

3.5.3 Rail-based New Town Development Plan (Lat Krabang East New Town and Others)

3.5.3.1 Concentric New Town Development

(1) General

1) Model of Rail Town Development on the Main Section of Suburban Commuter Line

Rail town development shall be implemented in conformity with the planning framework and guidelines set up in the structured plan proposed in this study. This section discusses a model rail town development on the main section of the suburban commuter line in the hope that it will be applied in the actual course of planning and implementing the integrated urban and rail development.

It has been repeatedly mentioned in this study report that it is quite hard to map out a detailed land use plan with high certainty of implementation at this time as it is dependent on the uncertain future of the existing proposed development projects. What can be presented, instead, is just a model development.

Highest priority is placed on the early establishment of a complete suburban commuter line on the main section of Eastern line. Correspondingly, the study focuses the model development on the main section, especially in the district of Lat Krabang.

2) Targeted Population for New Town Development

Population projection for new development by district is made applying the general rule of expected urbanization along the improved railway. This orderly population distribution is made with a view to moderate ridership forecast and hence railway improvement planning. It is not uncommon that the planned total control and population distribution is likely to change in an upward direction in reality especially depending on the outcome of the implementation of existing proposed development projects such as BMA sub center, NHA new towns, and so on.

The model development plan is to target a population of 300,000 for the district of

Lat Krabang which includes the West and East new towns, rather than 200,000 which was originally set in the socio-economic projection. This is to provide for possible expansion of cities/towns.

The Lat Krabang West New Town, with a planned population of 200,000 and East New Town with 100,000, are designed to expand and develop into the BMA Suburban Center and NHA New Town with a targeted population of 300,000 respectively if/when they are successfully implemented as planned.

Table 3.5.23 Population Projection and Targeted Population

	Pravet	Lat Krabang	Chachoengsao
Population Projection by District for Railway Improvement	200,000	200,000	140,000
Targeted Population		300,000 ↓ West East 200,000 100,000	
Possible Expansion	100,000	100,000 200,000 ↓ ↓ 300,000 300,000 BMA Sub Center NHA New Town	200,000

The rail town development and land use plan for Lat Krabang West and East New Urban Communities are presented in the Fig. 3.5.21

(2) Urban Structure and System of Railway Town

The urban structure for each community shall be established to unite the north and south sides of the SRT railway, with the urban central districts developed around the Express Train Station (Lat Krabang East - newly opened, Lat Krabang - existing and Lat Krabang West- newly opened) being the nodal points in the rail towns.

1) Hierarchical Structure

The rail new town hierarchically consists of the following units.

Space Unit	Laf Krabang East	Laf Krabang West
New Town	Population : 200,000 Land Area : 4,200 ha	Population : 100,000 Land Area : 1,240 ha
Urban District	10	3
Neighborhood	33	9

Usually one urban district consists of four neighborhoods (one neighborhood with a population of 5,000 to 10,000) while one new town consists of urban districts (the number of districts in a new town dependent upon the total population of the new town).

2) Urban Center in New Town

Urban Centers will be located in accordance with the above mentioned space structure as follows:

	<u>Service Area</u>
• Central District	New Town
• District Center	District
• Neighborhood Center	Neighborhood

The neighborhood system in the new towns is shown in Fig. 3.5.22

A neighborhood is a basic unit (socially and physical) of a new town, with one neighborhood center serving the neighborhood. A district center will serve the neighborhood contained in the district.

In the same manner, a new town urban center (urban center) will serve the districts developed in the new town. The new town centers shall be developed centered on the following stations.

Fig. 3.5.21 Urban Development and Land Use Plan



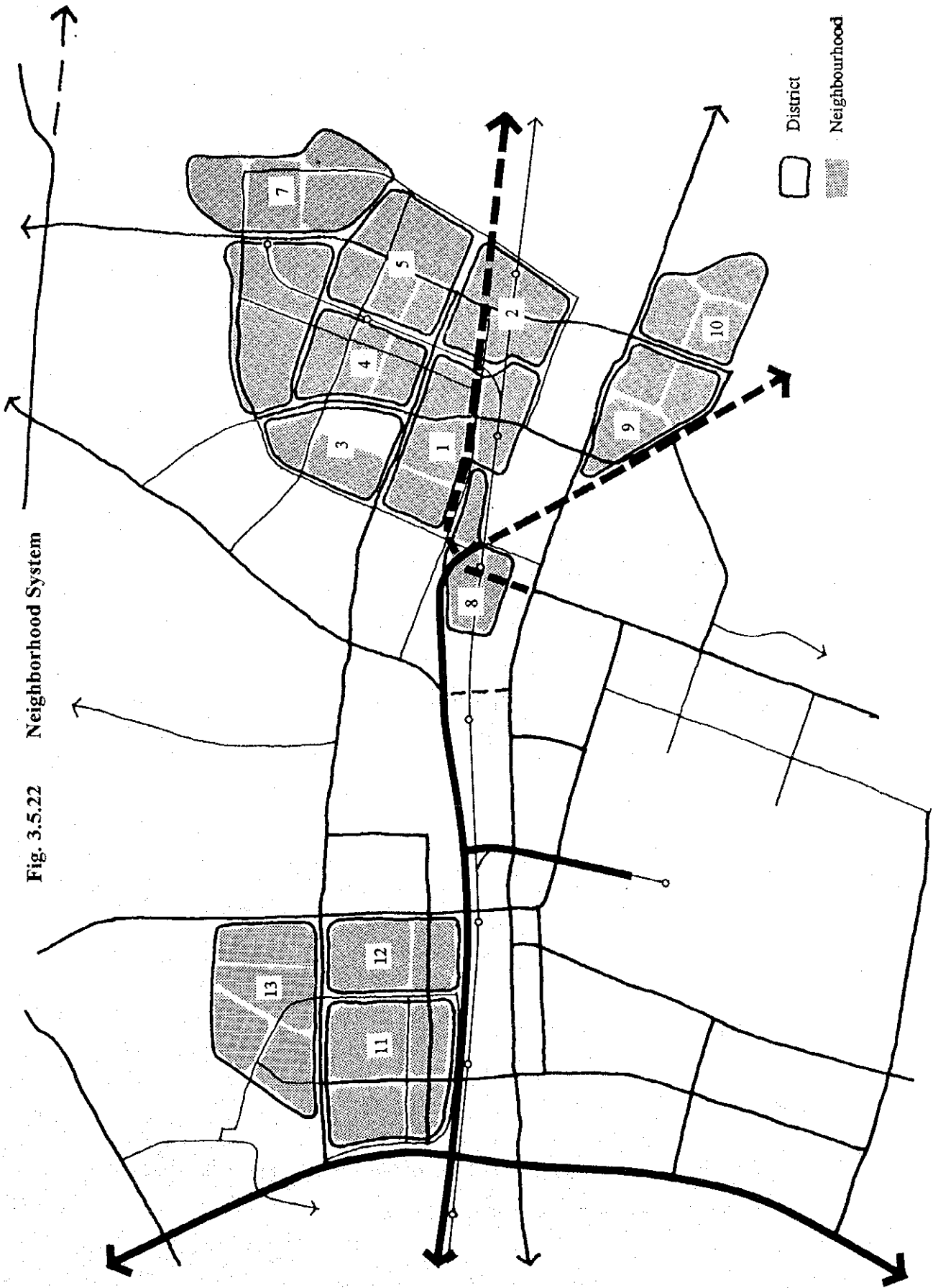


Fig. 3.5.22 Neighborhood System

Lat Krabang East

Lat Krabang West

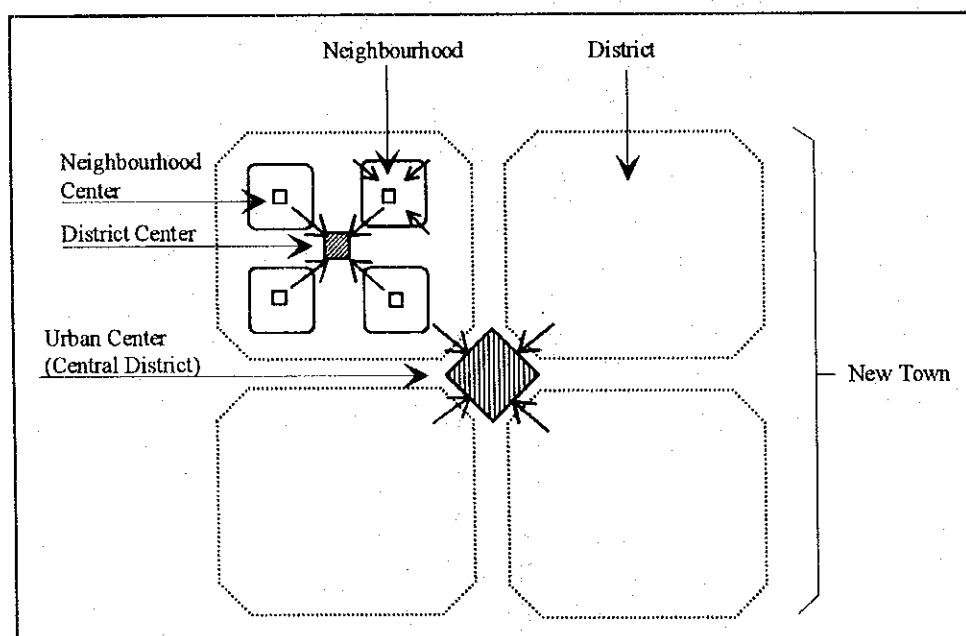
- Lat Krabang East Station

- Lat Krabang West Station (BMA Center)

- Lat Krabang (Existing)

Accordingly, the land use plan of new town shall be formulated with the new town centers being the core of the new town.

Fig. 3.5.23 Hierarchical Urban Space and Center



(3) Land Use Plan

1) Residential

High density residential areas shall be designated around the stations, especially within the direct service area (walking distance).

The residential areas are planned as follow:

	Lat Krabang East	Lat Krabang West
Population	200,000	100,000
Residential Area	4,200 ha	740 ha
Density	50	80

- A neighborhood with one elementary school and one neighborhood park shall be shaped by the arterial road, railway and others.
- On the north side of the expressway, residential areas shall be developed with a mixture of high, medium and low density. Special attention must be given to landscaping the residential area.

2) Commercial

Commercial areas shall be located around the Lat Krabang West and Lat Krabang Station so as to be convenient for the special business zone, airport passengers and workers.

3) Industrial

Industrial areas shall be designated close to the existing industrial area, with high accessibility to road transport.

(4) Transport System

1) Basic Policies

The basic policies for transport improvement of the new towns are set forth as follows:

- a) Increase the accessibility to the rail stations, especially the express train stations.

- b) Establish an hierarchical road network.
- c) Support the space structure uniting the urban district and neighborhoods as proposed above.

2) Road Network

- a) The hierarchical road network consisting of Highway, Arterial Road, Major Road and Minor Road shall be developed with the following standards:

	Distance Between Roads (km)	Lane	Row (m)	Crossing with Rail Line
Arterial Road	3 - 5	6	40 - 50	Fly-over
Major Road	1.5 - 2.0	4	30	Fly-over
Minor Road	0.5	2	15 - 20	No Crossing

- b) The BKK - Chonburi Express Way is accommodated as planned and designed by DOH while the alignment of the Chachaengsao is changed for land use planning.
- c) Direct access should be made possible for the new towns.

(5) Public Utilities

Urban facilities shall be hierarchically located in the centers as follows:

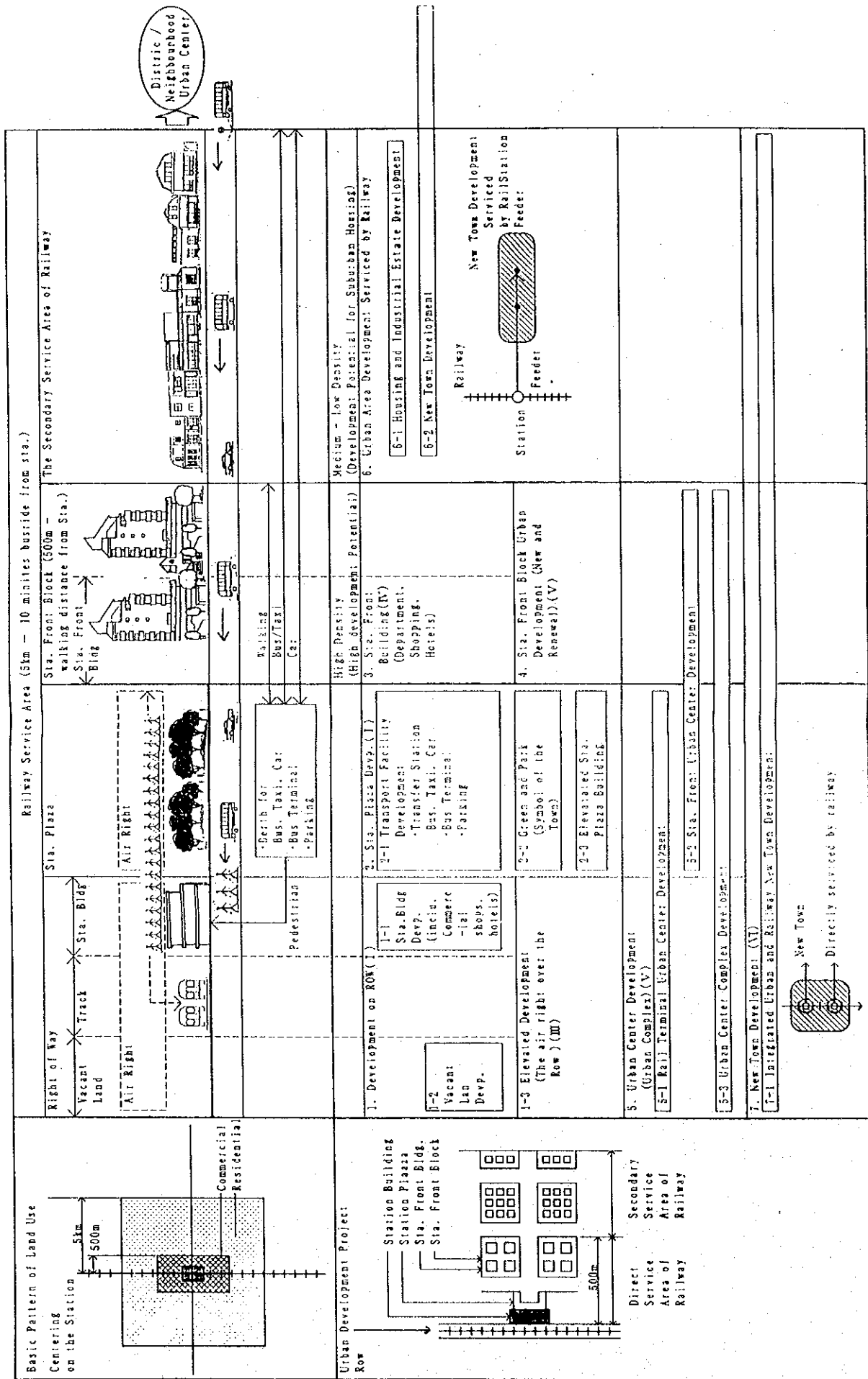
	Education	Park	Commercial
New Town Center	Universities	City Park	Department, Shopping Mall
District Center	High School Secondary School	District Park	Supermarket
Neighborhood Center	Elementary School Kindergarten	Neighborhood park	Supermarket

Urban development, especially potential commercial development, varies in accordance with the distance from stations. The building density also changes, with the highest

around the station. The urban area of a new town shall be structured, as shown in Fig.

3.5.24

Fig. 3.5.24 Urban Development Projects Based on Railway



3.5.3.2 Rail-based New Town Urban Center Development with High Urbanity

(1) Lat Krabang East Station

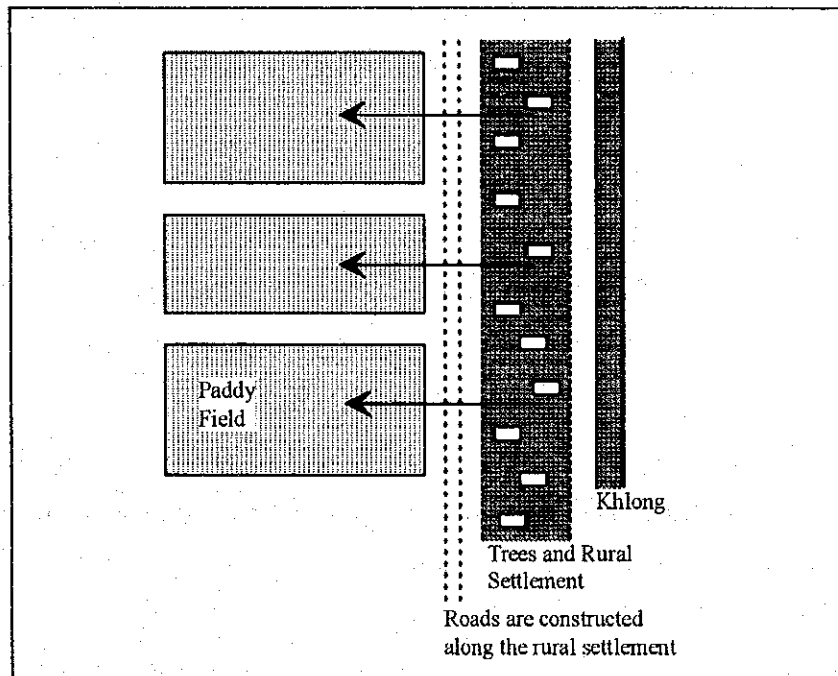
1) Location and Existing Condition

The project site is located between the Khlong Luang Phaeng station and Lat Krabang station (Hua Takhe), as shown in Fig. 3.5.25. The basic features of the project site are summarized below.

a) Agricultural Land Use

The site is mainly under agricultural land use, with typical farmland and settlement structure shown below.

Fig. 3.5.25 Typical Farm Land and Settlement Structure in Thailand



b) The aqua-culture ponds are scattered.

c) It is a flood/swampy area.

- d) Buildings, including factories, apartment and others, are predominant on the south side of the railway, along the Luang Phaeng Road.

2) Development Advantages

Following are the advantages of this area for integrated urban and railway development:

- a) New Station construction is possible taking into consideration the interval (distance) between stations and available open land.
- b) The service areas of the new station are undeveloped and awaiting urban development.
- c) The construction of the new station and the railway improvement are deemed to create high development potential around the station, resulting in a great increase in land value.
- d) The expected high land value may help the IURD System including value capture, work efficiently and effectively. This project should be a successful model of urban area development through the IURD System.
- e) The new station will provide great benefits to land owners and developers. This is expected to help gain good coordination and consensus among them for the implementation of the urban project.
- f) This area is located at the central point of the Lat Krabang East new town. This is the reason why this area is selected for the new town center.
- g) In addition to the rail transport service, the accessibility to the planned interchange of Chonburi Expressway and Chachoengsao Expressway will be quite high.

- h) This area is located close to the special business zone 1 planned on the east side of SBIA.
- i) The existing road is available for access to the new station. Development can start immediately after the construction of the station.

3) Development and Land Use Plan

Based on the new town development plan, the Urban Development and Land Use Plan has been formulated as shown in the Fig. 3.5.28. The plan includes the commercial area in the vicinity of the new station, university, parks and others.

Fig. 3.5.27 General Structure of Urban Center Development around Lat Krabang East Station

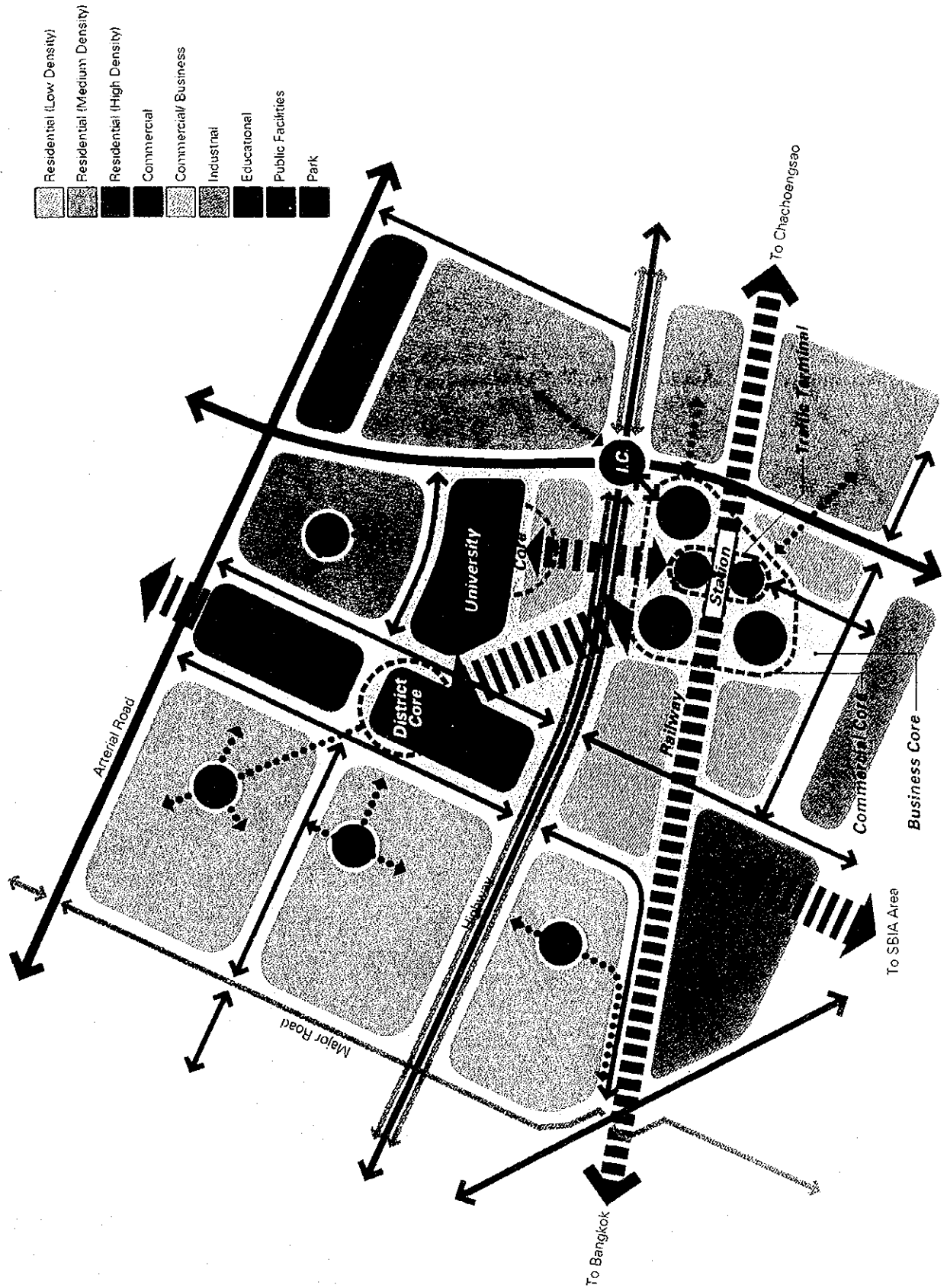


Fig. 3.5.28 Conceptual Land Use Development around Lat Krabang East Station

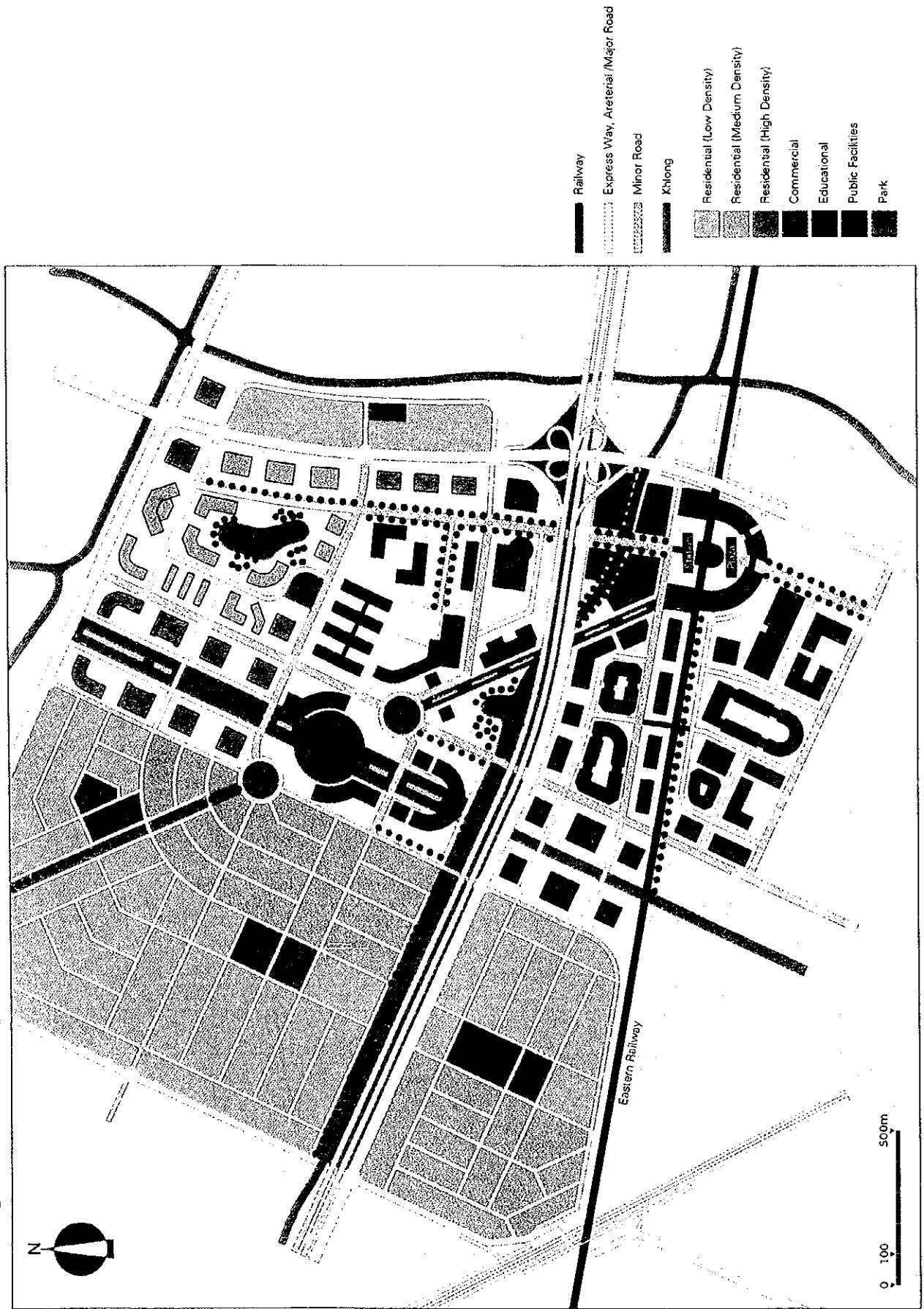


Fig. 3.5.29 Imaginary View of Urban Center Development

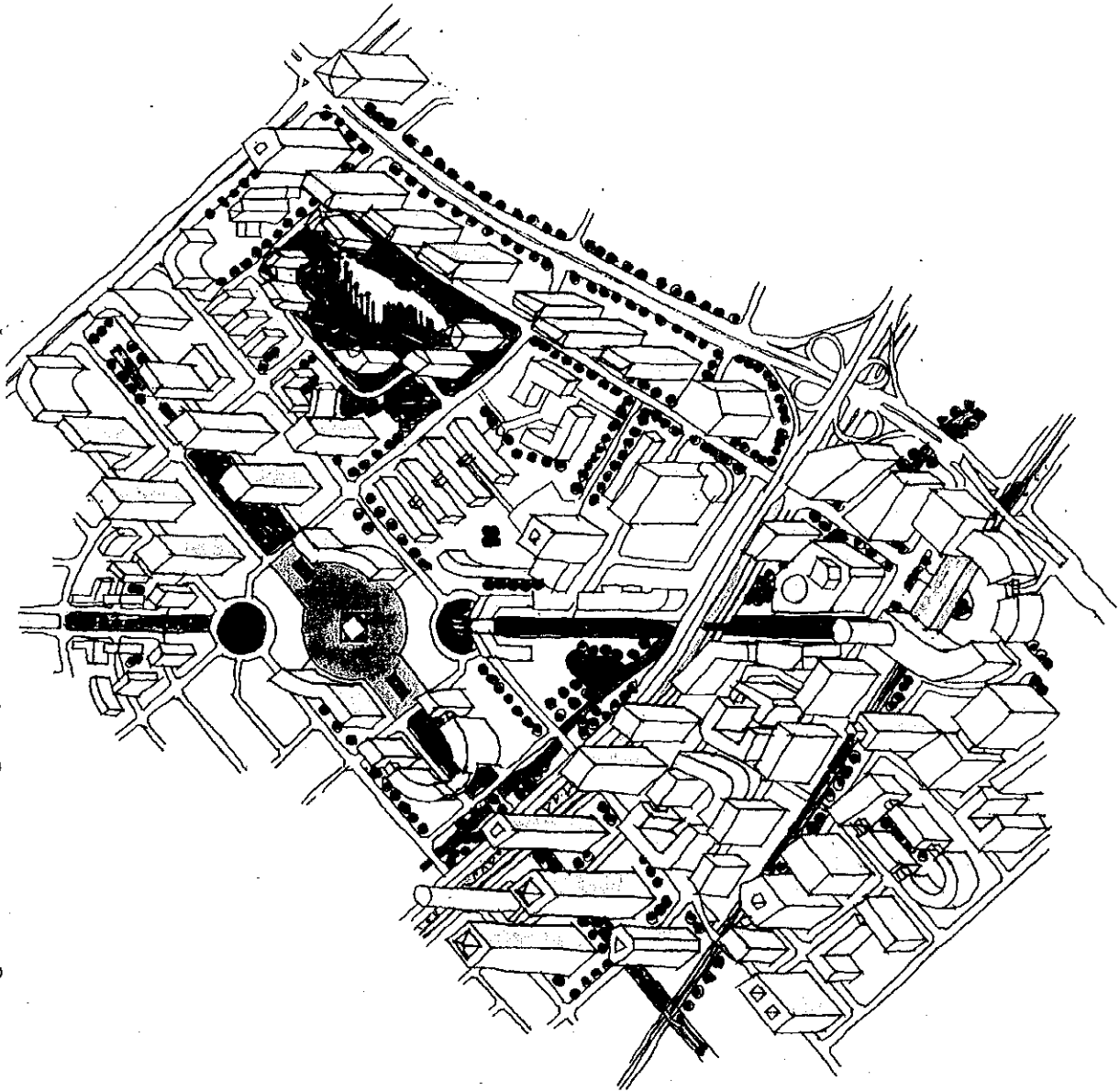
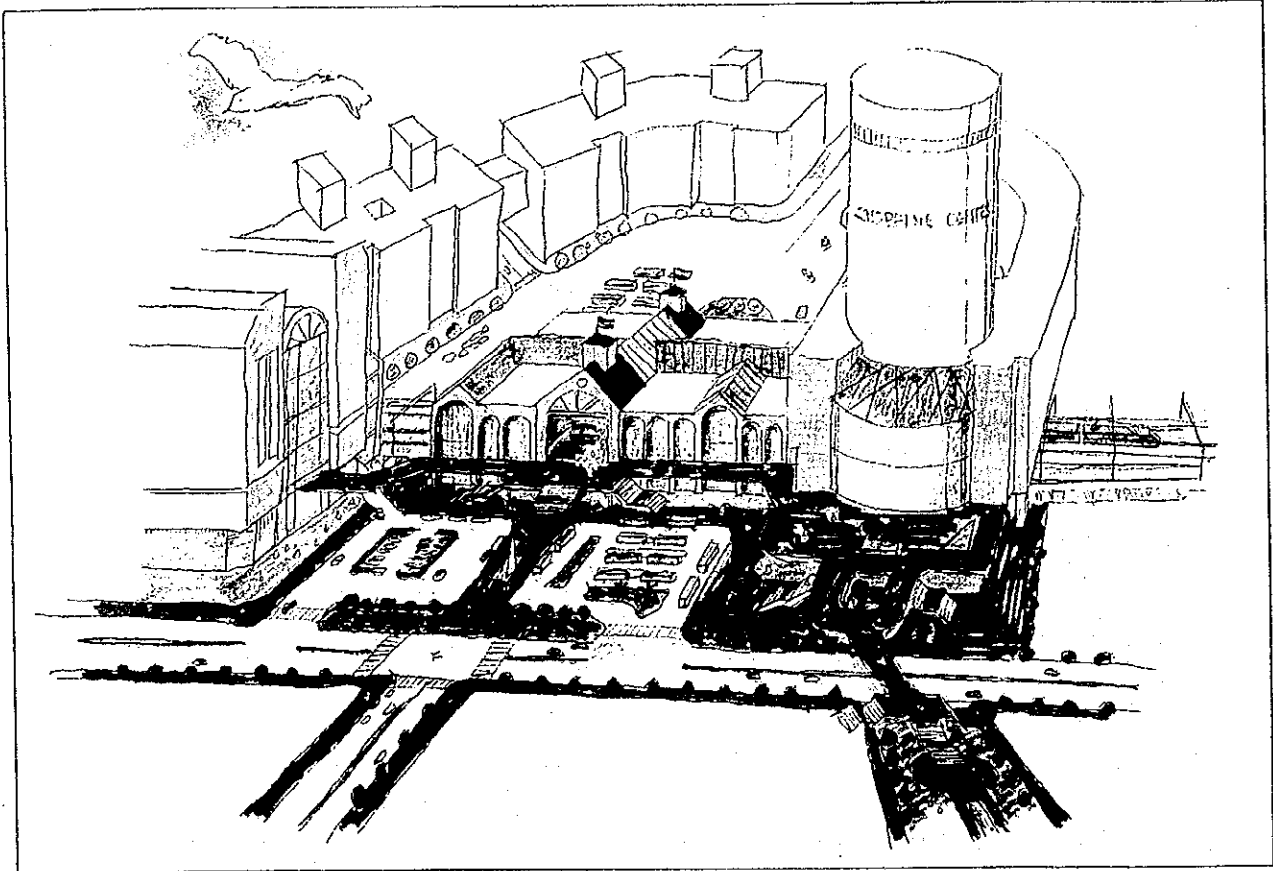
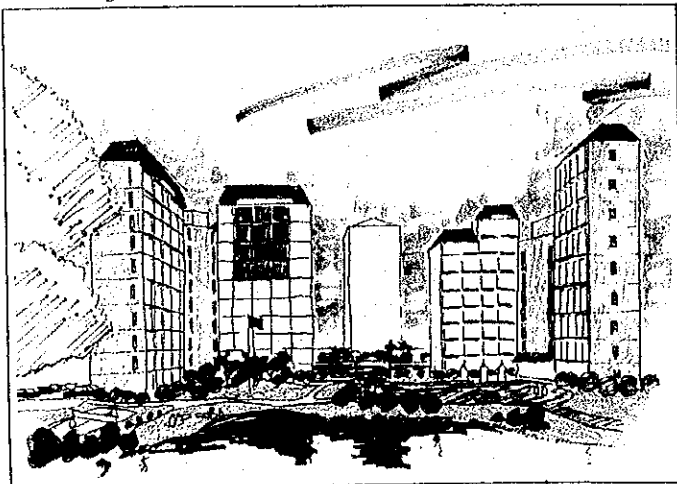


Fig. 3.5.30 Imaginary View of Developments

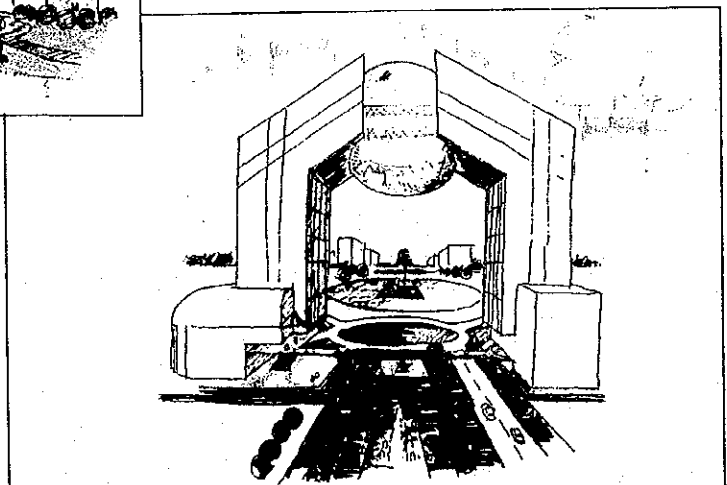
The Image of Lat Krabang East Station



The Image of Residential Area (Medium Density)



The Image of Park



(2) Others Rail-Based New Town Development

1) Development Plan for Catchment Area of Hua Takhe Station

Hua Takhe station is located in the central downtown area of Lat Krabang City. There is a university (Faculty of Agricultural Technology, King Mongkut's Institute of Technology) in this area. To enhance the area's function as a college city, it is suggested that the open space in the catchment area be utilized. The northern area of BKK-Chon Buri Highway is a Flood Retention Area; therefore it should be conserved.

The outline of the development plan is shown in Figure 3.94 and summarized as follows:

- a) Hua Takhe station will be developed as a transport node with the station plaza to integrate the present Hua Takhe station and Phra Chang Klao station and station plaza.
- b) Major arterial road from south to north will be developed as grade separation with the BKK-Chon Buri Highway, Eastern Railway and Khlong. Collector roads will be developed utilizing the present roads.
- c) In the BKK side area, railway will be separated from roads vertically. The land use of catchment area will be developed for business, commercial and hotel to enhance the urbanization.
- d) The outside area will be developed as a residential area.

2) Development Plan for Catchment Area of Chon Buri Station

Since the catchment area of the Chon Buri Station is spatially underdeveloped and the R3 bypass passes through the area, it is suggested that the area be developed an orderly manner as a local transport node.

Fig. 3.5.32 shows the development plan in the area.

The entire plan has the following components:

- a) Roads will be provided in a good hierarchical manner in order to achieve smooth circulation as well as accessibility to the station. A station plaza will also be developed at the end of the road network.
- b) The arterial and secondary roads will cross a railroad with elevated structures while minor roads will not, in principle.
- c) Taking the connection with the urbanized area as well as the arterial roads into account, the north side of the area will be developed as a town center, and thereby offices, hotels and roadside commercial complexes such as restaurants, supermarkets, car dealers and petrol stands will be allocated. Residential development will be encouraged in the rest of north side area.
- d) On the other hand, the south side area is planned for the branch offices of the factories located along 334, research institutions and a general hospital. A large parking space will be allocated nearby the station building for the park-and-ride users.

Fig. 3.5.31 Conceptual Land Use Development around Hua Takhe Station

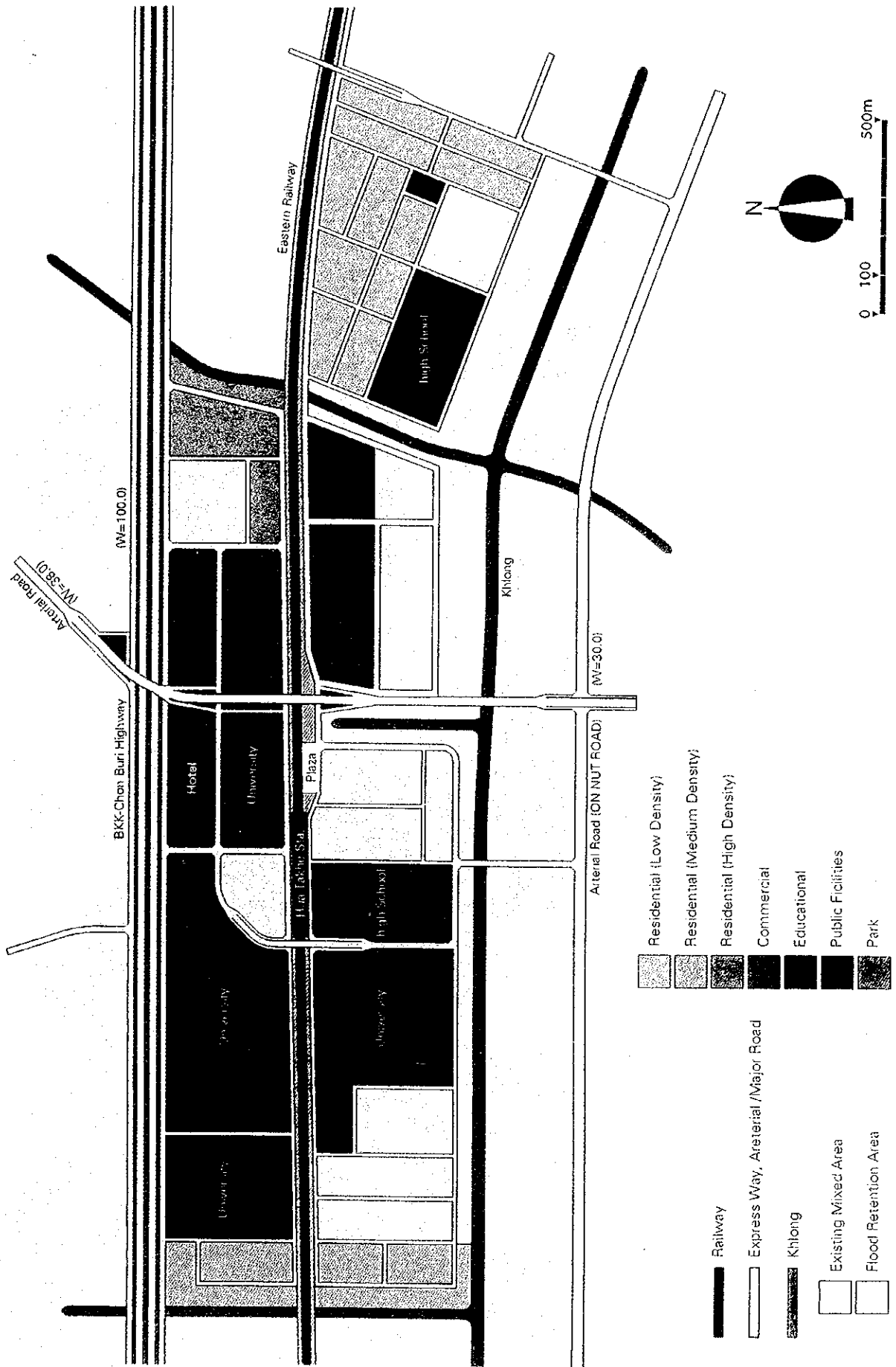
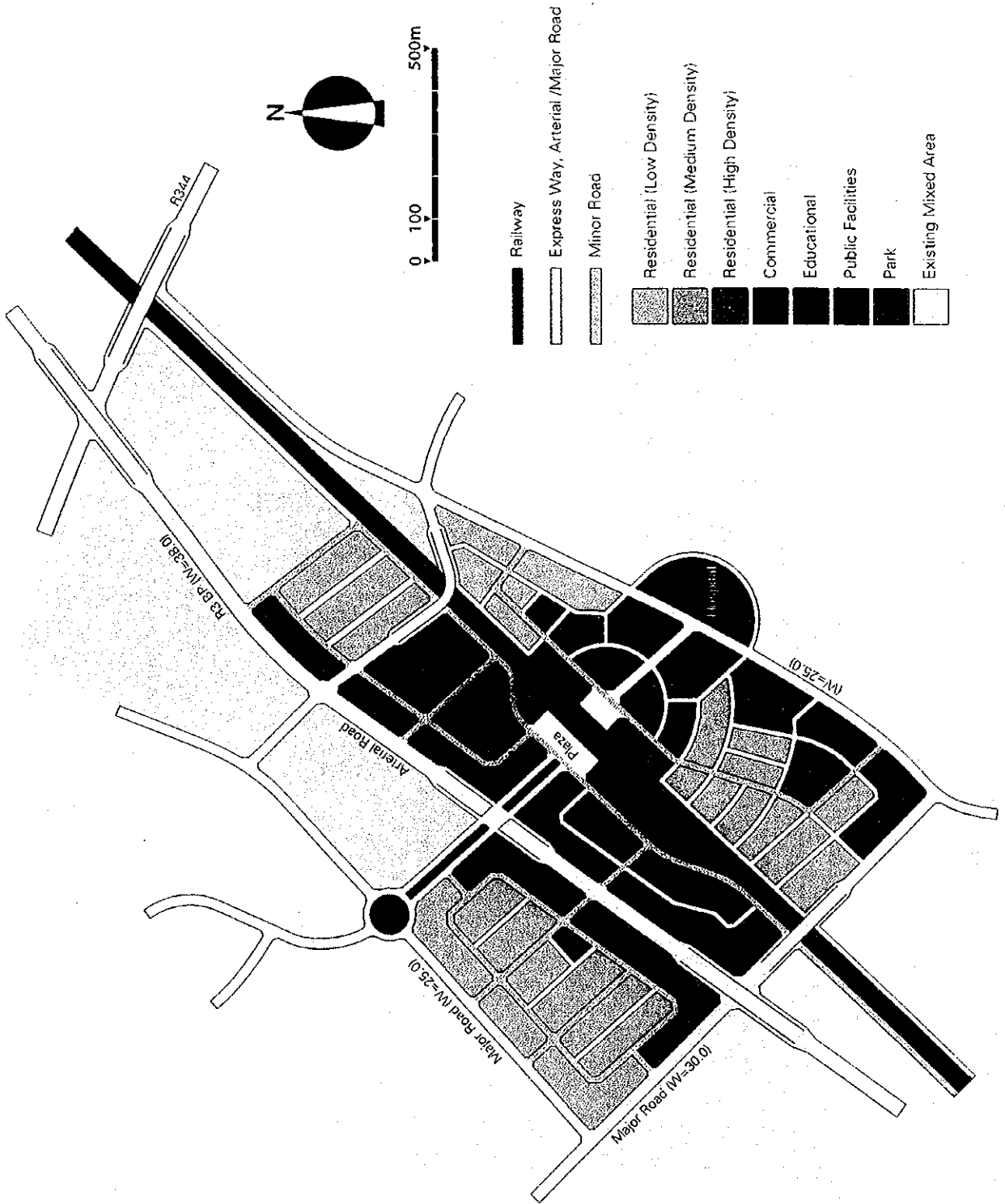


Fig. 3.5.32 Conceptual Land Use Development around Chon Buri Station



4 STUDY ON PROJECT IMPLEMENTATION OF URBAN AREA DEVELOPMENT AROUND RAIL STATION

4.1 Necessity and Purpose of Urban Area Development Project Around the Stations

The structural plan of Eastern Corridor within the 50 km radius area was defined in the preceding chapter. Furthermore, the concept plan of Rail Towns (Lat Krabang East and Lat Krabang West New Town) was proposed based on the structural plan, and then a conceptual development plan of the area around Lat Krabang East Station which was assumed to be a nodal point in the rail town, was designed.

In this chapter the Model Urban Area will be narrowed down to approximately 100 ha, and will be discussed further in detail.

The objectives of the planning process are summarized below:

- 1) Suggestion of planning measures for the Model Urban Area to ensure the successful implementation.
- 2) Creation of an urban core to induce Lat Krabang East New Town to the rail-oriented urban development.
- 3) Providing an appropriate set of urban infrastructures.

The implementation system suggested is that urban development should be executed through the application of the Land Readjustment (L/R) system. Accordingly, hereafter, the planning procedure of Model Urban Area shall be in line with the L/R system.

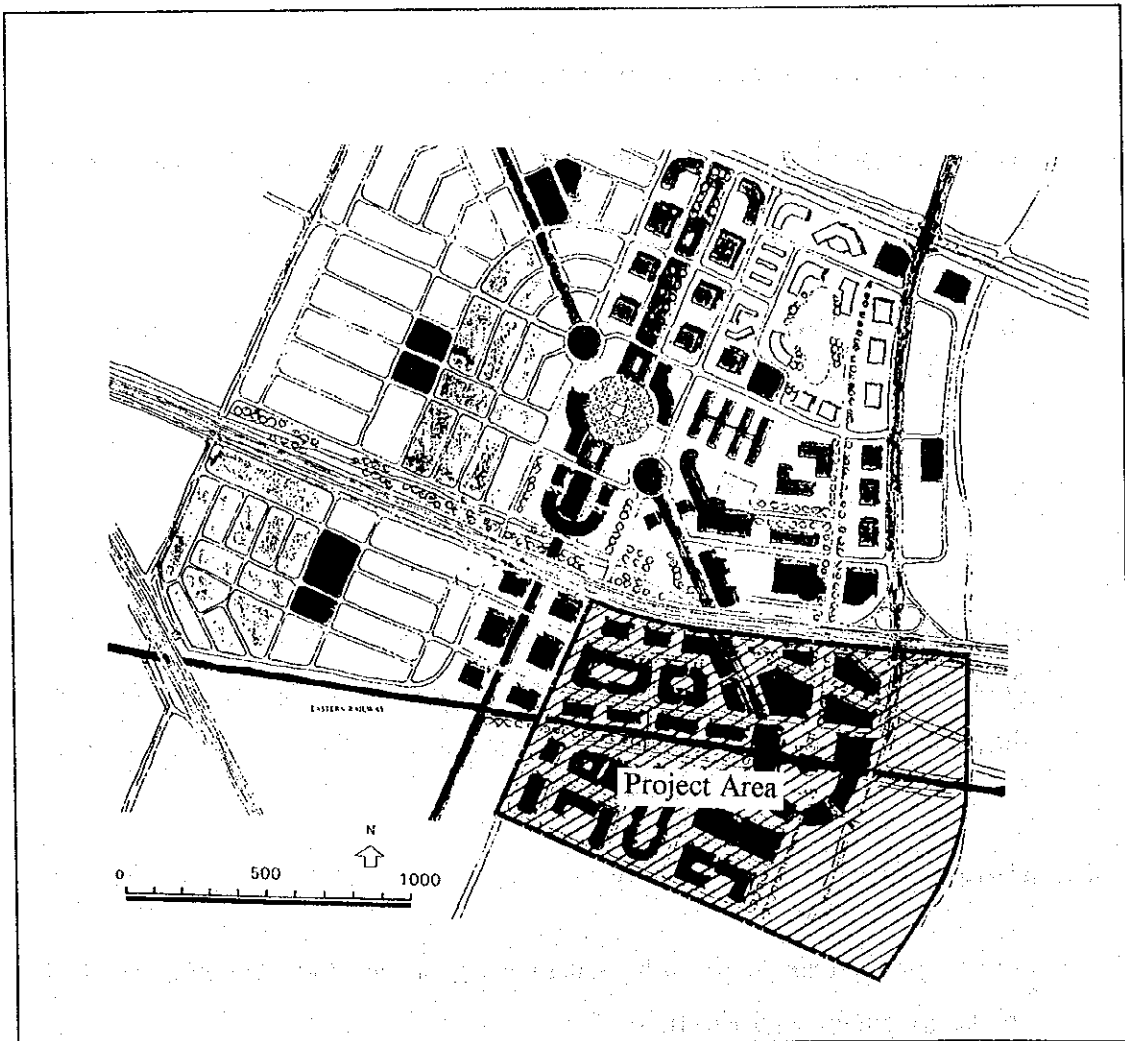
4.2 Selection of Project Site for Study

An area of approximately 100 ha is designated for the Model Urban Area. Following are the criteria for such selection:

- 1) Lat Krabang East Station has to be the nucleus in the project area in order to draw up an urban development plan integrated with the railway.
- 2) The project area is assumed to have high development potential.
- 3) The project area has to have an appropriate number of lots in order to avoid complicated coordination among landowners.
- 4) The future land use of the project area forms a unity as far as possible.
- 5) Infrastructure improvement should take precedence over other areas taking into account the tendency of urbanization in the surroundings.

The selected project area (120.9 ha) is shown in Fig. 4.2.1.

Fig. 4.2.1 Selection of Project Area



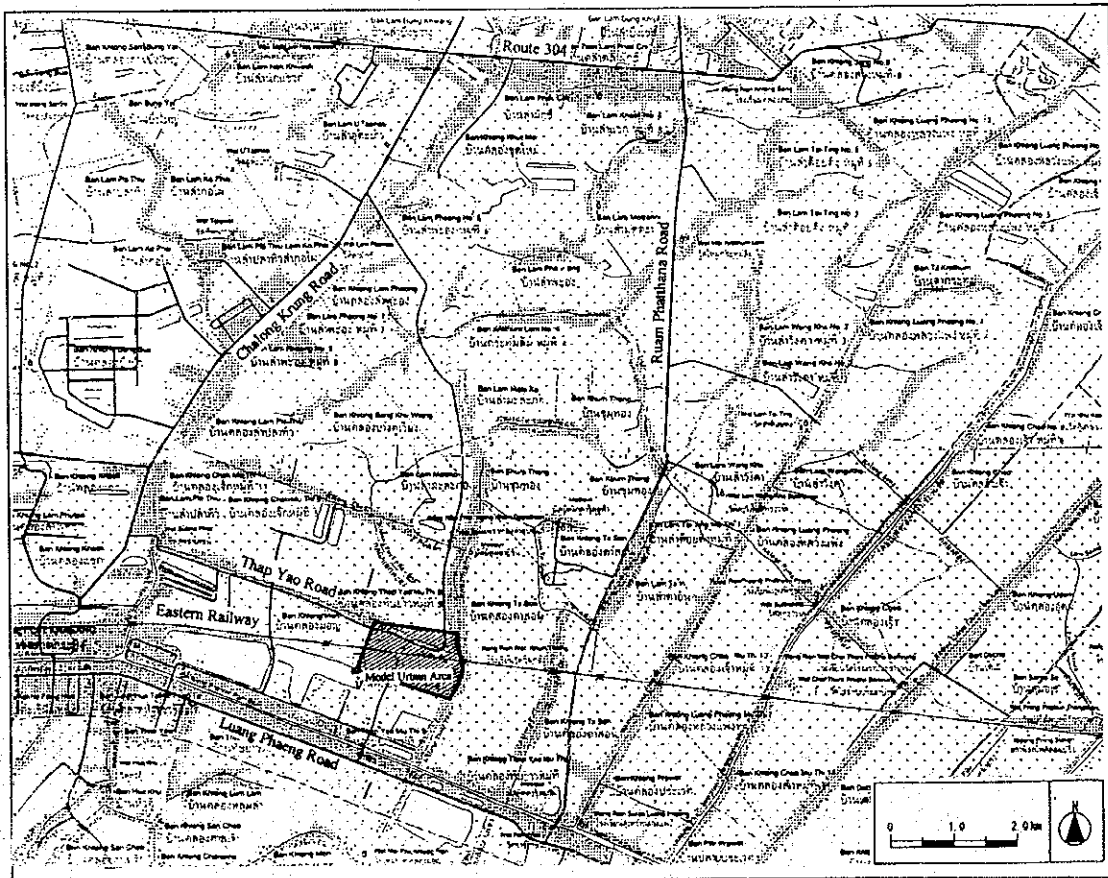
4.3 Urban Area Development/Implementation Plan through Application of Land Readjustment

4.3.1 Existing Situation in/around the Model Urban Area

4.3.1.1 Geography

The Model Urban Area belongs to Amphoe Lat Krabang and is situated in the Chao Phraya and Bang Pakong river basins. The ground elevation of Amphoe Lat Krabang was +0.5 m (MSL) in 1984, but the present ground elevation is lower due to subsidence caused by excessive groundwater extraction. Accordingly, the model urban area and its vicinity are subject to seasonal flood. The recorded inundation during the catastrophic flood of 1983 was +1.45 m (MSL) in the Amphoe Lat Krabang area. The location of the model urban area is shown in Fig. 4.3.1.

Fig. 4.3.1 Location of Model Urban Area



4.3.1.2 Population and Households

The Model Urban Area is located in Kwaeng (sub-district) Tab-Yao which belongs to Amphoe Lat Krabang. Amphoe Lat Krabang consists of six kwaengs and had a registered population of 81,432 in 1993. Population of the amphoe has grown very rapidly due to the forces of urban expansion from Bangkok Metropolis, especially Kwaeng Lat Krabang and Khlong Songtunnum in the west side of the amphoe area. Fig. 4.3.2 shows the Kwaengs' boundary and general information on Amphoe Lat Krabang. The registered population of respective kwaengs is shown in Table 4.3.1.

Fig. 4.3.2 Administrative Boundaries Amphoe Lat Krabang

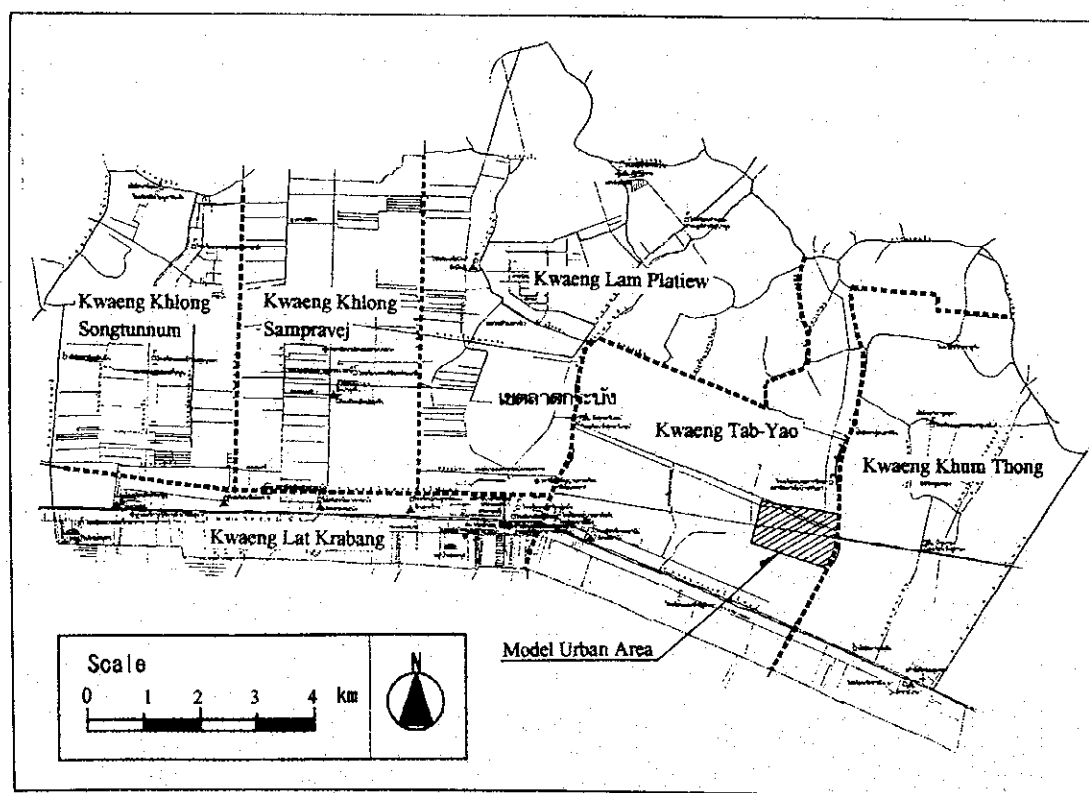


Table 4.3.1 Registered Population of Respective Kwaengs in Amphoe Lat Krabang

Kwaeng	Area (sq.km)	1985			1990			1993		
		Population	Density	Household	Population	Density	Household	Population	Density	Household
Lat Krabang	10.82	17,918	1,656	3,362	26,560	2,454	6,623	28,138	2,600	7,007
Khlong Songtunnum	14.30	4,051	283	575	13,731	960	3,521	21,706	1,518	5,467
Khlong Sampravej	17.46	2,851	163	485	3,674	210	934	4,836	277	1,770
Lam Platiew	33.75	5,606	166	802	8,333	247	2,232	10,492	311	2,924
Tab-Yao	25.83	7,438	288	1,024	8,953	347	2,046	11,068	428	2,496
Khum Thong	21.70	4,703	217	324	4,434	204	1,011	5,192	239	1,076
Total	123.86	42,567	344	6,572	65,685	530	16,367	81,432	657	20,740

source: NESDB

There are 28 households in the Model Urban Area. It is estimated that the Model Urban Area has an approximate population of 120, using the average household size of Kwaeng Tab-Yao in 1993.

4.3.1.3 Land Use

(1) General

Generally speaking, urbanization of the Bangkok fringe area commenced by forming a ribbon development pattern along highways or major roads. Area along Luang Phaeng Road in Kwaeng Lat Krabang has been urbanized in this way, and Kwaeng Khlong Songtunnum has already been developed even at same distance from major roads. However, urbanization has not yet reached Kwaeng Tab-Yao so that area is still dominated by rural characteristics and an abundance of water in multiple forms.

As for the existing land use in Kwaeng Tab-Yao where the Model Urban Area is located, urbanization has been beginning along Luang Phaeng Road and Khlong Pravet Buri Ram while the area on the north side of the khlong is still under agricultural use as paddy fields, fish ponds and open grass lands. Rural settlements are formed along most of the khlongs. Fig. 4.3.3 shows existing land use in the Model Urban Area and its vicinity.

Fig. 4.3.3 Existing Land Use in/around Project Area



(2) Buildings

In the project area, there are only 28 wooden houses and most of them are along khlongs.

(3) Existing Lot Size

Fig. 4.3.4 presents the recent cadastral map of the Model Urban Area. Lots by size are summarized in Table 4.3.2

Fig. 4.3.4 Cadastral Map



Table 4.3.2 Lots by Size

Lot Size (sq.m)	Number of Lot	Ratio (%)
Less than 1,000	12	13.0
1,000 - 5,000	14	15.2
5,000 - 10,000	36	39.1
10,000 - 20,000	16	17.4
20,000 - 40,000	9	9.8
More than 40,000	5	5.4
Total	92	100.0

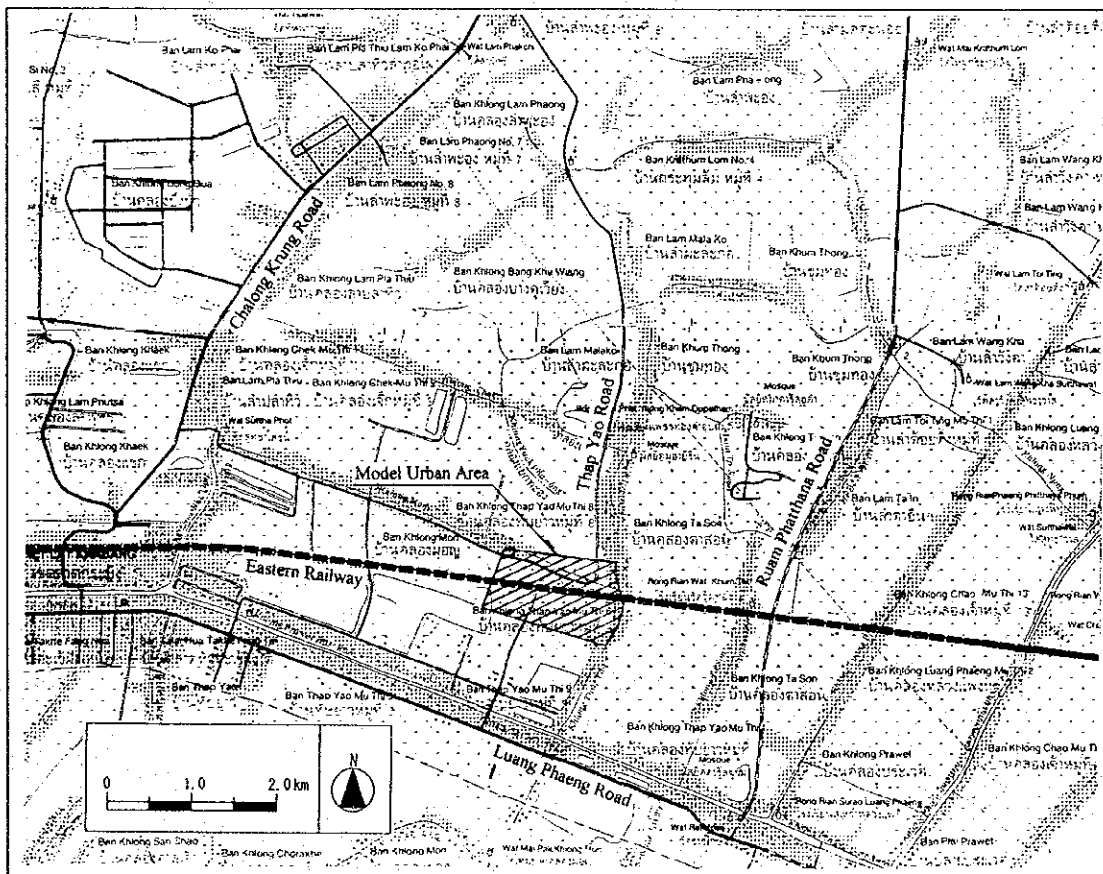
4.3.1.4 Transportation

At present, the Model Urban Area and its vicinity have remained rural in character. Farming villages are formed along khlongs, and the inhabitants are using khlongs for transport purposes such as going to and from agricultural land, access to major roads and railway stations, and so on.

The condition of the road network in Tab-Yao is far from adequate. There is only Luang Phaeng Road as a major road, which is barely paved and is easily damaged by seasonal flood.

In the Model Urban Area, there is Thap Yao Road (Liap Khlong Mon Road) that connects to major roads (Luang Phaeng Road and Chalong Krung Road). This road is single lane with a width of 5 to 6 meters, and is partially paved. Fig. 4.3.5 shows the existing transportation system of the Model Urban Area and its vicinity.

Fig. 4.3.5 Existing Transportation System



4.3.1.5 Drainage

The Rainwater in this rural area flows into khlongs which basically form a grid pattern. However, as mentioned in the preceding chapter, the drainage capacity of khlongs is limited. Accordingly, the Model Urban Area and its vicinity are severely affected by seasonal flooding. Existing khlongs are shown in Fig. 4.3.6.

4.3.1.6 Public Facilities

(1) Water Supply

So far MWA's water supply system has not extended to the Model Urban Area. The source of water for the inhabitants is currently groundwater from wells and khlongs.

(2) Sewerage

Septic tanks or leaching pits are utilized in this area. These systems are not performing satisfactorily due to unsuitable soil conditions and the high groundwater level.

(3) Electricity and Telephone

MEA and TOT are supplying electricity and telephone services to this area. At present, electric wires and telephone lines are installed along Thap Yao Road.

4.3.2 Site Evaluation

4.3.2.1 Identification of Elements to be Conserved

(1) Khlongs (Canals)

Two canals pass through the Model Urban Area. One is Khlong Mon and the other, Khlong Tap Yao. These canals should be protected from water pollution and improved to enhance their value, because they are useful for a flood prevention, transport use and environmental assets.

Fig. 4.3.6 Existing Khlongs in/around Model Urban Area



(2) Trees

Vegetation associated with rural settlements is formed along the canals. This is a natural resource, therefore, most trees should be conserved as much as possible.

4.3.2.2 Identification of Hazardous Elements

(1) Natural Disasters

Model Urban Area is affected by seasonal floods. It is necessary to take flood protection measures by providing sufficient structures and facilities. In addition, the area has experienced land subsidence due to excessive groundwater extraction. The progress of land subsidence causes the area to be more prone to the effects of flooding.

(2) Solid Waste

Large amount of trash is disposed in the waterways which connect to canals.

4.3.2.3 Identification of Lacking Elements

(1) Road Network

In the Model Urban Area, there is only one local road connecting to major roads. The condition of the local road is poor because of seasonal floods. Accessibility in the north-south direction is not efficient, there is no direct access to Luang Phaeng Road.

(2) Public Transport

This area is served by buses which are converted from trucks. However, there are a few buses and these depend on the size of rural settlement in and around this area.

(3) Water Supply

A treated water distribution system is lacking in this area. All households have their own groundwater supply from wells.

4.3.3 Development Issues

4.3.3.1 Railway Line

SRT's railway line is physically dividing the Model Urban Area into north and south. This is one of the reasons why the accessibility in the north-south direction is poor. Therefore, it is necessary to consider effective accessibility in this direction in order to develop the north and south sides of the railway line together.

4.3.3.2 Area Around Lat Krabang East Station (Proposed New Station)

Urban development of this area needs to be integrate with the new railway station. Traffic flow to and from the station has to be smooth, and a transport plaza should be planned in front of the station as facilities for the node between railway and road traffic. In addition, there is also a need for "park and ride" facilities near the station for the convenience of railway users.

4.3.3.3 Thap Yao Road

At present, this narrow road is the access to rural settlements formed along the khlongs. The area surrounding the proposed Lat Krabang East Station will be converted from agricultural land into a commercial/business area according to the land use of Rail Town Development Plan, and a new road network will be entirely built up. As a result, this road will vanish and be included in the new road network.

4.3.3.4 Settlement along Khlong Thap Yao

This typical farming settlement along the khlong should be converted for some other land use in order to make a better urban environments. If it were to be maintained for residential use, the environmental conditions of the khlong would get progressively worse turning into slums or dumping sites, as can be easily found in the built-up areas of Bangkok. In addition, trees along the khlong should be conserved as much as possible for parks or greenbelts.

4.3.3.5 Settlement along Khlong Mon

New Chachoengsao Expressway, which links the Chon Buri Highway at Lat Krabang to Route 304 on the western side of Chachoengsao, is proposed in the Master Plan and

Feasibility Study for the Area around SBIA. At present, it is just a recommendation so the route location is unclear. However, it has to be considered to make a plan for the Model Urban Area.

For this plan, it is assumed that the right-of-way will be allocated along Khlong Mon. Accordingly, the settlements along this khlong will be moved to another place.

4.3.4 Basic Framework

4.3.4.1 Basic Policies

The Model Urban Area is proposed around Lat Krabang East Station where the suburban express service will be provided as well as local train service.

In general, commercial/business facilities in suburban areas are generated spontaneously around this kind of station. At the beginning, it is important to take effective measures to prevent unsystematic or piecemeal urbanization in order to support progress as an attractive commercial/business area centering on the railway station.

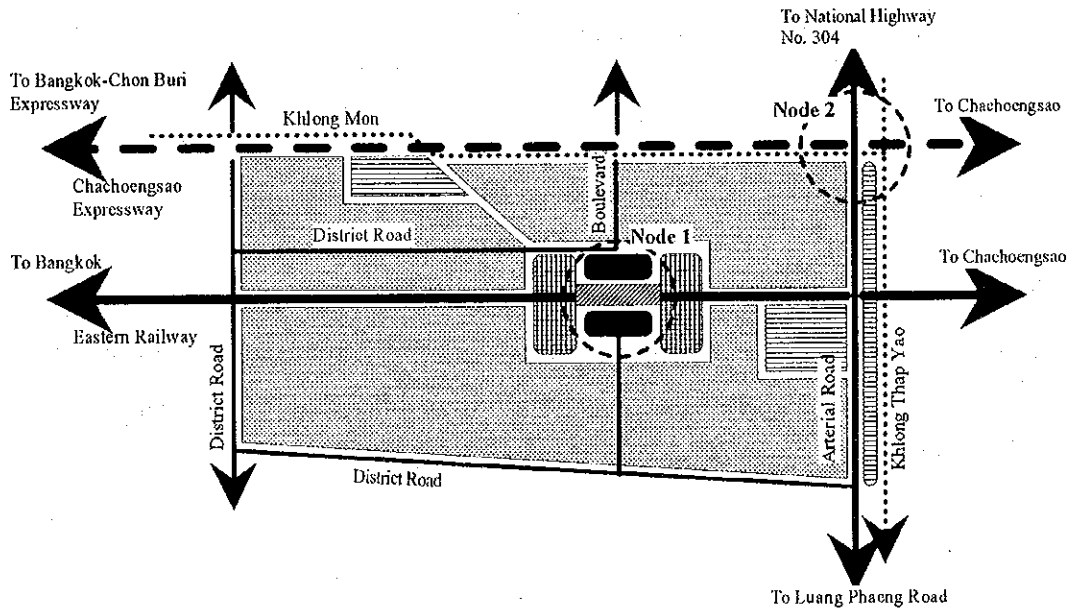
According to the preconditions mentioned in a preceding chapter, the basic policies of city planning and development for 120.9 ha of the Model Urban Area are summarized below.

- 1) Creation of New Town Center Integrated with Railway Station
- 2) Connection Development between North and South Side of Railway
- 3) Creation of Efficient/Functional Urban Structure
- 4) Inducement of Systematic Urbanization for Area around Model Urban Area

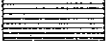




4.3.4.2 General Structure

To create a new town center in accordance with above-mentioned policies, the general structure of the Model Urban Area is shown in Fig. 4.3.7 and described below.

Fig. 4.3.7 General Structure of Model Urban Area



LEGEND

	Public Use		Station Building
	Commercial		Station Plaza
	Commercial/Business Use		

(1) Development Components

The Model Urban Area is physically divided into two areas by the railway line. The north side of the railway line should be characterized by a modern commercial area centering around the station building, while the south side should be characterized by commercial/business area related to the SBIA. The two areas are connected by pedestrian overpasses in station building.

The area along Khlong Thap Yao should be developed for public use such as park, greenbelt, parking for "park and ride", retention pond, and so on.

(2) Development Structure

The crossing points between railway line, expressway, roads and pedestrian ways are transportation nodes where people approach from different directions. The major nodes of the Modern Urban Area are described as follows:

1) Node 1

Node 1 is the most important point as the main gateway to Lat Krabang East New Town and transferring to/from trains so that this place will become the largest gathering point. Multifunctional station building, station plaza and modern commercial buildings should be built, taking the landscape and accessibility into consideration.

2) Node 2

Chachoengsao Expressway connecting the Bangkok - Chon Buri Highway and Chachoengsao is proposed along the north side of Model Urban Area. In the Lat Krabang East New Town, the whole section of its main roads should be planned as elevated to avoid the segregation of urban functions. Node 2 is where the arterial road crosses the Chachoengsao Expressway. Access to/from Chachoengsao Expressway shall be provided at this location.

3) Zoning for Land Use Plan

a) Around Lat Krabang East Station

This zone will become the largest gathering point, so that land use will be composed mainly of commercial buildings integrated with the station building and station plaza.

b) Area on the South Side of Railway Line

The south side of the railway line is deemed to be influenced by the activities of SBIA more than the north side; therefore, this area will be planned for a mixture of office and commercial buildings having some relation with SBIA.

c) Area on the North Side of Railway Line

This zone is mainly influenced by the activities of Lat Krabang East New Town so the land use will be planned for a mixture of office and commercial buildings which will serve the residential, educational, and public area in Lat Krabang East New Town.

d) Area along Khlong Thap Yao

This zone is formed along Khlong Thap Yao and the arterial road, and it is suitable for public facilities such as parking, greenbelt, park, retention pond and so on.

(3) Transport Plan

The transport system in the Model Urban Area is subject to the existing and proposed future road network in its surroundings. It is important to pay special attention to Lat Krabang East Station and Chachoengsao Expressway in order to make the transport plan of the Model Urban Area.

A hierarchical road network is proposed, with the following components :

1) Arterial Road

This road is designed to be a main service road for each district as well as

connecting the districts together in Lat Krabang East New Town with the direct access to such primary arterial roads as Ruam Phatthana Road, Luang Phaeng Road, Suwinthawong Road (Route 304) and proposed Chachoengsao Expressway.

2) Boulevard

A boulevard is designed as the main access road connecting to the station plaza, and will be the main street of the Model Urban Area. Accordingly, its landscaping should be carefully designed with the aim of making it an amenity for both drivers and pedestrians.

3) District Road

This road is designed to be a main service road in the Model Urban Area, and distributes traffic from the arterial road to major/minor distribution roads.

4) Major Distribution Road and Minor Distribution Road

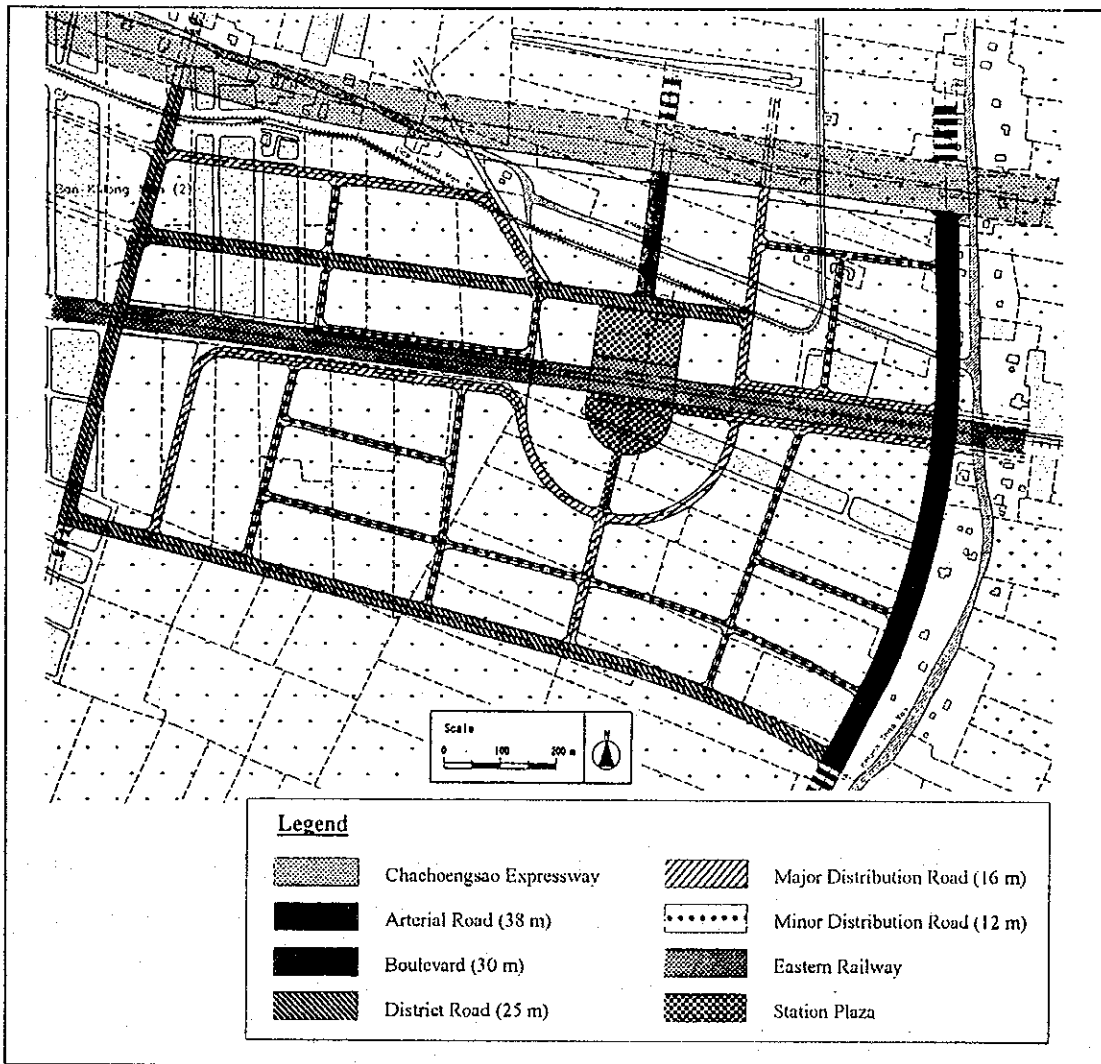
These roads distribute traffic from arterial/district road to each block in the Model Urban Area.

5) Access Road

This road distributes traffic from major/minor distribution road to each block. However, this road shall not be planned in this study because it is prepared for access within super block.

Fig. 4.3.8 is showing the transport system of Model Urban Area.

Fig. 4.3.8 Transport System



(4) Pedestrian Network

Vehicle traffic and pedestrian flow should be segregated as much as possible so as to prevent traffic accidents and improve environmental conditions for pedestrians.

The pedestrian network shall be composed of sidewalks, greenbelt along the klong and railway, and an exclusive pedestrian way. The exclusive pedestrian way is provided from the station plaza to the educational/public area adjacent to the Model Urban Area, catering to the amenity, convenience and safety of pedestrians.

(5) Parks and Greenbelts

Proposed standards in the Bangkok General Plan is as follows :

- Local recreational park (playground etc.)
2.0 sq.m/person
- Parks, stadiums and other recreational areas (district park, sports park, etc.)
4.1 sq.m/person

According to this standard, 122 ha of parks, green area and recreational area will be provided in Lat Krabang East New Town (200,000 people \times 6.1 sq.m = 1,220,000 sq.m).

As for the Model Urban Area, not less than 3.6 ha of the above should be allocated in proportion to its area. The park and green system is planned to have the following : :

1) District Park

This park is to provide a place of recreation and relaxation for workers and shoppers in the Model Urban Area, and shall be planned with a rainwater retention pond.

2) Exclusive Pedestrian Way

Exclusive pedestrian way will have a sufficient space and landscaped design with plants, for pedestrians.

3) Greenbelt

Greenbelts shall be developed along the klong.

(6) Flood Protection System

The following measures are applied to the Model Urban Area.

1) Land Filling

The whole of Lat Krabang East New Town is considered to be suitable for a

coordinated polder system because of the large size of development. However, the Model Urban Area is proposed for commercial development as an urban core of the New Town, and the area is relatively small. In addition, it is not assumed that the development of the polder system is made prior to the Model Urban Area. Therefore, land filling is an applicable measure for flood protection. At present, the ground elevation of Model Urban Area is around +0.5 m (MSL). According to the recorded inundation in Lat Krabang, the area should be filled up to a ground elevation of +1.5 m (MSL).

2) Rainwater Retention Pond

Urban development causes an increase of runoff discharge due to the decrease of natural rainfall retention function. The retention pond is planned to regulate the runoff discharged from the drainage area. Thus, through the retention pond, the increased runoff discharge caused by urban development is regulated to the condition before development. Two rainwater retention ponds should be allocated near the Khlong Thap Yao and Khlong Mon.

(7) Water Supply

The Metropolitan Waterworks Authority (MWA) is responsible for the supply and distribution of water in the Model Urban Area. The water supply system of MWA has not reached the Model Urban Area. However, Lat Krabang pumping station is planned to be completed in 1997. The pumping station will have sufficient capacity to cater to the demand of its service area including SBIA and relevant development.

In order to provide a water supply system for the Model Urban Area, it is assumed that transmission and main distribution from the new pumping station to Lat Krabang East New Town will be authorized and will be constructed in parallel with the Model Urban Area.

(8) Sewerage System

Building developers must provide a sewerage treatment plant in accordance with the BMA standard regarding waste water disposal when constructing buildings. A

community sewerage system will be the responsibility of developers under present regulations.

Treated water will be discharged to the Khlong Thap Yao through drainage pipes and the rainwater retention pond.

(9) Electricity and Telecommunication

Electricity and telecommunication services are provided by the MEA and TOT.

4.3.5 Land Readjustment (L/R) Design

4.3.5.1 Lot/Block Design

The lot/block design determines the appropriate size, shape and location of lots and blocks encompassed by roads, in consideration of land use, space design, image of urban environment, building development, replotting, road network, etc. The determination of lot/block design will be a factor affecting the urban environment and social life style in future. This is also related to the amount of public land and contribution ratio, which is one of the determinants of project feasibility.

(1) Framework for Lot/Block Design

- Allocation of appropriate block size according to the size of existing lots.
- Introduction of super block system around railway station so as to accommodate densely concentrated commercial/business activities.

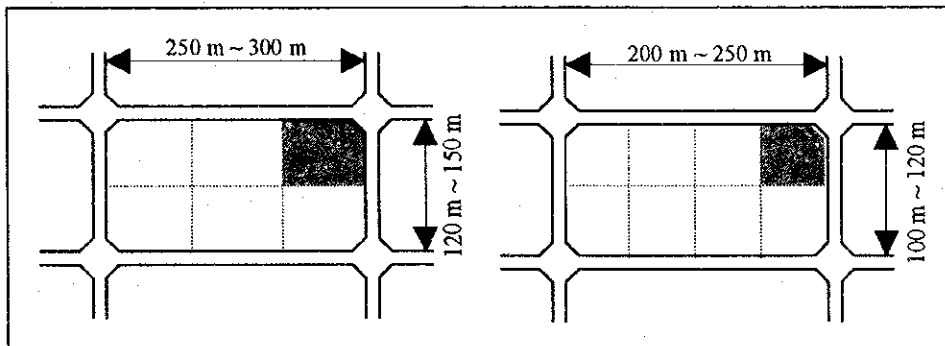
(2) Basic Units of Lots

The basic units of lots are assumed to be about 3,000 sq.m and 6,000 sq.m according to the size of existing lots. These figures are also set up, taking into consideration the future urban activities such as commercial/business land use.

(3) Basic Units of Block

The basic units of block of which is based on the above-mentioned assumption, are shown in Fig. 4.3.9. The super blocks are allocated to owners whose existing land sizes are too large to replot to the basic units of block.

Fig. 4.3.9 Basic Units



4.3.5.2 Road Design

(1) Road Alignment

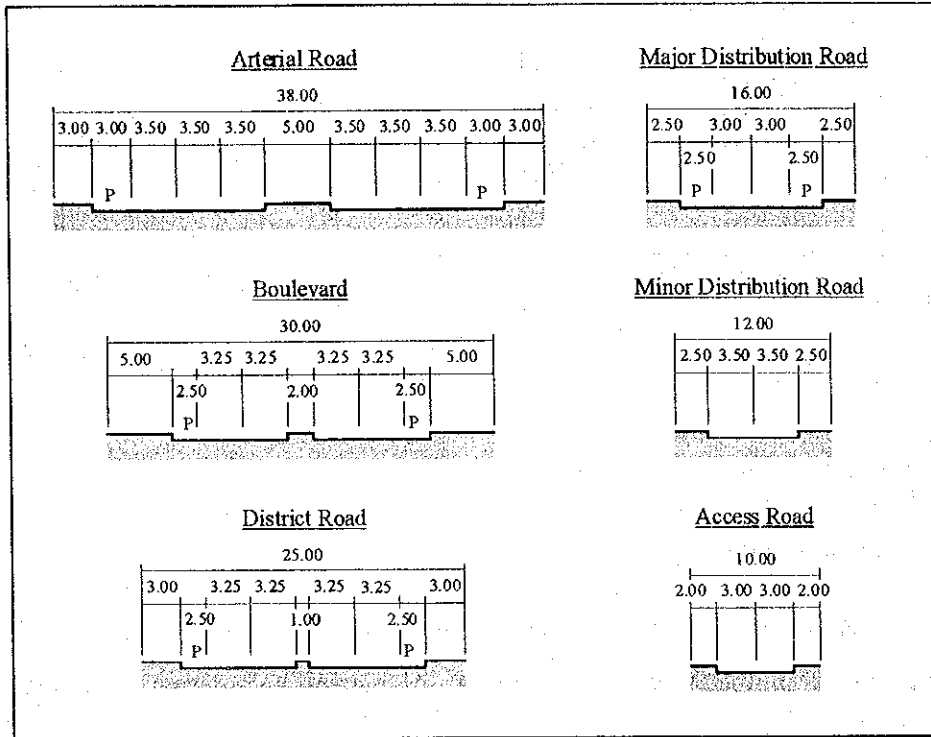
In order to realize safe and smooth traffic, the hierarchical road network system is introduced in the Model Urban Area. Alignment and design of roads should be elaborated on the following points :

- Integration of the north and south side areas which are physically divided by the railway.
- Introduction of sufficient width of roads to cater to the traffic demand which is caused by commercial/business activities.
- Connection to the railway station and Chachoengsao Expressway.
- Providing appropriate shape of block.

(2) Cross Section of Road

Cross section of hierarchical roads are designed to satisfy the requirement of the DTCP standard, and shown in Fig. 4.3.10

Fig. 4.3.10 Cross Section of Roads



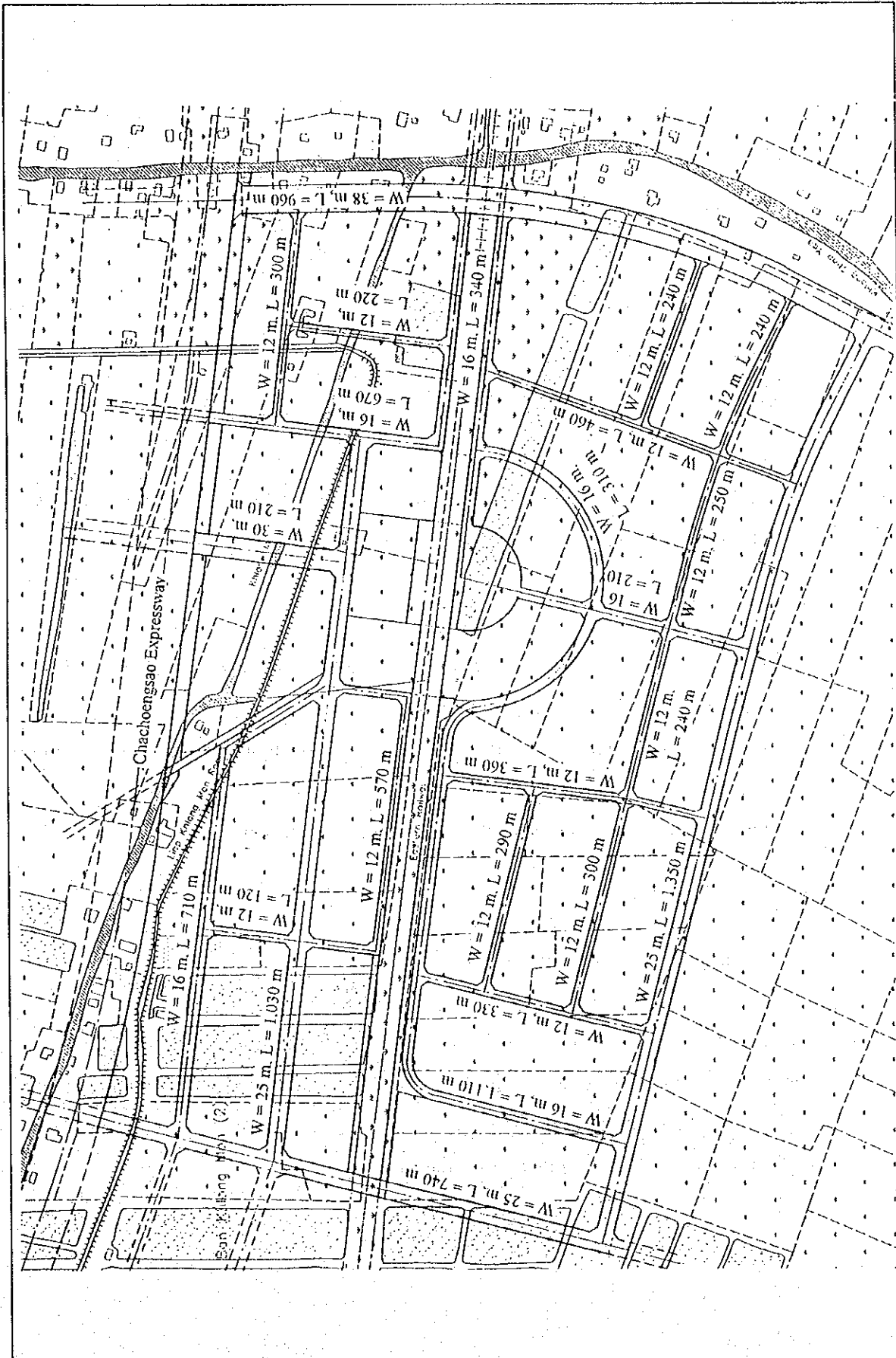
(3) Road Network Plan

The proposed Road Network Plan is shown in Fig. 4.3.11 and summarized in Table 4.3.3.

Table 4.3.3 Summary of Road Plan

Name of Road	Width (m)	Length (m)	No. of Bridge
Arterial Road	38	960	2
Boulevard	30	210	1
District Road	25	3,120	0
Major Distribution Road	16	3,350	1
Minor Distribution Road	12	3,920	0
Access Road	10	0	0
Total	-	11,560	4

Fig. 4.3.11 Road Network Plan



4.3.5.3 Station Plaza Design

(1) Functions

Station Plaza is one of the most important facilities as a transportation node in the urban area, and is an indispensable facility to further the utilization of such public transport as trains and buses. The major functions of the station plaza are as follows:

1) Transport Function

- Efficient traffic control for transfer between rail transport as a mass transit and road transport.
- Prevention of traffic snarl among such users of commercial/business facilities around the station plaza as shoppers, workers, and others.

2) Environmental Function

- Gateway to urban centers, from which people will probably form an initial impression about the urban characteristics.
- Resting space where people can relax during shopping and also use as a waiting place.
- Open space which induces a favorable commercial/business environment.

3) Disaster Prevention

- Open space for evacuation in case of disaster.

The station plaza not only has a function as a transportation node, but also other functions as mentioned above. The scale needed is calculated by estimating future railway and station plaza users. However, it should be planned to be large enough in consideration of the various functions of the station plaza.

(2) Area Needed by the Station Plaza

1) Daily Railway Users

The number of daily railway users at Lat Krabang East Station is 17,500 person/day as estimated in a later chapter dealing with demand forecast for the railway.

2) Daily Station Plaza Users

Lat Krabang East Station is defined as a major railway station on the suburban line and the area around the station will advance the development as an intensive commercial/business district. It is assumed that the ratio of the number of station plaza users to railway users is 2.5 : 1, based on reference materials in Japan. In addition, it is also assumed that 70 percent will use the North Station Plaza and the remainder will use the South Station Plaza according to the land use and road network in the area served by the station.

North Station Plaza Users: $17,500 \times 2.5 \times 0.7 = 30,625$ person/day

South Station Plaza Users: $17,500 \times 2.5 \times 0.3 = 13,125$ person/day

3) Needed Scale

Based on the above-mentioned number of users, the needed scales are calculated, and the results are shown in Table 4.3.4

Table 4.3.4 Needed Scale of Station Plaza

		North Station Plaza	South Station Plaza
Buses	No. of Berth (boarding)	3	2
	No. of Berth (getting off)	1	1
	Total	4	3
	Area for Buses	335 sq.m	234 sq.m
Taxies	No. of Berth (boarding)	2	2
	No. of Berth (getting out)	1	1
	Total	3	3
	Parking Capacity for Taxies	20	9
	Area for Taxies	672 sq.m	335 sq.m
Private Cars	No. of Berth	1	1
	Parking Capacity for Private Cars	2	1
	Area for Cars	80 sq.m	50 sq.m
Area for Roadway, Walkway, etc.		3,634 sq.m	1,561 sq.m
Total (Needed Area)		4,721 sq.m	2,180 sq.m

(3) Framework for Station Plaza Design

Both the North and South Station Plazas will be principal station plazas as gateways to Lat Krabang East New Town, so they should have sufficient area to enhance its following functions :

- Exclusion of through traffic.
- Simplification of traffic control at the intersection connecting to Boulevard/District Road.
- Inducement to the formation of an intensive commercial/business district centering on the station plaza.
- Allocation of effective traffic flow to public transport, taking priority over private cars.
- Creation of harmonious landscape with connecting roads.

(4) Flow Diagram

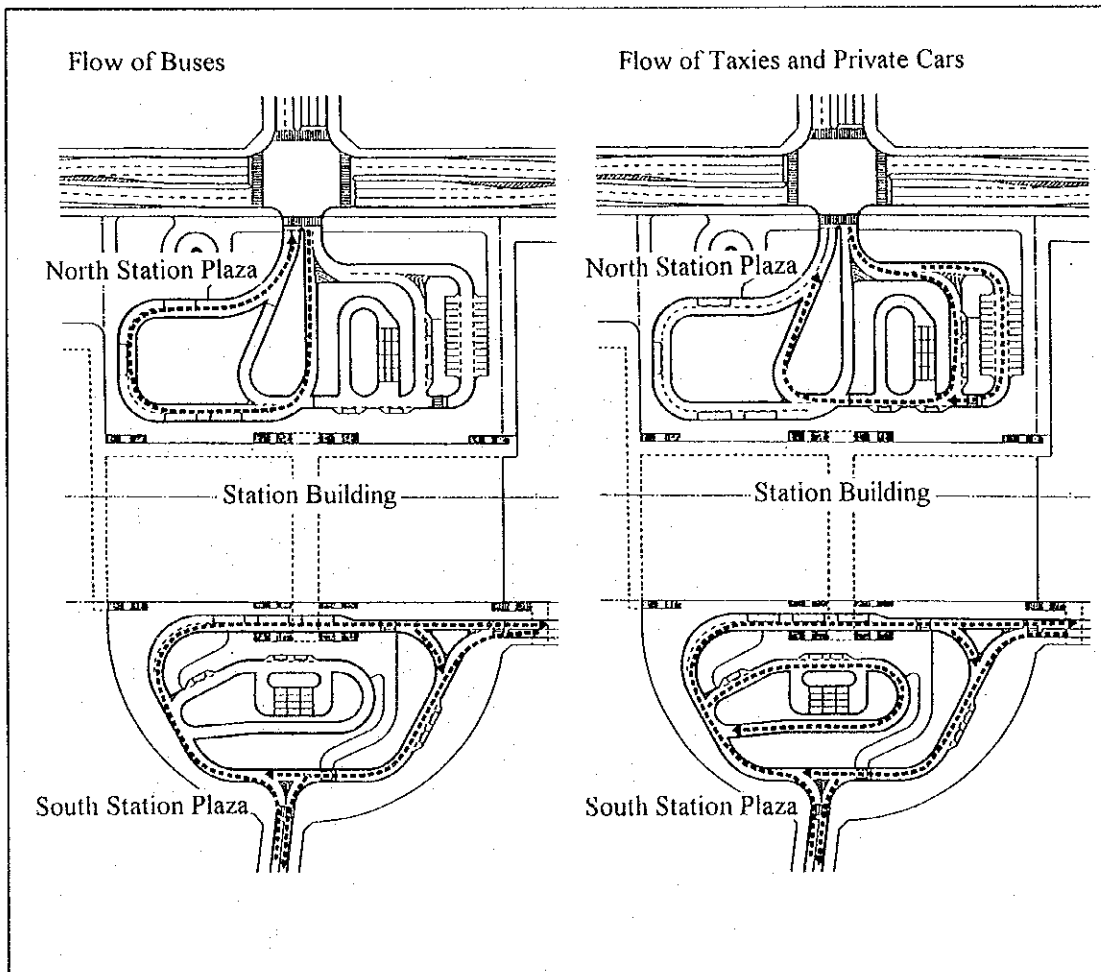
1) North Station Plaza

- The flow of buses is segregated from the flow of taxis and private cars.
- Crossing the roadway by pedestrians is minimized as much as possible.
- An area for Samlor and Silor serving both boarding and parking is allocated apart from taxis.

2) South Station Plaza

- A rotary type of station plaza is selected to treat the traffic flow from two roads.
- Berths for taxis are not allocated along main road of rotary to smooth the traffic flow.

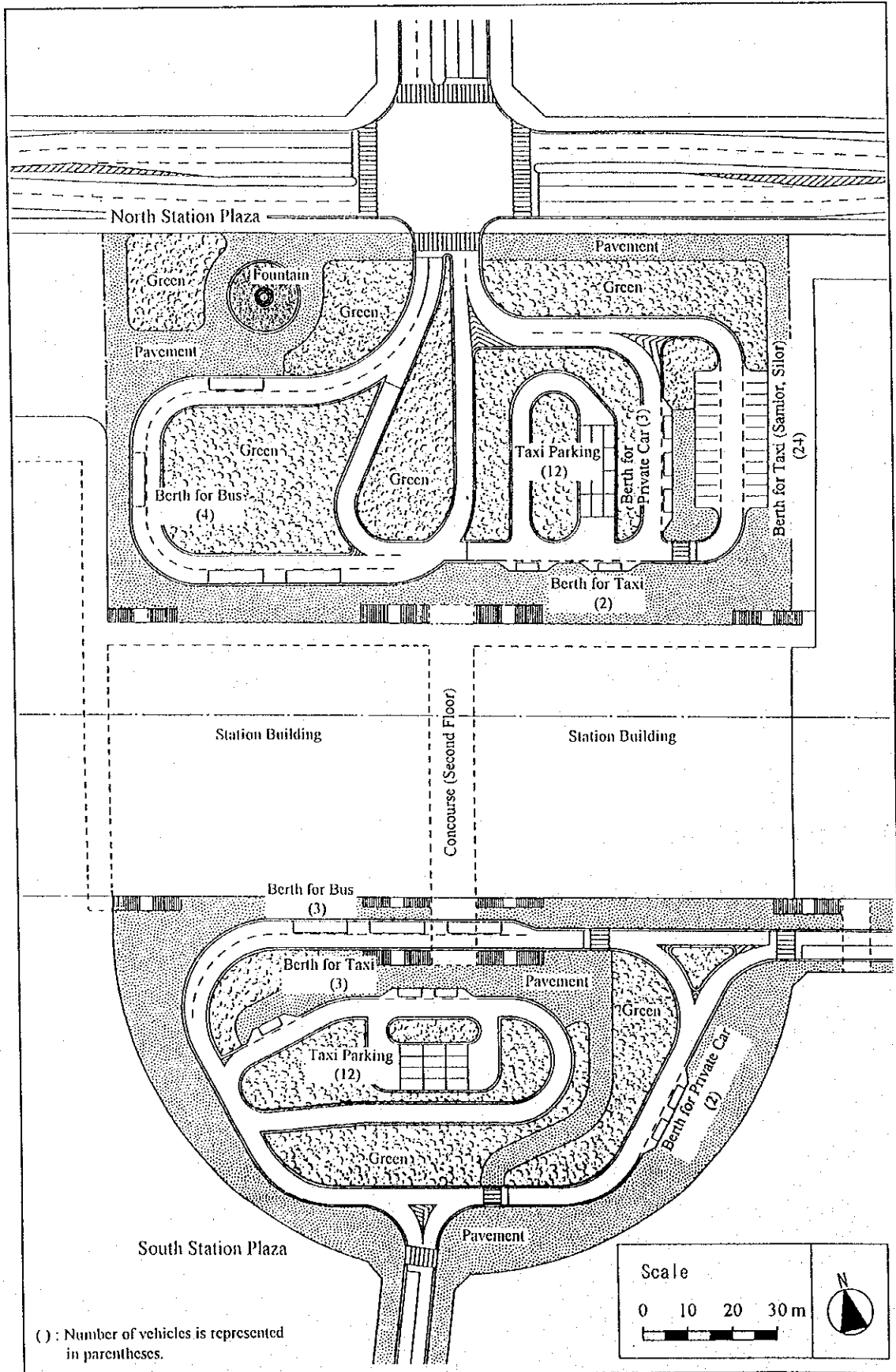
Fig. 4.3.12 Flow Diagram in Station Plaza



(5) Station Plaza Plan

Fig. 4.3.13 shows the station plaza plan.

Fig. 4.3.13 Station Plaza Plan



4.3.5.4 Drainage and Flood Protection System

(1) Outline of Drainage and Flood Protection System

1) Landfill

The Model Urban Area shall be reclaimed up to the ground elevation of +1.5 m (MSL) from the present elevation of around +0.5 m, in order to prevent inundation during seasonal floods.

2) Khlongs

- Khlong Mon

This khlong shall be improved in consideration of land use plan, block design and landscape as well as increase of cross section.

- Khlong Thap Yao

This Khlong forms the eastern boundary of the Model Urban Area, and the right-of-way is excluded from the Model Urban Area. Consequently, it should be conserved in its present condition. However, the area stretching between the arterial road and khlong will be designed as an amenity space with vegetation, for the public.

3) Drainage

Rainwater of the Model Urban Area shall be collected by pipes laid under the roads and led to the rainwater retention pond by gravity, and then finally discharged to Khlong Thap Yao by pumping.

4) Rainwater Retention Pond

The rainwater retention pond will be planned near Khlong Thap Yao in order to minimize the increase of flood in the surroundings owing to the development of the Model Urban Area. It has to be landscaped in order to blend into the urban environment.

(2) Hydrological Calculation

1) Rainfall Intensity

The adopted design rainfall intensity based on the Master Plan of Flood Protection / Drainage Project in Eastern Suburban Bangkok by JICA in 1985, for this kind of urban development is as follows :

- Drainage System
2 year's return period: $i = 5,690/(t+37)$
- Retention Pond
5 year's return period $i = 7,600/(t+40)$

where i = rainfall intensity for 2 or 5 year's return period (mm/hr)
 t = time of concentration (min.)

2) Runoff Coefficient

The runoff coefficient is as follows :

Condition of Land Use	Runoff Coefficient	Remark
Before Development	0.6 ~ 0.7	dominated by more than 70 % of forests/fields
After Development	0.9	dominated by more than 40 % of impermeable surface

Source: Design Standard for Sewerage Facilities by Japan Sewerage Works Association

3) Drainage Design

a) Time of Concentration

The time of concentration is the sum of overland flow time (t_o) and drain flow time (t_d). The average overland flow time is 7 minutes in this kind of urban development, while the drain flow time is calculated from the following equation :

$$\text{Drain Flow Time } (t_d) = L/V \text{ (min.)}$$

where L = length of drain (m)

V = average velocity in drain (m/sec.)

b) Peak Discharge

The peak discharge flowing to pipes is estimated by using the formula of Rational Method.

$$Q = 1/360 \cdot C \cdot i \cdot A$$

where Q = peak discharge of T years' return period (m^3/sec)

i = rainfall intensity for a duration equal to the time of concentration,
and a T years' return period (mm/hr)

A = catchment area (ha)

C = runoff coefficient

c) Drainage System

The drainage system of the Model Urban Area is determined by using the above-mentioned measures.

4) Rainwater Retention Pond Design

a) Formula for Estimation of Required Retention Volume

The adopted formula (quoted from Design Standard for Retention Storage by Japan Sewerage Works Association) is:

$$V_i = (r_i - r_c/2) \cdot 60 \cdot t_i \cdot C \cdot A \cdot 1/360$$

where V_i = required retention volume (m^3)

r_i = rainfall intensity at time t_i (mm/hr)

r_c = rainfall intensity which meets to the allowable discharge quantity
(mm/hr)

A = catchment area (ha)

C = runoff coefficient

In the above formula, the maximized V_i at t_i is to be required for the retention volume, and the allowable discharge quantity is estimated from the formula of Rational Method using the runoff coefficient of before development.

b) Required Retention Volume

The conditions for estimation and results of required retention volume according to the above-mentioned formula are summarized in Table 4.3.5.

Table 4.3.5 Retention Volume

Conditions	
Catchment Area (ha)	120.9
Allowable Discharge (m ³ /sec)	16.6
Runoff Coefficient	0.9
Rainfall Intensity (mm/hr)	7,600/(t+40)
Results	
rc (mm/hr)	54.9
t (min.)	92
Vmax (m ³)	96,100

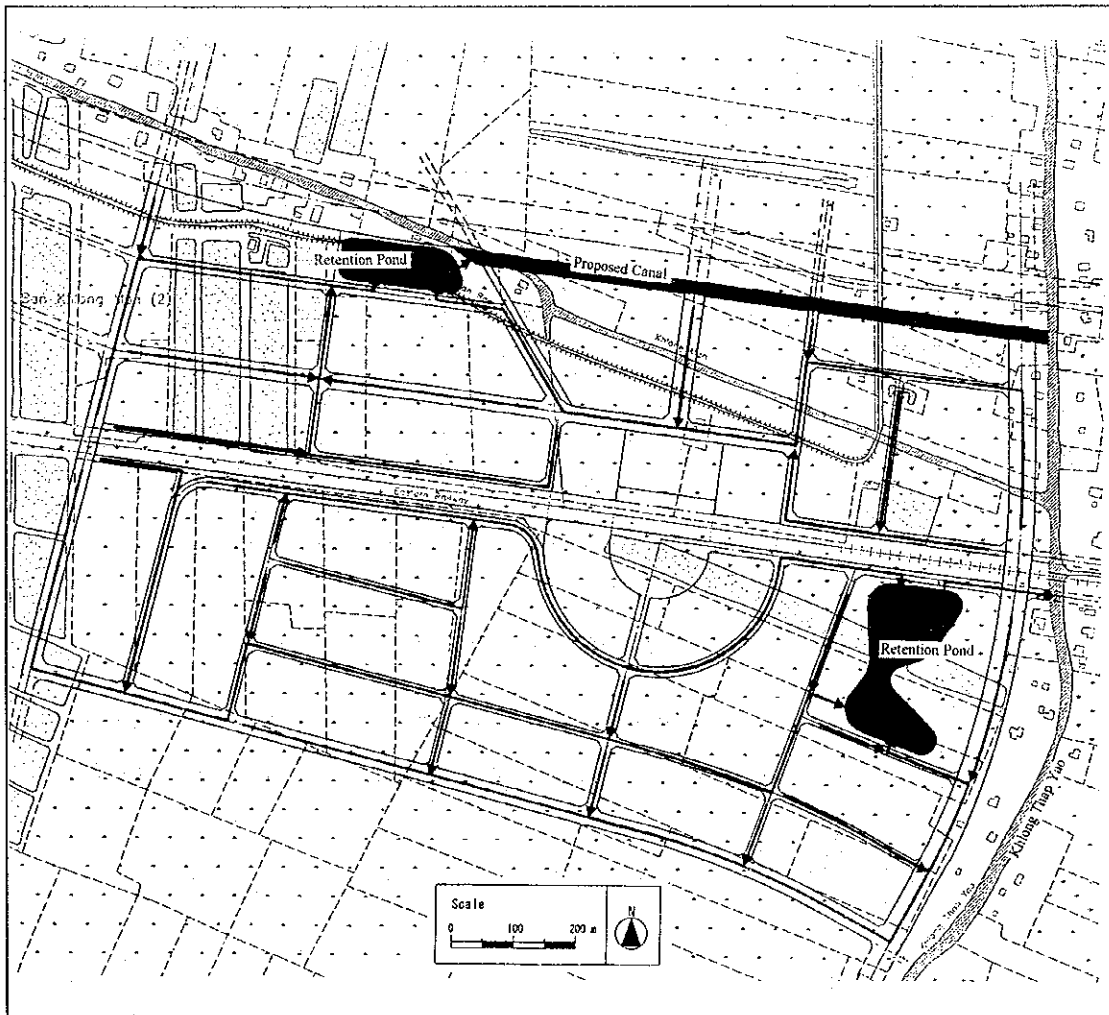
(3) Design of Drainage System

Fig. 4.3.14 shows the design of drainage system in the Model Urban Area, and Table 4.3.6 gives the length of drainage pipeline to be constructed.

Table 4.3.6 Summary of Drainage Pipeline

Drainage Pipe	Length
Dia. 400 - 600	2,740 m
Dia. 800 - 1,000	5,200 m
Dia. 1,200 - 1,800	3,600 m

Fig. 4.3.14 Drainage System



4.3.5.5 Water Supply

According to the basic framework adopted in the study, it is assumed that MWA's main distribution is constructed along the arterial road in time for the completion of the Model Urban Area. It is planned that the water supply to the Model Urban Area is from the MWA's main distribution.

Water demand of the area where land use is planned for commercial/business purpose, is to be 1.5 m³/day/rai corresponding to the forecast in the studies for the area around SBIA. Building developers will provide a water tank for water distribution in buildings or blocks, so that the water supply pipeline for Model Urban Area is designed based on daily maximum water demand.

A fire-hydrant will be installed at every road intersection for fire-fighting.

The water supply pipeline network can be estimated according to the above-mentioned preconditions, and the construction work in the project area is summarized in Table 4.3.7.

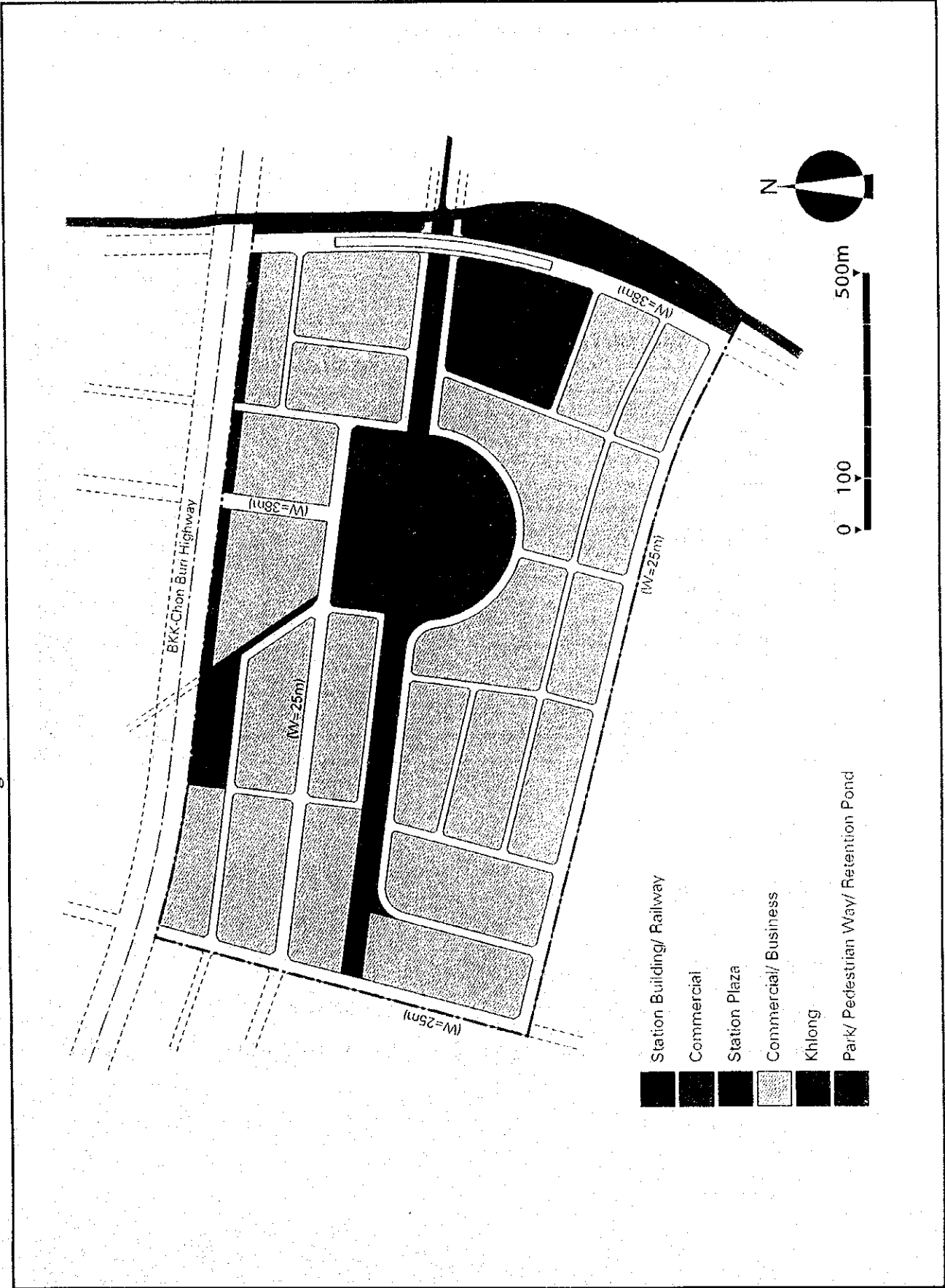
Table 4.3.7 Summary of Water Supply Pipeline

Distribution Line	Length
Dia 100 - 150	17,800 m
Dia 200	500 m
Fire-hydrant	47 unit

4.3.5.6 Summary of Land Readjustment (L/R) Design

L/R design map has been prepared and is shown in Fig. 4.3.15. the comparison of land use for the Model Urban Area before and after the project is shown in Table 4.3.8

Fig. 4.3.15 L/R Design Map



In this table, the areas for station plaza and station building are excluded from public land, because it is assumed that those areas will be purchased by a quasi-independent corporation assumed with the SRT, before the project implementation.

Table 4.3.8 Land Use Comparison

Category			Before Project		After Project	
			Area (sq.m)	Ratio (%)	Area (sq.m)	Ratio (%)
Public Land	Road	Arterial Road	0	0.00	35,010	2.90
		Boulevard	0	0.00	6,350	0.53
		District Road	0	0.00	77,150	6.38
		Major Distribution Rd.	0	0.00	53,710	4.44
		Minor Distribution Rd.	0	0.00	47,380	3.92
		Access Road	11,200	0.93	0	0.00
		Sub Total	11,200	0.93	219,600	18.16
	Railway	59,200	4.90	59,200	4.90	
	Canal	19,200	1.59	15,600	1.29	
	District Park	0	0.00	75,400	6.24	
	Pedestrian Way	0	0.00	13,450	1.11	
	Greenbelt	0	0.00	38,500	3.18	
	Total of Public Land	89,600	7.41	421,750	34.88	
	Private Land	Residential		0.00		0.00
Commercial			0.00	787,250	65.12	
Private Road			0.00		0.00	
Government			0.00		0.00	
Agriculture		1,119,400	92.59		0.00	
Unused Land			0.00		0.00	
Others			0.00		0.00	
Total of Private Land		1,119,400	92.59	787,250	65.12	
Grand Total			1,209,000	100.00	1,209,000	100.00

4.3.5.7 Public Land Ratio

Public land ratio is shown as follows:

Public land ratio before the project = 89,600 m² (7.41 %)

Public land ratio after the project = 421,750 m² (34.88 %)

Contribution ratio for public use = $((421,750 - 89,600) / 1,119,400) \times 100 = 29.67 \%$

4.3.5.8 Comparison of Urban Environments Before and After Land Readjustment

Table 4.3.9 shows the comparison of urban environments before and after L/R.

Table 4.3.9 Comparison of Urban Environments Before and After Land Readjustment

Elements to be Conserved	
Khlongs	Khlong Mon is allocated along Chachoengsao Expressway, and to be a buffer zone. Right bank of Khlong Thap Yao forms a greenbelt along arterial road.
Trees	They are utilized and improved for vegetation of greenbelts and park.
Hazardous Elements	
Natural Disaster	Rainwater retention pond and landfill secure against flood
Solid Wastes	They are collected by responsible agency
Lacking Elements	
Road Network	A new road network is to be developed, and north-south accessibility is improved.
Public Transport	Utility of railway is improved by station plaza, and new road network induces the advancement of public transport network.
Water Supply	MWA's water supply system covers the area.

4.3.5.9 Project Cost

Project cost is estimated at 1,319,380,000 Baht, including the project's compensation cost, infrastructure development costs, survey and design fees, and operation costs as shown in Table 4.3.10

The total project cost includes total construction costs and total interest due on loans. However, interest charges are calculated for project length and various revenue sources. Actual total project cost shall be calculated in the preparation of the Financial Plan which shall be proposed in the latter stage of this study.

Table 4.3.10 Summary of Project Cost

Item	Amount (thousand baht)	Remark
1. Compensation Cost	28,700	Refer to Table 3.3.11
2. Infrastructure Development Cost	1,023,430	Refer to Table 3.3.12
3. Survey and Design Fee	147,300	14 % of item (1.+2.)
4. Operation Cost	119,950	10 % of item (1.+2.+3.)
Subtotal	1,319,380	
5. Repayment of Interest		To be estimated by financial plan
Total Project Cost		

Table 4.3.11 Compensation Cost

Work Item	Unit	Unit Price	Quantity	Amount (baht)
1. Demolition of Wooden Building	m2	180	4,200	756,000
2. Temporary Move Program	unit	34,500	28	966,000
3. Reconstruction of Wooden Building	m2	5,800	4,200	24,360,000
Total				26,082,000
Physical Contingency (10 % of Total)				2,608,200
Grand Total				28,690,200

Table 4.3.12 Infrastructure Development Cost

Work Item	Unit	Unit Price	Quantity	Amount (baht)
1. Land Filling Work	m3	400	964,000	385,600,000
2. Road Work				
Arterial Road (W= 38m)	m	28,400	960	27,264,000
Boulevard (W= 30m)	m	22,400	210	4,704,000
District Road (W= 25m)	m	18,000	3,120	56,160,000
Major Distribution Road (W= 16m)	m	11,400	3,350	38,190,000
Minor Distribution Road (W= 12m)	m	8,000	3,920	31,360,000
Elevated Road (crossing railway)	Ls		1	80,500,000
Bridge Works	m2	23,000	1,980	45,540,000
3. Station Plaza Work	m2	-	-	-
4. Park and Green Work				
Exclusive Pedestrian Way	m2	600	13,500	8,100,000
Greenbelt Improvement	m2	250	38,500	9,625,000
Gardening of Public Park	m2	600	34,700	20,820,000
6. Rainwater Retention Pond Work	Ls		1	88,470,000
5. Drainage Work				
Khlone (Khlone Mon)	m	36,800	890	32,752,000
Drainage Pipe (dia. 400 - 600)	m	2,700	2,740	7,398,000
Drainage Pipe (dia. 800 - 1,000)	m	4,900	5,200	25,480,000
Drainage Pipe (dia. 1,200 - 1,800)	m	6,700	3,600	24,120,000
7. Water Supply Work				
Pipeline (dia. 100 - 150)	m	1,800	17,800	32,040,000
Pipeline (dia. 200)	m	4,100	500	2,050,000
Valves and Fire-hydrant	Ls		1	10,215,450
Total				930,388,450
Physical Contingency (10 % of Total)				93,038,845
Grand Total				1,023,427,295
Grand total / 1,209,000 m2 =		847	baht/m2	

4.3.5.10 Financial Plan

(1) Forecast of Land Prices and Increase Rate

According to the "National Urban Development Policy Framework" by NESDB, the relationship between land prices (1990) and distance from the center of Bangkok is shown in the following equation. (Fig. 4.3.16)

$$V_x = e^{-0.06x + 16.6}$$

where x : distance from center of Bangkok (km)

V_x : land price at a point x (million baht/rai)

Use of the improved railway will cut down travel time by half compared to the road use. Accordingly, it is supposed that the average land price after railway improvement around Lat Krabang East Station becomes equal to the average land price at a point halfway between the center of Bangkok and the Model Urban Area. Therefore, the increased rate around Lat Krabang East Station can be estimated at 3.31. The average land price before the project is approximately 1,500 baht/m² in accordance with actual data of land transaction.

However, the above-mentioned equation expresses only a tendency of average land prices by distance from the CBD. The actual land prices vary at the same distance, as Fig. 4.3.16 shows. It is deemed that the difference in land prices are caused by land use, condition of infrastructure, and other factors. The other regressive line showing the highest land price by distance is shown in Fig. 4.3.16. Those land prices are supposed to represent the price of land in the urban center or commercial center located in/around Bangkok.

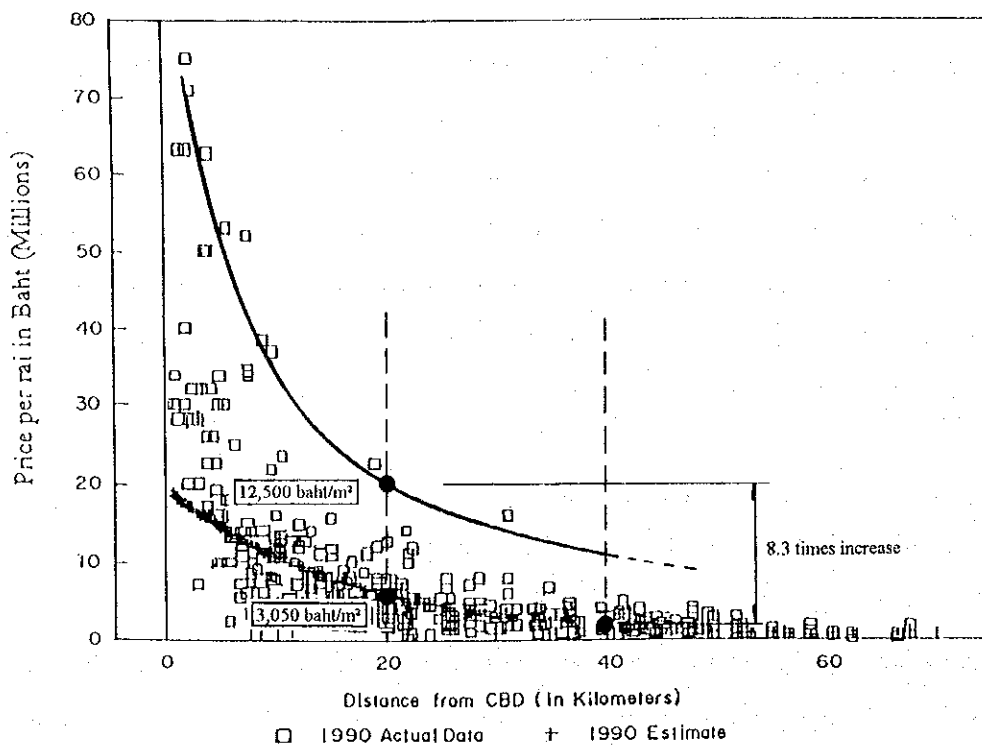
After the development, the 500 m radius area of Lat Krabang East Station, which is the Model Urban Area, is characterized as follows :

- Model Urban Area shall be the center of new town the population of which is 200,000.

- Agricultural land shall convert into highly improved commercial/business area.
- The area shall have a prominent convenience because of its proximity to the railway station.

It is presumed that the land price in the Model Urban Area is to increase to 12,500 baht/m² which is the present land price of the local urban center located 20 km away from the center of Bangkok, because of railway improvement and characteristics of development.

Fig. 4.3.16 Land Price as a Function of Distance



(2) Contribution Rate and Reserved Land Area

The proposed area for reserved land (M) is estimated as follows :

$$M = (1,319,380,000) \times 1.08^* \div 12,500 = 114,000 \text{ m}^2$$

* : Repayment of interest on loan is estimated at 8 % of the whole project cost.

Table 4.3.13 shows the contribution rate, while Table 4.3.14 presents the proposed served land area and prices.

Table 4.3.13 Contribution Rate

Private Land before Project	Private Land after Project		Contribution Land Area		Contribution Rate		
	Private Land included Reserve Land	Private Land excluded Reserve Land	Contribution Area for Public Use	Added up Public and Reserve Land	Contribution Rate for Public	Contribution Rate for Reserve Land	Aggregated Contribution Rate
A (m ²)	B (m ²)	C (m ²)	D=A - B (m ²)	E= A - C (m ²)	F= D/A*100 (%)	G= M/A*100 (%)	H= E/A*100 (%)
1,119,400	787,250	673,250	332,150	446,150	29.67	10.18	39.86

Table 4.3.14 Proposed Reserved Land

Total Land Price before Project	Land Price before Project	Total Land Price after Project	Increased Land Price (Total)	Land Price after Project (Unit)	Maximum Land Area for Reserved	Reserved Land Area	Ratio
I= A*a (million baht)	a (baht)	J=B*b (million baht)	K= J-I (million baht)	b (baht)	L= K/b (m ²)	M (m ²)	N= M/L*100 (%)
1,679.10	1,500	9,840.63	8,161.53	12,500	652,922	114,000	17.46

5. INTEGRATED URBAN AND RAILWAY DEVELOPMENT IMPLEMENTATION SYSTEM

5.1 The Scope and Policy of IURD Development and Implementation System

5.1.1 Defined Scope

5.1.1.1 Urban and Suburban Lines

The implementation system will be developed in the light of the necessity and purpose as specified in the master plan (section 1). It is designed to establish a favorable cycle of supply and demand of rail transport (urban development supported by railway, railway development supported by urban development) and a circulation of funds for cost recovery and reinvestment for railway improvement.

To attain these objectives, the areas of integrated urban and railway development are specified in the suburban areas which are defined within the range between 30 km and 50 km radius from the center of Bangkok.

Item 1. Value capture dependent on the types of rail line

The international and regional trunk lines are due to spread the development effects and benefit all over the regions and country, not limited to cities and towns along the railway. The benefits would be assumed to be great although they spread all over the regions. It seems difficult to identify the amount of the benefits to individuals, as well as the specific beneficiaries. In this regard, value is to be captured through more broadly and generally applicable measures such as those of the traditional taxation like property tax, income tax, etc. Urban development would make less sense for value capturing in the case of the trunk line of railway.

In contrast the suburban lines are due to yield a great amount of benefits in specific areas because of the great increase of land value boosted by urbanization along the lines. It is also stated that the beneficiaries and the amount of benefits are likely to be

easily identified in the service areas of the suburban lines. It is advisable that the principle of cost-sharing by beneficiaries be applied to those who can enjoy the high benefits accruing from the suburban line development. Urban development can be very instrumental for value capturing.

Item 2. Rail transport demand

For increasing the transport demand of the trunk lines, the regional development efforts over the broader areas along the railway are more essential than urban development. The improvement of the eastern line and northern line of the SRT are in line with the government's regional development policies toward the Eastern Seaboard and the Upper Central Region, respectively.

The proposed urban developments in the limited areas, such as the regional business district and the regional urban service centers along the trunk lines in the extended BMR provinces, seem to be less effective for increasing the regional traffic passenger and freight demand of the trunk lines. In contrast, voluminous passenger demands are very likely to be generated by the improved suburban lines because they tend to be accompanied by massive urban and housing developments.

The discussions on Items 1 and 2 indicate that the integrated urban and railway development aiming value capturing and increasing transport demand should target the suburban areas of Bangkok.

It must also be noted that equally important are urban developments along the sections of improved suburban lines in the central district, which offer great chances for fulfilling these purposes. Unfortunately, though they are excluded from the scope of work of this study.

5.1.1.2 Legal Aspects

It is not uncommon that legal implementation systems of railway development/improvement and, city planning and development are respectively

established and developed by different agencies of the government with the view to achieve the goals and missions tasked by them. It is certain that their tasks are broader than the scope of the integrated urban and railway development.

In the course of achieving their own tasks, there are occasions necessitating coordination between them mainly for their own or mutual benefits. Based on the discussions between the parties, agreement on issues as to how to harmonize and smoothly implement the railway development and urban development will be made. The agreement may be converted into either act, ministerial decree or instruction, provincial ordinance, or simply an undertaking between them.

The ideas on integrated urban and railway development in this study seem to go beyond these bureaucratic concerns, appealing on one side to the railway development and operation to give more attention to urban/suburban railway operation for improving the serious urban transport conditions, and the other side to city planning and development to give due attention to railway improvement. The advantages of the improved suburban lines as well as urban development supported by them have been repeatedly shown in the preceding sections. This is the most important message of this study.

However, it must be also stressed that the railway development whether heavy or light and city planning and development of Thailand would never be limited to the integrated urban and railway development. Therefore, the implementation systems of railway development/improvement further expanding the rail network and operation including the intra-urban, suburban, inter-urban, region and national trunk lines, and the city planning and development responding to the urbanization globally taking place in Bangkok should be respectively established before elaborating the legal system of the integrated urban and railway development.

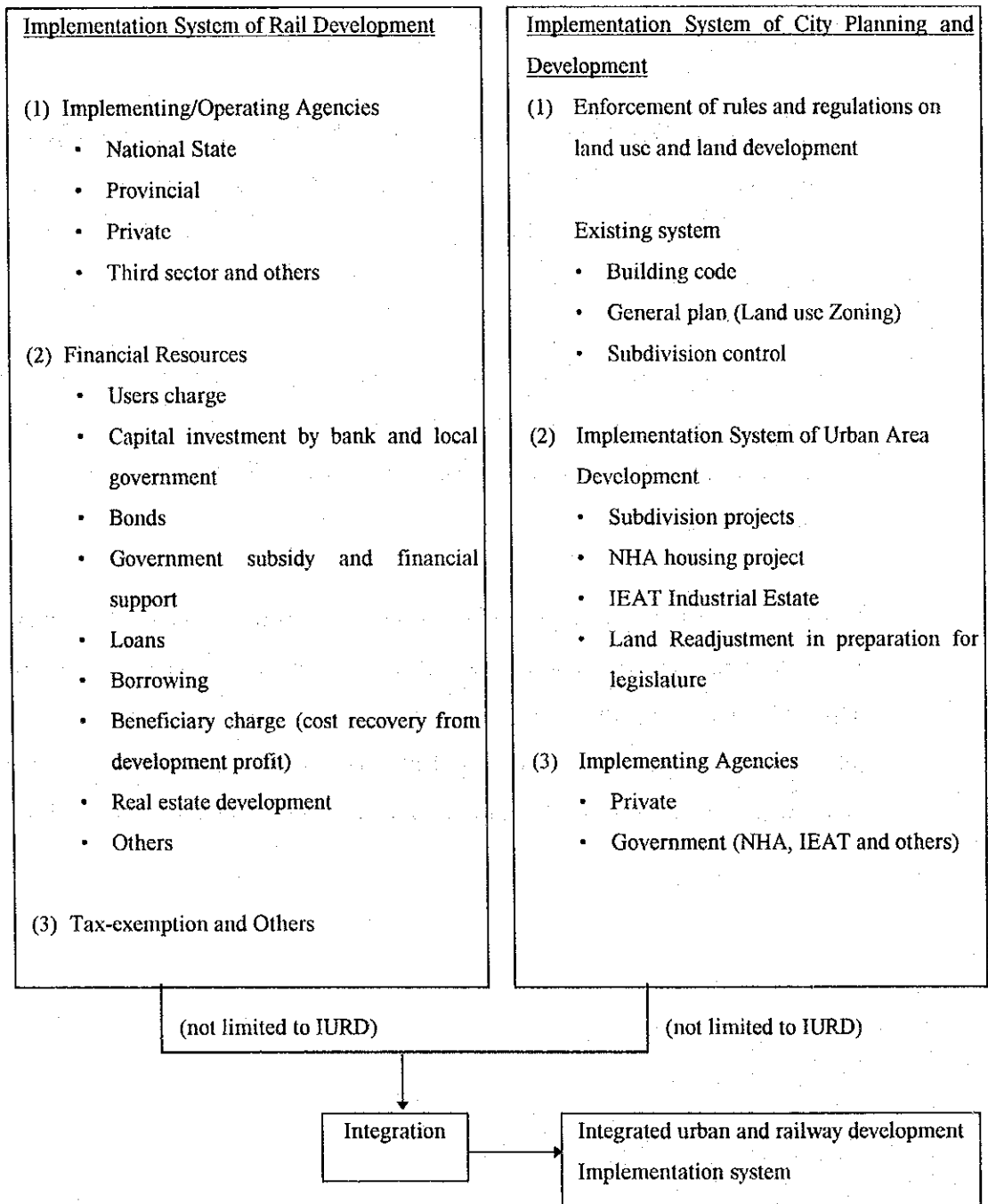
The best expected system of the integrated urban and railway development should be a combination of the independently established railway development system and city planning/ development system designed to achieve their goals in maximum scale. This is shown in the diagrammatic figure of Fig. 5.1.1.

Each of the systems should be established something like those shown below.

- 1) Thai Railway Development Implementation System, especially institutionalizing the revenue resources through cost recovery such as those of taxation on the beneficiaries, contribution from the benefited developers and land owners, and the like must be set up.
- 2) Thai City Planning and Development Implementation System, especially institutionalizing urban development projects such as those of land readjustment, and enforcement of strict rules and regulations on land use and land development must be set forth.

However, this JICA study regrets that it is not in a position to generally recommend the future desirable implementation system of railway and city planning and development of Thailand, which should be combined to develop into the implementation system of the integrated urban and railway development. The scope of the study is limited to the areas which are concerned with both of them, as shown in Fig. 5.1.1 and below.

Fig. 5.1.1 Combination of Railway and Urban Development Implementation System

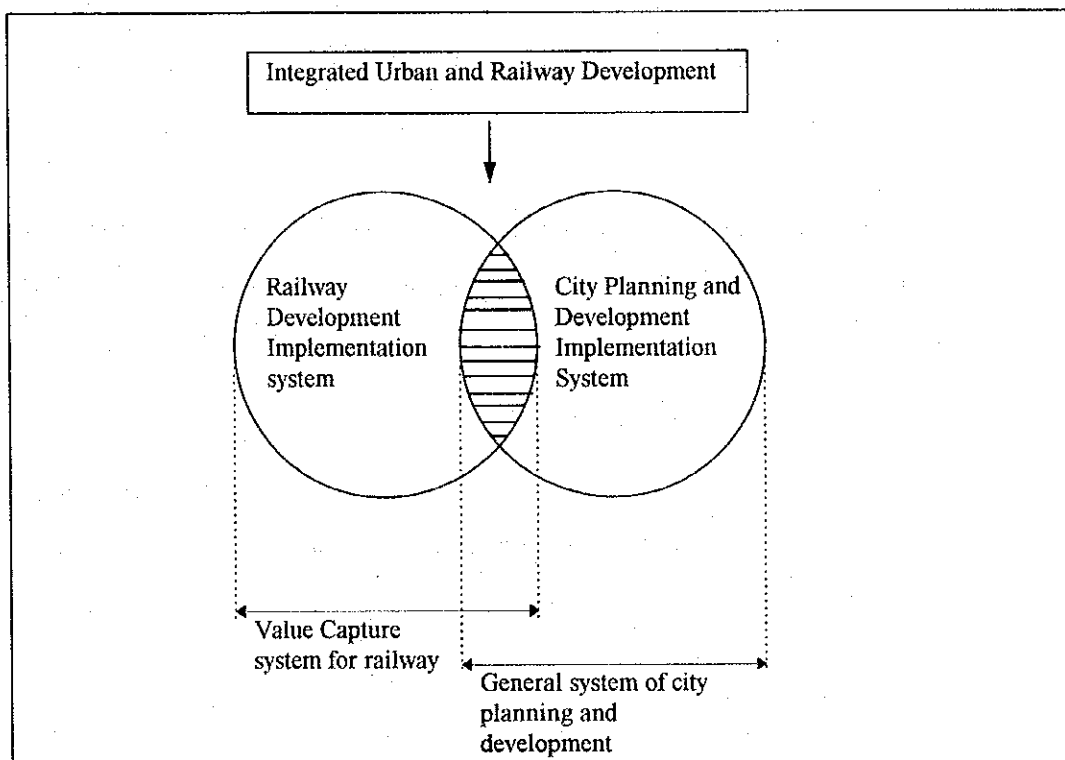


For instance, the value capturing system has a wider spectrum ranging from the fare collection, taxation system, etc., In this volume of the study report, only the value capturing system through urban development is discussed. Some urban development systems regarding the IURD system will also be proposed. But these are not made

from the global viewpoint of development of Thai City planning to generally be applied to all the urban areas of Thailand.

The defined scope of the integrated urban and railway development in this study leads to the basic policy described in the following section.

Fig. 5.1.2 The Areas Concerned with Integrated Urban and Railway Development



5.1.2 Basic Policy of Implementation System Proposal

As shown in the other studies recently carried out, great improvements in Thai City planning and development system, especially enforcement of land use rules and regulations, as well as the implementation systems such as land readjustment, new town development system and others have been called for. This JICA study does not intend to propose any implementation system for improving the Thai city planning system, but only those needed in such distinct areas as urban development along the railways.

The basic policies for working out the IURD development and implementation system are set forth below.

5.1.2.1 General Application, Not Limited to IURD Area

Those systems which are unique and possible only in IURD area would not be proposed. Rather, those which are generally applicable in Thailand should be applied in this area. The urbanization and urban development system in IURD area would not be so very different from those in other areas. Even if the unique system seems more effective, it may face difficulties in acquiring consensus and support among the people. It also threatened to bring confusion and complexity to the Thai city planning and development system.

To cite examples, the land readjustment system which the Thai government has been preparing is generally applicable in Thailand, and also very effective in IURD area. The subdivision control presently in force is also effective with some amendments.

5.1.2.2 Innovative Urban Development System

It is apparent that some kind of innovative urban development/implementation system will be definitely required in/or "necessary" order to implement such large scale urban development projects as planned in this study.

To cite the MRSP Study:

The next phase of Thailand's development, which is already underway, includes the planning, development and construction of large and highly capital-intensive projects and programs, which -- in order to meet their intended performance levels -- are absolutely dependent on publicly-stated and widely-disseminated, comprehensive, reliable, and rigorously enforced land use and land development rules and regulations.

It is an undeniable fact that Thailand has been preparing and making advances in pursuit of the innovation and improvement of Thai city planning and development which is brief by discussed in the following section. However, it must be admitted that progress in having made steadily since it takes a long time to give birth to even one act regarding city planning, especially one limiting the private rights, for instance the property rights, the right to use land, etc., in quest of public interest.

In the situation mentioned above, even if innovative systems, especially those requiring legislative arrangements are proposed, it should not be expected that the proposed systems are at once legally established and enforced for implementing the proposed development project. This leads to the following observation:

- 1) Time lag must be always taken into consideration for proposing new systems needed for implementing the proposed development project.
- 2) Innovative urban development/implementation system should be elaborated and scheduled for the progressive improvement of Thai city planning and development.

5.2 Basic Features of Existing and Currently Proposed Development /Implementation System

5.2.1 Outline of City Planning and Practices

The Thai Town Plan Act, which is based on the English Town Plan Act, was enacted in 1936 and amended in 1952 and 1975. At present the 1975 act (BE 2518) is in force. This act aims at public health, comfort, convenience, order, landscape, utilization of property, public security and peace, improvement of economy, society and environment, valuable place in art, architecture and history, and so on.

The town planning act established a general plan and specific plan. The general plan includes plans and regulations which work as a guideline for urban development and preservation. It is enforced by ministerial ordinance. The specific plan includes plans and programs for urban development and preservation in specified areas. It is enforced by PRB.

The act stipulates the following:

- Formulation of plan and its implementation and compensation
- Authority, responsibility, procedure for enforcement
- Items to be determined in the plan, approval of committee, public inspection, calculation method of compensation, appeal.

By the virtue of the town planning act, city plans for all the cities and municipalities (about 140) are formulated by DTCP.

Planning items are largely categorized into land use plan and transport communication plan.

Land use control which is a major means for plan implementation is exercised through (1) building permission system of municipalities based on the building code and (2) subdivision control system which the Department of Land is in charge of. Infrastructure development is implemented in compliance with city plans by the corresponding administrators of infrastructure.

The following are identified for the improvement of Thai city planning (JICA study):

- 1) Thai city planning system is not empowered entities with implementation measures. Accordingly, plan implementation is dependent upon the cooperation of other agencies concerned.
- 2) The long term plan of infrastructure development is to be excluded from the general plan.
- 3) Land use control/zoning seems to be elusive and less concrete, less effective.
- 4) Infrastructure is individually developed by different agencies so that it becomes difficult to formulate an integrated infrastructure plan.

5.2.2 Outline of Land and Other Related Laws

5.2.2.1 Land Act (BE 2497)

Matters of land ownership in Thailand are covered by the land act and the civil and commerce code. The act stipulates definition of land ownership, certificate of rights of ownership, possession and use, issuance of certificate and registration of rights and deeds.

5.2.2.2 Subdivision Control Act (BE 2530)

Land subdivision project is a typical development project of serviced land and housing by the private sector in Thailand, where land and infrastructure including roads and

others, are developed on large tracts of land and land is subdivided for sale.

The basic features of the subdivision control act are enumerated below.

- Permission for the subdivision project where more than nine (9) lots of land are developed must be granted by the Ministry of Interior.
- The act sets forth the standards of land development.
- The sizes of land are set by land use.
- The right of way must be more than 8 m wide generally and 12 m wide in commercial areas.
- The standards of public facilities to be constructed are set as follows:
 - playground/kindergarten; in proportion to the number of lots
 - parks/sports ground/elementary schools; subdivision with more than 2000 lots
 - junior high school; subdivision with more than 4000 lots

5.2.2.3 Property Expropriation Act (BE 2530)

This act is to be employed when and where the government needs to acquire properties for the public interest in such cases as projects of national interest, preservation of natural resources, city planning, economic development, land reform and the like. The act stipulates the procedure of expropriation and compensation, including the committee for determining the amount of compensation, the council for the appeal of complaints on the compensation.

The amount of compensation is to be calculated based on the land prices on the day when the ordinance (PS) specifying the area of expropriation is placed in effect. Where and when rapid increase of land prices takes place, the gaps between the amount of compensation and real land value are likely to enlarge, thus resulting in an impediment to the smooth implementation of the project.

The act also includes an article stipulating that where/when the land prices of remaining land of landowners rise, an amount equivalent to the increased land value shall be

deducted from the compensation determined. This article is viewed as one of factors causing opposition of the landowner against land expropriation.

5.2.2.4 Agriculture Land Consolidation Act

The agriculture land consolidation project aims at increasing farm land productivity through the improvement of the irrigation system. It is different in terms of purpose but similar in terms of implementation system with L/R project. There are two (2) types of project implementation.

One type is an integrated/unified development project inclusive of adjustment of ground level and shape of the farmland and construction of irrigation system. The other is a project of developing irrigation systems along the existing boundaries of farm lots without the adjustment of their shape.

Areas as large as 260,000 ha of farm lands have been developed through this system by the irrigation project offices. This act is composed mainly of articles stipulating organizations such as the central committee which is empowered to decide and approve the implementation plan of projects, the local committee which is in charge of the plan formulation and implementation and procedures for project implementation including the survey, implementation plan, infrastructure development plan, replotting plan and the like.

5.2.3 Land Management and Acquisition

The urban and land developments are mostly initiated and implemented by the private sector in Thailand. They are subject to the subdivision control law and the zoning system in the legal general plan.

The urban and land development by the public sector is quite limited as follows, leaving most of the urban developments to the private real estate business and market.

- Social welfare type projects such as low cost housing, slum-upgrading and others by NHA.

- National economic development type projects such as the Export Processing Zone and Industrial Estate Development by IEAT, the Agricultural land consolidation projects to achieve the national goals of the increase of agricultural production.

Thus, the government is equipped with only limited urban land development system of NHA and IEAT in purpose and development size on the one hand, and the less effective regulatory measures of zoning and subdivision control on the other hand. It appears quite difficult to develop such large service areas of railway as planned in this study. It is necessary to develop innovative measures for urban and land management and development. The existing legal arrangement, especially eminent domain/expropriation for land management and acquisition are summarized in Table 5.2.1. Issues regarding land acquisition and expropriation are raised as follows.

Table 5.2.1 Legal Arrangement of Urban and Land Management

Act	Legal Power	Act	Royal Decree	Ministerial Regulation
Expropriation Act	Expropriation		Lands to be expropriated	
Public Works Act	Expropriation		Royal decree based on Expropriation Act	
Agricultural Land Consolidation Act	Expropriation of land of dissidents		Areas of land consolidation programme Expropriation	
Town Planning Act	Compulsory	Specific plan		General Plan
Industrial Estate Authority of Thailand Act	Expropriation		Export processing zone	General Industrial Zone
National Executive Council Decree No. 316 (National Housing Authority)	no power to expropriate Expropriation in slum upgrading		National executive council decree Acquisition of land Clearance of degenerate settlements	Rules, Procedures Conditions
Subdivision Control Act	no power to expropriate			

- 1) It is natural that the power to buy land, expropriation is strictly limited from the view point of protection of the individual right of property owners and disturbance to the real estate market by government intervention. Expropriation is justified only

in the public interest for national benefit and national security in the Thai legal system.

- 2) Although NHA and IEAT can use the power of eminent domain for their project implementation, they seldom resort to it. BMA-MIT study interprets that except for transportation projects, the government has never used the power of eminent domain.

In Thailand, this doctrine (the power of eminent domain for public purposes) will be very useful since the experience of NHA has shown the reluctance to use the power of eminent domain due to the difficulty of defining the “public purpose”.

- 3) With the strict limitation on the utilization of the power of eminent domain NHA and IEAT have developed a unique land acquisition and development method. With the public announcement of development projects such as IEAT Industrial Estate within a certain range of areas and regions (not definite locations) the government advertises for the land for development. If/when the developers or land owners apply to the projects offering the consolidated land for the projects, the government embarks on planning and developing the land.

The BMA-MIT study defines “public solicitation” as follows:

The basic procedure that NHA uses to acquire land is through public solicitation. NHA will advertise for landowners to offer land that meets a specific criteria. After obtaining recommendation for approval and authorization to purchase from the governor and board of directors (if the purchase is more than 10 million baht/US\$ 435,000), the committee can negotiate the land price with the land owners.

If no agreement is achieved, the process (which normally takes a year) is repeated. This seems to be an inefficient system of acquiring land and new methods should be considered for new town development.

- 4) Specific plan entitled with the power of eminent domain/expropriation under the Town Planning Act has been considered the most effective and instrumental for

developing urban areas. However, it is reported that the specific plan has never been legally applied in Thailand due to the difficulties and complexities of legal procedures for legislation through the parliament.

- 5) In this situation highlighted is “Land Readjustment System”, as an effective tool of land management for urban development/improvement. Because it will never use the expropriation and hence never eject the existing land owners, just force them to participate in the project implemented in the interest of the public as well as the landowners.

5.2.4 The Currently Proposed Development/Implementation System in Other Studies

The existing legal or practical systems of land use management and land development in Thailand have already been analyzed in detail in many other studies especially those of Chao Phraya Multi-politan Structure Plan, Strategic Planning for Metropolitan Bangkok, SBIA M/P, Application Scheme of Land Readjustment in National Urban Development Thrust and so on. Based on the analysis the studies made proposals on the desirable development/ implementation systems applied to their own development projects respectively, which are summarized in Fig. 5.2.1 and individually outlined in Fig. 5.2.3 to 5.2.6. The proposed improvement systems seem something like a mirror reflecting the current conditions of Thai city planning and development.

The JICA study would like to, in principle, agree with the generalized principles of land use management and land development implementation strategy which MRSP study set forth as follows.

5.2.4.1 Generalized Principles of Land Use and Land Development Implementation Strategy

(MRSP study - Fig. 5.2.2.)

The study states that Thailand’s development has come to the end of an era of informal, unplanned, uncoordinated and unregulated land use and development. The government needs to establish appropriate regulatory and institutional structure, which Thailand’s

famous and widely admired cultural characteristic of making decisions by consensus needs to be reconciled with, taking into consideration the next phase of Thailand's development featuring large/highly capital - intensive projects. The following important remarks are made in the study.

- 1) Guarantees and assurances that the investment will not be jeopardized by lack of sufficient urban development and development coordination.
- 2) Necessity of fairly enforcing land use and land development rules and regulation. (Publicly-stated and widely - disseminated, comprehensive, reliable and rigorously enforced rules and regulation)
- 3) Majority representing a consensus sufficient to enforce planning and development decisions, despite the contrary interest of a few.

In conclusion, the study recommends to review and reform the existing legal framework which regulates and enforces urban development standards, including the following existing legislative acts.

- 1) City and Town Planning Act (1975)
- 2) The Expropriation of Immovable Act (1987)
- 3) The Control of Building Construction Act (1979)
- 4) The Announcement of the Revolution Party #286 (regarding land allotment control)

Fig. 5.2.1 Summary of the Currently Proposed Development/Implementation Systems

Studies	Legal Arrangement	Organization Arrangement (*Implementation, #Land Acquisition)		
		Public Sector	Public/Private	Private Sector
SBIA Area M/P (Concession System)	Special Area Development Act	SBIA Public Dept. Corporation # [Land Acquisition]	* Joint-venture Enterprise	Private Investor /Developer
		Joint-venture of NHA, IEAT, AAT	Concession	* Private Investor # [Land Acquisition]
BMA Subcenter New Town Program (Competition System)	New Town Development Act and Land Acquisition Act	Development Corporation (National/Local) # [Land Acquisition]	* Public/Private Corporation 1. Public Sector 2. Private Sector	Private Developer Competitive Proposal
Lat Krabang Metropolitan Center (Agreement System)		Public Development Office (MBA and other agencies)	Agreement	* Private Developer # [Land Acquisition]
NHA New Town	New Town Law	* Administration of New Town (NHA) # [Land Acquisition]	J.V (Partially)	Private Investor
Land Readjustment	LA Act	Obligation		Landowners and Leaseholders
	Public Implementation (Government)	* Government Administrative Office of Implementation # [Land Management] (Replot/Land Contribution)		Compulsory Membership of Association
	Semi Public Implementation (Landowners Association)			L/R Association # [Land Management]
	Voluntary Implementation	Government Office (e.g. DTCP, NHA, Local Government)	Promotion, Guide Coordination	Agreement between Landowners * L/R Voluntary Group # [Land Management]

Fig. 5.2.2 Chao Phraya Multipolis Structure Plan - Generalized Principles of Land Use Management and Land Development Implementation Strategy (Component No.8)

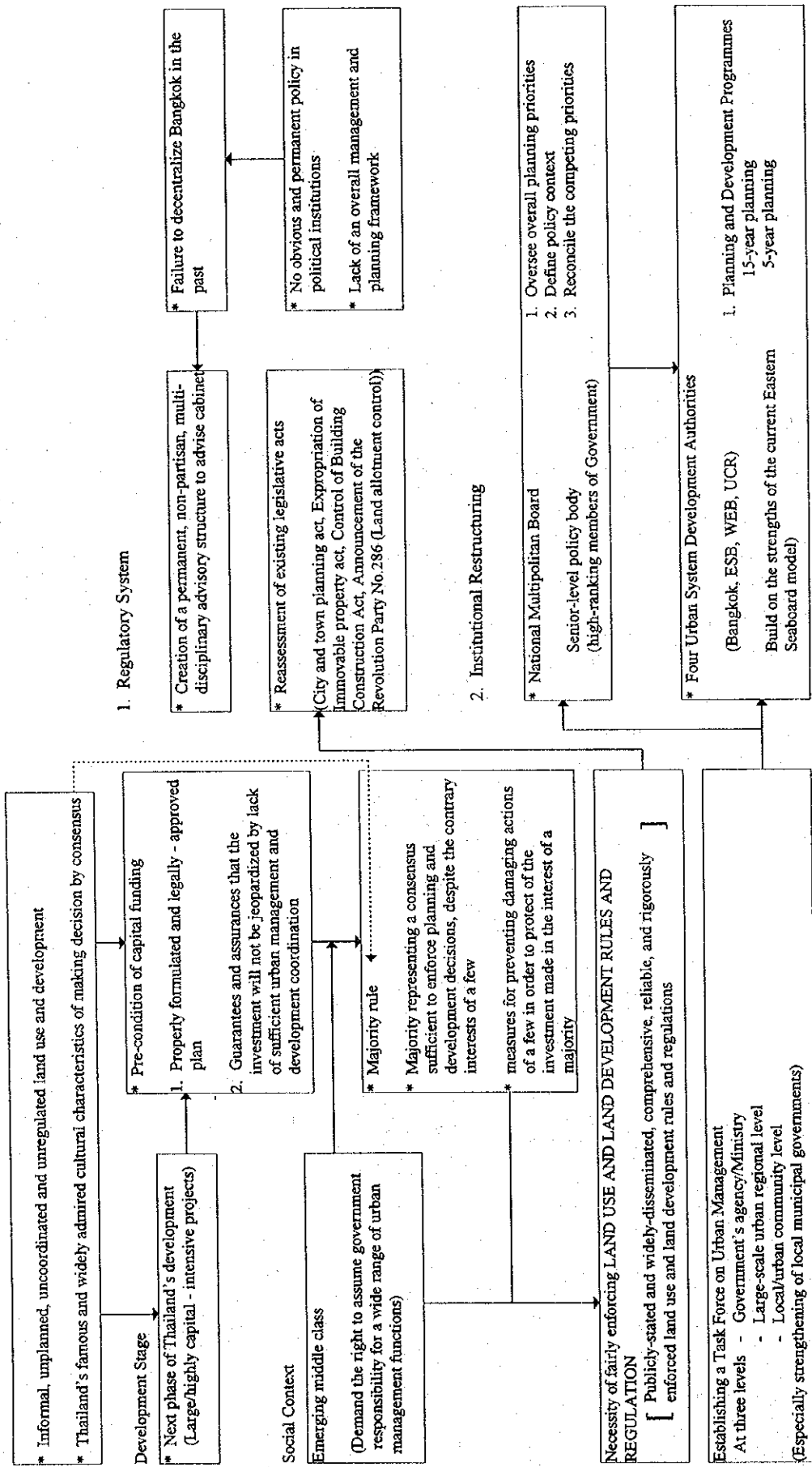


Fig. 5.2.3 Proposed Development System and Implementation Arrangement in SBIA M/P Study - PPP(Private Public Partnership)

	Land Use Control	Development Stimulation	Land Management
<p>Proposed System</p>	<ul style="list-style-type: none"> • Specific Land Use Plan for total area. 	<ul style="list-style-type: none"> • SBIA Public Development Corporation (Under the normal civil and commercial code) • Special Area Development Act <ol style="list-style-type: none"> 1. Special area 2. Public Development Corporation 3. Share holder -Government, state enterprises, general public 4. Establish joint-venture enterprise with private sector. 	<ul style="list-style-type: none"> • Land acquisition by SBIA Development Corporation <ol style="list-style-type: none"> 1. Declaration of special area. 2. No further development (freezing) 3. Authority to appropriate land.
<p>Implementation Arrangement</p>	<ul style="list-style-type: none"> • Specific Land Use Plan for 5km zone only (more limited on strategic areas) • General Land Use Plan for the remainder areas • BOI incentives (compliance with the plan for approval of BOI) 	<ul style="list-style-type: none"> • Joint venture enterprise with NHA, IEAT, AAT (Equity holding) 	<pre> graph TD A[Announcement of Land Use Specification] --> B[Provision of basic infrastructure] A --> C[Regulation on building alignments along the road(30 meters)] B -.-> Cost Recovery D[] B -.-> concession fee... E[] C --> F[Development Implementation] F --> G[Unacquired Lands] G --> H[Land Readjustment (on the basis of a voluntary Landowners association)] I[Land acquisition by private investor] --> J[Additional land Property Taxes] J -.-> C </pre>

**Fig. 5.2.4 Strategic Planning for Metropolitan Bangkok (BMA - MIT)
Management of New Town Program**

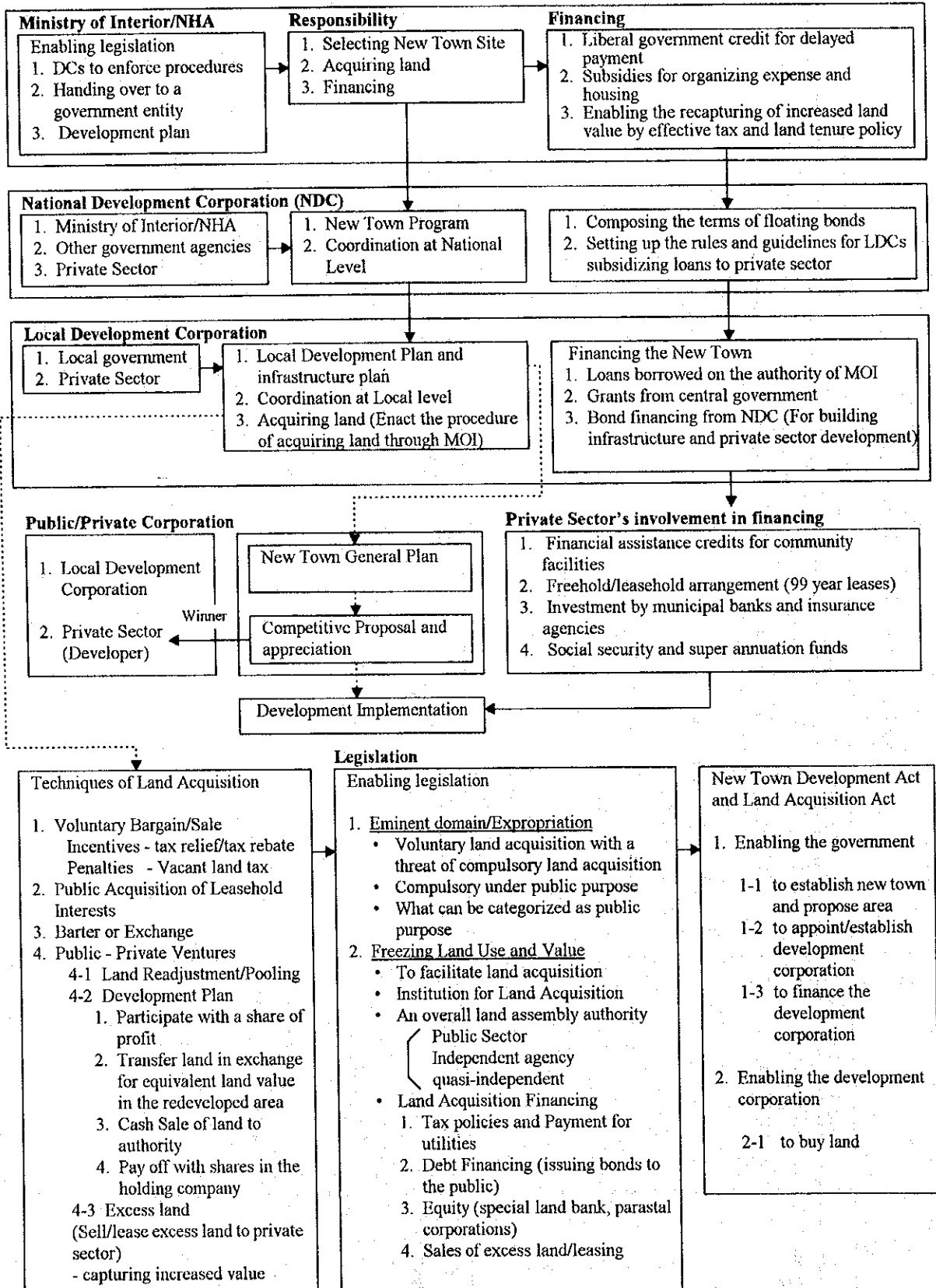


Fig. 5.2.5 Organization and Implementation Arrangement for Lat Krabang Metropolitan Center (BMA) Public-Private Partnership Agreement Base

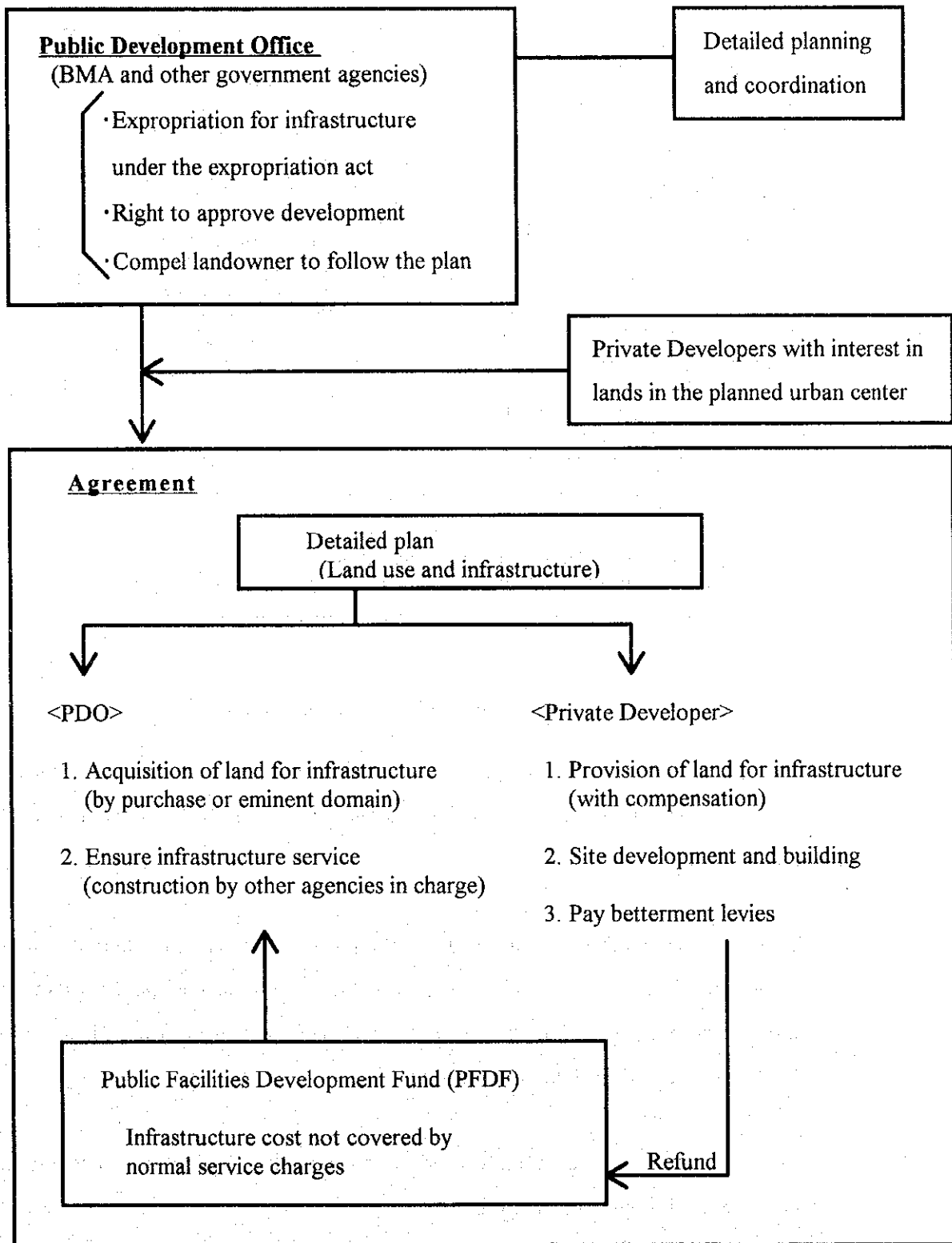
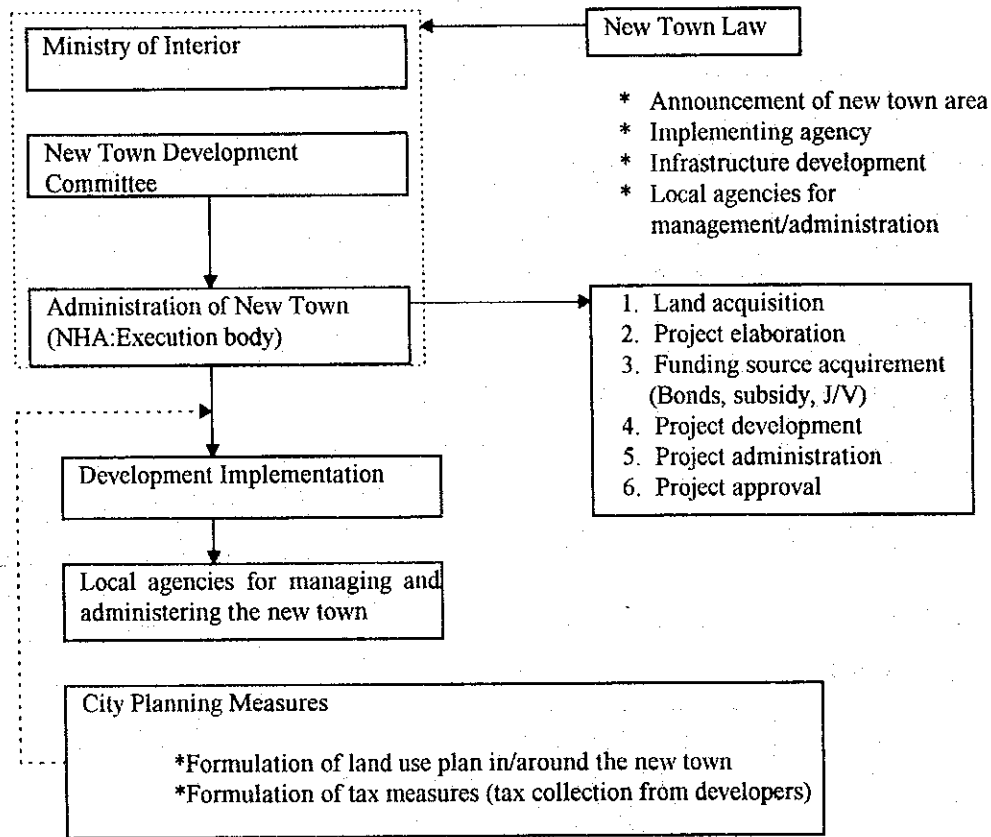


Fig. 5.2.6 NHA New Town Development - New Town Implementation



5.2.4.2 Synthesis of the Proposed Development/Implementation Systems

As shown in the preceding section quite a few development/implementation systems are proposed in other studies. As summarized in the Fig. 5.2.1 they can be generally synthesized as follows.

- 1) There is every indication that they each tend to propose two alternatives of implementation systems one being institutional, the other conventional (or arranged implementation system). The first one requires legal arrangement, namely legislation of new law, while the second one does not.
- 2) The first alternative is commonly what is called public development corporation with various different names as follows:

SBIA Area M/P; SBIA Public Development. Corporation
BMA Sub-center; Development Corporation
Lat Krabang; Public Development Office
NHA; Administration of New Town

The second alternative is commonly Public/Private Partnership with different contract systems as follows:

SBIA Area M/P; Concession
BMA Sub-center; Competition
Lat Krabang; Agreement

- 3) The first and second alternatives are distinguishable in land acquisition as follows; while in the first alternative the proposed development corporations are supposed to take charge of land acquisition with expropriation empowered to them in new law, in the second alternative the private investors/developers are tasked with land acquisition through ordinary transactions.
- 4) It can be considered that the power of expropriation, which is not always applied however, is necessitated taking into consideration the scale and magnitude of the proposed development projects — SBIA International Business Zone, 910,000 population of MIT subcenter, 300,000 population NHA New Town and others. Who can imagine such large scale projects will be implemented without a supportive legal system like expropriation and others.

However, it is anticipated that the legal arrangement necessary for them will take a long time, while the proposed development projects must be launched soon in response to the urgent urban problems. It is reasonably thought that in this pressing situation, the second alternative relying on the private sector for land acquisition came about.

However, the studies made no mention of how effective or workable they are. If they are considerably effective, what is the use of the first proposed alternative?