CHAPTER TWELVE:

FACILITIES PLANNING AND DESIGN

12.1 SITE-A

12.1.1 Site Planning

(1) Surrounding conditions

East: Public road (Pracha Songkhro Road, recently improved, heavy through traffic, dangerous to cross by pedestrians)

West: Internal complex road (there are a number of commercial facility and street vendors. Very lively and popular)

South: Makkasan pond (blocking access to Sukhumvit area)

North: Continue to NHA housing complex

(2) Outline of Site Planning

- The public road (Pracha Songkhro) on the east has a very narrow (50cm) pedestrian's walkway. This width is dangerous for walking. Crossing to the other side is also dangerous because of heavy vehicle traffic. An internal road will be provided on the east side, integrating the existing pedestrian's walkway, which will serve at the same time as fire engine maneuvering area. The total width of the combined road will be about 6.5 m.
- Along the east side internal road, open parking space will be arranged. It will be grown with trees to make the strip along the road greenery space.
- Over-bridges will be provided between this site and the other side of Pracha Songkhro road to provide safe access for the pedestrians. The site will have a number of public welfare and amenity facilities such as a daily market, a kindergarten, and movie theater, which will be open to the residents on the other side as well.
- In the north end of the site, a square having commercial facility will be planned to serve the residents in this site. This place is in a conjunction zone between the site and existing NHA housing complex further north, which will be renewed in

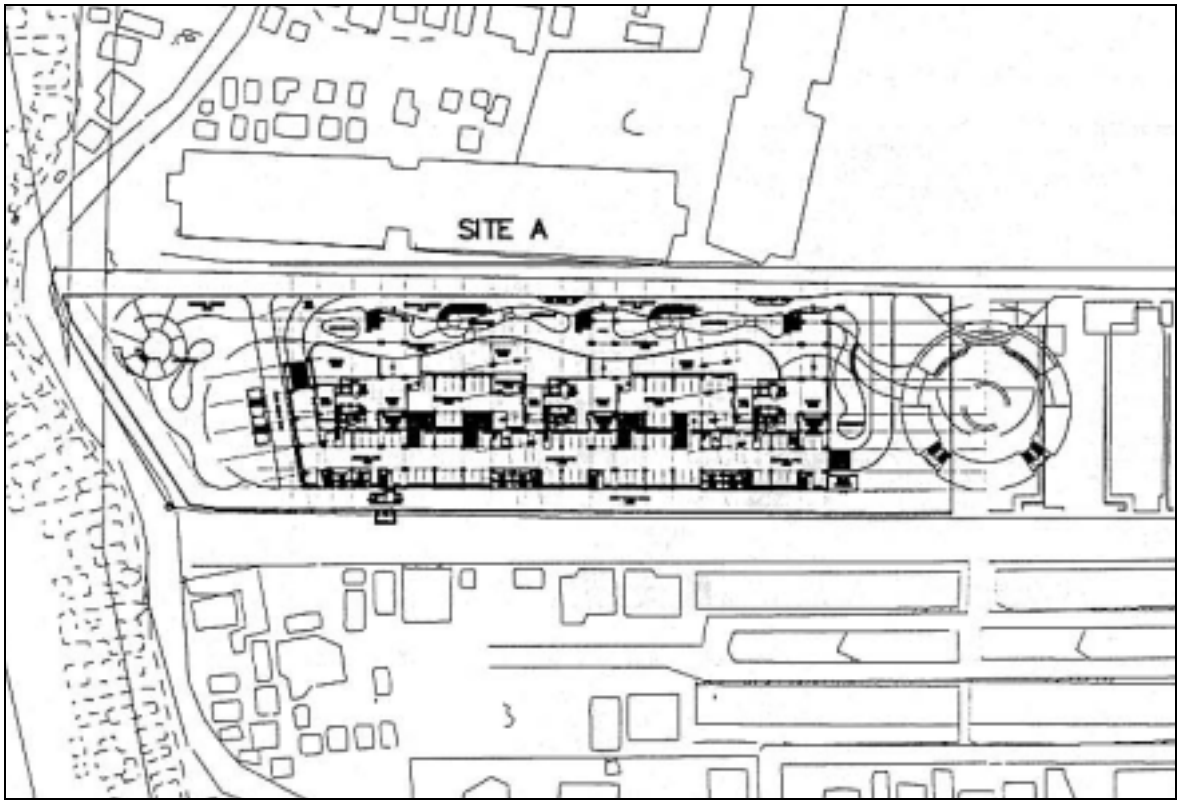
the succeeding development phase. This place will, therefore, commonly serve both sites. As such, facilities like bus stops that should be planned in the vicinity to provide the residents with access to the public mass transit system.

- On the west side of the site, a promenade will be planned, with adequate greenery and a shallow stream, rendering a quiet and safe walkway.
- On the west boundary, sub-access entrances to the site will be arranged for use mainly by the residents of the buildings in this site.
- Along the west wall of the building, an elevated pedestrian deck will be planned, and will be a part of the elevated pedestrian deck system laid out over the entire area of the Din Daeng Community (100ha) in the future as a vehicle-free pedestrian walkway. This system will connect the community with the outside areas particularly Sukhumvit area, creating a direct access-way from the new BMA city hall to this area. The deck will be provided with various commercial facilities.

Table 12.1: Land Use Plan at Site-A

		Area (m^2)	Ratio (%)
1.Building	High rise apartment Commercial	5,958.00	40.8
2.Road	Fire engine maneuvering road Parking access road	2,178.00	14.9
3.Landscaped area	Green Garden, Stream, Plaza	6,388.00	43.8
4. Others	Bare land		
5.Total Land Area		14,584.00	100

Figure 12.1: Site Plan at Site-A



12.1.2 Building Designing

Three coupled building blocks will be laid down in the site which will be linked together by three lower floors: ground floor, second floor and the third floor. The second floor will be used as an elevated pedestrian deck, open to the public, scattered with commercial facilities. The third floor will be used as common space for the residential building blocks. The fourth floor and above will be residential buildings, where residential units for the handicapped are interspersed in every three floors.

1) Ground floor:

- Commercial facilities will be continuously arranged facing the promenade on the west. It will be occupied by day to day commodity shops such as mini-marts.

- Entrances to the residential building blocks will be arranged building by building on the west side through the commercial space. Entry/exit will be controlled by security guards and electronically encoded card lock system.
- The car park will be sited on the east of the site with entrances on the north and south edges and also on the west. The car park floors will be designed in skip-up floor system. Floor levels are staggered from those of the commercial space, which will enable unobstructed natural ventilation.

2) Second floor:

- An elevated pedestrian deck will be arranged on the west, which is designed as a first part of the elevated pedestrian deck system throughout the Din Daeng Community aiming at providing vehicle-free walkway to Sukhumvit area from as far as the new BMA city hall.
- Commercial facilities will be scattered over the pedestrian deck. They will be oriented to welfare and educational purposes such as clinics, vocational training center to enhance employment opportunity.

3) Third floor:

- The common space will be arranged with clusters of facilities, which will be functionally linked with outdoor facilities.

  a) Formation of community

  Community center, conference room, and a prayer room

  (Related facility: Outdoor community activity space (for ceremony), spirit house, and religious service places (Buddhism, Islam, Christianity)

  b) Life support facility

  Health center and vocational training center

  (Related facility: clinic and shop)

  c) Children and elders:

  d) Kindergarten, day nursery, play room, and day care center

  (Related facility: Play space, garden, and play lot)

  e) Youth activities

  Youth center and recreation center

  (Related facility: sport court)

Figure 12.2 : Building Layout Plan at Site-A (Basement Floor～P2A,B Floor)

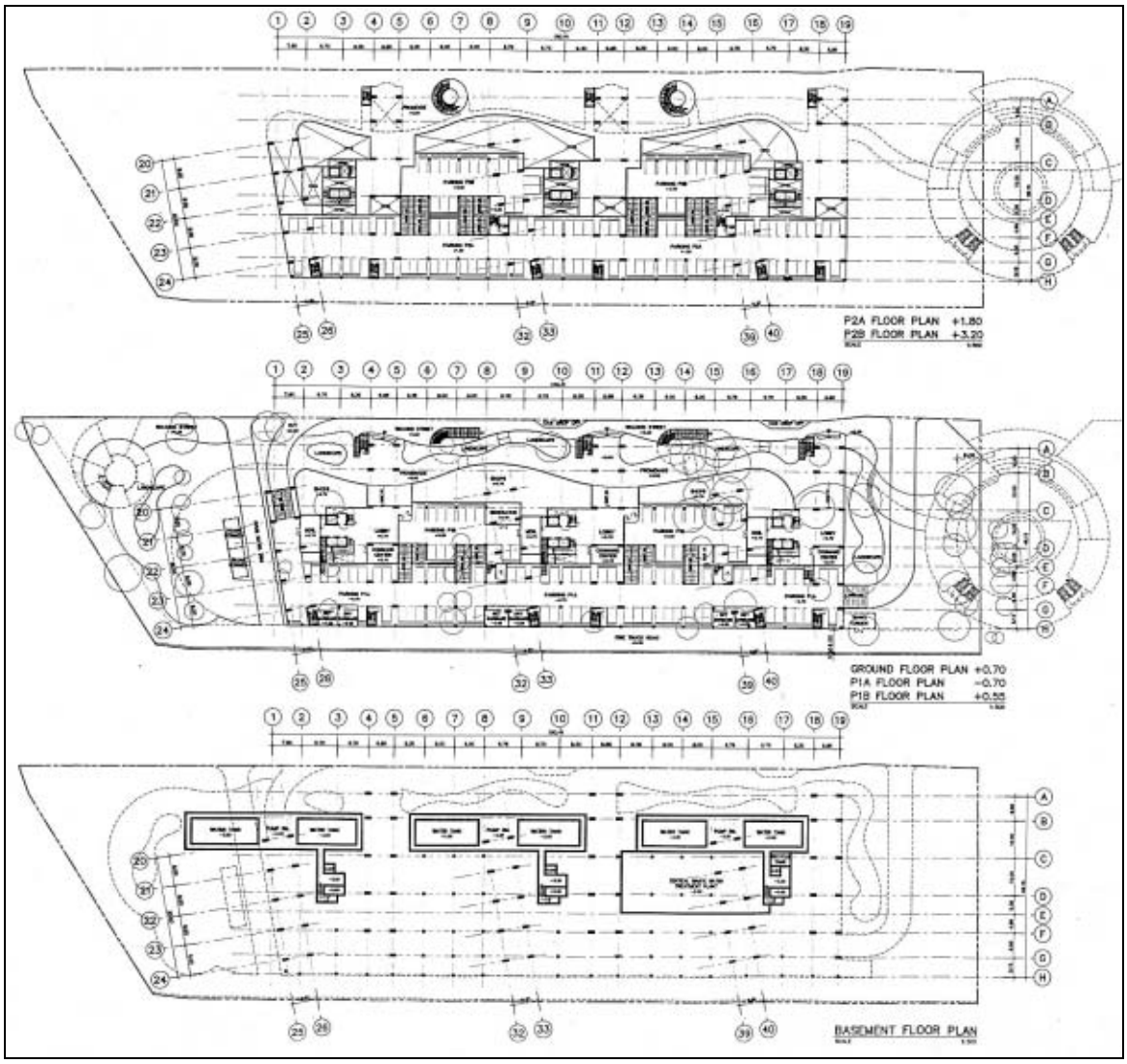


Figure 12.3 : Building Layout Plan at Site-A (P3A,B Floor～3RD Floor)

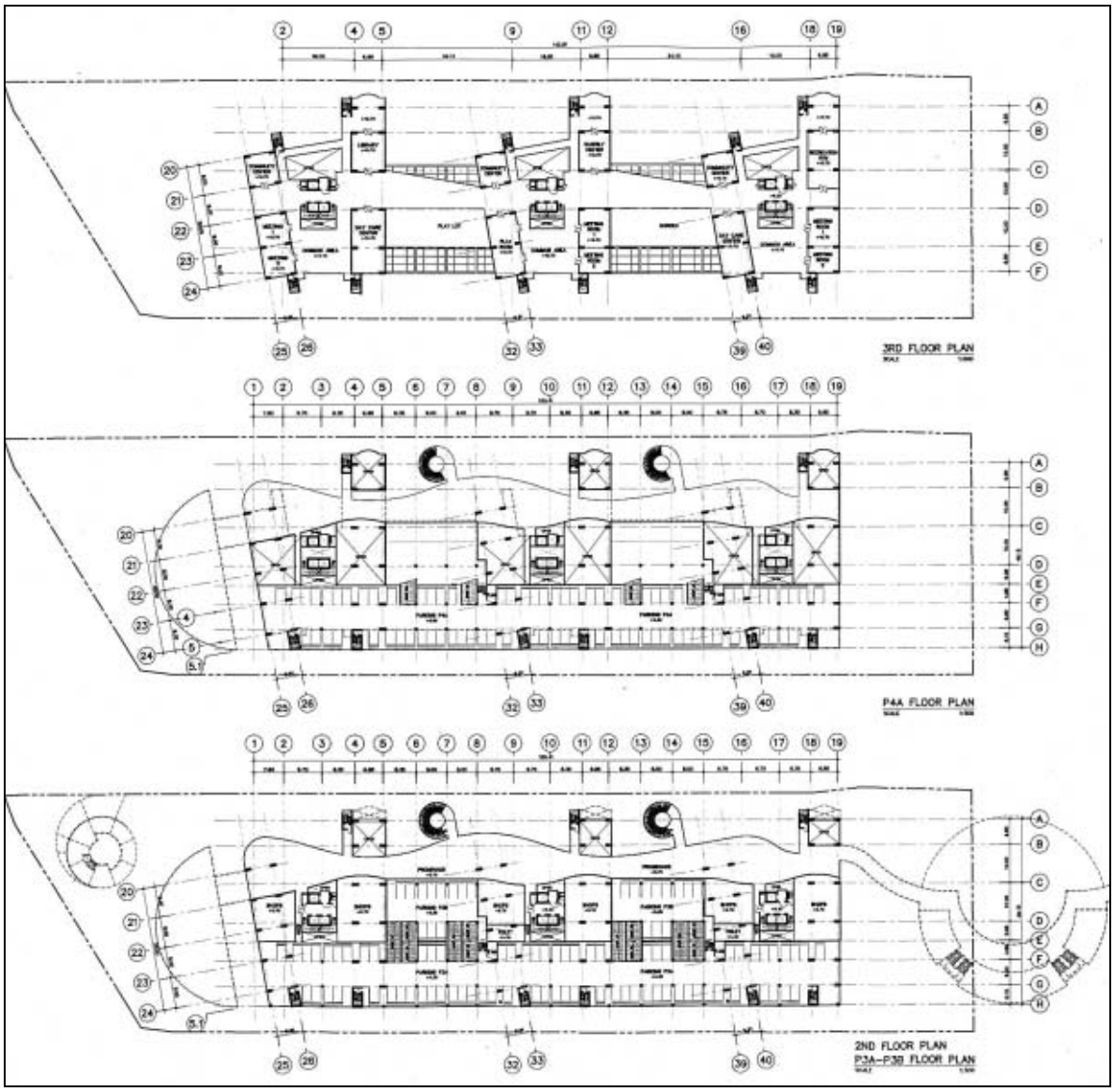
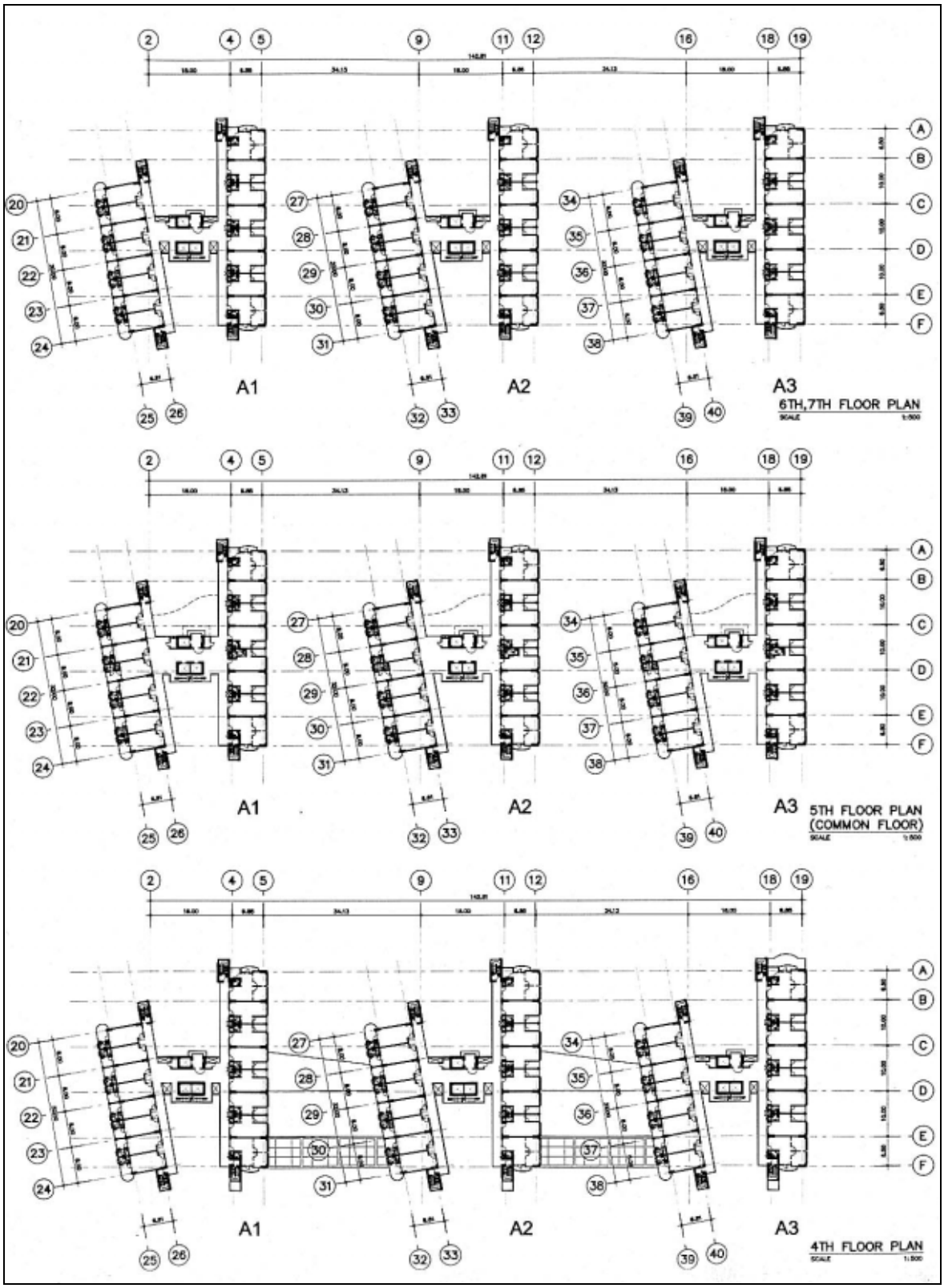


Figure 12.4 : Building Layout Plan at Site-A (4TH Floor～7TH Floor)



12.2 SITE-B'

12.2.1 Site Planning

(1) Surrounding conditions

The site is composed of a NHA's land block and a parcel of land transferred from BMA to NHA.

East: Public road (Pracha Songkhro Road). There is a bus stop. A spirit house is standing on the pedestrian walkway, blocking the traffic. Width of the road is planned to be enlarged by BMA.

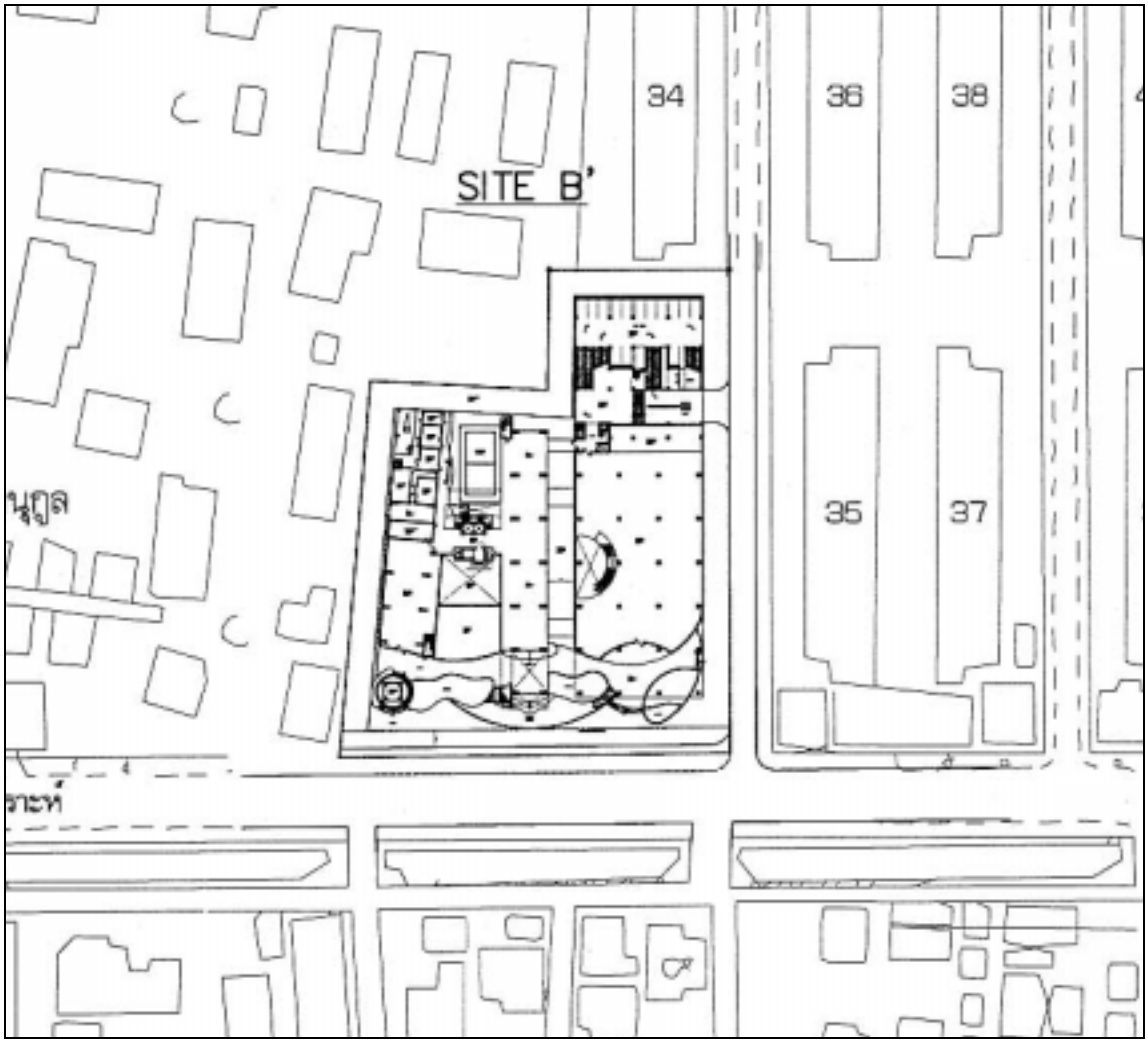
(2) Outline of site planning

- The buildings will be placed in the southern part of the site, which used to be the BMA's property. The existing building in the northern part will be kept in service (current residents go on living) until the new building in the other land has been completed, when all the current residents will move to the new residences. This is the first step of the resettlement procedure of the whole NHA Din Daeng Housing Community Renewal Project.
- Major facility to be set up in the northern land will be commercial space and car parks. To meet building code regulations, only wastewater treatment and essential systems, such as fire alarm, fire fighting, emergency lighting, will be provided for this northern part. There will be a provision of service space prepared for future tenants, who will install their own system, if needed, at their own cost and convenience.
- The existing spirit house as mentioned above will be relocated inside the site to improve traffic condition over the pedestrian walkway.
- A cafeteria will be set up adjacent to the bus stop to serve the waiting passengers.
- Food market could be one of candidate facilities in the commercial space on the ground floor.
- A festival plaza will be set up facing the front public road as a gathering place for the community.

Table 12.2 : Land Use Plan at Site-B'

		Area (m^2)	Ratio (%)
1.Residential/commercial area	High rise apartment Commercial and Parking	3,996.50	47.5
2.Road	Fire engine maneuvering road Parking access road	1,146.00	13.6
3.Landscaped area	Green Garden, Stream, Plaza	3,259.50	38.7
4.Others	Spirit house	16.00	0.2
Total Land Area		8,418.00	100

Figure 12.5: Site Plan at Site-B'



12.2.2 Building Designing

One coupled residential building block will be erected in the BMA-transferred block of land.

A commercial building and a car park will be erected on the other block (where Bldg. No. 33 is currently standing)

(1) Residential building

1) Ground floor:

- Commercial space will be arranged on the east side facing a public road.
- The commercial facility here will mainly cater to passengers at the bus stop.
- NHA's administration office will be put up on the east side facing the public road.
- It will render public relations service, guidance to the residential building which is aimed to be a pilot project and administration services for all the facilities of the project.
- Entrances to the residential building will be taken on the east side through the commercial space.
- Entry/exit will be controlled by security guards and electronically coded card lock system.

2) Second floor:

- Commercial space will be laid down here. It will be designed to enable linkage with the other commercial facility adjacent to this site in the future.

3) Third floor:

- The common space will be scattered with clusters of facilities which will be functionally linked with outdoor facilities. This space will be linked with a common space, which is planned on the roof of the commercial building next-door with a connection corridor. Child/elder facility: Play room, day care center garden, and play lot
- Youth activity place: youth center, sports court

(2) Commercial building:

Commercial facilities will be provided on the ground and second floors.

Roof will be linked with the common space in the residential building as mentioned above.

(3) Car park building:

The car park will be sited on the west of the site with its entrance to the north.

Its floors will be designed in skip-up floor system.

Figure 12.6 : Building Layout Plan at Site-B'(Basement Floor～P2A,B Floor)

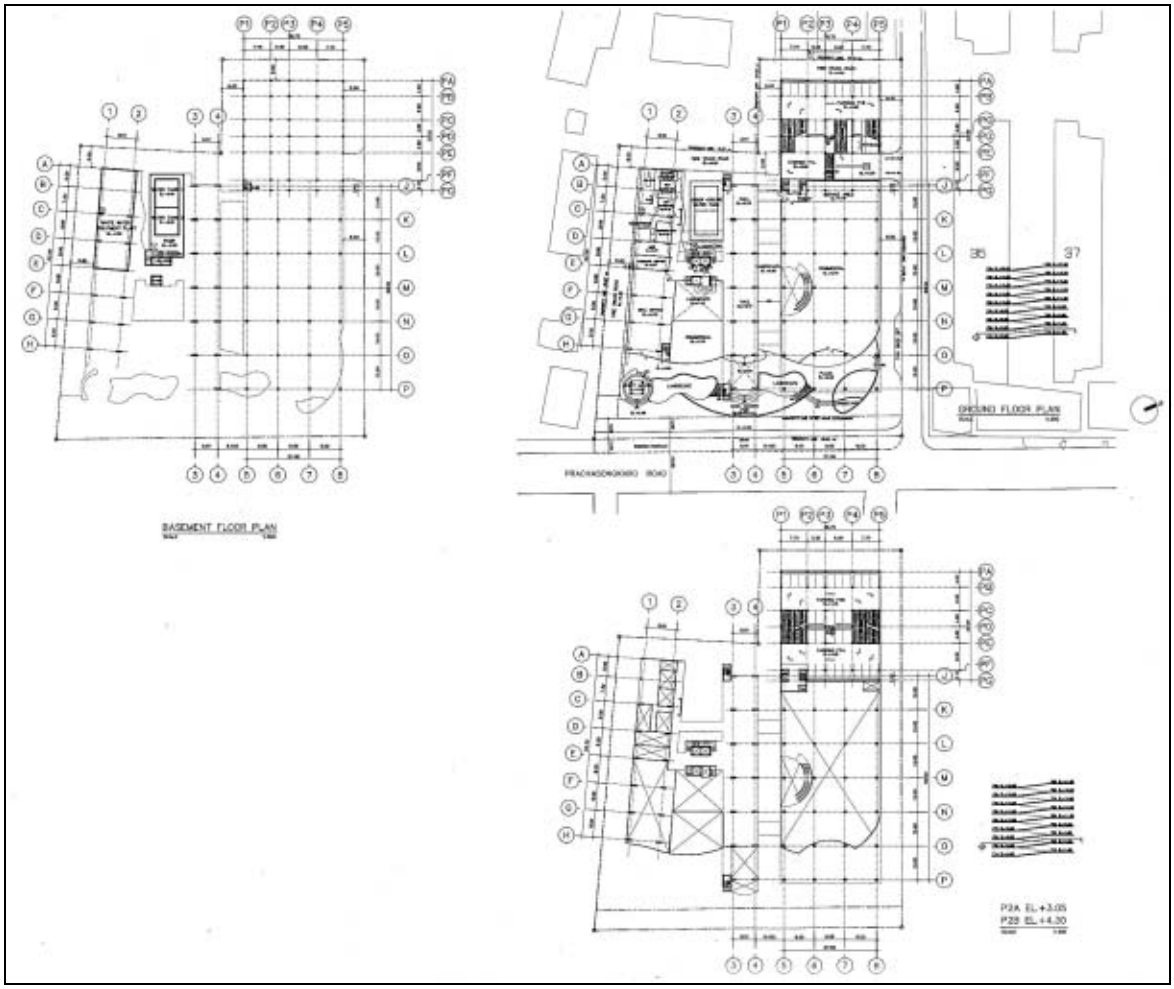


Figure 12.7 : Building Layout Plan at Site-B'(2ND Floor～P6A,B Floor)

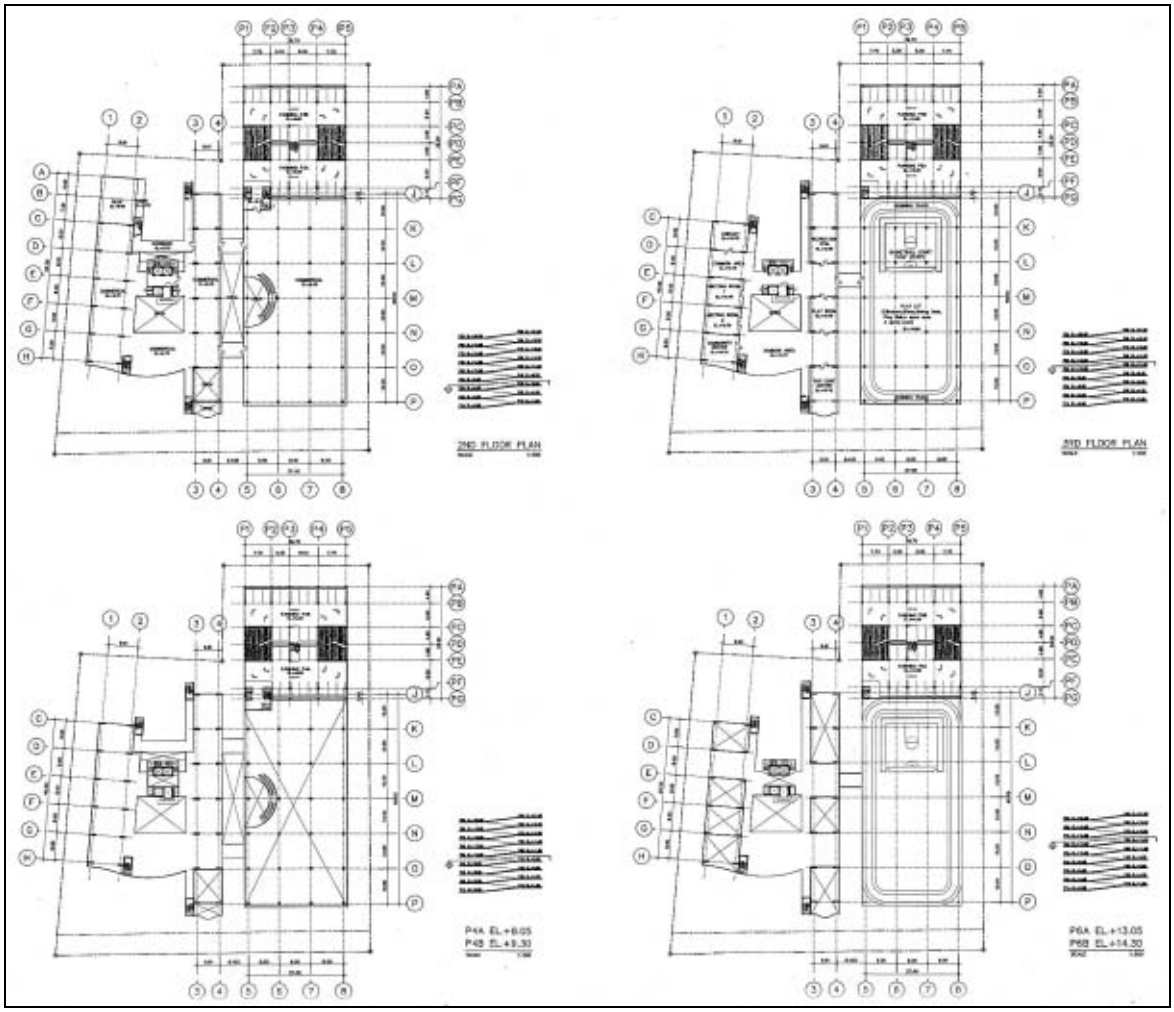
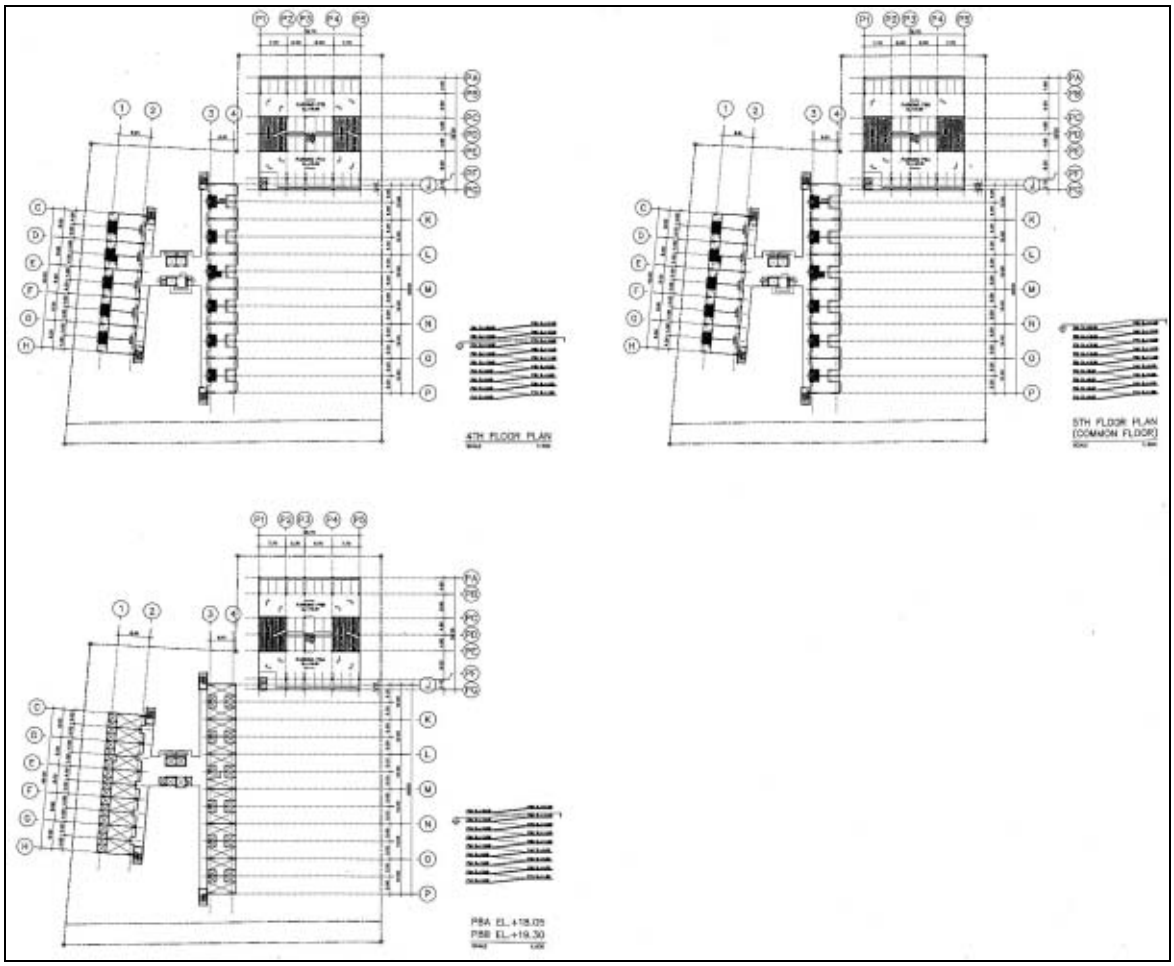


Figure 12.8 : Building Layout Plan at Site-B'(4TH Floor～5TH Floor)



12.3 SITE-C

12.3.1 Site Planning

(1) Surrounding conditions

The site is blessed with a number of tall and nice looking trees, which are worth preserving.

East: Public road (Pracha Songkhro Road). There are two bus stops.

North: Din Daeng Sewage Treatment Plant of BMA.

West: A school and vocational training center.

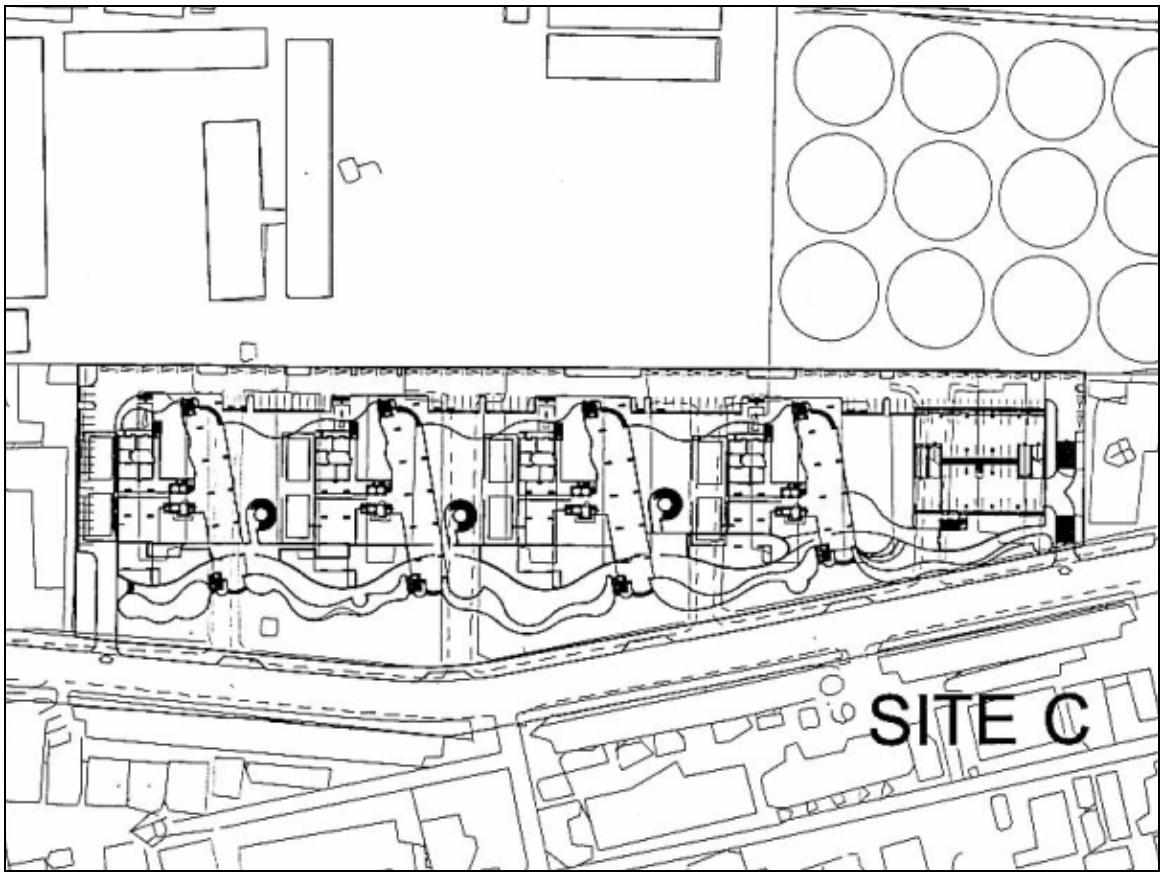
(2) Outline of Site Planning

- Public passageways will be secured across the site from west to east to maintain the current movement of people between the school and vocational training center and the bus stops to and from.
- Residential buildings will be placed further away from the sewage plant.
- Car parks will be placed adjacent to the sewage plant.
- A square will be planned facing the east public road where a part of the function of the existing market square in Site B will be relocated.
- Layout of the buildings will be worked out such that the existing trees could be preserved as much as possible in their places.
- Fire engine maneuvering road will be laid down all along the site boundaries at a width of 6m.

Table 12.3 : Land Use Plan at Site-C

		Area (m^2)	Ratio (%)
1.Residential/commercial area	High rise apartment Commercial and Parking	6,690.00	28.4
2.Road	Fire engine maneuvering road Parking access road	2,532.00	10.8
3.Landscaped area	Green Garden, Stream, Plaza	12,707.00	54.0
4.Others	Parking (Outside)	1,595.00	6.8
Total Land Area		23,524.00	100

Figure 12.9: Site Plan at Site-C



12.3.2 Building Designing

Four coupled building blocks will be laid down. A car park building will be located on the north side of the site adjacent to the Din Daeng Sewage Treatment Plant.

(1) Residential building:

All building blocks will be linked with three lower three floors: ground, second and third floors. On the second floor, an elevated pedestrian deck will be provided with scattered commercial facilities. The third floor will be used as common space for the residential building blocks. The fourth floor and above will be residential, where units for the handicapped are interspersed in every three floors.

1) Ground floor:

- Commercial space will be continuously arranged on the west. It will be occupied by day to day commodity shops like mini-marts.
- The entrances to the residential building blocks will be arranged building by building on the east of the site through the commercial space. Entry/exit will be controlled by security guards and electronically encoded card lock system.
- The passages will be secured through the ground floor for people to travel between the schools on the west and bus stop on the east of the site.
- The car park will be connected with the residential building blocks with a covered corridor such that the residents can walk to and from the car park without being exposed to rain.

2) Second floor:

- An elevated pedestrian deck is arranged on the east, which is designed as a first part of the elevated pedestrian deck system throughout the Din Daeng Community aiming at providing a vehicle-free walkway to Sukhumvit area from as far as the new BMA city hall.
- Commercial space will be scattered over the pedestrian deck. They will be oriented to welfare and educational facilities such as clinics, vocational training center to enhance employment opportunity. The pedestrian deck will be extended to the car park building.

3) Third floor

- Common space will be scattered with clusters of the following facilities:

a) Formation of community

Community center, conference room, and prayer room

Related facility: outdoor community activity space (for ceremony), spirit house, and religious service places (Buddhism, Islam, Christianity)

b) Life support facility

Health center, and vocational training center

(Related facility: clinic, shop)

c) Children and elders:

d) Kindergarten, day nursery, play room, and day care center

(Related facility: Play space, garden, and play lot)

e) Youth activities

Youth center, and recreation center

(Related facility: sport court)

(3) Car park building:

The car park building will be sited on the west of the site with its entrance on the north.

Its floors will be designed in skip-up floor system.

Figure 12.10 : Building Layout Plan at Site-C(BASEMENT Floor～GROUND Floor)

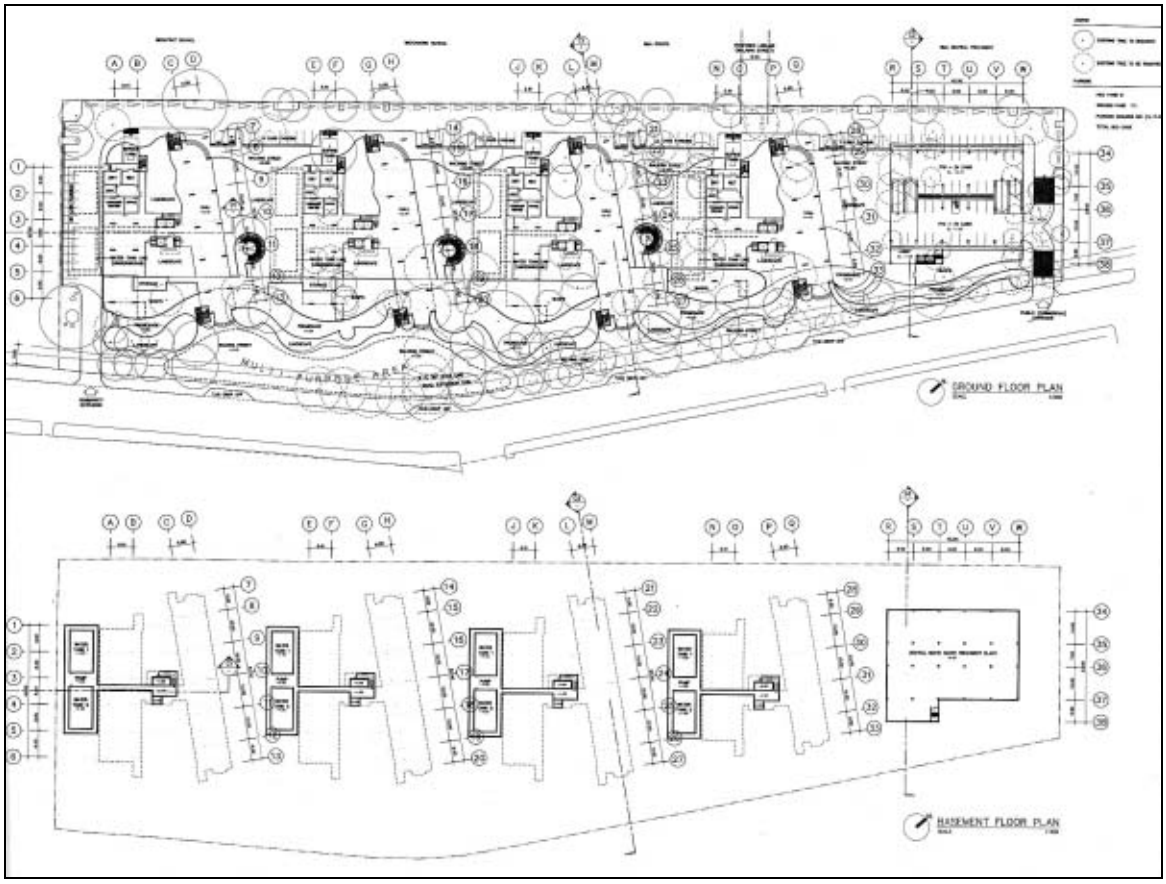


Figure 12.11 : Building Layout Plan at Site-C (2ND Floor～3RD Floor)

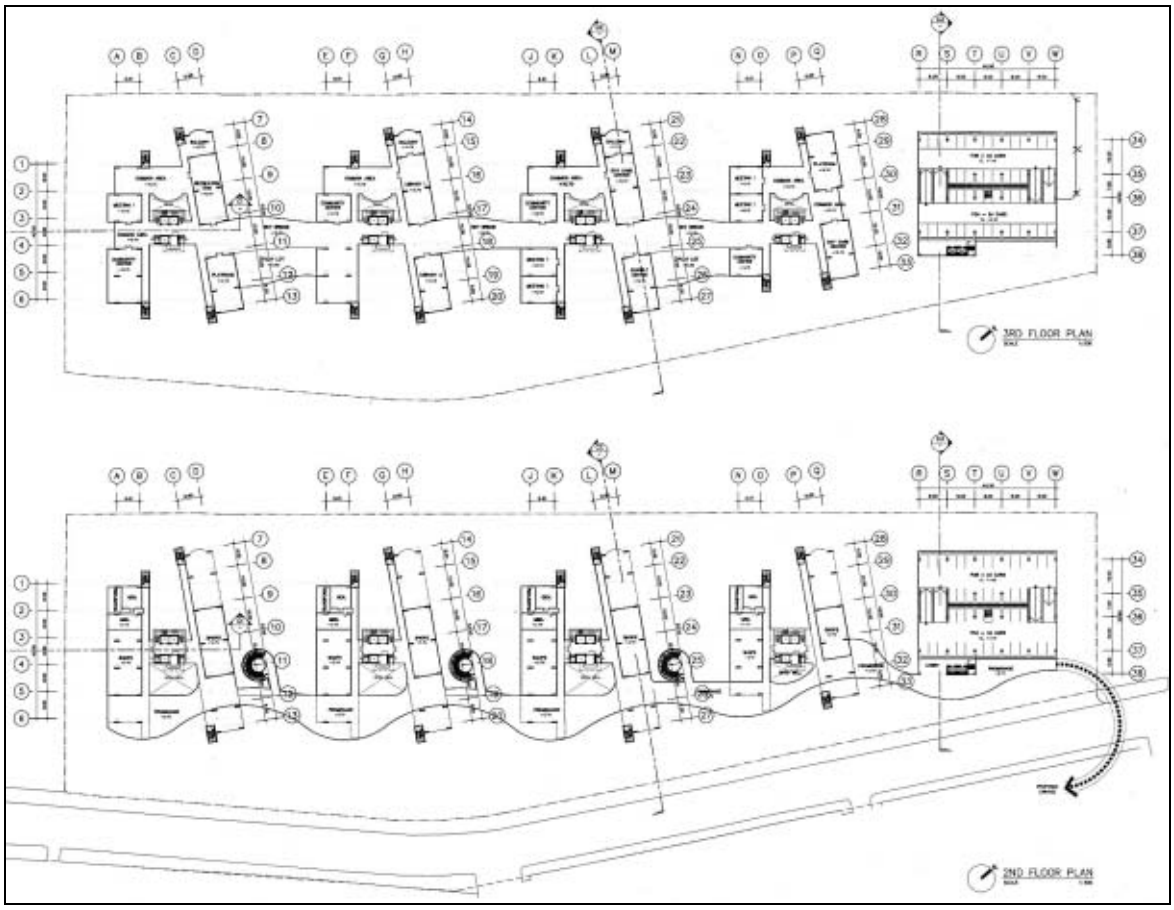
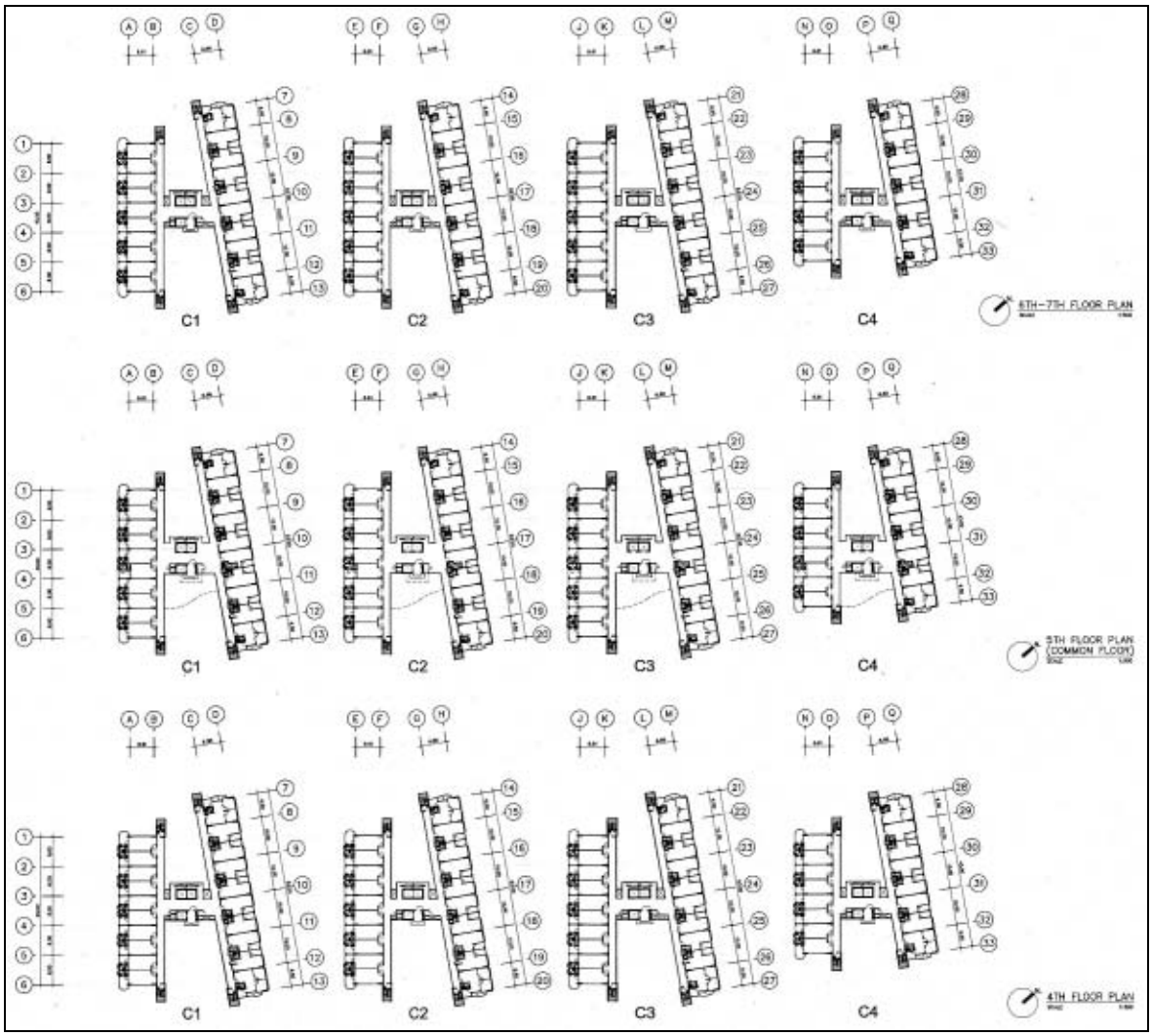


Figure 12.12 : Building Layout Plan at Site-C (4TH Floor～7TH Floor)

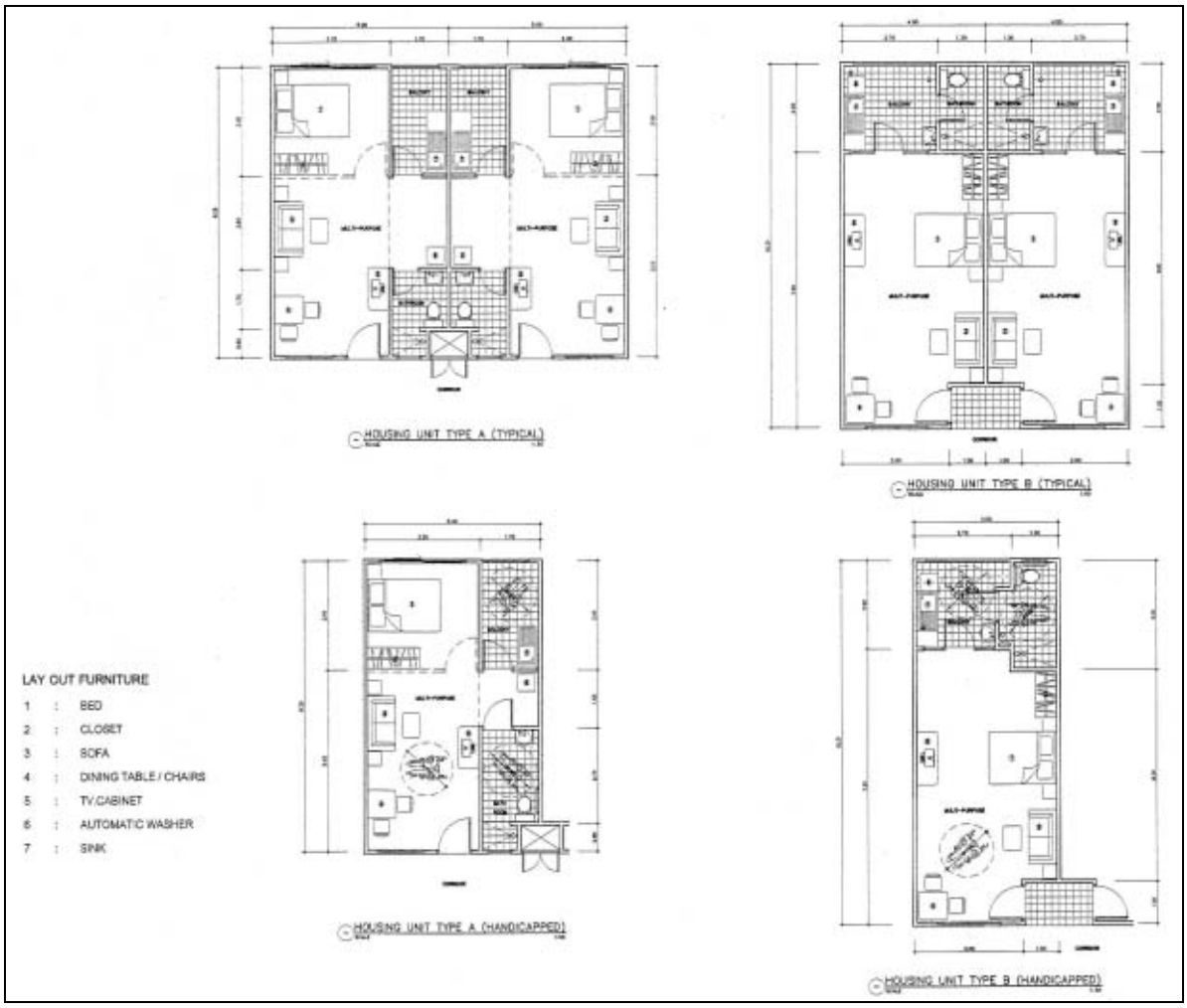


12.4 HOUSING UNIT PLANNING

To fill the gap between "Required Room Type" and "Proposed Room Type" as mentioned above, four typical room types are prepared. Four typical types are illustrated in Figure 12.13. In the figure, the distinction between Type A and Type B is the location of bathrooms. Both types are further classified into typical and handicapped. For handicapped units, the person on a wheelchair can smoothly turn around in a multi-purpose room, a balcony, and a bathroom. The balconies and bathrooms for handicapped persons are slightly larger than those for the others. The multi-purpose room for the handicapped persons is a bit smaller than the others, although the space for them to turn around is secured.

In addition to four typical room types, one corner room type is prepared at the corner of the building.

Figure 12.13 : Housing Unit Plan



12.5 STRUCTURAL SYSTEM

12.5.1 General

The main structure of the building will be of reinforced concrete. Concrete will be of cast *in- situ* concrete. Pre-cast concrete elements will be employed partially; in the ground floor.

In coordination with the modular system in the architectural design, the structural plan of columns will basically be arranged in 8x10m and 10x6m grids. Those grids will be divided into two to make the residential units.

12.5.2 Foundation

(1) Foundation Pile

Cast *in-situ* bore piles will be used to carry the main building structures because of the height of the building, which is beyond the normal load carrying capacity of the traditional pre-cast pre-stressed concrete pile. Size of the pile will be 60cm in diameter and in depth, 30-32m below the existing ground surface. The diameter and depth of the pile will have to be verified by a loading test, which will be executed before the start of construction. The diameter and depth are, therefore, assumed ones referring to the geological investigation record in the site of BMA's new city hall.

(2) Foundation

Foundations will be individual footings under each column, which will be connected with each other by reinforced concrete grade beams. The grade beams will support reinforced concrete grade slabs as they occur.

The grade slab will be made of pre-cast pre-stressed concrete planks laid across the grade beams. Top of the planks will be covered by cast *in-situ* concrete topping, which will constitute composite floor slab with the pre-cast planks.

12.5.3 Superstructure

(1) General

1) The structural system of superstructure will be of socalled non-beam structural

system with post-tensioned floor slab. This structural system has been increasingly popular for medium to high-rise buildings in Bangkok and other large cities in Thailand since the introduction of post tensioning technology in or around 1998.

2) Columns, slabs and some of the walls will be of cast *in-situ* reinforced concrete.
3) Shear walls provided to resist horizontal forces (wing load) will also be of cast *in-situ* reinforced concrete.
4) Service and escape staircases, elevator shafts and the like will be of cast in situ reinforced concrete as well.
5) Pre-cast concrete elements will be used in the grade slabs as described above.
6) Comparison of structural system for floor slab; (a)cast *in-situ* beam and slab, (b) pre-cast planks across structural beams with cast *in-situ* topping and (c) post tensioned floor system were executed. These overall superiority of the post-tensioned floor system on the following basis:
    - Vertical space can be economically used because of the absence of cross-over beams;
    - Construction cost is much the same;
    - Construction period could be shorter than others;
    - Post-tensioning technology has got to be a standard construction technique in Bangkok area; and
    - Post-tensioning will reduce chances of cracks, enhancing water-tightness.

(2) Post-tensioned Floor Slab

Thickness of the post tensioned floor slab will generally be 250mm, which will partially be recessed at its top in bath room and balcony portions in residential unit. Soffit (underside) of the slab will be flat. The recess will be used for internal plumbing, and wiring etc.

(3) Non-structural Elements

Non-load bearing walls such as exterior walls and interior partition walls will be constructed of bricks or concrete masonry units.

12.6 BUILDING SERVICE SYSTEMS

12.6.1 Water Supply System

(1) Water Demand

a. Design criteria

Unit demand of domestic water for each person on average: 200 liter/day

b. Water demand for residential portion

In addition to the above criteria, the average family size is assumed as follows;

Average family size: 3.5 persons/family

Table 12.4 : Water Demand for Residential Portion

	Site-A	Site-B'	Site-C	Total
Number of residential unit	700	300	1,200	2,200
Total population	3,500	1,500	6,000	12,000
Unit water demand (m^3/person/day)	0.20	0.20	0.20	
Water demand (m^3/day)	700	300	1,200	2,200

c. Water demand for commercial space:

The criteria for estimation for commercial space are as follows:

- 40% is restaurant area (50 m^3/person/day)
- 40% is office area (5 m^3/sq.m.)
- 20% is meeting and related activities area (10 m^3/person/day)

Table 12.5 : Water Demand for Commercial Space

	Site-A	Site-B'	Site-C	Total
Total floor area (m^2)	5,503.50	5,988.40	8,945.50	20,437.40
Total population	N/A	N/A	N/A	N/A
Unit water demand (m^3/person/day)	N/A	N/A	N/A	N/A
Water demand (m^3/day)	69.80	75.80	12.3.40	259

d. Summary of Water Demand

The estimated volume of domestic water demand from the project facility is summarized below:

Table 12.6 : Water Demand by Land Use

(m^3/day)

	Site-A (year 2005)	Site-B' (year 2004)	Site-C (year 2006)	Total (as of year 2006)
Residential portion	700	300	1,200	2,200
Car park	28	12	48	88
Commercial space Restaurant 40% Office 40% Meeting 20%	69.80	75.80	123.40	259
Others	7.50	2.50	10	20

(2) Supply system

City water will be tapped on the supply main running along Pracha Songkhro Road and water is conducted to an underground reserve water tank provided at each site. Water is distributed throughout the building from an elevated water tank installed on the roof of building. The capacity of the underground reserve tanks will be as given below:

Table 12.7 : Capacity of Water Reserve Tank

	Site-A	Site-B'	Site-C	Total
(a) Water reserve tank (m^3)	1,320	600	2,100	4,020
(b) Total Water Demand (m^3/ day)	805.3	390.3	1,381	2,577
(c) Life of reserve tank (hr) ((a)x24/(b))	39.3	36.9	36.5	37.4

The above number is for the total 4,020 m^3 for each site, including the 1,720m^3 for fire fighting reserve.

12.6.2 Waste Water Drainage and Treatment System

(1) Volume of Waste Water

Wastewater from the project facilities will be sewage from the bathrooms and toilets, i.e., as kinds of domestic wastewater. The estimated volume of waste water from the project facilities summarized below:

Table 12.8 : Volume of Sewage

(m^3/day)

	Site-A (year 2005)	Site-B' (year 2004)	Site-C (year 2006)	Total
Residential portion	560	240	960	1,760
Car park	22.40	9.60	38.40	70.40
Commercial space	55.78	60.68	90.65	207.12
Others	6	2	8	16
Total	644.18	312.28	1,097.05	2,053.51

(2) Sewage Treatment System

1) Design criteria for sewage treatment facility

According to the regulations of the Pollution Control Division (PCD), design criteria for the wastewater treatment plant will be as follows:

- Raw sewage: BOD 250mg/L, SS 200 mg/L, pH 5-9
- Treated Effluent: BOD20 mg/L, SS30 mg/L, p.H.5-9

2) Sewage Collection System

The sewer pipe to collect sewage and to carry it to the sewage treatment facility will be of:

- Cast iron for the above ground part; and
- High Density PolyEthylene (PE) for the underground part.

3) Sewage treatment facility

Sewage treatment facility will be an activated sludge system. It will be provided individually for each site to treat the sewage of the volume as assumed in the above table. Each facility will be constructed of reinforced concrete.

The activated sludge system for the project comprises: i) pre-sedimentation tank, ii) equalizing tank, iii) aeration tank, iv) sedimentation tank, v) effluent tank, and vi) sludge storage tank.

Some sludge produced at the sedimentation tank will be directed to the aeration tank, and some will be sent to the sludge storage tank.

The design criteria of each sewage treatment facility is as given below:

Site A : Design flow rate 650 m^3/day
Site B : Design flow rate 320 m^3/day
Site C : Design flow rate 12.00 m^3/day

The flow diagram of sewage treatment system will be designed as shown in the following figure.

4) Sludge Treatment

Some excess sludge will be generated at the end of the process.

Regular service of evacuating sedimentation on bottom of the tanks will be carried out by a contracted cleaning company engaged by the management and administration office set up by NHA or BMA.

12.6.3 Storm Drainage

The retention facility is planned to secure 5cm precipitation to the total site area.

Table 12.9 : Retention Capacity and Retention Facility at Each Site

	Site-A	Site-B'	Site-C	Total
Retention Capacity	730 (>14,584m^2x5cm)	3.60 (>8,418m^2x5cm)	14.40 (>23,524m^2x5cm)	2,360m^3
Retention Facility	Landscape pond	Under the parking building	Under the parking building	

12.6.4 Solid Waste Disposal System

(1) Source and Characteristics of Solid waste

The sources of solid waste will be kitchens in the residential units and commercial spaces. Solid waste from these places will be house waste containing perishable meats, fish, vegetables, and left over foods. The waste will also contain containers and wrapping materials such as bottles, cans, boxes, paper and clothe.

The space required for solid waste collection at residential, commercial and other spaces is given is the following table. These spaces will be provided in the building facilities.

Table 12.10 : Estimated Volume of Solid Waste

(m^3/day)

	Site-A	Site-B'	Site-C
Residential buildings	8.40	3.60	14.40
Commercial space	2.20	2.40	3.60
Others	2.20	2.40	3.60
Total	12.80	8.40	21.60

(2) Solid waste management

Separation of solid waste into household waste, recyclable waste, and hazardous waste will be made mandatory to all households and tenants of commercial spaces.

Waste will be taken to the waste collection bins placed at garbage depots on the ground floor of each building. Waste will be hand carried by the residents and tenants to these waste collection bins.

Waste will be regularly hauled out by the Din Daeng district office under the jurisdiction of Department of Public Cleansing (DPC), BMA to the municipal sanitary landfill site through a transfer station.

The management and administration office of NHA set up specifically for this project will supervise the solid waste separation and delivery by the residents and tenants, waste hauling by DPC, and take responsibility for keeping the waste collection depots in hygienic condition and the collection of the solid waste collection charge.

12.6.5 Air-conditioning System

An air conditioning system will not be provided fully to the buildings. Air conditioning units will be of the split type throughout the buildings. They will be procured and installed at the residents' convenience and cost in the residential units, and by the tenants in likewise manner in commercial spaces.

Provisions will, however, be made in the building so that the residents can install the air-conditioning units later on without altering building structure or installing new wiring conduit.The provisions will include laying electric circuits conduit to where the air-conditioners are likely be installed and structural supports for outdoor units (condensing units) to avoid disorderly tampering with the building

structure or finishes. (Only electricity capacity and electrical conduit to the condensing unit outside shall be provided by NHA.)

12.6.6 Ventilation System

(1) General

The ventilation system will comprise individual ventilation fans which are wall mounted.

Residential units will not be provided with mechanical ventilation equipment.

In the commercial spaces ventilation fans will be installed by the tenants on their own accord to the business they are engaged in. In case the space is used for food center or restaurant, its kitchen will have fans on the exterior wall, which will be the major source of smell or fume. Details of installation of ventilation fans in the commercial spaces cannot be known at present because these will be determined according to the floor lease contracts made between the building owner and the tenants.

(2) Air Pollutant Filtration System

There will be no major air pollutant exhausts from the buildings as these are apartment houses.

12.6.7 Fire Protection System

Fire protection system will be consist of:

- Automatic sprinkler system,
- Fire hydrant, and
- Portable Fire Extinguisher (chemical)

These systems will be provided individually in each building. Sprinkler system will be provided to all residential units and commercial spaces.

It will be accompanied with underground water reserve tanks and an elevated water tank. Reserve water capacity for fire fighting purpose will be as follows:

Table 12.11 : Reserve Water Capacity

(m^3)

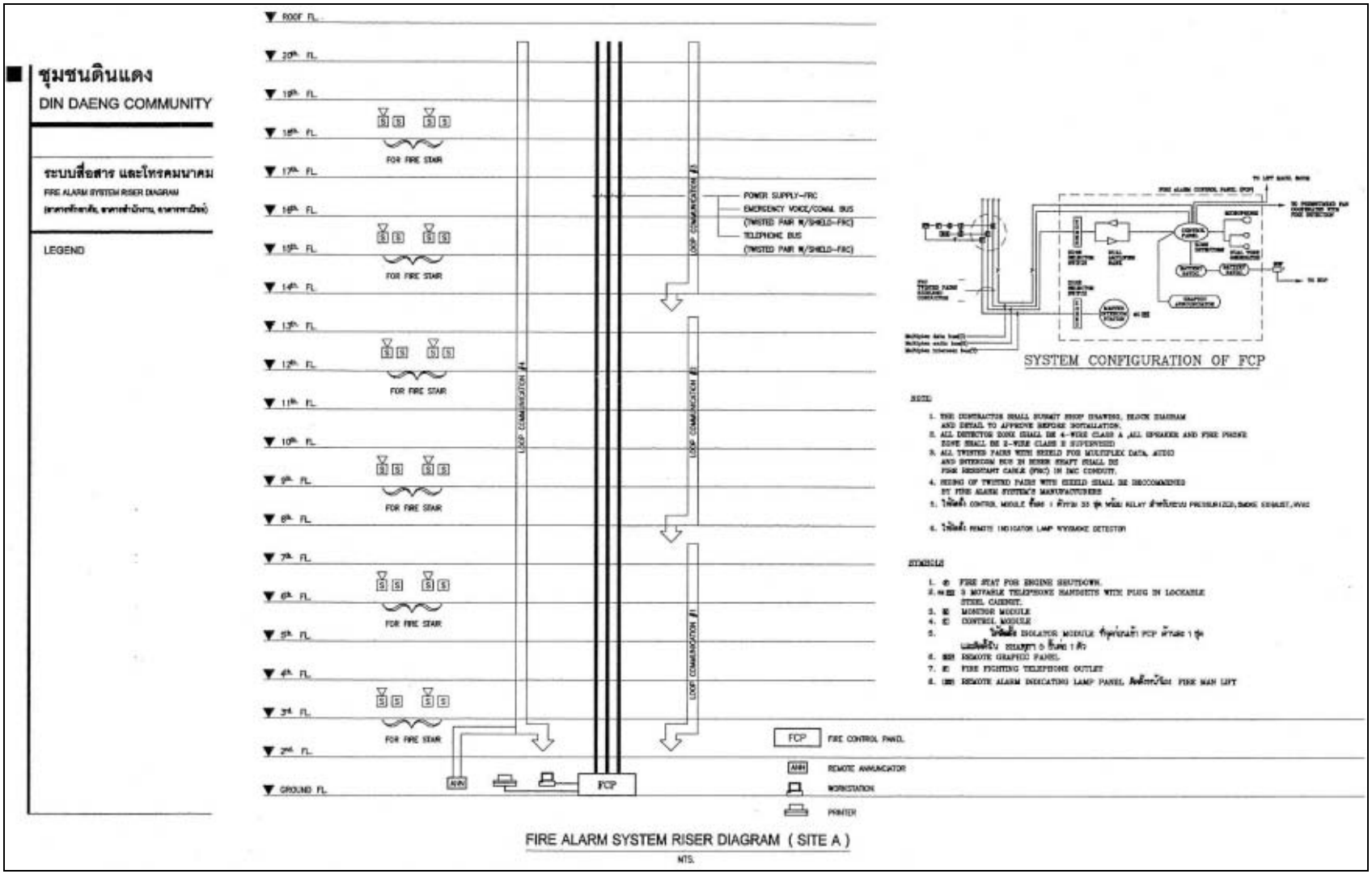
	Site-A	Site-B'	Site-C
Underground Tank	510	170	680
Roof Tank	135	45	180

Fire hydrants will be provided for the use of the fire brigade. The size of the hydrant pipe riser will be150mm in diameter, accompanied with hose reel of 30m length.

The fire extinguisher will be of portable, dry chemical powder type, 4.5kg in weight. These will be installed in the hallways of residential and commercial buildings and car parks.

A fire detection system will also be provided in all residential units and commercial spaces, which will be smoke detector type. A control panel will be installed in the fire command center or management/administration office at each site.

Figure 12.14 : Fire Prevention System at Site-A



12.6.8 Electric Power System

(1) Power demand

Power demand in each site will be estimated and summarized as below:

Table 12.12 : Power Demand by Site

	Site-A	Site-B'	Site-C
Total gross area (m^2)	67,892	37,426	12.9109
Total power demand (kVA)	6,000	3,000	10,000

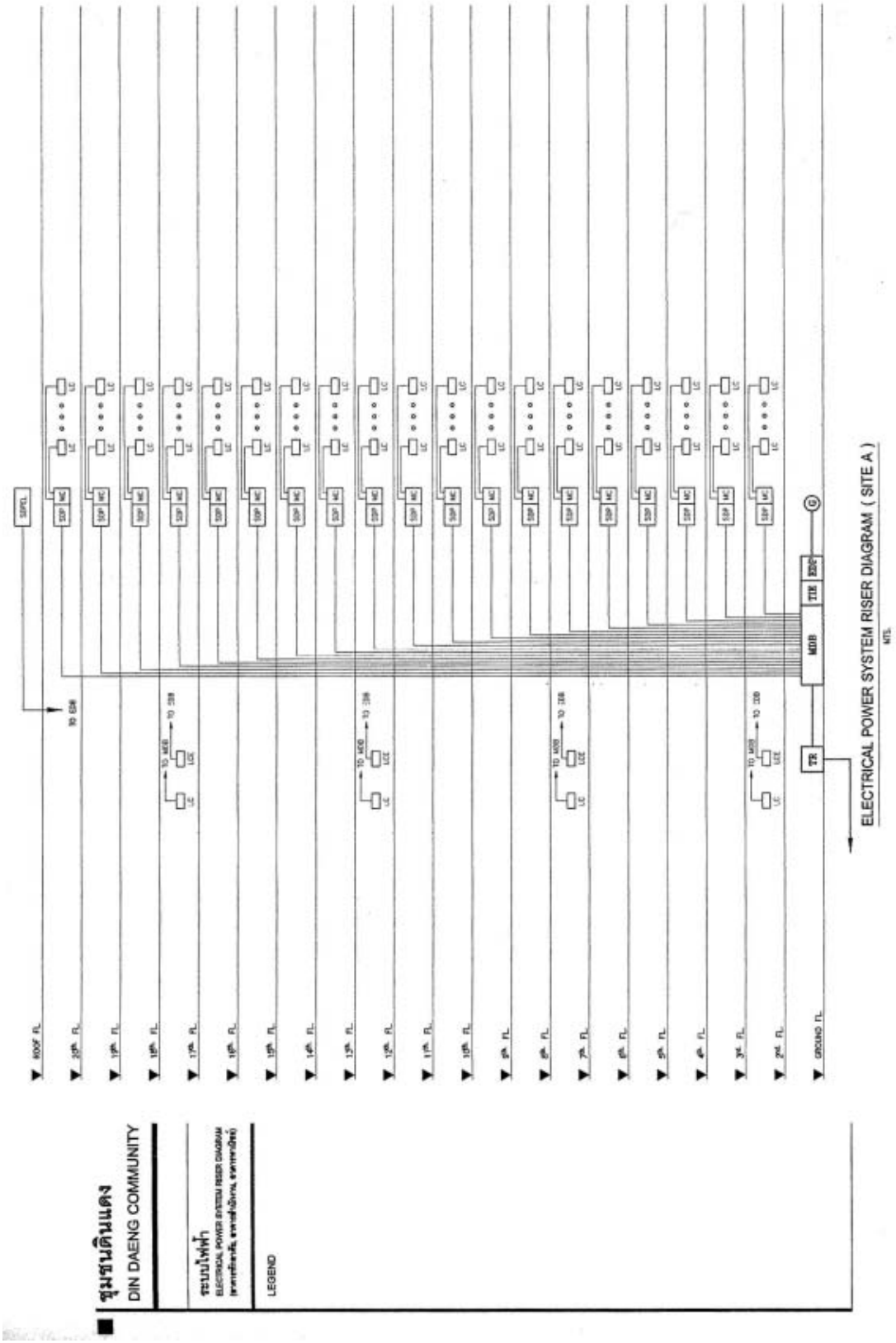
(2) Power receiving point

Electric power will be obtained from MEA's distribution lines.(Metropolitan Electricity Authority). Characteristics of power on primary side will be 12/24kV, 50Hz, 3-wires system.

(3) Power distribution system

Power distribution system inside the project will be buried underground in 12/24 kV, 50Hz, 3-wire system. Distribution cables will be extended from the power receiving point to switching station at each project site.

Figure 12.15 : Electric Power Supply System at Site-A



(4) Switching station

The switching stations shall convert the primary electrical supply from 12/24 kV. to 380/220 V. The station will be constituted of a load breaking switch, transformers, and circuit breakers. The switching stations will be housed in the electric room at each of the buildings. Internal power will be supplied in 380/220V, 50Hz, 4-wire system.

(5) Emergency power generator

The electric power supply system will be accompanied with emergency power generating units which will be a diesel engine generator as a back-up provision for power failure in the MEA's system. Power will be supplied to some of the essential facilities such as emergency elevator, fire protection systems, emergency evacuation facilities. The capacity of the diesel generator will be estimated and summarized below:

Table 12.13 : Capacity of Diesel Generator

	Site-A	Site-B	Site-C	Remarks
Capacity (kVA)	600 kVA	300 kVA	1,000 kVA	

(6) Power supply system

Power will be supplied throughout the building from the switching stations through switchboards and panel boards each having electric meters and circuit breakers. Electric wires and cables will be insulated 750V, 70°C, PVC installed in steel conduits.

(7) Indoor lighting

Indoor lighting will be by use of fluorescent lamps and incandescent lamps.

(8) Outdoor lighting

Outdoor lighting will compris street lighting and exterior wall lighting.

The lighting fixtures of outdoor lighting will be weatherproof fluorescent lighting fixtures. The street lighting will be provided along the internal roads at intervals of approx. 30m. Exterior wall lighting will be provided in the corridors and at corners of each building to illuminate the passage and building profile at night.

(9) Energy saving features

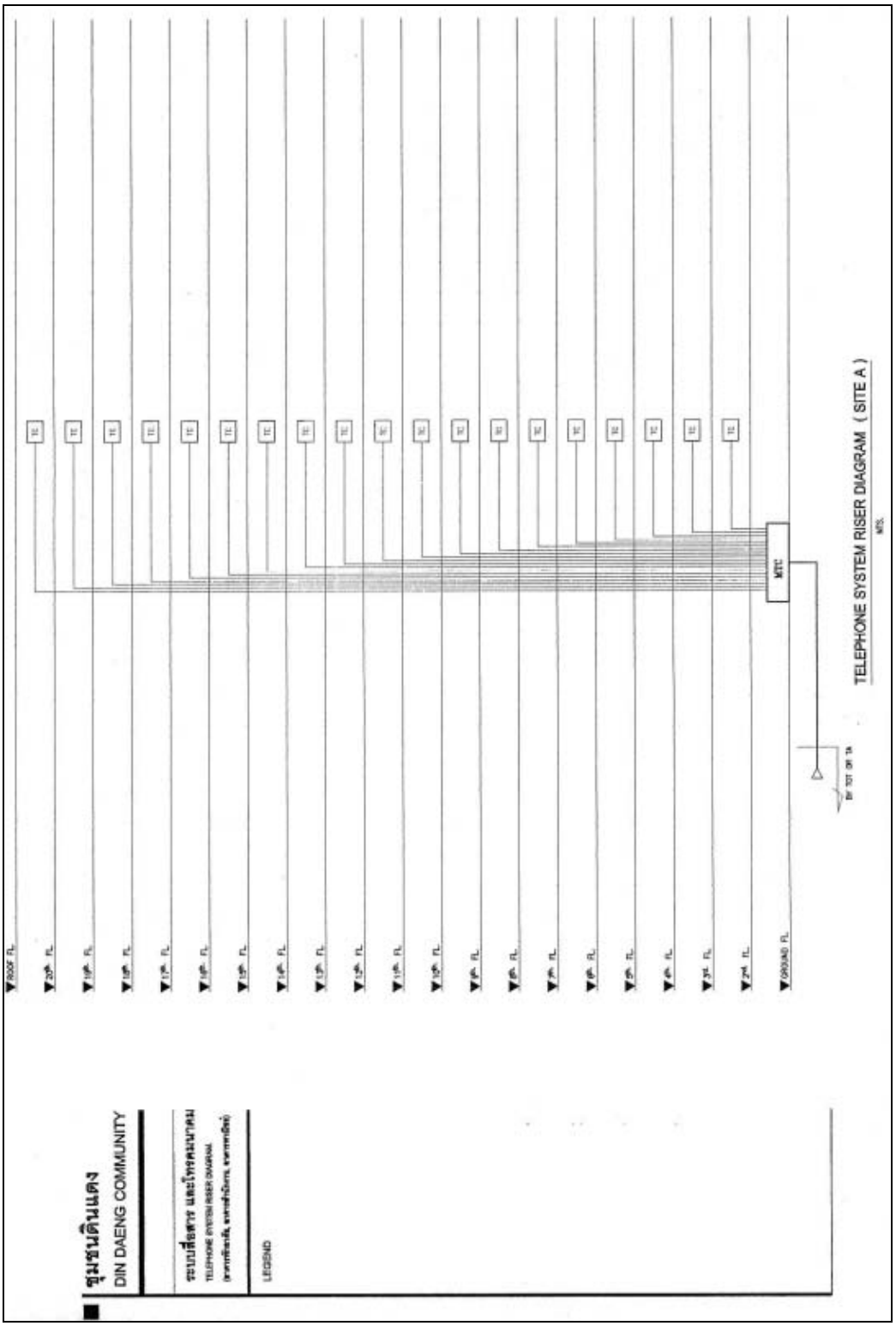
All outdoor lighting systems will be furnished with photo-electric switches such that power will be automatically switched off when there is sufficient light. All windows in the living rooms and commercial spaces will be of air tight aluminum windows to prevent outdoor air from encroaching upon the indoor space when air conditioners are put in service.

12.6.9 Telecommunication System

The telecommunication system will comprise telephone system, and two telephone lines for each resident. No PABX system is provided for.

The facility provided by the project will be conduit piping with telephone line at the main riser in the residential units and commercial spaces which are accompanied with telephone outlets. Telephone cable and receiver set will be installed by the telephone company later, on demand by the residents or tenants. Terminal box for telephone line distribution will also be provided at each building.

Figure 12.16 : Telecommunication System in Site-A



12.6.10 Central TV antenna system

A central TV antenna system will be provided individually to each building. The TV antenna system will be constituted of antenna, coaxial cables, amplifier, distributor and receptacles and capable of receiving all domestic TV channels in Thailand. The antenna will be erected on the roof of each building. TV antenna outlets will be provided to all residential units, commercial spaces and car parks.

12.6.11 Lightning protection system

Lightning protection system will be constituted of air terminals, down conductors and grounding plates. The air terminals will be individually erected on the roof of each building. The number and height of the air terminals on each building will be determined such that the entire building is enclosed by inverted cones, 120 degrees internal angle, from the tip of the air terminals. Down conductors will be run down along the exterior wall to the grounding plates embedded in the ground. The grounding plates will be of copper plates capable of quickly releasing the lightning current to the ground.

12.6.12. Internal Road Plan and Car Park

(1) Number of vehicles and car park

The capacity of car parking facilities has been determined according to Ministerial Regulation No.7 as summarized in the following table:

Table 12.14 : Car Park Capacity

	Site-A	Site-B'	Site-C	Total
Total number of residential unit	(651)	(304)	(1,228)	
Total number of car-park for residential portion	195	91	368	654
Total net area of commercial floor (m^2)	(3,770)	(4,816)	(6,145)	
Total number of car park for commercial floor	204	153	231	588
Total number of car park	399	244	599	1,242

(2) Layout of transportation system

All project sites are facing Pracha Songkhro Road on the east boundary. Access to the sites will basically be taken from this road. Pracha Songkhro Road has four

traffic lanes, 12 m total width, and is asphalt paved. On both sides of the road there are pedestrian walkways, 5 m in width, and asphalt paved.

Inside the site, internal roads will be laid down encircling all around the building. The layout will be determined to allow unobstructed maneuvering of fire engines to access the external wall of the building.

(3) Standard feature of internal roads

Internal roads are designed for two-way vehicle traffic in two lanes within a carriage width of 6 m. These will afford ample maneuvering space for fire engines as well. Sections of the internal roads are illustrated in the attached figure.

CHAPTER THIRTEEN:

IMPLEMENTATION PLAN

13.1 CONSTRUCTION SCHEDULE AND METHODS

13.1.1 Construction Schedule

Based on the Phasing Plan, the completion year of construction works for SiteB' will be in 2004, and that for Site A and Site C will be 2006 and 2007, respectively.

Construction begin with the demolition of existing buildings in 2002. The construction periods will be for 30 months at Site A, 24 months at Site B, 33 months at Site C.

The following works are to be implemented at each site:

- Demolition of existing buildings;
- Foundation piling work;
- Excavation work;
- Concrete work;
- Brick work;
- Architectural finishing work;
- Plumbing work;
- Electrical work; and
- Airconditioning/ ventilation work.

The following figure shows the construction schedule:

Figure 13.1 : Construction Schedule at Each Site

	Month																			
	1/2	3/4	5/6	7/8	9/10	11/12	13/14	15/16	17/18	19/20	21/22	23/24	25/26	27/28	29/30	31/32	33/34	35/36	37/38	39/40
Site-A																				
1.Demolition of existing buildings																				
2.Foundation piling work																				
3.Excavation work																				
4.Concrete work																				
5.Brick work																				
6.Architectural finishing work																				
7.Plumbing work																				
8.Electrical work																				
9.Airconditioning/ventilation work																				
Site-B'																				
1.Demolition of existing buildings																				
2.Foundation piling work																				
3.Excavation work																				
4.Concrete work																				
5.Brick work																				
6.Architectural finishing work																				
7.Plumbing work																				
8.Electrical work																				
9.Airconditioning/ventilation work																				
Site-C																				
1.Demolition of existing buildings																				
2.Foundation piling work																				
3.Excavation work																				
4.Concrete work																				
5.Brick work																				
6.Architectural finishing work																				
7.Plumbing work																				
8.Electrical work																				
9.Airconditioning/ventilation work																				

13.1.2 Construction Organization

Whole construction works including demolition of existing buildings, new buildings and appurtenant outdoor structures will be entrusted to a general contractor at each site engaged by NHA.

Substantial part of construction is building construction. Associated outdoor construction will include internal roads, landscaping and exterior utility such as electric power cabling, water piping, drainage piping, and drain ditches.

Construction will be technically supervised by a consultant also engaged by NHA. Construction methods will be nothing special and much the same as other multi-floor concrete building construction.

13.1.3 Site Clearance

There are a number of apartment house buildings standing in the site, all of them will be demolished for construction of new apartment buildings. These buildings are of reinforced concrete structure with brick masonry walls. Details of demolished buildings in each site are as summarized previously in Chapter 11.

The buildings are resting on pre-cast concrete foundation pipes, but they will not be removed from the ground. Existing pavement and utilities such as water supply pipes, and drainage pipes in the ground will also be removed if they interfere with the new building construction.

13.1.4 Transportation of Construction Materials

Transportation route to and from the sites will be Pracha Songkhro Road running on the east side of the sites. Basically construction materials will be brought to the project sites at night in order to avoid conflict with the daytime traffic.

13.1.5 Construction Materials and Equipment

1) Aggregate and Cement

Sand and gravel for concrete works which are delivered to the sites in their raw form will be very small in quantity as concrete will be obtained in ready-mixed form from batching plants located near the project sites. Cement will not be stockpiled in the site by the same token.

Considerably large quantity of sand will be used for plastering works. This, however, will not be stockpiled in the site in large quantity; it will be delivered to the site frequently in small batches as the plastering work progresses. The same will be the case with cement. These materials will be purchased from the suppliers in or around Bangkok.

2) Brick

Large quantity of bricks will also be used for walls in the building. This will also be purchased from the supplier in or around Bangkok.

3) Pipes

Pipes used in the building will be PVC pipes for water supply and drainage, which will be obtained from the suppliers in Bangkok.

4) Finishing Materials

Architectural finishing materials such as paint, aluminum windows, steel doors, floor and wall tiles, granite stone, wood doors, will all be obtained from the suppliers in Bangkok. No materials will be imported from foreign countries specifically for the project. The same will be true of electrical and mechanical materials and equipment.

13.1.6 Construction Site Management

(1) Solid waste

At the time of demolishing existing buildings, solid waste will consist of debris of concrete, bricks, reinforcement bars, cement mortar and all other finishing materials such as doors, windows tiles, pipes. The debris will also include pipes, cables, sanitary ware, and lighting fixtures. from electrical and mechanical equipment installed in the buildings.

During construction of buildings, solid waste generated at the project site will be surplus construction materials that have not been used up. Solid waste during demolition of existing buildings will be hauled out of the site promptly without stocking the debris at the site using loaders and dump trucks. The dump trucks will haul the debris to the designated dumping place by the authority.

(2) Labor Camp etc. and Temporary Construction Facility

There will be no labor camp allowed at the site as the place is a densely built-up area. All labor for construction will be transported to the site by a regular transport service by the contractor. Water supply, drainage, sewerage, power supply, and telecommunication systems for construction purposes will be temporarily constructed at the site by the contractor under the supervision of the construction supervision consultant.

(3) Vibration, Noise, and Wastewater

a. Vibration

Concrete breaking machines cause vibration to the ground during demolition works of existing buildings. However, the vibration will not be so intensive as to reach outside the site boundary.

b. Noise

Concrete breaking machines cause noise beyond the site boundary. Since the existing buildings are merely 5-storeyshigh, the noise will not spread to a wide area.

c. Waste water

A number of field latrines will be provided at the construction site for use of the construction crew. Waste water will be treated by septic tanks before discharging to existing drainage ditches.

13.1.7 Preliminary Construction Cost Estimate

Preliminary construction cost estimate is shown in the following table. There are seven cost items cost: 1)structural work, 2) architectural work, 3) electrical work, 4) sanitary work, 5) air condition work, 6) lift, and 7) landscape work. Among them, structural work has the largest share of the cost. It amounts to about 35 percent of the total cost.

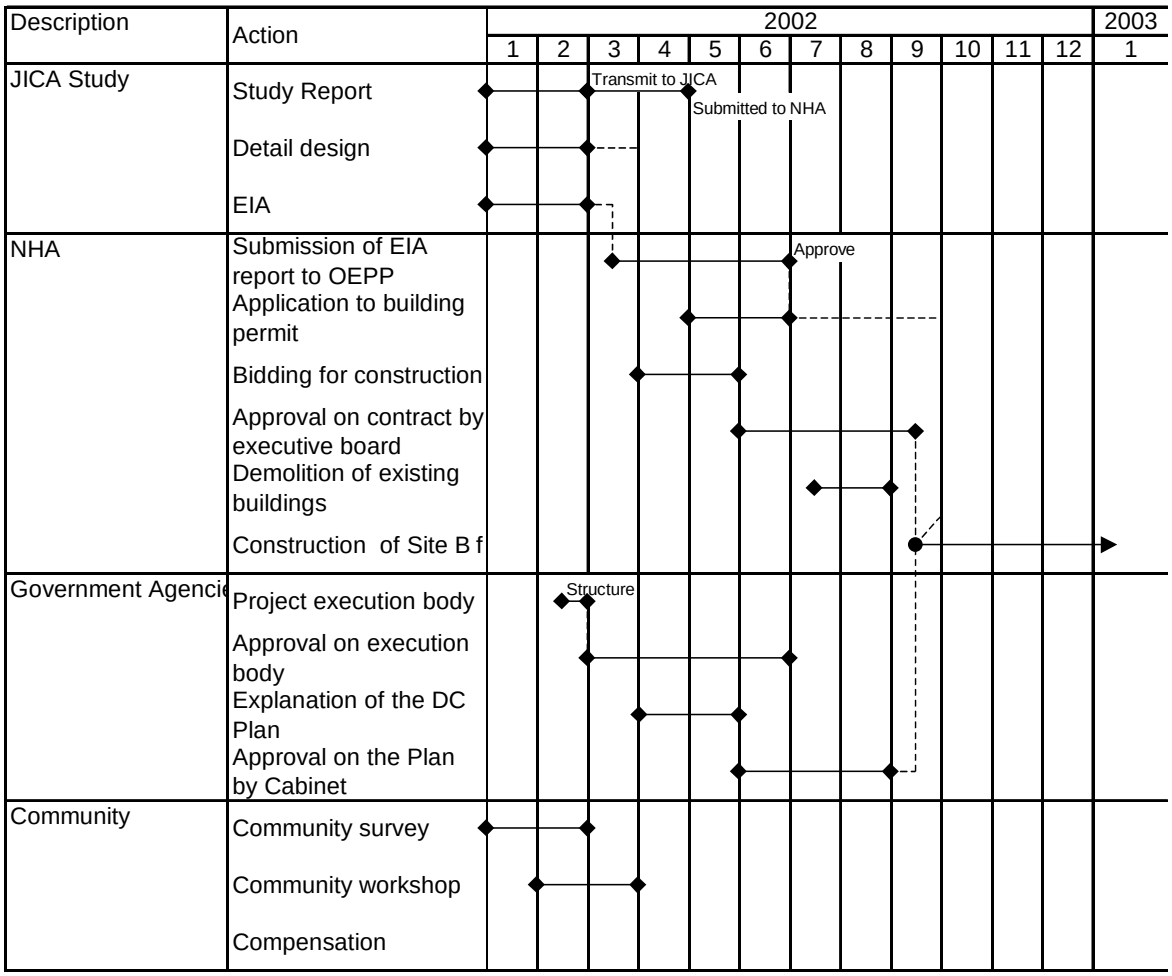
Table 13.1: Preliminary Construction Cost Estimate at Each Site

Site-A		
Items	*Descriptions*	*Amount (Baht)*
1	Structural Work	286,914,000
2	Architectural Work	130,381,000
3	Electrical Work	101,800,000
4	Sanitary Work	104,970,000
5	Air Condition Work	9,000,000
6	Lift	30,000,000
7	Landscape Work	15,375,000
	Total	678,440,000
	Overhead + Profit (14.84%)	100,680,000
	Total	779,120,000
	Tax (7%)	54,538,000
	Total Cost	833,658,000
Site-B'		
Items	*Descriptions*	*Amount (Baht)*
1	Structural Work	154,474,000
2	Architectural Work	61,202,000
3	Electrical Work	56,000,000
4	Sanitary Work	54,410,000
5	Air Condition Work	4,000,000
6	Lift	10,000,000
7	Landscape Work	8,531,000
	Total	348,617,000
	Overhead + Profit (14.84%)	51,735,000
	Total	400,352,000
	Tax (7%)	28,025,000
	Total Cost	428,377,000
Site-C		
Items	*Descriptions*	*Amount (Baht)*
1	Structural Work	474,449,000
2	Architectural Work	220,372,000
3	Electrical Work	178,000,000
4	Sanitary Work	180,000,000
5	Air Condition Work	8,000,000
6	Lift	40,000,000
7	Landscape Work	21,492,000
	Total	1,122,313,000
	Overhead + Profit (14.84%)	166,551,000
	Total	1,288,864,000
	Tax (7%)	90,220,000
	Total Cost	1,379,084,000

13.2 ACTION PLAN

Following is the action plan focused on the Case Study Plan. The illustration is intended to show the sequence of activities and their inter-relation, not to indicate exact time schedule as there is a large uncertainty for each event to take place.

Figure 13.2: Action Plan (Implementation Schedule) Focusing on the Case Study



13.3 FINANCIAL PLAN

13.3.1 Cost Estimate

(1) Outline

The project cost is constituted of construction cost (direct construction cost, survey, planning and design costs, site clearance cost, compensation, land readjustment cost), project administration cost and contingency. The costs are estimated by facilities (residential building, commercial buildings and car parks) based on the provisions as described below.

1) Distribution of Floor Area:

In order to reasonably distribute the common floor space in each building to residential, commercial and car park sections, the procedure at item 3) below was followed.

2) Kinds of Common Floor Space:

The common floor space comprises those that are related to the entire building (residence, commercial facility and car park), and those related only to a part (component) of the building. Demarcation of these was worked out on the design drawings of the building to obtain floor areas.

3) Procedure of Common Floor Space Distribution:

i) Distribution of common space exclusive to certain part of the building to the specific part.
ii) Distribution of common space related to two or more components of the building in proportion to floor areas of related components and add them to the result of above i).
iii) Distribution of the entire common space in proportion to the floor space as a result of individual distribution in the above and add them to the result of 3) ii).
iv) Distribution of construction cost for the common space in proportion to the result of 3) iii).

It is proposed that the construction costs at each site will be covered by each other in the financial arrangement; cost for promenade and outdoor facilities in Site A and C will be partly covered by the profit from commercial facility in Site B and residential buildings in Site B will be covered by the profit from the commercial facilities in Site B.

(2) Method of Project Cost Estimate

The construction cost of the project was estimated first from direct construction costs (directly related cost) for each component facilities (residences, commercial facilities and car park), partial common space, common space and promenade individually. Thereafter, cost for the common space was distributed to each component facility in the manner discussed earlier. Profit and tax were distributed in proportion to the amount of the direct construction costs.

Distribution of the cost for the promenade was made as summarized in the table below.

Table 13.2: Allocation of Common Floor Space

Description	Site- A		Site- B'		Site- C		Site A and C
	Partial common space	Comm-on space	Partial common space	Common space	Partial common space	Comm-on space	Promenade
Residential building	-	71.64	-	57.81	-	77.49	10.00
Commercial facility	21.46	6.09	34.87	14.71	29.54	6.65	85.00
Car park	78.54	22.27	65.13	27.48	70.46	15.86	5.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Project administration cost and contingency were distributed in the same proportion of those of the common floor space.

(3) Estimated Project Cost

Following the above procedure, project costs of each component of the project facility were estimated as summarized in the table below.

It is observed that the unit floor construction cost in Site B is a little lower than the others. This can be attributed to the fact that the proportion of commercial facility is relatively larger here than the others, plus commercial building will not be fully finished or provided with service systems. Unit floor construction cost for commercial facility in Site A is found to be higher than the others, which is

attributable to the fact that scale of building is smaller here. With regard to the residential building, unit floor construction costs are much the same.

Table 13.3 : Summary of Project Costs

(Baht)

	Residential building	Commercial facility	Car park	Total
Site A Project cost <Floor area> (Unit floor cost/㎡)	859,814,177 <52,776.65> (16,292)	74,121,457 <4,483.89> (16,531)	214,645,365 <16,404.46> (13,085)	1,148,580,998 <73,665.00> (15,592)
Site B' Project cost <Floor area> (Unit floor cost/㎡)	343,087,688 <23902.58> (14,354)	68,169,237 <6,082.88> (11,207)	110,560,114 <11,363.54> (9,729)	521,817,039 <41,349.00> (12,620)
Site C Project cost <Floor area> (Unit floor cost/㎡)	1,340,753,242 <94,706.76> (14,157)	105,795,353 <8,129.31> (13,014)	244,141,800 <19.386.43> (12,593)	1,690,690,395 <122,222.50> (13,833)
Total	2,543,655,107	248,086,047	569.347,278	3,361,088,432

(Ref. Data-5 Project Cost Breakdown)

13.3.2 Financial and Economic Evaluation

The expenditure of the project cost comprises payment for the construction according to its progress and re-payment of loaned money. Income of the project comprises loaned money, house rent, floor rent and parking charge.

The administration cost of the project facilities after completion of construction is neutral cost if all expenditure are collected.

(1) Disbursement of Project Costs

1) Construction Cost

Disbursement of the project costs was distributed annually.

Construction costs were distributed according to the construction schedule. In case the construction period continued for many years, the cost was divided in proportion to the periods in each year.

2) Repayment of Loan

Repayment of loaned money was figured out according to the following conditions: For interest rate, another case (7%) was incidentally checked.

- Equal annual disbursement in 30 years
- Interest 5% per annum (7% per annum)

(2) Income

Project income (fund) was assumed to comprise interest-free own fund, government subsidy and loaned money. The project income includes house rent, commercial floor rent, car parking charge and space rent for street venders.

1) Fund Raising

Fund raising will primarily be made of ordinary bank loan as indicated in the re-payment scheme. Other possible sources of fund are foreign loan, and issuance of bond in money market. These sources, however, require an official request from the Thai Government for the loan or guarantee of the Government for the bond.

It is not clear at present if foreign financial ODA can be applied to a housing project for low income population, as the Thai government generally does not intend to use foreign money for housing provision. Issuance of bond in money market, however, could be possible depending on the market situation if it is accompanied with a guarantee of the Thai government.

2) House Rent, Commercial Floor Rent, Car Park Charge

Income from housing, commercial facility and car park was computed based on the conditions tabulated in Table 13.3. It should be noted that all unit rates will be raised at a rate of 15% in every three years. However, in order to cope with the difficult situation in obtaining consent of the residents, another case, 15% hike every 10 years, was examined incidentally. Similar supplementary case study was made also for commercial facility (half rate: 275 baht/m^2) in consideration of the current rent level.

Table 13.4: Quantities of Revenue Generating Facilities and Unit Rates

Description	Site- A	Site- B'	Site- C	Total	Monthly unit rent rate (per month)
Residence (unit)	627	309	1,208	2,144	1,500 Baht/house
Commercial facility (floor area m^2)	1,835.00	3,858.00	2,813.00	8,506.00	550 Baht/m^2
Car park (bay) (outside)	473 (86)	260 (0)	792 (212)	1,525 (298)	1,500 Baht/bay
Street vender (no.)	20	0	50	70	*1,000Baht/no

Note: Stationary street vending space rent in Din Daeng area (average unit area: $20m^2$) is 2 Baht/m^2/day

3) Financing Schemes

Financing schemes were examined in a project life period of 30 years on how income and expenditure will balance according to the foregoing paragraphs 1 and 2. The result is summarized in the tables below.

Financial balance is the best in Site B owing to a relatively large commercial facility, while in Site A and C, most of the periods are in the deficit. However, the balance would turn to the black after 30 years in almost all cases. The situation would further be improved with the introduction of interest-free own fund or government subsidy.

In sum, in this project, mobilization of own fund or securing government subsidy would be a prerequisite for sound financial management. The results of case studies are presented below.

【Case A】 Financing Conditions

① Repayment Principal: 30 years equal Interest: 5.0% per annum	④ Parking charge 1,500 Baht/bay/mth
② House rent 1,500 Baht/house/mth	⑤Street vender 1,000 Baht/unit/mth
③ Floor rent 550 Baht/m²/mth	⑥ Escalation (②～⑤) 15%/every 3 years

Description	Fund component (%)			Balance after 30 years(x1,000Baht)	Deficit period (years)	IRR (%)	Appraisal
	Own fund	Subsidy	Bank loan				
Site A							
Case1	0	0	100	550、767	23(R)	-2.24	×
Case2	20	10	70	1,162,383	13 (R)	0.05	×
Case3	30	20	50	1,570,132	2 (R)	1.63	◎
Case4	30	30	40	1,774,008	Whole period(B)	2.44	◎
Site B'							
Case1	0	0	100	1,764,367	Whole period(B)	7.36	◎
Case2	10	0	90	1,856,983	Whole period(B)	8.07	◎
Site C							
Case1	0	0	100	1,974,506	16 (R)	0.64	×
Case2	10	10	80	2,574,703	10 (R)	2.03	○
Case3	20	20	60	3,174,895	3(R)	3.50	◎
Case4	30	20	50	3,474,992	2 (R)	4.28	◎

Note 1: (R), (B) denote "in the deficit" and "in the black" respectively
2: × poor, ○ fair, ◎ good

【Case B】 Financing Conditions (Shaded portions were changed in Case A)

① Repayment Principal: 30 years equal Interest: 7.0% per annum	④ Parking charge 1,500 Baht/bay/ mth
② House rent 1,500 Baht/house/ mth	⑤Street vender 1,000 Baht/unit/ mth
③ Floor rent 550 Baht/m²/ mth	⑥ Escalation (②～⑤) 15%/every 3 years

Description	Fund component%)			Balance after 30 years(x 1,000Baht)	Deficit period (years)	IRR (%)	Appraisal
	Own fund	Subsidy	Loan				
Site A1							
Case1	0	0	100	194,696	29(R)	-3.42	×
Case2	20	10	70	913,136	18(R)	-0.82	×
Case3	30	20	50	1,392,086	8 (R)	0.92	○
Case4	30	30	40	1,631,575	2(R)	1.84	◎
Site B'							
Case1	0	0	100	1,602,612	4(R)	6.05	◎
Case2	10	0	90	1,711,411	1(R)	6.82	◎
Site C							
Case1	0	0	100	1,974,506	16(R)	-0.52	×
Case2	10	10	80	2,574,703	10 (R)	1.03	○
Case3	20	20	60	3,174,895	3 (R)	2.67	◎
Case4	30	20	50	3,474,992	2(R)	3.54	◎

Note 1: (R), (B) denote "in the deficit" and "in the black" respectively
2: × poor, ○ fair, ◎ good

【Case C】 Financing Conditions (Shaded portions were changed in Case A)

① Repayment Principal: 30 years equal	④ Parking charge 1,500 Baht/bay/ mth
Interest: 5.0% per annum	⑤Street vender 1,000 Baht/unit/ mth
② House rent 1,500 Baht/house/ mth	⑥ Escalation (②～⑤) 15%/every 3 years
③ Floor rent 275 Baht/m²/mth	

Description	Fund component (%)			Balance after 30 years (x 1,000Baht)	Deficit period (years)	IRR (%)	Appraisal
	Own fund	Subsidy	Loan				
Site A1							
Case1	20	10	70	393,532	24(R)	-3.4	×
Case2	30	20	50	801.281	14(R)	-1.56	×
Case3	30	30	40	1,005,157	6 (R)	-0.65	○
Case4	40	30	30	1,209,025	Whole period(B)	0.27	◎
Site B'							
Case1	0	0	100	730,991	13(R)	1.47	×
Case2	10	0	90	823,609	9 (R)	2.15	○
Site C							
Case1	0	0	100	601,429	Whole period (R)	-2.87	×
Case2	10	10	80	1,201,626	18(R)	-1.30	×
Case3	20	20	60	1,801,818	11(R)	0.30	×
Case4	30	20	50	2,101,915	6(R)	1.11	○

Note 1: (R), (B) denote "in the deficit" and "in the black" respectively
2: × poor, ○ fair, ◎ good

【Case D】 Financing Conditions (Shade portions were changed in Case A)

① Repayment Principal: 30 years equal	④ Parking charge 1,500 Baht/bay/ mth
Interest: 7.0% per annum	⑤Street vender 1,000 Baht/unit/ mth
② House rent 1,500 Baht/house/ mth	⑥ Escalation (②～⑤) 15%/every 10 years
③ Floor rent 550 Baht/m²/ mth	

Description	Fund component (%)			Balance after 30 years (x 1,000Baht)	Deficit period (years)	IRR (%)	Appraisal
	Own fund	Subsidy	Loan				
Site A1							
Case1	0	0	100	－822,298]	Whole period(R)	-14.68	×
Case2	20	10	70	－103,858	Whole period (R)	-7.86	×
Case3	30	20	50	375,092	15(R)	-4.62	×
Case4	30	30	40	614,581	2(R)	-3.14	○
Site B'							
Case1	0	0	100	477,673	10(R)	-0.40	○
Case2	10	0	90	586,472	5(R)	0.60	○
Case3	10	10	80	695,267	Whole period (B)	1.63	◎
Site C							
Case1	20	20	60	721,411	15(R)	-3.64	×
Case2	30	20	50	1,073,920	5(R)	-2.30	○
Case3	30	30	40	1,426,416	2(R)	-0.99	○
Case4	40	30	30	1,778,931	1(R)	-0.33	○

Note 1: (R), (B) denote "in the deficit" and "in the black" respectively
2: × poor, ○ fair, ◎ good

【Case E】 Financing Conditions (Shaded portions were changed in Case A)

① Repayment Principal: 30 years equal Interest: 7.0% per annum	④ Parking charge 1,500 Baht/bay/ mth
② House rent 1,500 Baht/house/ mth	⑤Street vender 1,000 Baht/unit/ mth
③ Floor rent 275 Baht/m²/ mth	⑥ Escalation (②～⑤) 15%/every 10 years

Description	Fund component (%)			Balance after 30 years (x 1,000Baht)	Period of deficit (year)	IRR (%)	Appraisal
	Own fund	Subsidy	Loan				
Site A1							
Case1	0	0	100	－1,260,615	Whole period(R)	DIV/0	×
Case2	20	10	70	－542,175	Whole period (R)	-14.31	×
Case3	30	20	50	－63,225	28(R)	-8.73	×
Case4	30	30	40	176,264	20(R)	-6.69	×
Site B'							
Case1	10	0	90	－14,851	29(R)	-6.25	×
Case2	10	10	80	93,944	23(R)	-4.93	×
Case3	20	20	60	311,550	9(R)	-2.40	○
Site C							
Case1	20	20	60	－61,371	Whole period(R)	DIV/0	×
Case2	30	20	50	291,138	22(R)	-6.09	×
Case3	30	30	40	643,634	11(R)	-4.46	×
Case4	40	30	30	996,149	2(R)	-2.92	○

Note 1: (R), (B) denote "in the deficit" and "in the black" respectively
2: × poor, ○ fair, ◎ good

4) Administration Cost of Common Space

Residential buildings and commercial buildings are composed of main components (residences and commercial floor) and common space such as corridor, staircase, machine room. Energy cost and water cost in the main component are borne by the renters, while the costs accrued from the common space have to be carried by the concerned renters or users. Those costs jointly carried are defined as administration cost for common space.

i) Classification of Administration Cost for Common Space

The administration cost for common space in residential buildings comprises "Routine administration cost" (cleaning cost, electric charge in corridor) and "Long-term repair cost" for periodical repair of building and equipment (painting on exterior wall).

Cost bearing parties for the common space in rented apartment or rented commercial facilities are divided into two parties: building renter and building owner. Costs of a) insurance on building (fire, third party), b) long term repair cost, c) routine administration cost, and d) taxes are borne by the

building owner, while others are borne by the renters.

ii) Administration Cost for NHA Housing

In NHA housing, the administration costs of both group of the above are included in the house rent. However, these costs are not sufficiently recovered by the extraordinarily low rent for middle-low income households. Consequently, the administration costs in this project are to be borne all by the renters.

iii) Administration Cost Items

Following are the items included in the administration cost for common space.

Table 13.5: Administration Cost Items

[User's responsibility]	[Owner's responsibility]
• Routine repair cost: Inspection of electric equipment, hazard protection, elevator etc. • Environment, sanitary: Cleaning of water tank, water quality test, daily cleaning etc. • Energy and water: Electric charge, water charge etc. • Consumables: Replacement of electric bulb, minor repair etc. • Contingency: Certain percentage money	• Routine repair cost: Inspection of electric equipment, hazard protection, elevator etc. • Environment, sanitary: Cleaning of water tank, water quality test, daily cleaning etc. • Energy and water: Electric charge, water charge etc. • Consumables: Replacement of electric bulb, minor repair etc. • Contingency: Certain percentage money • Insurance: Fire insurance, workmen's compensation insurance etc. • Long term repair cost: Building, electric system, water supply system etc. • Commission: Commission for Management Company

iv) Long-Term Repair Cost

Long-term repair costs are periodical (every 5 or 10 years) ones for building and replacement cost for component/parts of electro-mechanical building service. These are basically computed based on the building construction cost. Disbursement schedule is worked out based on the standard repair or replacement cycles for building repair and service life of equipment.

Unit rate of the long-term repair cost is computed assuming a project life of 30 years and accumulated total cost is distributed in proportion to site and floor area. which are then equally divided into monthly charge.

v) Result of Computation of Administration Cost for Common Space

The administration cost is believed to be a heavy burden for the households in NHA housing. The result of the computation summarized hereunder shows an average 990 baht (almost 1,000 baht/month). Against the set monthly house rent (1,500 baht/house for 42.6m^2), this amount is no doubt too much if charged straight forwardly. This rate is nearly equal to that of Khlong Chan Project of NHA (1,150 baht/house), which is a high-rise (27-storey), medium grade (50- 75m^2) housing.

Table 13.6: Monthly Administration Cost

(Baht/m^2)

Description	Site A	Site B'	Site C	Average	Remarks
Renter's share	16.49	14.16	19.62	17.47	
Building owner's share	5.80	5.57	5.78	5.74	
Total (Baht/house)	22.29 (950)	19.73 (810)	25.39 (1,080)	23.21 (990)	
Total residential floor(㎡)	28,718.00	13,870.00	55,090.00	97,678.00	
Residential unit (㎡)	42.8	41.3	42.7	42.6	
Number of unit	627	309	1,208	2,144	

vi) Household Income vs. House Rent

Theoretically, house rent is figured out on the basis of construction cost, cost recovery period (in this project: 30 years), and profit. In reality, the rent is governed by the market situation (location, environment).

Proportion of house rent in the total household expenditure is generally said to be around 20%. House rent for the First Phase of Din Daeng Community Area redevelopment project has been set at 1,500 baht/month, which was determined in consideration to low income population. The administration cost has been figured out to be 1,000 baht/house/month in the foregoing paragraph. The sum of house rent and administration cost 2,500 baht must be charged to the residents. In order for this charge to be acceptable, the household income has to be a minimum of 12,500 baht/month.

The average monthly household income in Din Daeng Housing Complex is believed to be about 11,000 baht. Therefore, the difference of 1,500 baht has to be somehow coped with, which does not seem to be insurmountable in

view of the dual-income life style in Bangkok.*

vii)House Rent and Administration Cost

House rent for new comers has been set at 5,600 baht/house/month. The balance between the house rent and the administration cost (1,000 baht/house/month) as previously set down is in the ratio of 85:15. Total charge (house rent + adm. Cost = 6,600 baht) vs. administration cost comes to be in a proportion of 82:18. This proportion of the administration cost seems to be a reasonable one.

13.4 ENVIRONMENTAL IMPACT ASSESSMENT

The environmental impact assessment (EIA) was carried out on the Study in accordance with the requirements set by the Thai government. The requirements are stipulated in the environmental acts as shown in Table 13.7. The EIA Report was separately compiled in the Thai language.

The EIA found no significant impact to either natural or social environments.

Table 13.7 Environmental Acts referred in EIA

	Description
1	National Environmental Quality Act
2	Cleanliness and Orderliness of the Country Act
3	Public Health Act
4	Hazardous Substances Act
5	Ground Water Act

* Minimum wage in Thailand is 165 baht/day since January 2001. Minimum household income in dual-income family at this level will be 8,250 baht/month by work 25 days