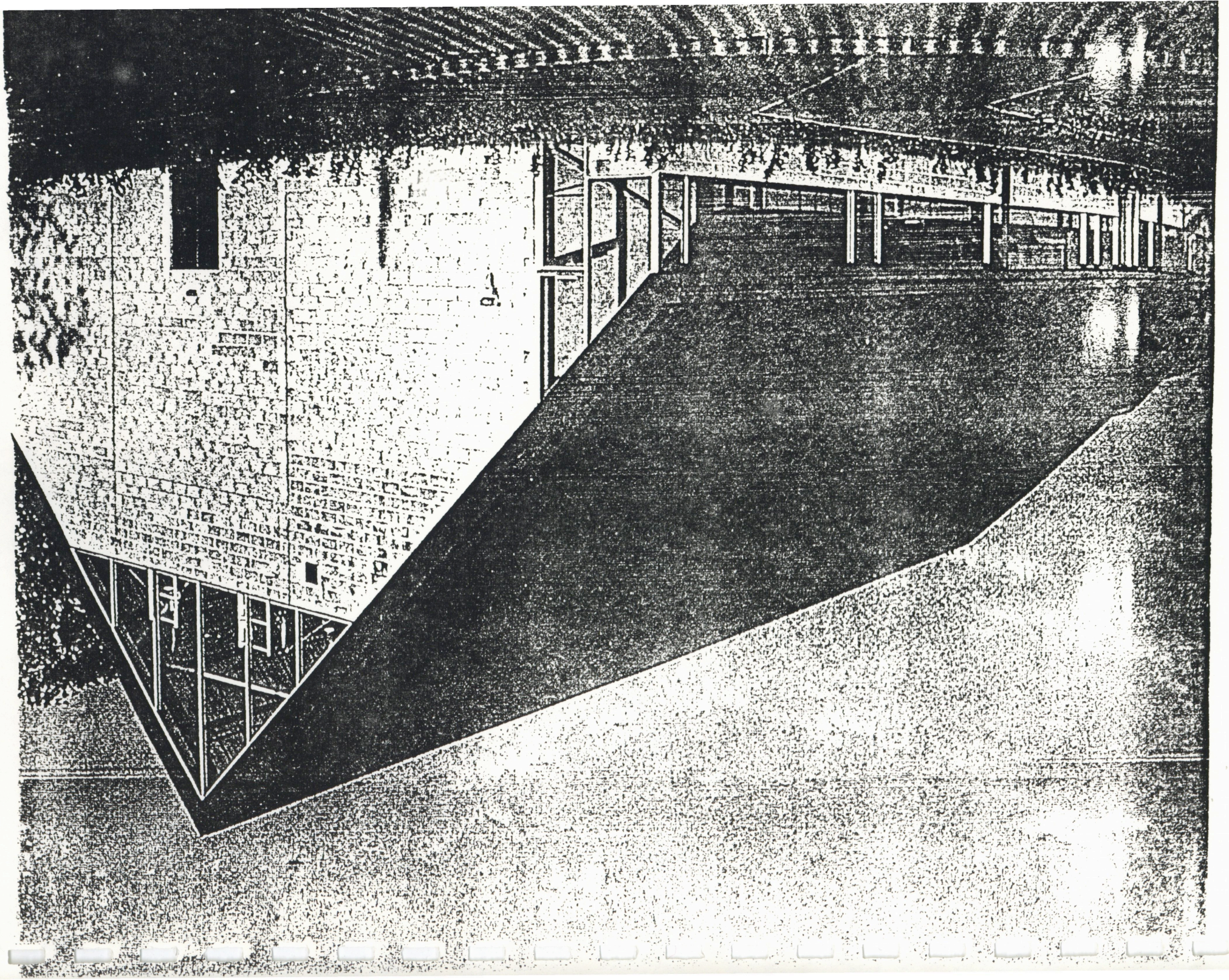


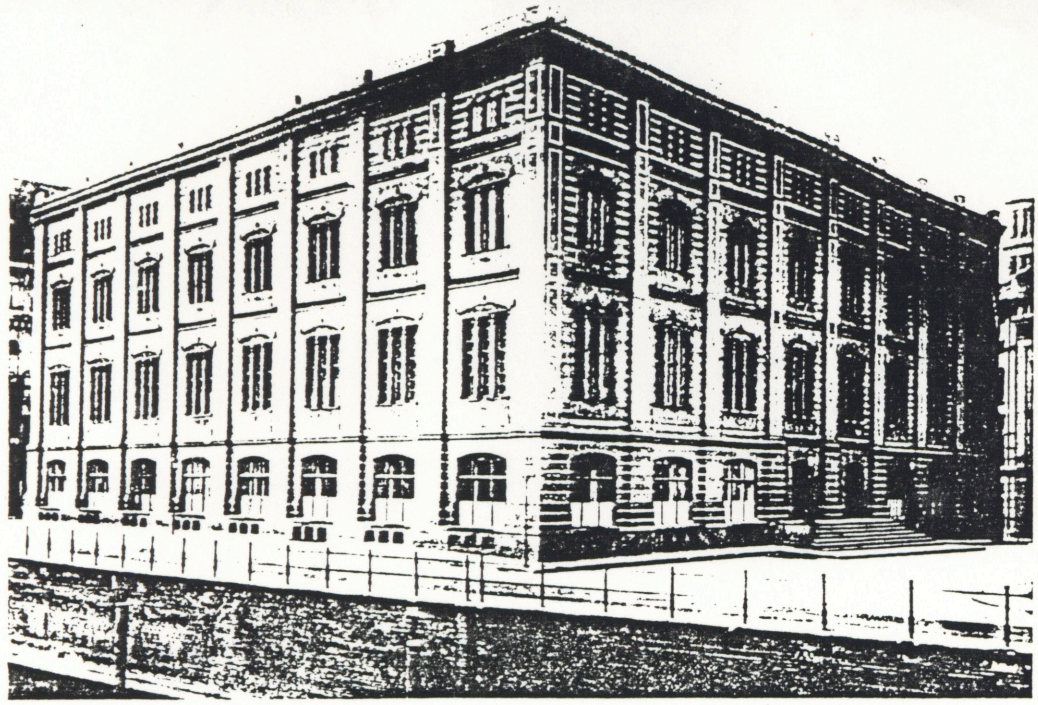
4 *Section.*





5 (facing page) *View from the south-east. The 'raised A-frame' is clearly apparent. Forticrete masonry was selected to match the existing school buildings.*





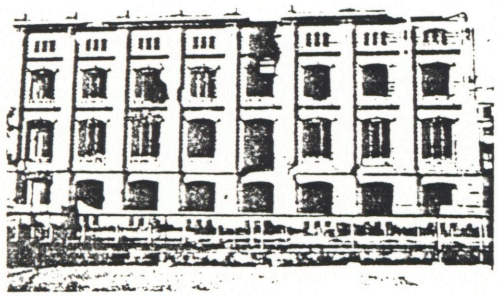
1

HISTORY

SCHINKEL

Schinkel is the only Neo-Grecian architect on the Continent whose name is familiar in this country, and rightly so: for he is the greatest. A measure of his greatness is the far less familiar fact that towards the end of his life, in the 1830's, for certain types of task, he turned away from Grecian inspiration towards a functionalism essentially independent of the past. His designs for a warehouse and public library were never executed, but his Bauakademie, 1, was and remains the most important example in the Europe of his age of monumental, officially accepted, functionalism.

If one says it remains, it must be added that it remains severely damaged towards the end of the war and never repaired. 2.



2

That it could be repaired has never been denied, but the East German authorities have decided not to repair it. Their argument, as put forward in a letter from the City Architect to Professor Pevsner, which Professor Pevsner published in *The Guardian* of June 1, 1961, is that the building in its present position would be a nuisance to the replanning of the centre of Berlin. No more is promised than to re-erect the façade in another place. That would be something; for the façade with its brick pilaster strips, its even fenestration of tripartite windows with a little North Italian Quattrocento trim, and its flat roof, is impressive enough. But can we trust the promise? The Royal Palace of about 1700 with all its splendid work by Schlüter—the other greatest Prussian architect—was razed to the ground for no good reason. So was the Stadtschloss at Potsdam and, also at Potsdam, parts of Rauch's celebrated monument to Frederick the Great are stored somewhere against re-erection at an unspecified moment. The finest square of Berlin, the one with Schinkel's theatre and the two identical domed churches by Gontard, stands in as ruinous a state as fifteen years ago and may soon, if nothing happens, be past salvation. Besides, it is surely an admission of defeat on the part of twentieth-century planners if they have to clear away key monuments of the past because they need a *tabula rasa* to do well. It may be too much to hope that the East German authorities will re-think their decision. So nothing remains to be done than to record it with dismay.

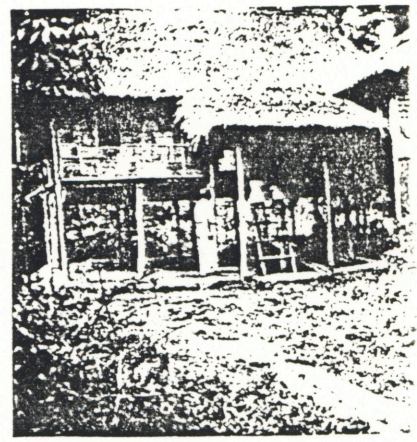
HOUSE TRADITIONS IN MALAYA

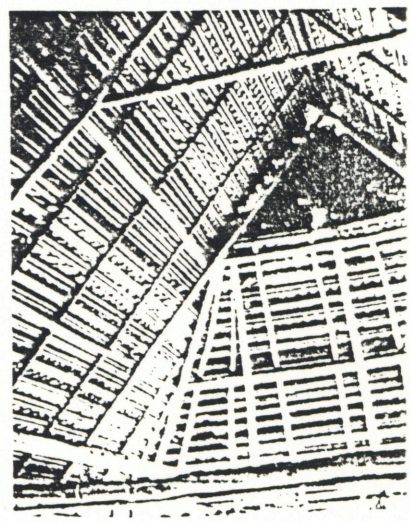
One can enumerate, in Malaya, several successive traditions in dwelling and house building. In historical order they are the tribal house, the Malay house, the Dutch house, the Chinese house, and the British colonial house. The Malay house itself appears in different forms, having been subjected to influences

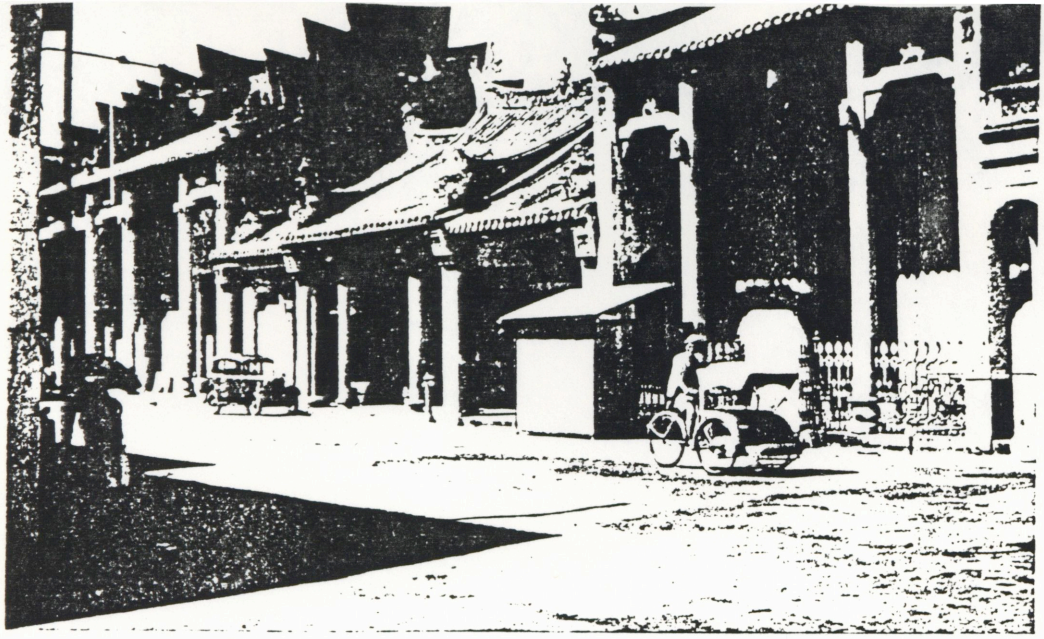
discount the Portuguese influen
Portuguese have left only one m
witnessing to their time of occup
small city gate in Malacca.

Tribal houses

The long-house is rare, and does n
the large size of Borneo long-hou
type most frequently seen in the
is a one-family house forming th
villages of tourist fame, which s
conveniently near the road leading
hills of Perak. In the best exam
structure is entirely of bamb
mostly, now, one sees a bamboo s
with an admixture of timber. The
members are lashed together with
slings, or a thinner pole is passed
an opening made in a bigger o
wall is made of panels of split
often woven into a pattern. 1. Th
roof is covered with 'attap'—mats
interwoven palm-leaves fixed
bamboo poles. These mats are ro
placed on the ridge when the carca
house is finished. The roll is then
and the attap mat thunders d
rafters. It is tied from inside to th
with bamboo slings. The roof sho
is a good example, though it is par
of timber. It also shows the gable
above the truncated hip, a feature
throughout East Asia. Often the
triangles are made of several tilte







15

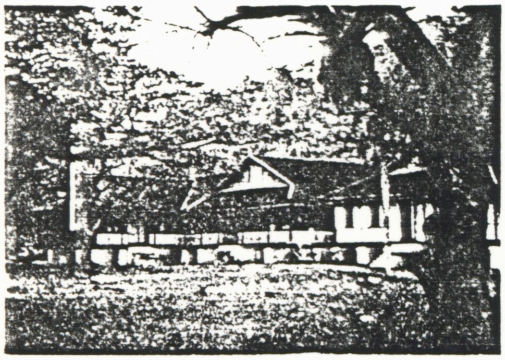
It is in Malacca, 14, that one finds the best surviving Chinese town houses in the true tradition. Everywhere else, one has to visit temples in order to see houses in the Chinese courtyard tradition, the Buddhist Chinese temple being essentially a courtyard house. 15 shows three temples in a row in Malacca.

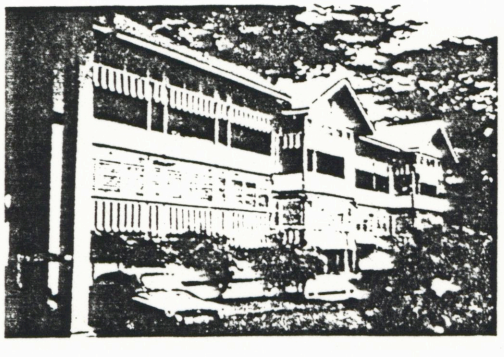
Perhaps the only point of contact between these Chinese structures and the native houses of the country is that in the Chinese house, also, timber predominates, though it is combined with brick walls. But the very heavy structure of Chinese timber roofs is no counterpart to the light roofs built by the earlier inhabitants. The Chinese shop-house, already illustrated in 4, is an abbreviation of the courtyard house. In its normal two-storey form the ground floor is occupied by a deep shop behind an arcade, with stores at the back, and the first floor forms an equally deep caravanserai, under the large Chinese roof with the ventilating lantern over the ridge. Any number of cubicles are partitioned off underneath this common roof, and any number of people are found living there. The court is reduced to a backyard.

The shop-houses are built of brick, with roofs covered with the fine Chinese pantiles. Their decoration, such as it is, is frankly European, with pilasters marking the party walls. They are plastered and painted light green, ochre, yellow – colours somehow too light for the glare of Malaya. The native timber, bamboo and attap provide a more fitting colour-scheme.

British colonial houses

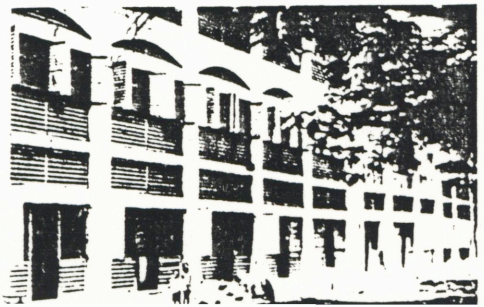
This last tradition is international: a colonial house in Malaya hardly differs from one in Ceylon or in British Africa. But it is a *tropical* type, and is therefore more akin to the aborigine and Malay house than to the Chinese. It is lifted off the ground and it makes extensive use of timber, though structurally mainly in the verandahs which, wherever possible, surround the house on all sides. The core is





16, 18



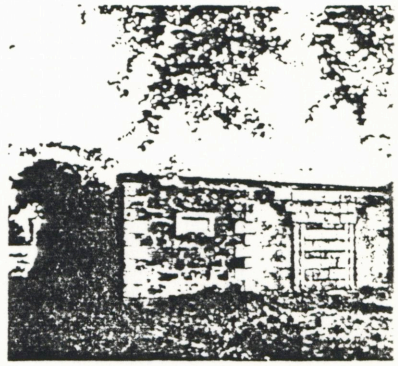


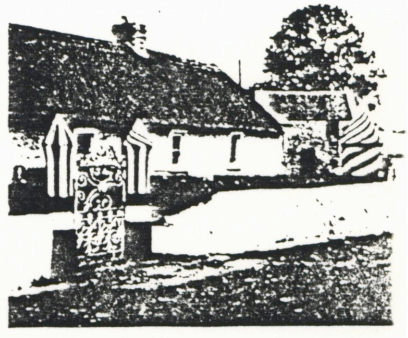
17, 19

of brick. It has a wide roof
16, a resthouse, shows these ver
generous depth (8 ft. is normal)
themselves protected by 'shiks'
roller-shutters. 17 also shows w
jecting eaves supported by strut
open, airy structure of the vera
the verandah-room projecting
drive. 18 is another Governm
house and 19 a large block of
in Kuala Lumpur, with a fro
without glass. If anything, thes
houses are too well protected ag
and glare. Often a truly Victor
pervades their vast and wasteful

ULSTER

John Cary designed and
Temple of Liberty. Learn
Select Amusement at Toon
in Northern Ireland in the ni
century, and he filled it with stai



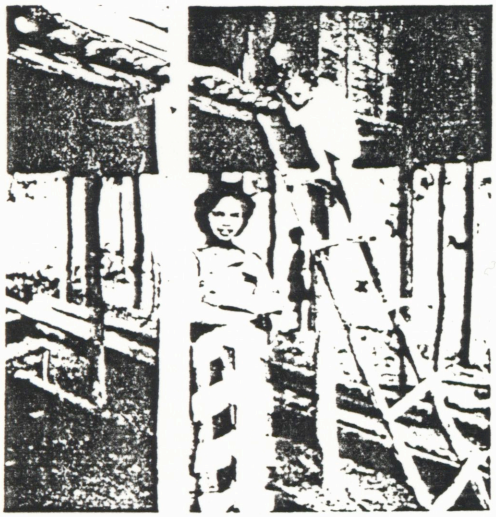


and busts of 'men of the world,'
free-thinking temple and a bold
a country which feels so bitter
religious schisms. The place, in
deliberately allowed to fall into
after its architect's death.

However, additions Cary mad
neighbouring residence still st
whorled candy gateposts he pat
make the eyes spin and his fancy
with lions' heads and serpent hair
2,3. One can, alas, only faintly trac
the thaumaturgic sigils which h
into the ground with pebbles. T
also still displays his 'Fountain o
1860,' an eight-sided pyramid wi

like large louvres, and in this form they help to ventilate the house. The roof is always open; there is no ceiling.

The attap roof breathes, though, if well made, it is also waterproof, being so steeply pitched. The panelled wall also breathes. The floor itself, invariably raised above the ground on stilts and made of split bamboo, lets in air from below. Windows are possibly a comparatively modern feature in this kind of house. It is possible to read in the light filtering through the slots in the walls, and this subdued light is very agreeable. In houses in Trengganu quite delicate weaving is done in rooms whose walls are made of the same material. 3 shows the floor-construction. The timber post with a bracket supporting the cross-beam is certainly not of traditional construction, however. In every good Eastern



3

structure, the crossbeam passes through a slot in the post. All members are remarkably thin, the floor in particular being quite springy, yet the houses are structurally enduring.

Malay houses

There is a multitude of types. Two only are illustrated here: a type showing influence from Sumatra, found in the region of Malacca, and a type common on the east coast. The Malacca house is most convincing in its clear articulation of the different parts of the plan. These are: a verandah-like entrance, often projecting beyond both ends of the house, the main room or rooms – there may be two – standing on a slightly higher level, and at the back, reached by a connecting passage which has its own back ladder, the kitchen.

Approaching Malacca from the north, along the coastal road, one passes through rice-growing village after village with houses of this type. Here is one of the rare parts of the Federation which is peasant country – very different from the large and regular rubber forest or the shapeless jungle. The road passes over rough, shrubby hills and again and again dips into these narrow rice-valleys. The core of the



4

Chinese shop-houses. 4. The Malay peasants' houses form long ribbons along the road, or skirting the hills at the edge of the valley, stretch between one Chinese shopping-centre and the next, which is sometimes ten miles away.

Each house stands in a neat plot or garden, with a water-buffalo or two tethered to a tree in a little dip, with a grass plot and, quite often, an array of plants in flower-pots all round the verandah, and chickens, goats and some tools and stores in the space underneath the raised floor. Entering, one finds the main part of the house, which is often quite large, subdivided by differences of level and also by low partitions or by shelves forming partition. The light is subdued and cool, and these freely-planned rooms under their steep, dark roofs have a quality that appeals to the architects of our generation. Equally convincing are the thin, widely spaced members framing these houses, in particular the elegant verandahs, whose proportions strictly modular, by the often very pleasing.

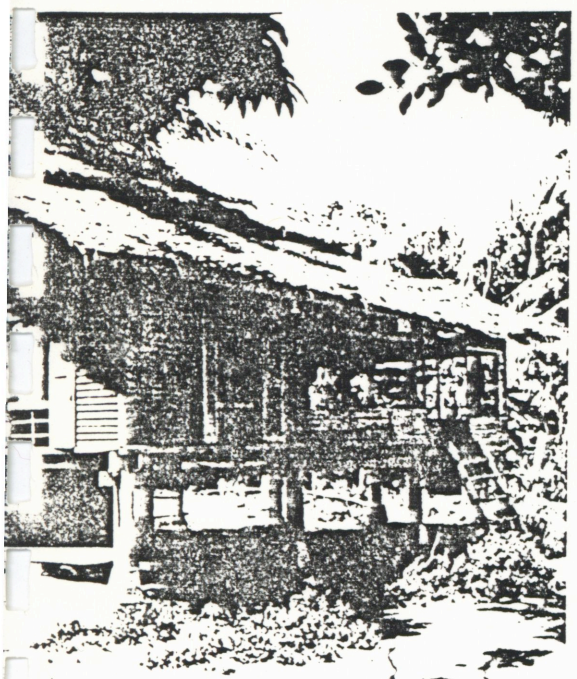
Some of these houses are as 150 years old; on the other hand still being built, though in the n the less steep parts of the roof are covered with attap, but with corrugated iron or asbestos as in 5, 6 is house standing just outside Mal floor construction is clearly sho verandah: the posts stand on sto or blocks of a traditional kind o



made of honey, crushed eggs limestone; a long lintol-piece through the posts at about 3 ft.

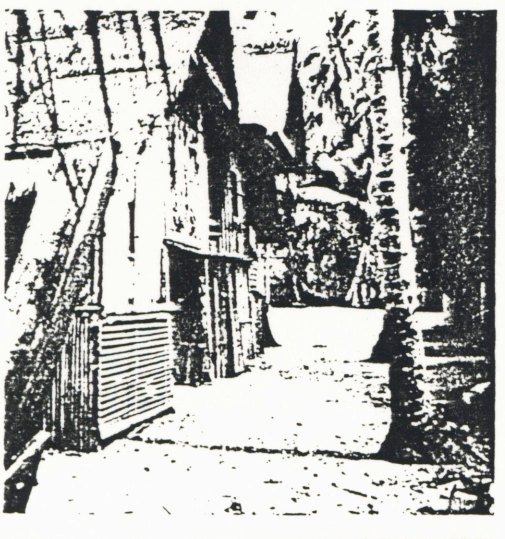


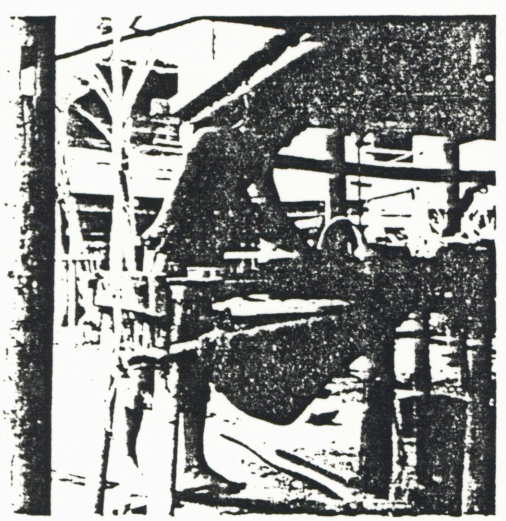














stone pads, and the crossbeam also pa through the posts but does not rest these lintols. These crossbeams sup the actual floor framing. The difference level are sometimes obtained by pla the joists of the verandah floor directl the lintol.

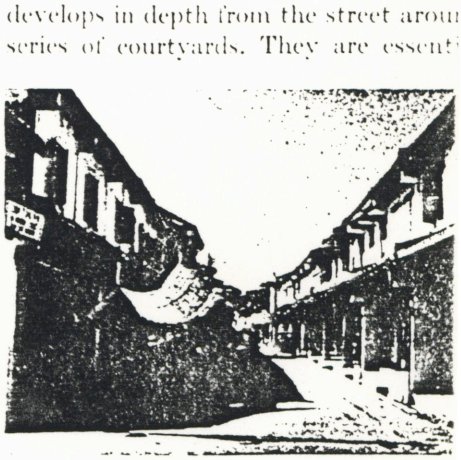
7 shows quite a large and new h from the northern end of the coast r 50 miles from Malacca. The three part the house are clearly shown, as are inclined breathing 'louvres' in the gable. 8 and 9 show a house at Lub China, about 25 miles north of Mala The verandah here is particularly proportioned, and it is interesting tha this house the out-buildings under lean-too roof behind the kitchen are with split bamboo and built of unsqu timbers. The projection under the lea eaves is a kitchen shelf.

The type of house built on the east c (Kuala Trengganu) is very different has a small, open entrance-porch a considerably lower level than the h itself. 10, which is lifted high above ground with the undercroft partly close and used as a workshop. 11 and 12. walls, hardly interrupted by openings, made of bamboo woven into colo patterns. The plan is less clearly articul than in the Malacca house, but the pat of the walls is often fascinating. Suc pattern is shown in 13 in the bamboo f in the foreground.

Malay houses are often dismantled re-erected somewhere else. Peter Mo in his writings about Malay hou mentions quite an old house which shifted place twice.

Chinese houses

Malay houses are typically trop Chinese houses, on the other hand, h been imported from a different reg They stand on the ground, and their develops in depth from the street arou series of courtyards. They are essenti



town houses, a type which neither aborigines nor the Malays had develo Those earlier intruders, the Dutch, developed a town house, a few survi specimens of which can be seen in Mala Significantly this is also a court house.

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