

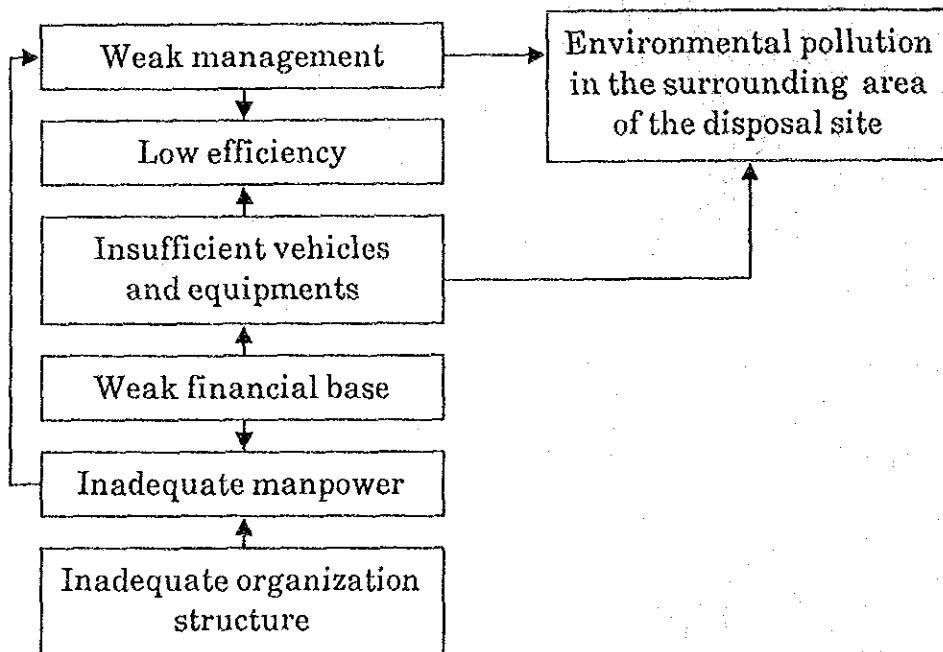
4.2.8 Solid Waste Disposal

1) Development Concept

(1) Background

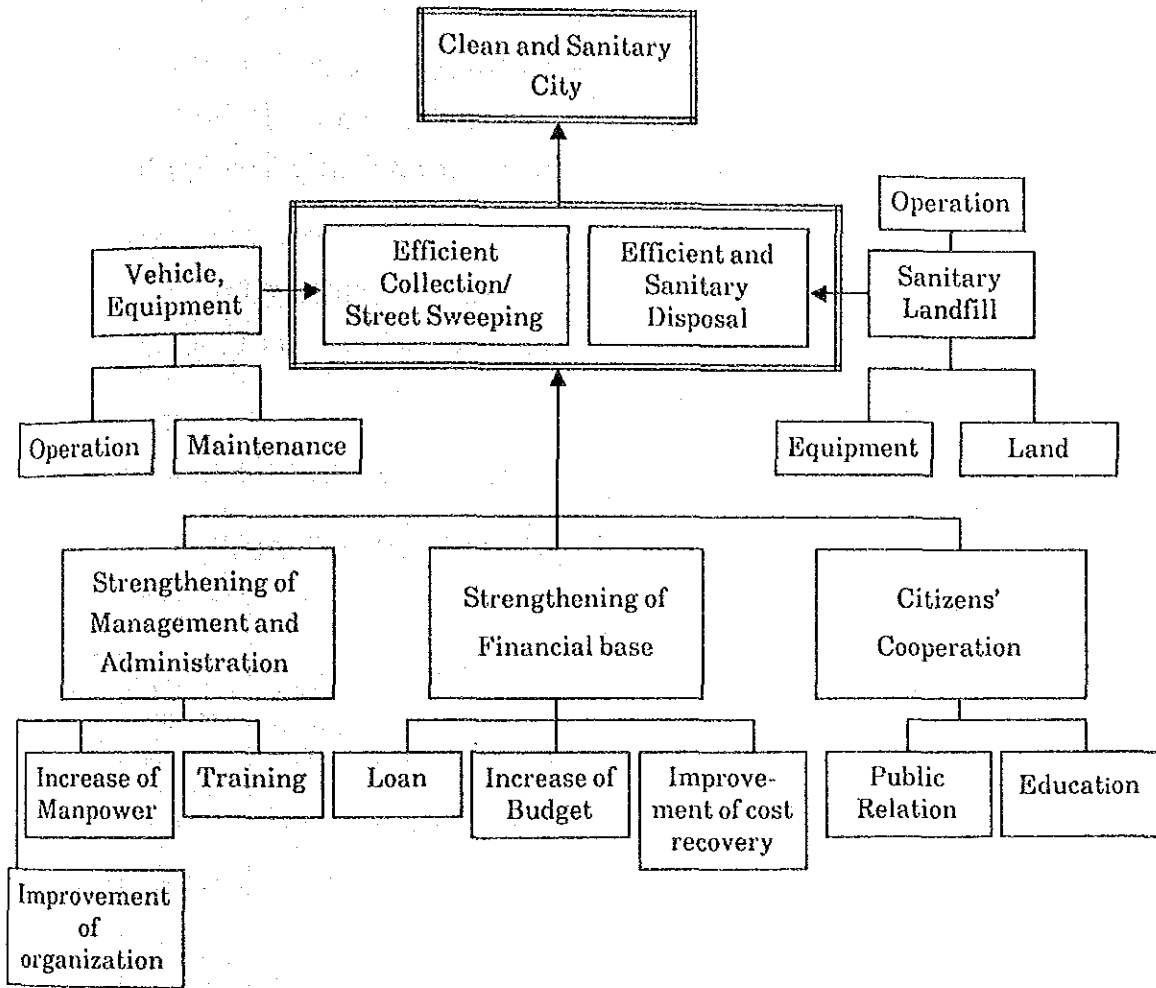
Solid waste management is getting more and more important from the viewpoint of sanitation, appearance and amenity of the city. The basic objective of solid waste management is to make "clean and sanitary city", which is a basic physical condition for both citizens and tourists.

At present, the following problems are identified.



Present Problems in Solid Waste Management

In order to cope with the problems, and to attain the objective of "clean and sanitary city", the following improvements should be carried out.



Improvement of Solid Waste Management

(2) Quantities and Qualities of Solid Waste

① Quantities of solid waste

Preliminary forecast of quantities of solid waste has been done based on the following assumptions:

- Domestic waste (including institutional waste):

- Average generation : 0.70 kg/day/capita (1989)
(increase annually 0.02 kg/day/capita)

- Tourism waste:

- Average generation : 2.1 kg/day/capita (1989)
(increase per year 0.01 kg/day/tourist)
- Average period of stay : 4 days

The forecasted quantities of solid waste is shown in following table.

FORECAST OF QUANTITIES OF SOLID WASTE

Area		1989	1996	2006	
Phatthaya	Domestic	Population	100,000	140,000	200,000
		Average generation (kg/capita/day)	0.70	0.84	1.04
		Amount (ton/day)	70.0	117.6	208.0
	Tourist	Number of tourists	1,609,000	2,281,000	3,241,000
		Average generation (kg/capita/day)	2.10	2.17	2.27
		amount (ton/day)	37.0	54.2	80.6
	Total Amount (ton/day)		107.0	171.8	288.6
	Area down to Bang Sare	Population	20,000	20,000	20,000
		Average generation (kg/capita/day)	0.70	0.84	1.04
Amount (ton/day)		14.0	16.8	20.8	
Total Amount (ton/day)		121.0	188.6	309.4	
Total Amount (ton/year)		44,615	68,839	112,931	

② Quality of solid waste

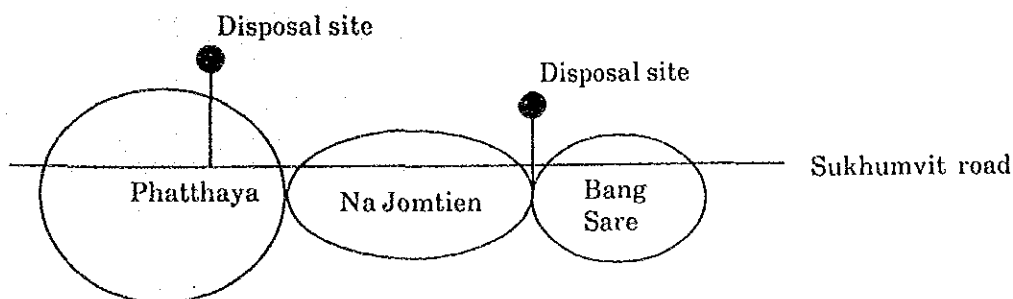
In general, there is a tendency that proportion of garbage decreases and that of paper and plastics increases with improvement of living standard and expansion of industrial activities. However considering pace of change, bulk density for designing is constantly set as 0.3 ton/m³ at discharging points, 0.4 ton/m³ in a side-loader and 0.8 ton/m³ after compaction in sanitary landfill site. Moisture content is about 50-55% of the total wet waste, which is not advantageous for incineration.

③ Kinds of waste

In the Study Area, there is no heavy industry. Solid waste of light industry will be collected together with domestic waste. Commercial waste is included mainly in tourism waste. Waste from the beach and streets is treated with domestic waste. Hospital waste is to be incinerated from hygienic point of view.

(3) Collection

The collection areas consist of the following three zones at present according to the local government.



To improve efficiency of collection, the following should be tackled.

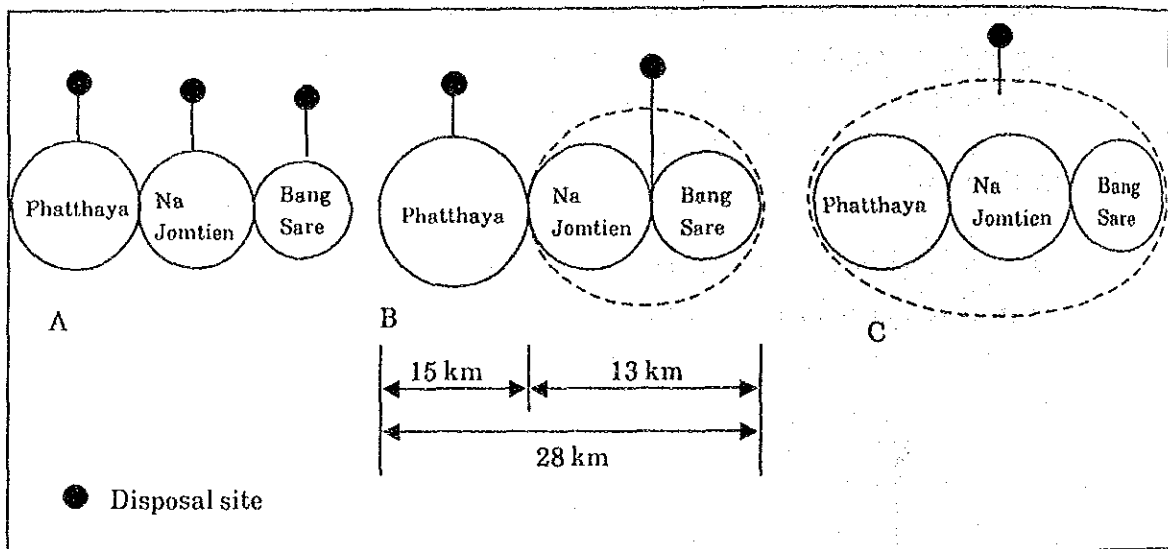
- Improvement of operation system
- Improvement of maintenance of collection vehicles
- Improvement of welfare of workers
- Data keeping and processing
- Increase of the number of vehicles

(4) Final Disposal

To dispose solid waste with minimum problem to environment, the following should be achieved.

- Implementation of sanitary landfilling
- Provision of sufficient and adequate disposal site

Basically disposal sites should be located near the collection areas to minimize transportation cost. On the other hand, for sanitary landfilling, to provide equipment and facilities, a certain size is required, and sharing site is advantageous. From the following three alternative system, B is considered advantageous because of the size and distance of the collection areas and administrative boundary.



2) Master Plan

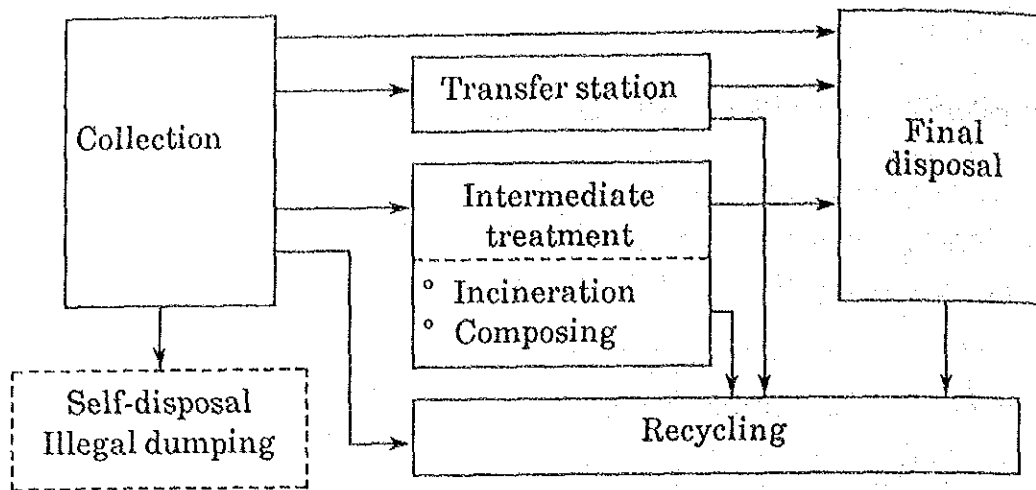
(1) System components and alternatives

The system components of solid waste management includes the following components as shown below. Each component will be studied in respective sections.

Source	Collection	Hanlage	Intermediate treatment	Final disposal
<ul style="list-style-type: none"> °Household °Commercial °Industrial °Hospital °Others 	(Method) <ul style="list-style-type: none"> °Station °Door to door °Container 	<ul style="list-style-type: none"> °Direct hanlage °Transfer station 	<ul style="list-style-type: none"> °Incineration °Composing °Pyrolysis °Crushing/shredding °Sorting °Recycling 	<ul style="list-style-type: none"> °Open dumping °Sanitary landfill °Sea reclamation
	(Frequency) <ul style="list-style-type: none"> °Daily °3 times/week °2 times/week 	<ul style="list-style-type: none"> °Vehicle °Railroad °Boat °Pneumatic/hydraulic system 		
	(Vehicle) <ul style="list-style-type: none"> °Sideloader °Compactor °Container carrier 			

System Components

Flow of solid waste differs according to intermediate treatment and/or introduction of transfer station as shown below.



Major Waste Flow Alternatives

(2) Collection and haulage

Storage, discharge and collection frequency

Generally speaking, cost of collection gets lower as interval of collection gets longer. Considering service level, sanitation of the city and high temperature which quicken rotting garbage, discharged waste should be collected as soon as possible. Collection frequency is to be considered in relation to public cooperation. If waste is discharged just before the collection, interval of collection can get longer. With cooperation of citizens, daily collection for household should be shifted to 3 times collection per week. In discharge, plastic bags and containers should be used for sanitation and the place and time should be fixed. Large quantity dischargers such as hotels should have storage of waste in their premises and should have containers which is attached to loading equipment in future.

Vehicles

Means of transport of waste other than vehicles are not realistic.

Each collection vehicle has following characteristics:

Side loader : Initial cost is low. Burden for workers is large. Bulky waste can be loaded.

Compactor : Initial cost is high. Collection productivity is high.

Compactor with mechanically loading small container

- : Initial cost is higher. Collection productivity is higher. Small portable containers are easily damaged.

Hoist truck will mountable container.

- : Productivity is highest. The place for the container is necessary.

In Phatthaya, compactor had once been introduced, however, it was given up as it was said from maintenance problem. Side loader seems most advantageous for the present. Compactor (with mechanically loading small container) and hoist truck with mountable container should be introduced with reliable maintenance service.

The number of vehicles in 1996 and 2006 is estimated as follows, assuming 2 trips per day of side loaders and 3 trips per day of compactors.

Area	Phatthaya		Na Jomtien, Bang Sare	
	11.4m ³ Side loader	10m ³ Compactor	11.4m ³ Side loader	7.4m ³ Side loader
1996	26	—	2	1
2006	32	6	3	1

(3) Transfer station

In case the distance from the center of collection area to disposal site exceeds 14~19 km, transfer station system would be more advantageous. *1) Transfer station ranges from simple open space to elaborated compactor container system. From view point of operation and maintenance difficulty, hopper system without compactor is considered preferable at present. From sanitation and efficiency, loading stage, hopper, truck scale, office, fence etc. will be required.

*1) Easter Seaboard - Regional Environmental Management Plan volume 11, Feasibility Study on the Management of the Disposal of Bangkok Municipal Waste

Considering 8 hours of working time per day, maximum distance between the center of the collection area to disposal site would be approx. 18 km, to attain 2 trips per day by side loaders.

The location of the transfer station should satisfy the following.

- Proximity to the center of the collection area
- Easy access to a main road
- Outside residential area, the main route should also avoid residential area.
- Minimum environmental impact
- Consensus of residents
- Reasonable land price

Assuming that the trailers should make 3 trips per day, and economic life be 8 years, the following number would be required.

NUMBER OF TRANSFER TRAILERS

Year	No. of Trailer
1992	5
1996	6
1999	7
2006	10

(4) Intermediate treatment

Intermediate treatment is to be introduced in order to reduce the volume of waste incorporated with recovery of energy or usable materials, as acquisition of disposal site is becoming difficult and environmental conservation is required.

Purposes of intermediate treatment is as follows:

- ① Volume reduction
- ② Resource recovery
 - extraction of usable material
 - extraction of energy
- ③ Prevention of environmental pollution of landfill

Among methods of intermediate treatment, the following are excluded from the study.

Method	Description	Disadvantage
Pyrolysis	Organic materials are processed to fuel by heat.	<ul style="list-style-type: none"> • High initial and operation cost • Technical immaturity and unreliability
Refuse Derived Fuel System	Only combustible materials are sorted and burned.	Ditto
Crushing and shredding	Shredded material is compacted better.	<ul style="list-style-type: none"> • High operation cost • Operational difficulty
Sorting (other than scavenging)	Reusable are sorted mechanically or manually	<ul style="list-style-type: none"> • Quality of waste is not adequate for this system

Incineration

Waste is combusted to reduce the volume. Heat and/or electricity may be recovered depending on the cost. Major differences in incinerators are waste feed system and grate design. Batch feed is declining in recent use in favor of continuous feed method.

Major disadvantage of incineration is the high capital, operation and maintenance cost and operational difficulty. The final disposal problem is still remains. Residue (15~20% of waste) must be landfilled. In view of effective use of resources, electricity or heat should be recovered, however in "Feasibility Study on the Management of the Disposal of

Bangkok Municipal Waste", recovery of electricity was concluded not feasible.

In Phatthaya, smaller scale makes the condition more difficult. For Koh Lan, from the view point of conservation of environment which is considered as important resource of the island, solid waste should be incinerated with small incinerators.

Composting

Composing is a system to decompose organic material of waste into fertilizer. 50% volume reduction of waste is expected.

The system includes high rate composting system, batch area, and batch windrow system etc.

There are following problems.

- Market for compost is necessary.
- It takes long time for fermentation
- Operation is not easy.
- Offensive odor is generated.

Comparison of sanitary landfill, incineration and composting

Through comprehensive comparison of sanitary landfill, incineration and composting, sanitary landfill is evaluated most preferable because of low initial/operation cost and easiness - reliability - flexibility in operation. In case that availability of land gets more difficult, incineration or composting should be re-considered. Table 4.2.19 summarized the comparison.

(5) Final disposal

Solid waste including residue from intermediate treatment should be finally disposed. Naturally open dumping and sea reclamation is excluded because it will damage the environment.

Sanitary landfill

Sanitary landfill, as defined waste filling with daily soil cover, may be largely classified into the following 3 levels, according to the way of treatment of leachate;

- ① without treatment of leachate
 - ② anaerobic treatment
 - ③ aerobic treatment
-
- ① This type may be adopted in case geological and underground hydraulic conditions are good not to give serious affection to the environment.
 - ② The quality of treated water is limited, however, initial cost can be low, without mechanical facilities.
 - ③ The high quality of treated water is attained. The cost of treatment facilities is generally high.

After site investigation, the level would be decided. ① is likely to pollute the environment. From economical and operational point of view, ② would be most advantageous.

Construction and operation

Landfilling work will be conducted in the following way.

- ① Initial construction: Phase - 1 area will be excavated. Excavated soil will be laid on the Phase - 2 site. Grading of the bed, leachate collection piping, pond, pump, insite road drainage, site office, maintenance house, weighbridge, fence and gate, planting, monitoring wells will be constructed.
- ② Operation : Wheel loader will load soil to dump truck. Dump truck will transport cover soil. Buldozer will spread and compact waste and cover soil on top. Compactor will compact the

covered waste and temporary access road in the landfill site.

Area

The area of approx. 135 rai not including access road will be required for the waste generated from 1992 to 2006. Considering difficulty of acquisition of the land, the above area should be purchased initially and construction work will be phased.

Equipment

To handle approx. 200 ton/day of waste and 60 ton/day of soil, two 110~140 Hp bulldozer will be required. Two will be also convenient for maintenance. For transportation of cover soil, two dump trucks and one wheel-loader will be used. To make temporary access road in the filling area and compact waste and cover soil, 110~140 Hp compactor will be necessary. Setting the economic life as 7 years, the following equipment will be required.

	1992~1999	2000~2006
Bulldozer (140 hp)	2	2
Compactor (140 hp)	1	1
Wheel loader (140 hp)	1	1
Dump truck (20 ton)	2	2

Location

In general, location of the landfill site is selected from evaluation of the factors such as;

- Possibility of land acquisition
 - o Land ownership - approval of owner
 - o Land use restriction - Conformity with comprehensive development plan
 - o Reasonable land price

- Possibility of community consensus
 - Approval of the community
 - Necessity of compensation

- Economic feasibility
 - Distance from the center of the collection area
 - Distance to the main road
 - Condition of access road
 - Availability of cover soil
 - Geological condition (surface and underground soil)
 - Hydrological condition
 - Underground water
 - Availability of utilities

- Environmental acceptability
 - Impacts on surface water pollution, underground water pollution, flooding, distance to residents, schools etc., dust and odor, slope stability, vegetation, wildlife, fishery, landscape, historical interest, religious place etc.

From site reconnaissance, four sites have been identified as shown in Fig. 4.2.21 for the candidate of sanitary landfilling avoiding reservoir and existing houses, schools or developed farms etc.

Each characteristics is as follows.

- Site A:
- It is in the vicinity of the previous and present disposal site.
 - There are a few houses near the site, and small community in radius of 1 km.
 - Approx. 3 km from Sukunvit Road and 12 km from the center of the city.

- Site B:
- Approx. 14~15 km from the center of the city
 - Accessible from Route 36 or Bang lamung - Map Prachan Reservoir Road.
 - Community could be avoided by selection of location. Agriculture community exists.

- Site C: • Approx. 8 km from Sukumvit Road
20 km from the center of the city
- To avoid agriculture community, the location has been selected remote from Sukumvit Road.

- Site D: • Laem Chabang Industrial Estate and New Town" has an idea to provide 300 rai of sanitary landfill site in future, approx. 10 km Sukhumvit Road or approx. 25 km from the center of Phatthaya.

A comparison of the four sites is summarized in Table 4.2.20.

The total cost of solid waste disposal including collection for the candidate sites with or without transfer station may not make much difference because of trade-off relation between the distance from the center and the price of land. (See Table 4.2.21)

Considering efficiency of transport and condition of surface and underground water. Site A is recommended as the sanitary landfill site. However it is located rather near (1~2 km) from urbanizing area, consensus with the community and prevention of pollution is indispensable.

Possibility of cooperation with Laem Chabang

Solid waste from Laem Chabang Complex is disposed of at Si Racha disposal site located 13 km northeast and waste from Export Processing Zone will be incinerated. New disposal site approx. 300 rai is planned to be prepared approx. 10 km east of Sukhumvit road. Cooperation with Laem Chabang Complex in sanitary landfill will have the following advantage and disadvantage:

- Advantage - Phatthaya city can cooperate with Laem Chabang Complex in the difficulty in land acquisition, engineering and operation.
Sharing equipment, facilities and site will reduce the initial and operation cost of landfill.

- Disadvantage - Coordination and approval of both authorities will be necessary, which may disturb smooth operation.
- Timing of development will be different between Phatthaya and Laem Chabang.

As it is difficult to estimate the magnitude of cost reduction in detail at this stage, the advantage of cooperation has not appeal remarkably.

However as the study of cooperation would progress or land acquisition and operation of sanitary landfill by Phatthaya itself would result difficult, cooperation with Laem Chabang should be highlighted.

Public cooperation and recycling

In order to reduce volume of solid waste and shorten the cost for solid waste management, public cooperation is necessary.

Recycling also reduce the volume of solid waste as well as it is beneficial to the total economy. Recycling would be done most economically and effectively at the source of discharge. After mixture, usable solid waste would get useless or damaged. Sorting at the source by discharges would be sought; Papers, bottles, plastics, garbages, etc. This should be achieved through well-programmed public relation, education, understanding and cooperation. In disposal site, some consideration for scavenging, such as space and time between dumping and soil covering, should be given.

Street Sweeping

As new roads are completed such as Phatthaya 3 Road, burden on street sweeping will increase. Considering present low efficiency of street sweeping, the number of sweeper should not be increased easily.

(6) Collection and disposal in Ko Lan

① Amount of waste

The following is forecast of amount of waste in Ko Lan:

	1989	1996	2006
Population	1,600	1,800	2,000
Tourist (average per day)	800	900	1,000
Generation rate (kg/day)	0.7	0.84	1.04
Tourist generation (kg/day)	0.7	0.7	0.7
Amount (ton/day)	1.68	2.14	2.78
Amount (ton/year)	613.2	781.8	1,014.7

② Disposal method

The disposal method should be decided considering special condition of Ko Lan such as

- Island

Ko Lan is isolated by the sea. Waste shall be self-treated or transported by boats.

- Topography

The hill is in the center of the island and flat area is narrow. The land inclination is generally steep.

- Geology

The layer of surface soil is considered shallow.

- Land ownership

All lands are actually owned but not registered officially. So it is very difficult to acquire land officially.

- Environmental conservation

Beautiful environment still remains in Ko Lan. It would be top priority to conserve the environment.

In view of the above conditions, the following are considered as disposal methods.

- Sanitary landfill

Land acquisition for landfill will be very difficult. The site will be in slope and near the sea, which is liable to cause pollution.

- Incineration

A small incineration will require fuel and full time person in charge for operation. Residue should be landfilled, however, incinerated residue will be sanitary.

- Sea transportation

The piers are not in good condition, so waste is liable to be scattered during loading and unloading, which will damage the environment. Also this is not reliable method in case of bad weather. In case that a new boat should be purchase, the cost would be highest.

From the evaluation, incineration is considered most advantageous from the view point of environmental conservation and availability of land.

	Sanitary landfill	Incineration	Sea transportation
Environmental conservation	●	○	△
Initial cost	○	△	●/1
Running cost	○	●	●
Reliability	○	△	△
Flexibility	○	△	△
Ease of operaton	○	●	△
Land acquisition	●	△	○

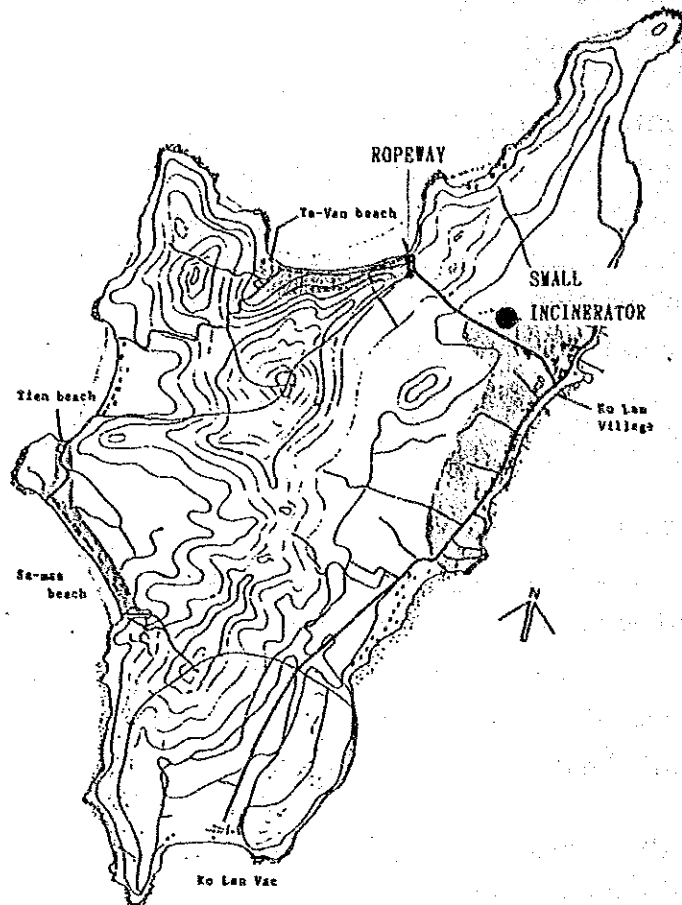
○ - Good

△ - Fair

● - Bad

/1 new boat purchased

The capacity of the incinerator would be 2.7 ton/day, assuming target year 1998 and 80% available. The location should be in the center of the island, along the road and slight inland.



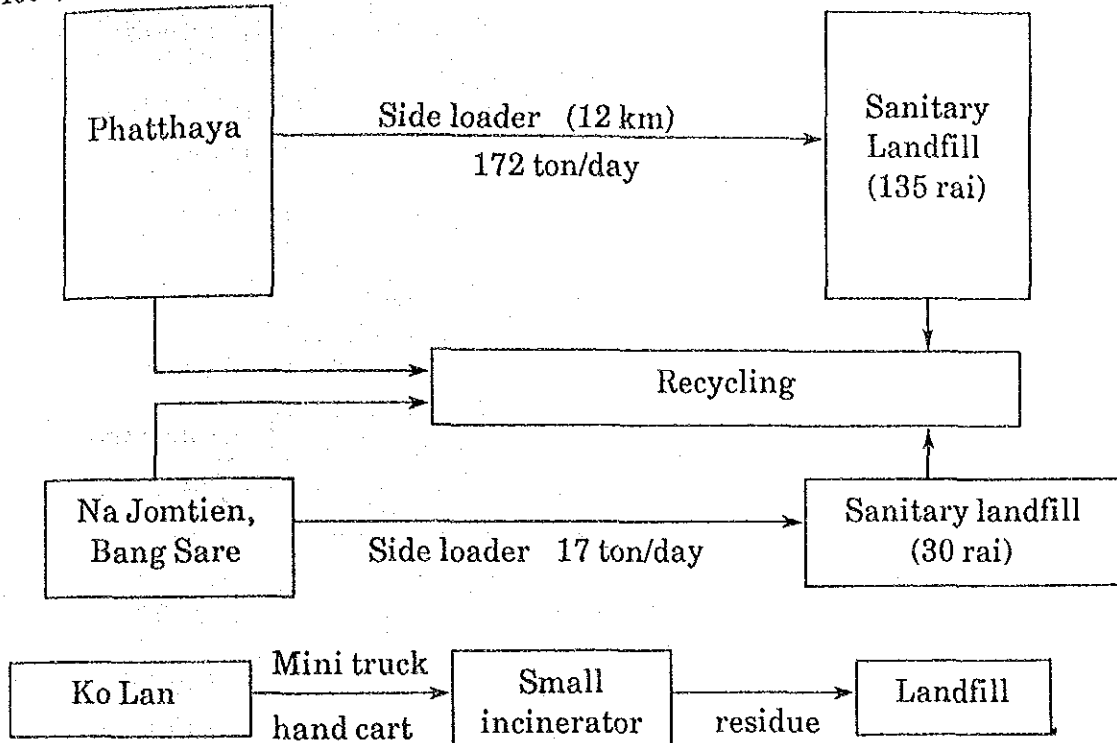
③ Collection

Discharged waste should be transported to the small incinerator. From operational point of view, one incinerator is considered. The roads are narrow and not well prepared, mini-truck and handcarts will be used for collection and transportation. To lift the waste from Tavan beach to the ridge, a ropeway is to be constructed.

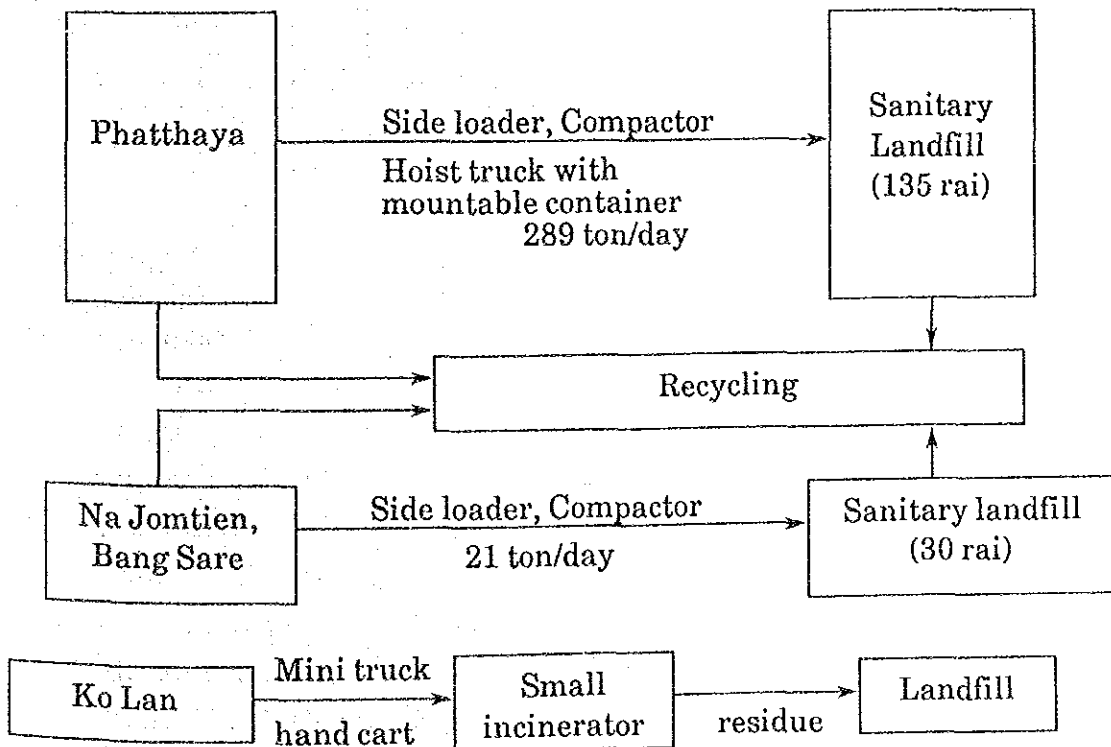
(7) Planned flow of solid waste

After the above study, the flow of solid waste is summarized as follows:

(1996)



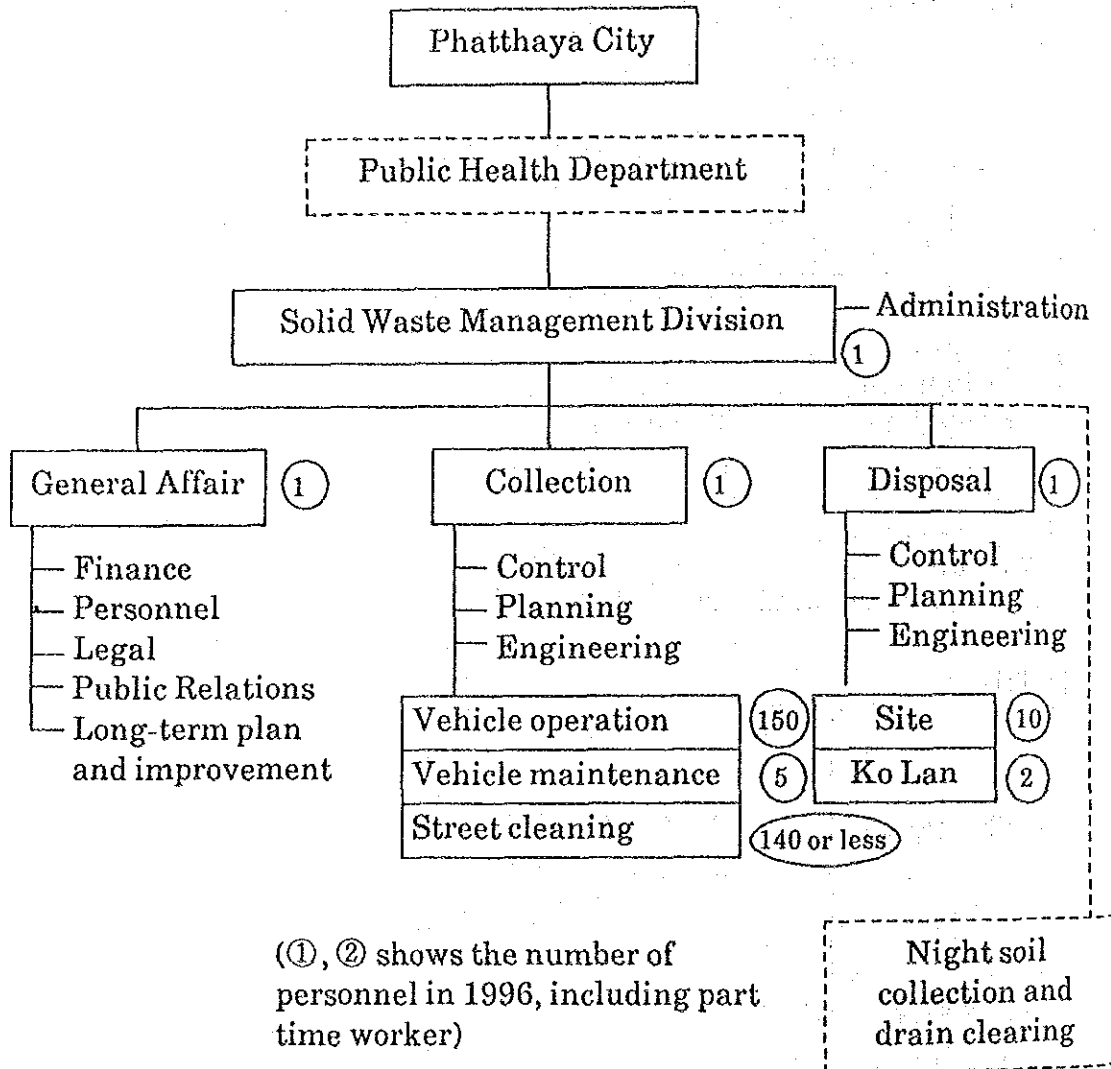
(2006)



(8) Organization and finance

Organization

Exclusive division for solid waste management should be formed separately or under Public Health Department with sub-divisions of General Affair, Collection and Disposal.



Privatisation

Various pattern of privatisation is considered about landfill, collection and street sweeping. In general, the more the risk is shifted to private sector, the more the cost increase and more difficult the public control becomes. For privatisation, reliable private sector is indispensable, and control, supervise and advice in operation should be always conducted by the public sector.

		A	B	C	D	E	F
Landfill	Ownership	■	■	○	■	○	○
	Operation	■	○	○	○	○	○
Collection	Ownership, Operation	■	■	■	○	○	○
Street Sweeping	Operation	■	■	■	■	■	○

■ Public
○ Private

It is the time to discuss privatisation when Phatthaya City purchases the land for landfilling and contracts construction work, including collection services.

Cost recovery

The percentage of fee collection to the total expenditure for solid waste has been less than 10%. Present level of cost recovery is estimated approx. 30 Bahts/ton, whereas the average present tariff is approx. 60 Bahts/ton and maximum tariff stipulated in the Regulation of the Ministry of Public Health B.E. 2528, is approx 220 Bahts/ton.. To improve this situation, fee collection should be strengthened as well as the tariff should be raised. From the view point of the principle, "beneficialies to pay", the cost for solid waste disposed should be paid by the dischargers in proportion to their quantity. However it will be difficult to measure each quantity and to collect fee directly from each.. To cope with it, surcharge system upon government tax or electricity fee should be taken into account. This system would improve percentage of

collection and cost for fee collection, although commission and consensus of cooperation authority is necessary.

3) Long-list Projects

The following are selected as long-list projects from the analysis of the conditions.

(1) Background and necessity

- The present disposal site will be filled up within a few years. Considering preparation period, selection of a new disposal site will be urgently required.
- Sanitary landfilling is considered to be proper disposal method.
- There are no garage for maintenance of collection vehicles, nor facilities for workers.

(2) Project outline and expected effects

a) Provision of new sanitary landfill site

First and most important step is purchasing the land for new landfill site. It often takes time to find adequate land, to negotiate the land-owner, to secure budget and to get approval of the local committee and therefore prompt action is indispensable. The next step will be technical and administrative process. The followings will be required:

① Study and design

- Study and design of sanitary landfill site and related facilities
- Training of personnel

② Construction of sanitary landfill site:

- Civil works
- Equipment (Bulldozer, Backhoe)
- Drainage
- Leachate treatment facility (Pump, Pond, Piping)
- Gas vent
- Access road

- Truck scale (Weigh bridge)
- Shelter
- Guard house
- Monitoring facilities
- Gate and fence
- Planting

b) Improvement of existing disposal site

Sanitary landfilling is expected to be conducted. However, the method is still open dumping at present, and the management is rather weak. Pollution of groundwater has been observed. The following improvements should be carried out:

- Installation of drainage facilities
- Supply facility for hygienic water for the village located in the east of the site
- Removal of adjoining housing
- Paving of the access road
- Construction of gate, office and shelter
- Maintenance of equipments

Solution or at least alleviation of the problems related to the existing disposal site can be expected.

c) Installation of maintenance facility

There are only simple shelter for collection vehicles. The following facilities should be constructed for maintenance of vehicles and good working condition of workers.

- Garage with maintenance equipment
- Shelter and car park
- Rest and shown room, office
- Car wash
- Drainage

Economy and stability in collection and improvement of work condition can be expected through the above provisions.

d) Procurement of collection vehicles

The collection vehicles are not sufficient in number and should be increased. Additional sideloaders and compaction cars should be procured for higher efficiency in collection.

e) Provision of incinerator in Ko Lan

To treat solid waste of Ko Lan, a small incinerator should be prepared.

Table 4.2.19 COMPARISON OF SANITARY LANDFILL, INCINERATION AND COMPOSTING

Educational facilities	Sanitary landfill	Incineration	Composting
Type	Anaeration facultative pond	Continuous feed system	High rate system
Initial cost	◎	●	○
Cost per ton	1	12	4
Operation cost	◎	●	○
Ease of construction	◎	●	○-●
Ease of operation/maintenance	◎	●	○-●
Waste reduction	●	◎	◎
Flexibility to change of waste	◎	○-●	●
Reliability	◎	●	○-●
Land area requirement	●	◎	◎
Worker safety and health	○	◎	◎
Surface and groundwater impacts	●	◎	◎
By-products	●	●	◎
Air quality	◎	○-●	◎
Sanitation	○	◎	◎-○
Total evaluation	◎	●	○

Key : ◎ Good ○ Fair ● Bad

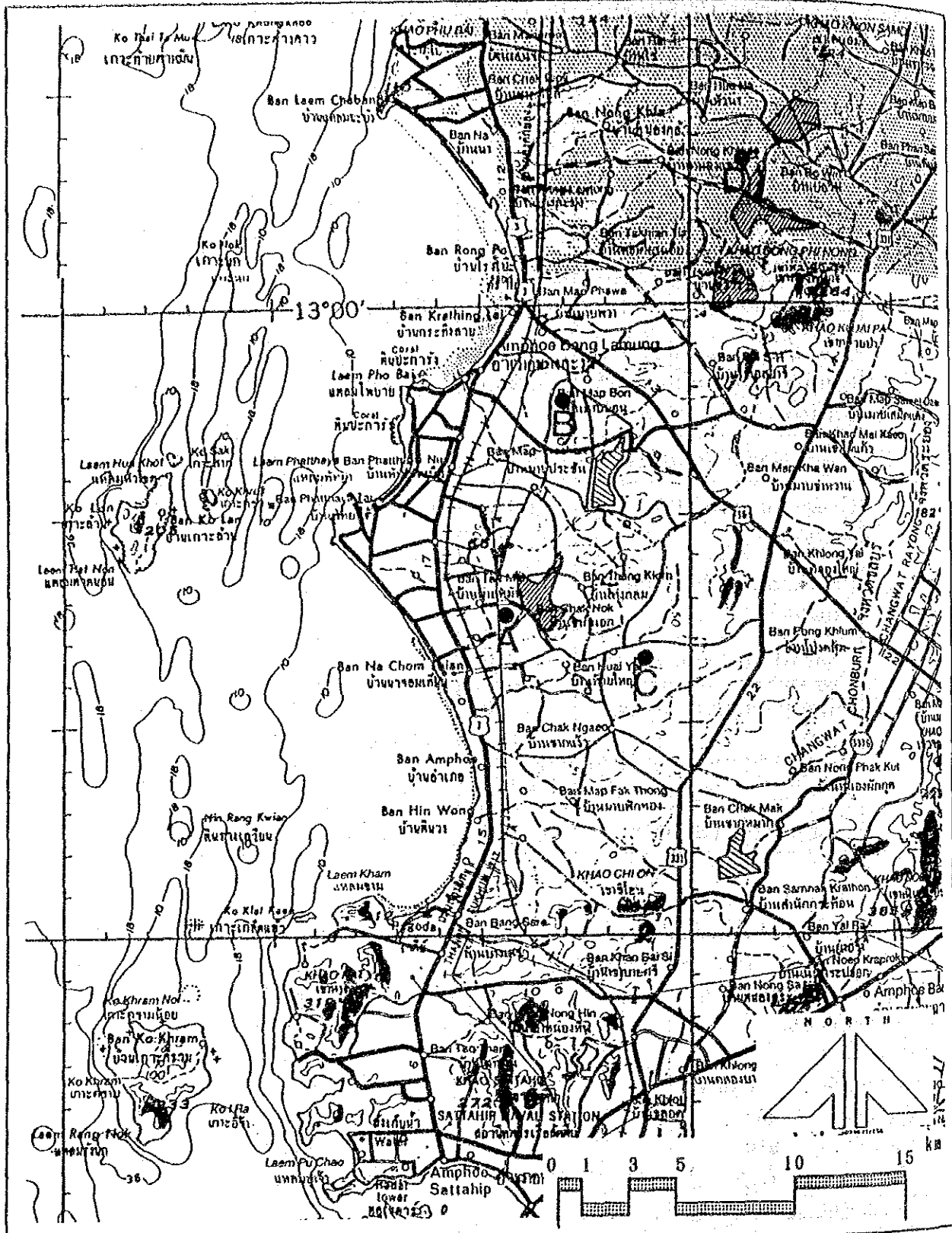
Table 4.2.20 COMPARISON OF CANDIDATE SITES

	Site A	Site B	Site C	Site D
Land use	Field, farm	Palm forest, Field	Palm forest, farm	Field
Location	12 km 5 km	14~15 km 6~7 km	20~22 km 8~10 km	25 km 10 km
Transfer station	no	no	yes	yes
Land availability	n.a.	n.a.	seems easier	n.a.
Official land price (Bahts per rai)	160,000~400,000	150,000~500,000	100,000~600,000	n.a.
Assumed land price (Bahts per rai)	500,000	400,000	300,000	n.a.
Problem of near-by community	anticipated	less anticipated	least anticipated	least anticipated
Geological	Terrace deposit	Terrace deposit	Terrace deposit	Terrace deposit
Possibility of impact on surface and underground water	fair	n.a.	n.a.	n.a.


Table 4.2.21 COST COMPARISON OF CANDIDATE SITES FOR LANDFILL
(Unit: 1,000 Bahts)

	A	B	C	D
Distance from the center (km)	12	16	20	25
Land Price (1000 Bahts per rai)	500	400	300	300
Land cost acquisition / <u>1</u> (135 rai)	4,500	3,600	2,700	2,700
Civil and building utilities / <u>2</u>	4,260	4,260	4,260	3,830/ <u>3</u>
Operation of landfill / <u>14</u>	5,390	5,390	5,390	4,850/ <u>3</u>
Collection (75,000 ton/year)	12,000/ <u>5</u>	8,250/ <u>6</u>	8,250/ <u>6</u>	8,250/ <u>6</u>
Provision of Transfer station / <u>7</u>	0	2,790	2,790	2,790
Operation of trailers / <u>8</u>	0	1,590	1,590	1,590
Improvement of access road	<u>9</u> 100	<u>10</u> 320	<u>11</u> 1,600	<u>11</u> 1,600
Total	26,250	26,360	26,740	25,770
Cost per ton (Bahts)	348	349	354	342

<u>1</u> Duration : 15 years	<u>6</u>	3 trips (110 Baht/ton)
<u>2</u> Duration : 15 years (Phase 1 & 2)	<u>7</u>	Land 400 (6,000/15)
<u>3</u> 10% is assumed to be discounted, due to cooperation		Facilities 265 (4,000/15)
		Trailers 2,125 (3,400×5/8)
		Total 2,790
<u>4</u> Economic life : 8 years	<u>8</u>	Personnel 660
Personnel 480		Fuel, Oil 340
Fuel, oil 910		Maintenance 850
Maintenance 1,140 (22,900×0.05)		Total 1,750
Equipment 2,860 (22,900/8)	<u>9</u>	8m×750m×250/15
Total 5,390	<u>10</u>	8m×2400m×250/15
<u>5</u> 2 trips (160 Baht/ton)	<u>11</u>	8m×1200m×250/15



LEGEND

 **PROPOSED RESERVOIRS AND THEIR CATCHMENT AREA**

THE MASTER PLAN STUDY FOR THE DEVELOPMENT OF PHATTHAYA AREA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 4.2.21
Location of Candidate Disposal Sites

4.2.9 Land and Air Transportation

1) Road Network

(1) General Plan

The General Plan specified a road network for the target year of 2007. It envisages a 30 meter-wide divided four-lane highway running through the middle of Phatthaya and Jomtien areas in the form of U with the top ends connected with Route 3. The General Plan has already been promulgated as Ministerial regulation (MOI). Implementation of road plans different from those specified in the General Plan will necessitate a lengthy process of changing the law.

The City's Five Year Plan (1987-1991) reserves some provisions for the implementation of the General Plan road network as explained later. However, most of the planned road projects specified in the City's plan are for the improvement of minor roads.

A considerable amount of land will have to be acquired to implement the General Plan as its present form. Some sections may not only require a high cost due to the already high and rapidly increasing land value but also prove very difficult due to the density of existing establishments along the existing roads. Fig. 4.2.22 shows the location and the extent of such required land acquisition.

A preliminary evaluation was made first to determine whether the road network plan specified by the General Plan was appropriate to expected future demand or not. Because of the fact that Phatthaya is rapidly becoming a developed urban area rather than a cluster of scattered hotels and resort facilities, it was felt necessary to adopt a formal approach of urban transportation analysis for the evaluation. The study area was divided into traffic generating or attracting zones, 57 in total including 2 external zones. The lack of surveyed data on trip origins and destinations was overcome by means of the use of a technique estimating trip origins and destinations from zonal socio-economic indicators and observed traffic counts at a good number of locations. Then the derived origin-destination table was expanded to future ones by applying the expected increase in socio-economic indicators for each zone. The resulting future origin-destination table was then assigned onto the

future road network considering roadway capacity and time delays caused by congestion.

Fig. 4.2.23 and Fig. 4.2.24 illustrate estimated trip origins and destinations for the present and for the target year of 2006. The Figures were prepared for aggregated larger zones for presentation purposes although actual traffic analysis was carried out using 57 zones to obtain a higher level of accuracy. A comparison of these two figures indicates that there will be a great deal of increase in traffic to and from Jomtien but in terms of the absolute level Phatthaya proper will still dominate the area as the center of traffic generation/attraction.

Fig. 4.2.25 illustrates projected peak hour traffic volumes in 2006 if no improvements are made. Because of congestion about 14% of trips can not be made during the peak hour. Road sections connecting Phatthaya Beach and Jomtien Beach will have traffic filling up their respective capacity. Fig. 4.2.26 illustrates the case of implementing all planned roads specified in the General Plan. All trips can be accommodated but a part of Route 3 would be operated at its capacity. Fig. 4.2.27 shows the case of no widening of Phatthaya 2 Road and Phatthaya Road but constructing new roads as specified in the General Plan. Parts of Thappaya Road and Route 3 would be saturated. Fig. 4.2.28 shows the case of extending Phatthaya 3 Road southward up to Wat Boon Road. In this case no traffic congestion is expected. In all cases Jomtien 2 Road south of Wat Boon Road would carry only light traffic.

The above analysis indicates the followings:

- a. Phatthaya Beach Road needs not to be widened if Phatthaya 3 Road be constructed.
- b. Phatthaya 2 Road can be a 4-lane road if Phatthaya 3 Road be constructed.
- c. Phatthaya 3 Road should be extended to Wat Boon Road.
- d. Jomtien 2 Road south of Wat Boon Road need not to be constructed as a 6-lane road for the time being.
- e. Provision of parking area is needed at several locations.

Top priority road from the view point of traffic are:

- a. New construction of Phatthaya 3 Road.
- b. Widening of Thappaya Road particularly connection to Jomtien Beach and Jomtien Roads.

Possible addition to road projects specified in the General Plan would be the extension of third Phatthaya Road to provide an access to the proposed reclaimed land in South Phatthaya. This road however should be regarded as a tourist facility. Beach roads in Phatthaya and in Jomtien are also very much of tourist facility and are discussed elsewhere in this report.

(2) Chonburi - Phatthaya Highway Extension

A preliminary evaluation was made on the possible extension of the planned Chonburi-Phatthaya Highway. The current plan by DOH is first to construct a four-lane highway from Chonburi-Bypass to Laem Chabang and later to extend it further to Route 36 by a two-lane highway. A considerable short cut from Chonburi Phatthaya Highway is possible by connecting the junction with Route 36 and Phatthaya area by a direct link rather than making a detour by taking Route 36 and then Route 3 to reach Phatthaya.

Fig. 4.2.29 shows a possible alignment of such extension. The Map Prachan reservoir is located sufficiently east of the proposed extension and therefore not a binding condition and the extension could be connected with Route 3 virtually anywhere in Phatthaya. Once such a connection is made, a large number of traffic would divert from the portion of Route 3 south of Laem Chabang, allowing the Laem Chabang area not to be interfered by non-Laem Chabang related traffic, thus contributing to the smooth industrial growth of Eastern Seaboard. Considering the long term possibility of constructing an interchange at the junction of Route 3 and the extension, it was determined that the end point of the extension should be at the junction of Phatthaya North Road and Route 3.

Fig. 4.2.29 and Fig. 4.2.30 show traffic volumes in year 2006 for cases with and without the extension. The projected traffic volumes indicate that the new highway will have to be a four-lane facility. Traffic on

Route 3 between Laem Chabang and Phatthaya will be much less than in the case otherwise. Only those traffic with trip ends in Laem Chabang area would use the purposed Laem Chabang spur attached to new Conburi-Phatthaya Highway. This should be a better arrangement than the case of the general traffic to and from areas beyond Laem Chabang to share the most important access road to Laem Chabang with industrial traffic to and from Laem Chabang area. However, this will necessitate the construction of the section of Chonburi-Phatthaya Highway south of Laem Chabang spur as a four-lane highway rather than the currently planned two lane one. It is recommended that Chonburi Phatthaya Highway south of Laem Chabang spur be planned as four-lane highway to be connected with North Phatthaya Road for the development of both areas of Laem Chabang and Phatthaya. Projected turning movements at the intersection of the Extension and Route 3 indicate that a semi-interchange with a flyover across Route 3 is needed.

(3) Actions Seing Taken by the City

Road related construction project budgeted by the City Hall are as follows.

Fiscal Year 1989

- ① Side ditch construction on Thathap-Na Klua Road - 12 million Baht.
- ② Widening of Phatthaya 2 Road from South to Central Phatthaya intersections - 12 million Baht.
- ③ Sewerage duct for Soi Yan Sabai - 88 million Baht.

Initial bidding prices by contractors exceeded the budgeted amounts by more than 100%. The City Hall is likely to out some of the protects above.

Fiscal Year 1990

- ① Sewerage ducts on both sides of Phatthaya North Road.
- ② Side ditch for Soi Phatthaya 17, block type, both sides.
- ③ Widening of pavement to 10m and adding of curb and side walk and 0.6m diameter sewerage duct for Jomtien Beach Road from Jomtien

corner to Chaivaphuk Road. The design cross section is the same as the existing Phatthaya Beach Road.

Total budget for the above three projects - Baht 30 million.

Fiscal Year 1991 and beyond - undecided.

Because of the difficulty in land acquisition, the widening of Phatthaya 2 will be done in a scaled down fashion compared with the DTCP's general plan. Instead of the DTCP proposed 6-lane road, the widened Phatthaya 2 will have 4 traveling lanes and 1 parking lane with side walks of 2 and 3 meters widths. By this scheme only one building at the corner of Central Phatthaya intersection will have to be cut by 4 meters for its entire one block length. The City Hall will compensate the owner by allowing him to construct a building higher than allowed by its building codes.

The City is carrying out survey work along Phatthaya 3 and Jomtien 2 Roads as proposed in the General Plan for the purpose of construction cost estimation. It is technically possible to include these two projects in this fiscal year budget, but an already committed large (Baht 70 million) project of sewerage treatment plant at Soi Kasem Suwan under Engineering Division precludes the inclusion in this fiscal year.

In 1985 the Office of Committee for the Management of Road Traffic (OCMRT) in the Ministry of Interior carried out a study on "Traffic and Transport Operation Plan for Phatthaya City", which resulted in recommendations on road and intersection improvements and traffic operation improvements. The study followed the framework set by the DTCP's plan at that time. The City Hall has been following OCMRT's recommendation whenever it can secured budget.

A new road from Thappaya Road to the sea shore skirting around the foot of Leam Phatthaya hill at the southern end of Phatthaya beach is being built by a private developer. Upon completion the road will be donated to the City. This road should be a logical replacement for the DTCP proposed Phatthaya 3 Road Extension, for which land acquisition would be very difficult along the already densely buildup proposed alignment. The DTCP alignment, however, was already announced to public. An official change of the plan and announcement will be required.

Priority Projects

By the above analysis selected road projects have been given high priority (See Table 4.2.22 and Fig. 4.2.31). The following describes current status of the selected projects and required future actions.

- **Phatthaya 2 (Central - South section) widening**
This section widening is to be tendered soon by the City Hall. Widening is to four-lanes, not to six lanes as specified in the General Plan. This is acceptable provided that Phatthaya 3 road be built in time. Needed intersection improvements are incorporated in the current tender.
- **Phatthaya 3 Road from North Phatthaya Road to Wat Boon Road**
The city started supplying in accordance with the General Plan. This road should be extended to Wat Boon Road.
- **Jomtien Beach Road**
The project was taken into 1990 budget in order to support the rapid development along Jomtien beach. It is to widen the exist road from Thapphaya Road to Chaiyabruk Road to be 10 meters width and also included parking lane and side walk.
- **Sukhumvit**
The project is unde the 1990 DOH plan to construct a new 2 lane paralleling roadway while improving curvatures from Phatthaya to Sathip and Rayong.
- **New Chonburi - Phatthaya Highway**
The project comprises two sections, from Laen Chabang to Route 36 and Route 36 to North Phatthaya. According to traffic forecasts, this road will required 4 lanes to be operated at level of service C or better. The section from Laen Chabang to Route 36 should be expanded to 4 lanes and the section of a new alognment from Route 36 to North Phatthaya should also be of 4 lanes. The route alignment is shown in Fig. 4.2.32.
- **Thapphaya**
The existing mountainous 2 lane road linking Phatthaya beach and Jomtien beach will be insufficient for future trip demand due to the rapid development in Jomtien. The project is to widen the existing road to a 4 lane road from Phatthaya 2 to Jomtien 2.

- **Jomtien 2**
The project is to construct a new 4 lane road from Thapphaya Road to Wat Boon Road in order to accommodate the future trip demand as well as to guide the future development in Jomtien.
- **Jomtien 3**
Jomtien 3 is an extension of Phatthaya 3 into the Jomtien area. The project is to construct a new 4 lane road from Theppasit Road to Wat Boon Road.
- **Wat Boon**
The existing Wat Boon road will not be enough for traffic entering into Jomtien from Sukhumvit Road. The widening of exiting road to 4 lanes is required.
The above improvement plans are a minimum plan which should be implement before the target year.

2) Parking

Public parking spaces attract outsiders to come to the area. Conversely the lack of public parking discourages outsiders. Thus provision or non-provision of public parking spaces can be used a measure to control the amount of trip makers to particular area. This is particularly true in the case of non-essential trips such as visiting a beach.

The North Phatthaya Beach is intended to remain as an up-market low density beach primarily for guests staying at hotels along the beach. Public parking spaces, therefore, are to be kept at minimum.

In the South Phatthaya area and in the Jomtien Beach, however, public parking spaces should be provided as these areas are expected receive a large number of visitors from outside of the respected areas.

A survey of parking spaces and their use was carried out in the primarily local beach resort of Bang Saen in order to gain insight for the public parking planning for Phatthaya. Relationship between traffic volume and parking space usage and other information were collected. There is a large public parking lot within 100 m of the beach available. However, it is much underutilized and many vehicles are double parked along the beach road. This seems to be caused by two factors: 1. control against double parking is lax, and 2. the off-street parking lot is

not sufficiently attractive in appearance including paths from the lot to the beach.

Parking space requirements were estimated using the survey results and projected traffic demand and amounts of various activities by type. Results were incorporated in the proposed designs of water front facilities described in Chapter 6.

- Parking Requirements for the New Reclamation Area

Parking requirements were estimated by vehicle type. Details are presented in Section 6.1.1.

- Parking Requirements for Jomtien Beach

In 2006, daytrippers of 8,100 would visit to Jomtien beach by private car which needs 2,000 parking lot and 4 ha as total area shown as follow.

- Daytrippers to Jomtien Beach in 2006 ... 27,000 persons (See Table 4.2.3)
- Daytrippers by private car ... $27,000 \times 30\% = 8,100$ persons
- Number of private car ... $8,100 \div 4$ persons = 2,000 cars
- Area for parking lot ... $2,000 \times 20\text{m}^2 = 4\text{ha}$

┌	Jomtien beach centre	: 700 cars (1.4 ha)
	Road side parking lot	: 800 cars (4,000 m ÷ 5m)
	Another parking lot in North Jomtien	: 500 cars (1.0ha)

Total 2,000 cars

3) Road Transport

The current policy of keeping the total number of licensed Song Taew at the existing level of 680 implies that any policy of introducing services competing with Song Taew will be severely resisted under the condition that only 300-400 Song Taew are sufficient to satisfy the demand. As the demand grows, acceptance to changes would gradually increase. A gradual program of improving public transport in Phatthaya is needed.

There could be, however, many ways to improve the services of Song Taew or to control the excesses by Song Taew drivers without provocation. Pre-condition for the success of any program should be a full cooperation by the Cooperative.

For example, it is possible to post a fare table in English prominently posted outside of each Song Taew in addition to the existing one in Thai posted inside of the deck. As in many of tourist places in Thailand, fares for foreigners may be set different from those for Thais but in a simpler flat fare system. Particularly on Beach Road Song Taew should be allowed to pick up passengers only at certain designated points. The points should be sufficiently frequent along Beach Road not to affect demand level.

Routing and scheduling of Song Taew may best to be left to the Cooperative to manage, matching with the changing demand pattern. There should be many small but effective ways to control and improve Song Taew services under the Cooperative's initiative. Song Taew could even be a tourist attraction in Phatthaya such as Tuk Tuk in Bangkok. The City Administration and the Land Transport Department should encourage the Cooperative to innovate in planning and managing its services.

A some point in the future, when the demand become sufficiently high to support both Song Taew and regular bus services, the latter should be introduced, it is important however that a clear explanation of demand and supply conditions be given to the Cooperative and the latter's cooperation be sought with a sufficient advance notice.

4) Air Transport

Air transport related to Phatthaya depends largely on the future of U-Tapao Airport located at 35 km south of Phatthaya. The current national policy with respect to U-Tapao Airport is to encourage early transition of the airport from its present status as a military base with occasional limited commercial use to a joint facility with emphasis on commercial development to serve international scheduled and charter flights.

In addition to the existing scheduled commercial flights by Dragon Air of Hong Kong and Tradewinds of Singapore, HAS is expected to commence regular flights to Chiang Mai and Phuket sometime next year. The Government has budgeted Baht 100 million for this fiscal year for rehabilitation work and minor terminal improvements.

To what extent and how fast U-/Tapao Airport will follow the above stated government policy will be determined by many factors, among which its role to Bangkok airport or airports will be the major one. There are some who are advocating that U-Tapao Airport become a major airport serving the entire Eastern Seaboard thus negating the need for the second Bangkok airport.

Recently Airport Authority of Thailand (AAT) has embarked a master plan study for airport under its jurisdiction, i.e., Bangkok, Chiang Mai, Phuket, and Hat Yai. The study will also look into the issue of what to do with regional airports including U-Tapao. Interim results of the study will become available by April this year.

More importantly the Government will carry out "a Feasibility Study and Master Plan for Development of U-Tapao Airport" with an assistance from USAID. Short-listing of consultants has already been made and the study is planned to start soon. The scope of the study will include the following.

- (1) Inventory and evaluation of existing facilities.
- (2) Determination of commercial development potentials.
- (3) Development of alternative strategies for realizing commercial potentials.
- (4) Comparative analysis to determine optimum staged commercial development strategies.
- (5) Requirement for co-existence of military operations and commercial development.
- (6) Preparation of a staged master plan for U-Tapao commercial development

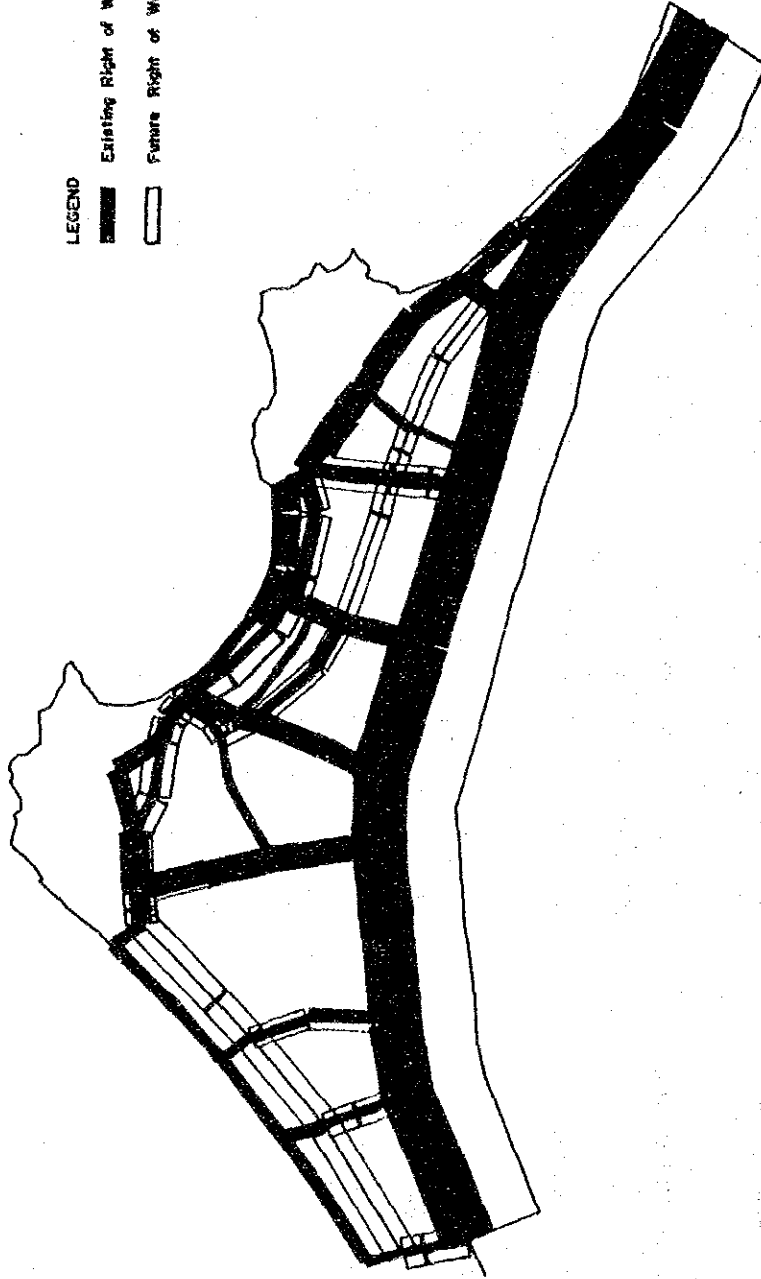
Experience elsewhere in the world shows that investment in airport is difficult for commercial operation by the private sector alone. Government policy to be emerged after the completion of the above study will determine the future of U-Tatao Airport.

Table 4.2.22 Road Improvement Plan in Phatthaya

Road	Section	Length (m.)	Project Description	Remarks
1. Phatthaya 2	Central - South Phatthaya	1,655	Windenning to 4 lane	Under 1988 plan of Phatthaya City
2. Jomtien Beach	Along Jomtien Beach to Chaiyapruk Rd.	3,110	Windenning to 10 m. width	Under 19787 plan of Phatthaya City
3. Sukhumvit	Phatthaya - Rayong	-	Windenning o 4 lane	Under 1990 plan of DOH
4. Chonburi- Phatthaya new Hwy.	Lam Chabang - Route 36 Route 36 - North Phatthaya	17,400 7,000	Windenning to 4 lane New 4 lane	
5. Thapphaya	Phattaya 2 - Jomtien 2	2,500	Windenning to 4 lane	
6. Phatthaya 3	North - Central Phatthaya Central - South Phatthaya South - Mountain Rd. Mountain Rd. - Reclamation Area	1,900 1,750 1,500 800	New 4 lane Windenning to 4 lane New 4 lane Windenning to 4 lane	
7. Jomtien 2	Soi 17 Thapphaya - Wat Boon	1,400 1,900	Windenning to 4 lane New 4 lane	
8. Jomtien 3	Theppasit - Wat Boon	2,100	New 4 lane	
9. Wat Boon	Jomtien beach - Sukhomvit	2,200	Windenning to 4 lane	

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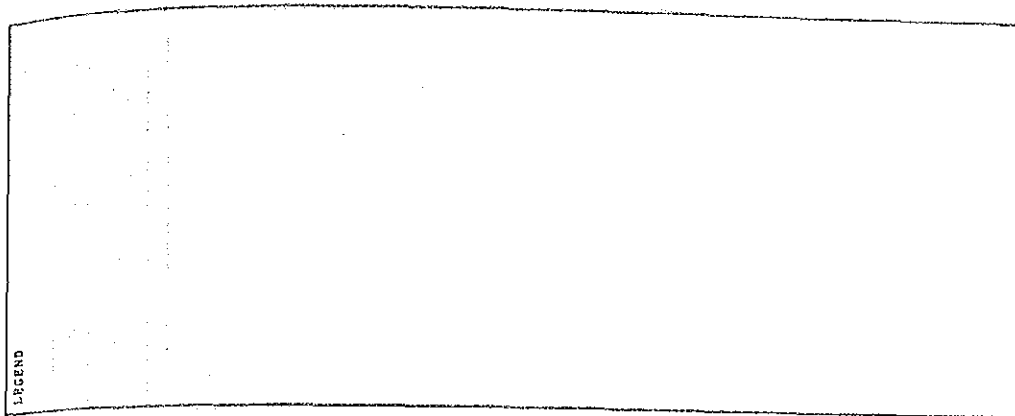
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Existing Right of Ways
Future Right of Ways



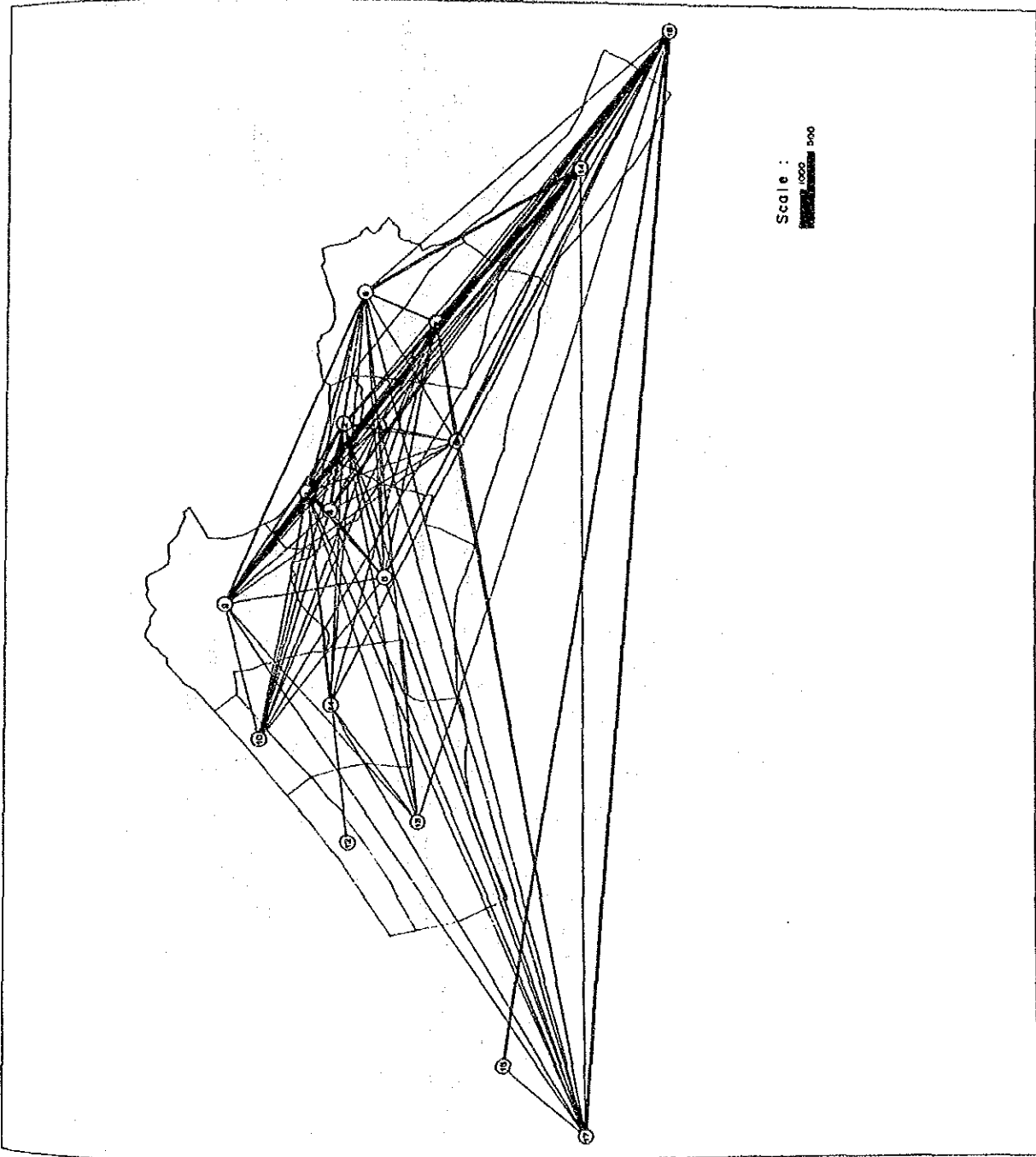
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— 1" = 1/4"

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JAPAN INTERNATIONAL COOPERATION AGENCY
Fig. 4.2.22 Land Acquisition
Requirements for Road

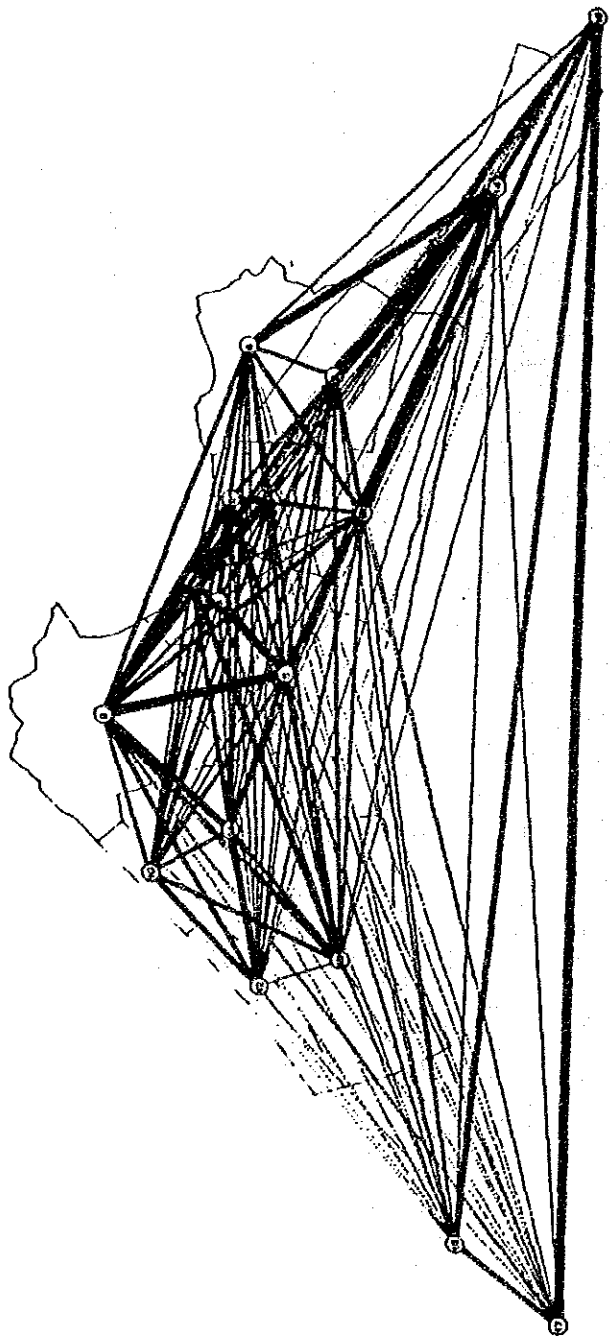
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Fig. 4.2.23 1989 Desire Lines



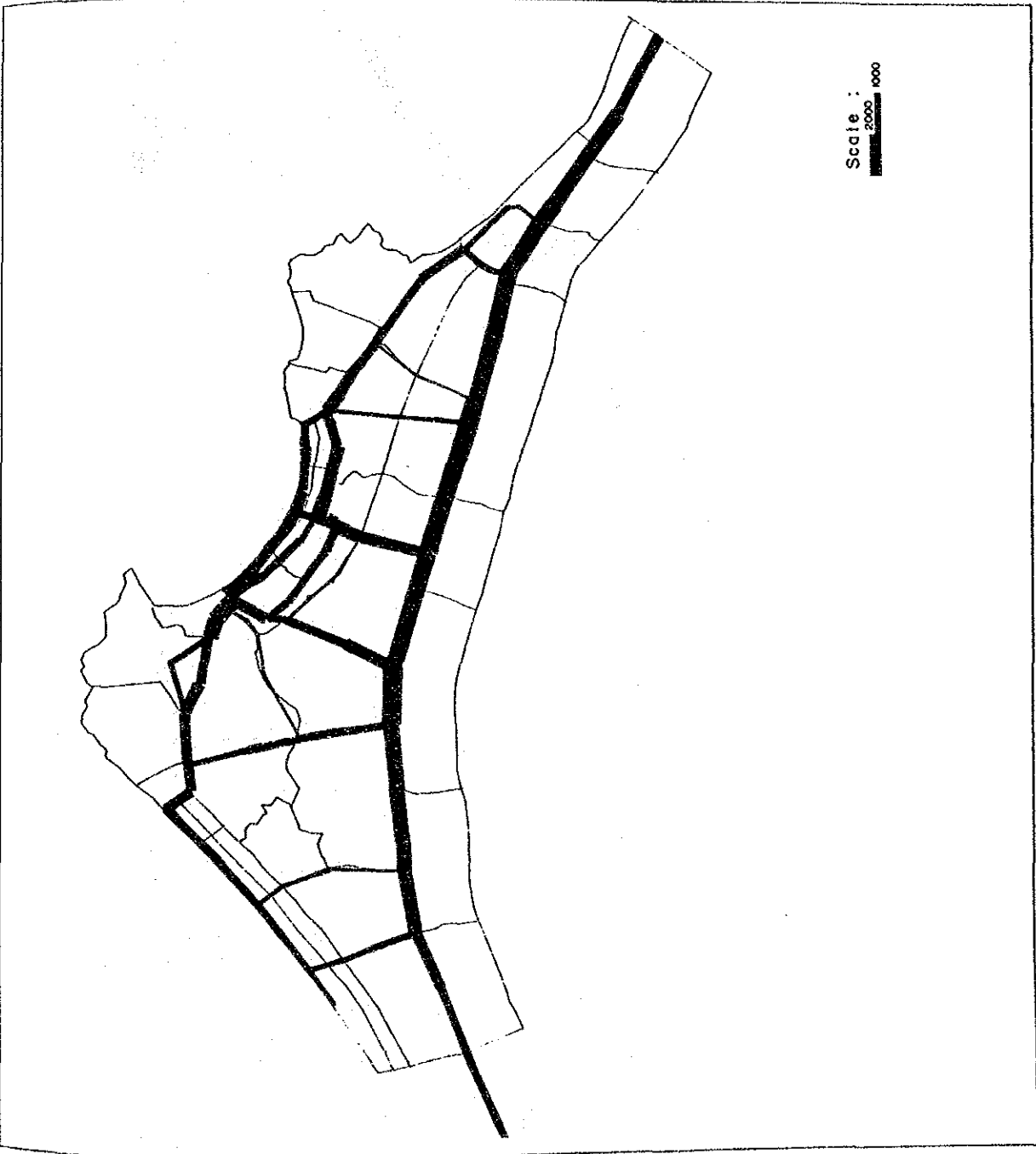
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Fig. 4.2.24 2006 Desire Lines

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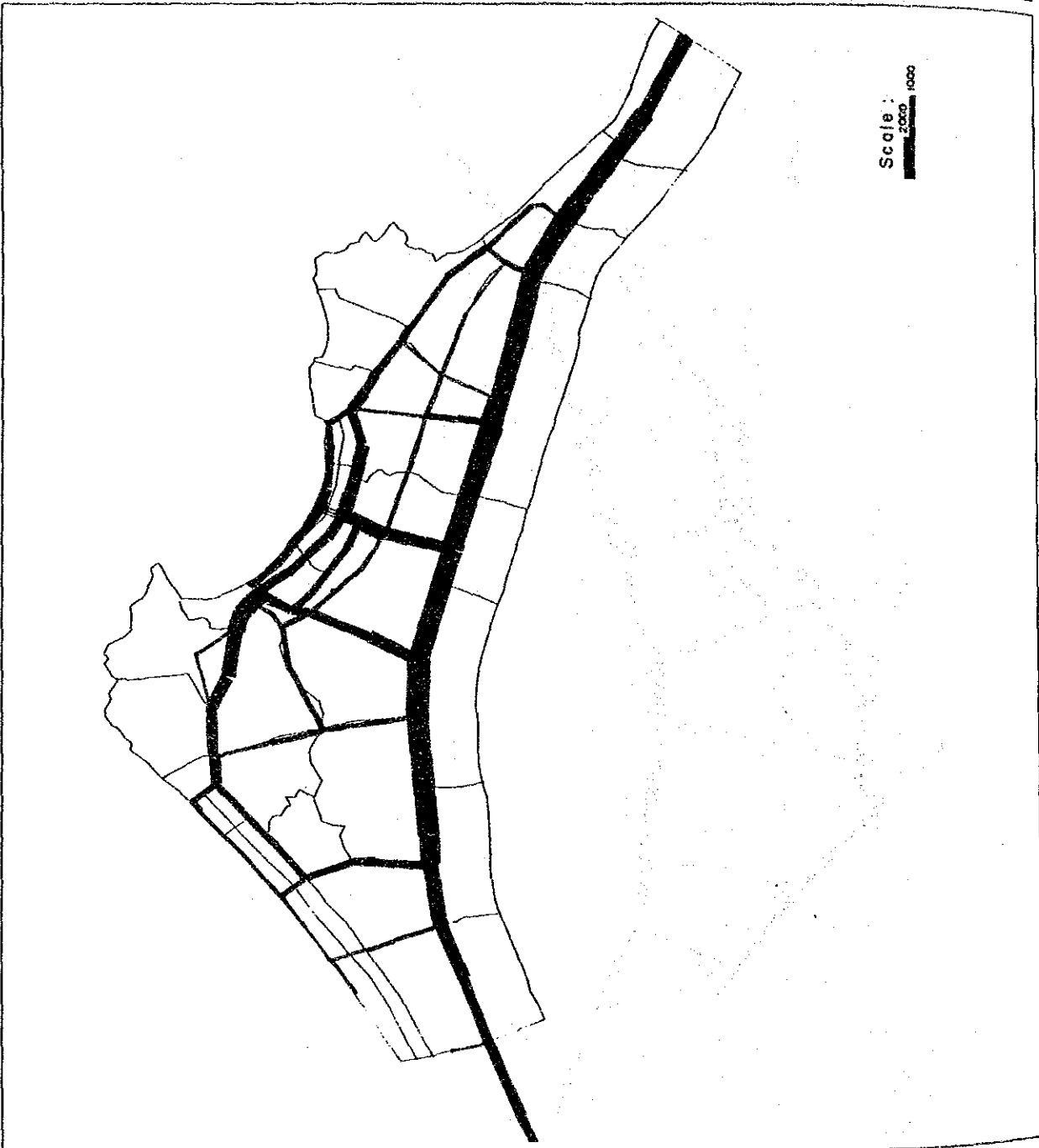


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0 2000 4000

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Fig. 4.2.25 Projected Traffic Volumes,
2006 Existing Roads Only

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Fig.4.2.26 Projected Traffic Volumes,
2006 All General Plan Roads



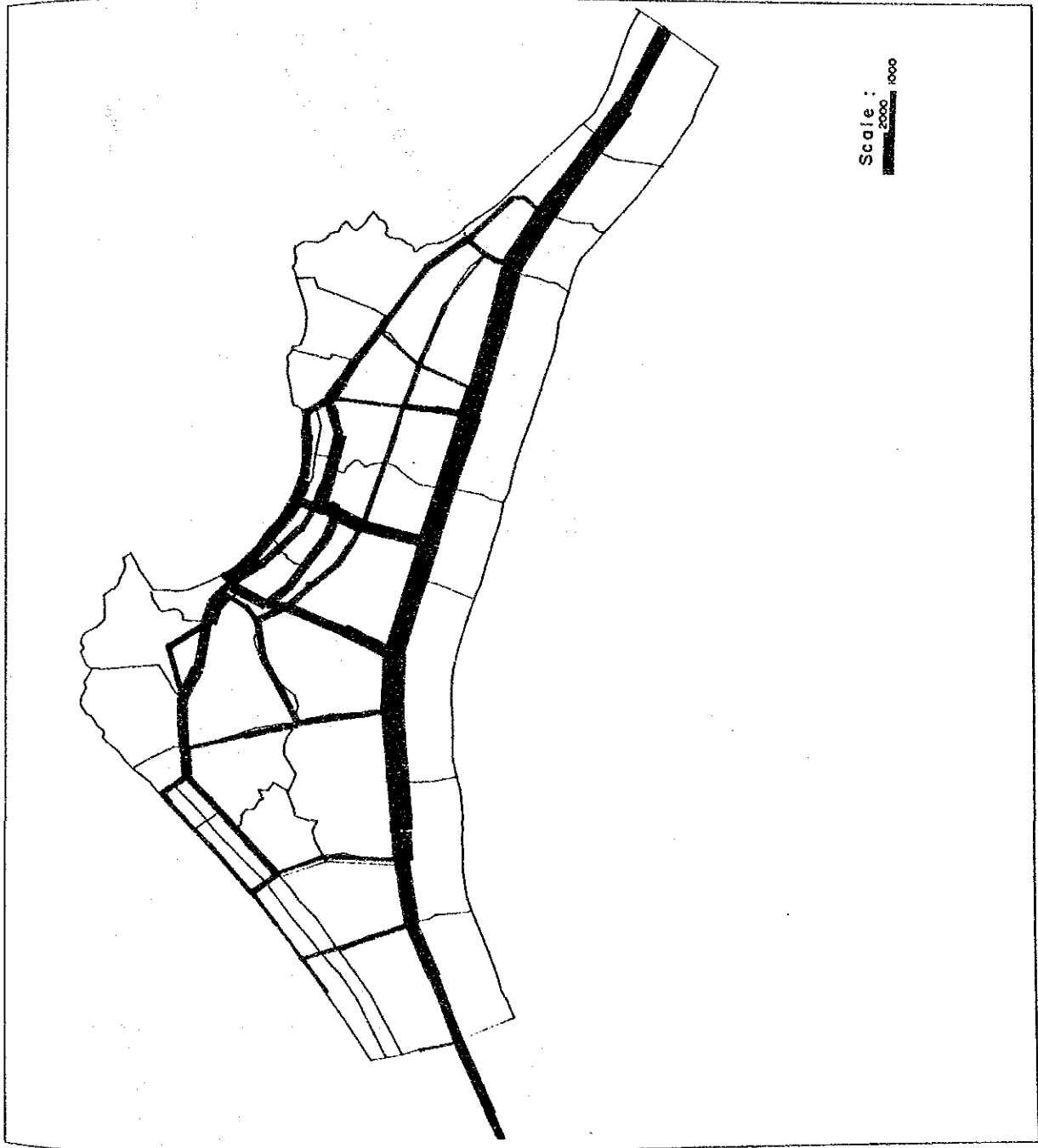
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with No Widening of Existing Roads

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FIG. 4.2.27 Projected Traffic Volumes,
2006 All General Plan Roads

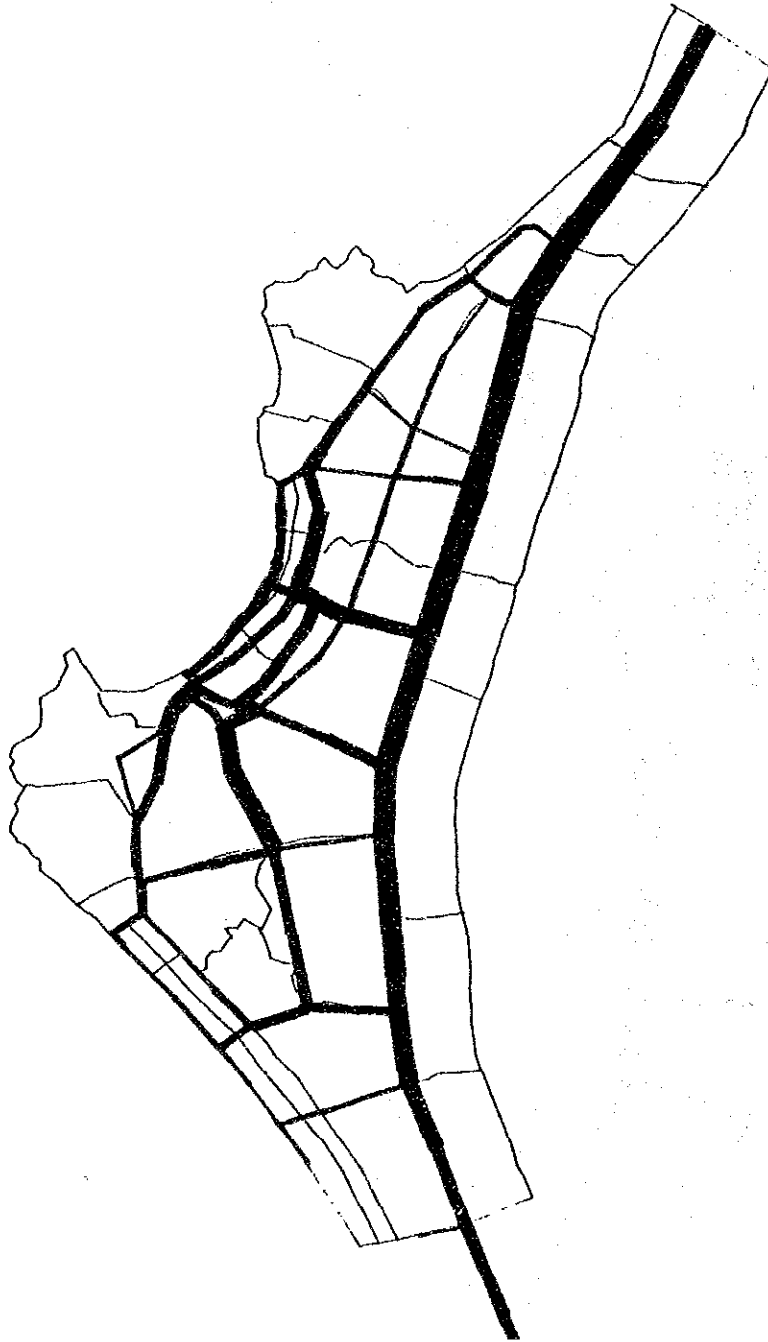


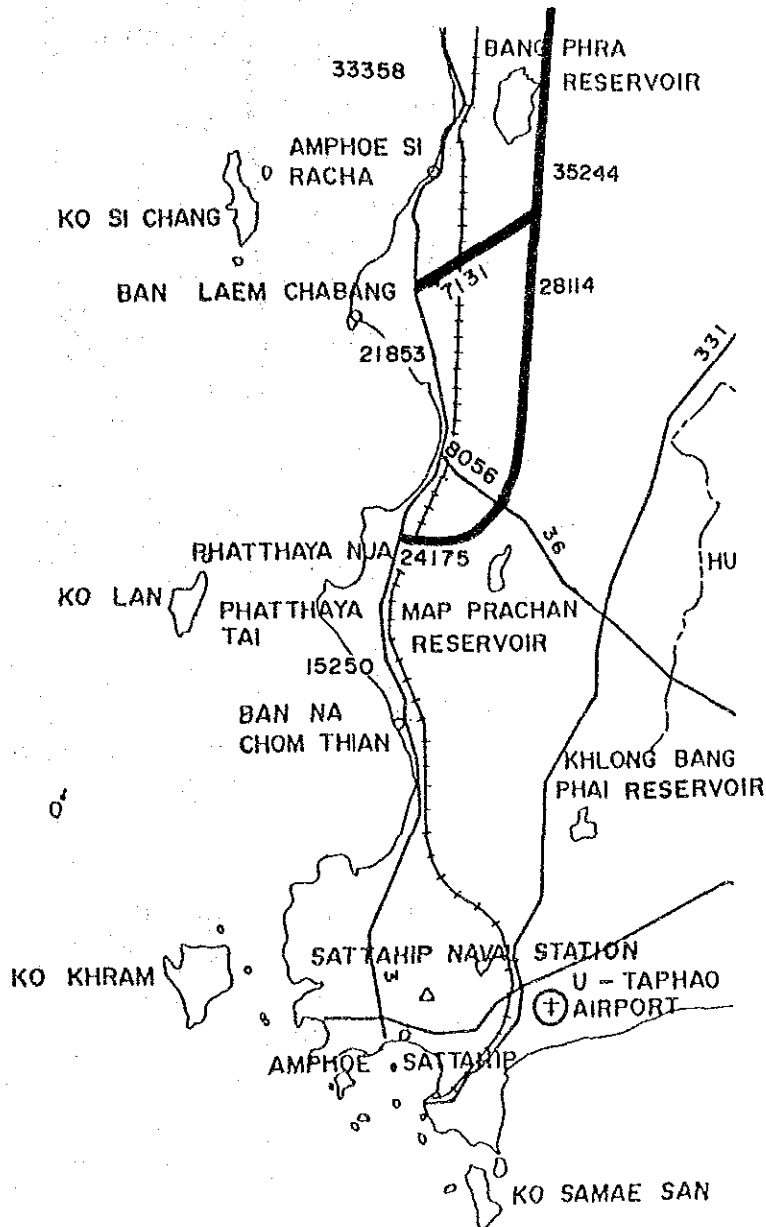
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FIG. 4.2.28 Projected Traffic Volumes,
2006 General Plan Road Plus Extension



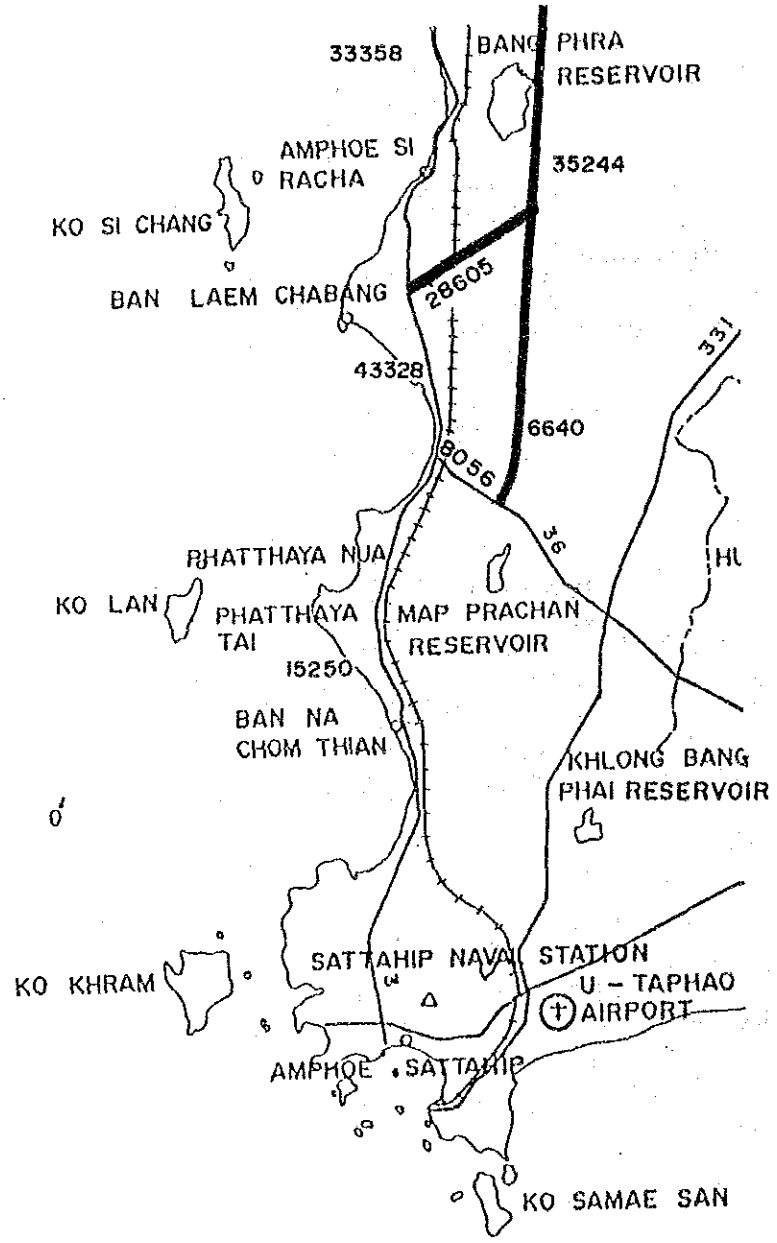


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Fig. 4.2.29 Possible Chonburi - Phatthaya
Highway Extension and Year 2006 Traffic

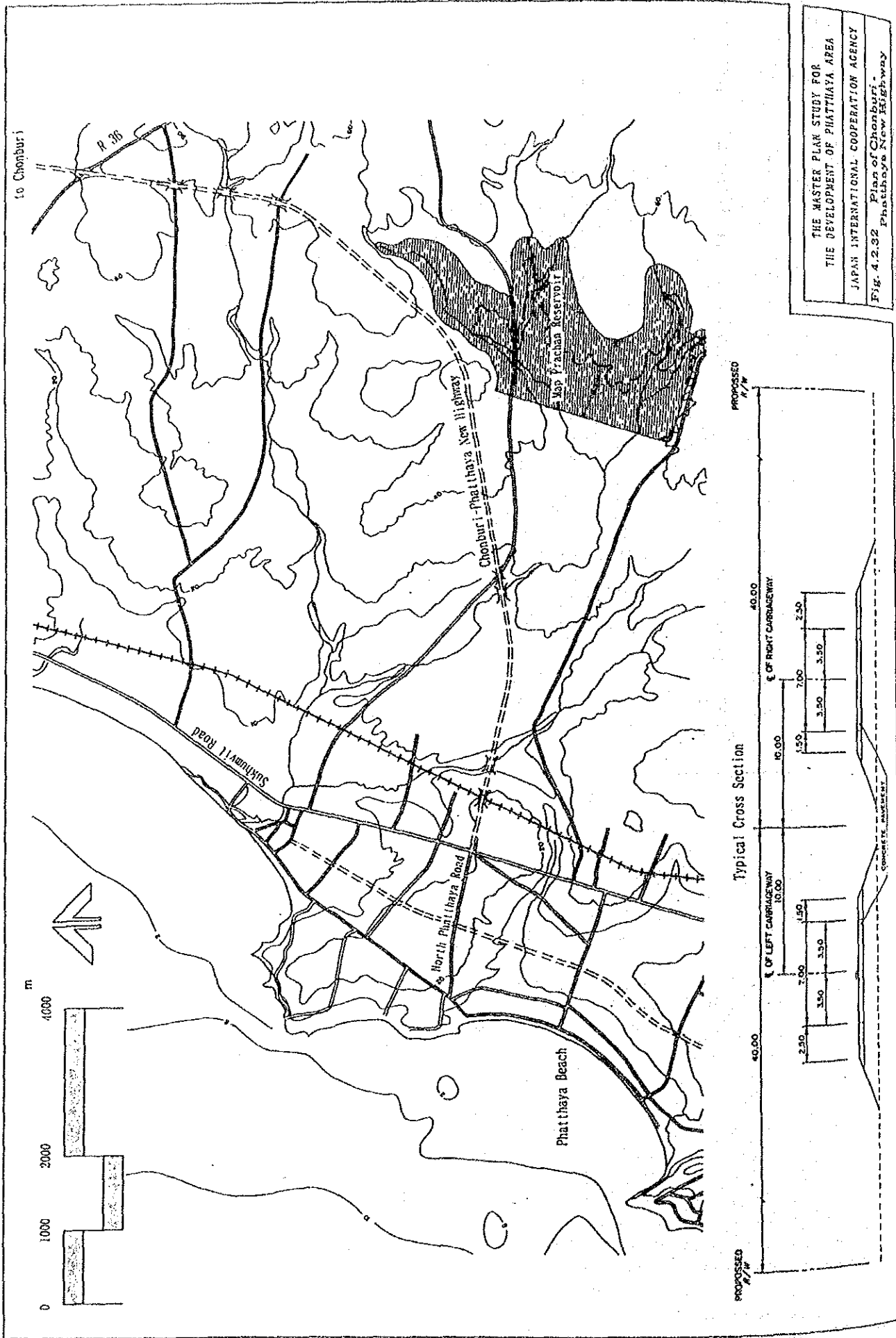


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Fig. 4.2.30
Year 2006 Traffic Without Extension



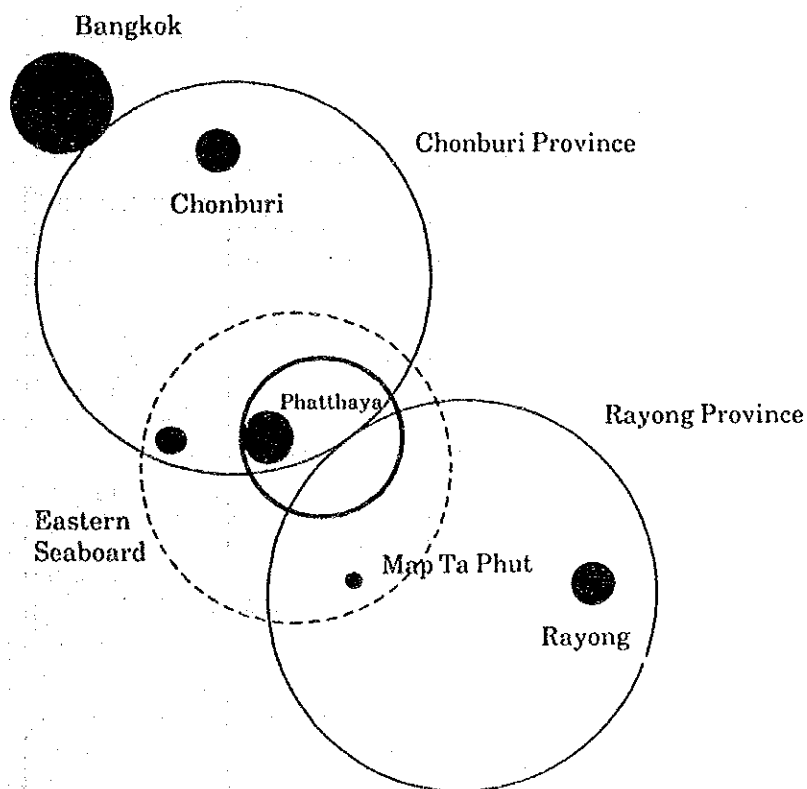
4.2.10 Urban Facilities

1) Objectives

Urban facilities in the Study Area should be expanded and upgraded in order to enhance social well-being and amenity of the residents as well as to support economic activities including tourism.

2) Role of Phatthaya Area in Urban Facility Plan

It is forecasted that the population of the Phatthaya City will reach 200,000 in 2006. This is the size of a regional center and Phatthaya City is expected to be the center of tourism and trade for the region, while Phatthaya is located between two provincial capitals, Chonburi and Rayong.



3) Urban facility standard (preliminary)

Urban facilities for the regional center level should be prepared in every adequate service area.

Population Facility	Neighbourhood 2,000	District 10,000	Regional center 200,000	State 1,000,000
Educational - Kindergarten - Primary school - Secondary school - Vocational school - Collage, University	→	→	→	→
Medical/health - Clinic - Hospital - Public health Center	→	→	→	→
Park and recreational - Play ground - Neighbourhood park - District park - Comprehensive park - Sports park	→	→	→	→
Cultural - Library - Cultural hall - Theater/cinema - Museum		→	→	→
Administrative - City hall - Police station - Fire station - Post office			→	→
Slaughterhouse			→	
Commercial - Retail shops - Neighbourhood Shopping units, Supermarket - Shopping center, Department store - Large department store, Shopping complex	→	→	→	→

4) Educational facilities

In Phatthaya area, the following standards for service distance, number of students and site area are considered. As the primary school is compulsory, priority should be given.

Public schools and private schools should be coordinated to meet the total requirement for education.

Educational facilities	Service distance (m)	Standard Number of Students per school	Standard Area (m ²)
- Kindergarten	400	80	800
- Primary school	800	600 ~ 1,200	6,000 ~ 12,000
- Secondary school	1,200-1,600	1,200 ~ 1,800	12,000 ~ 18,000
- Vocational school	-	600 ~ 1,200	12,000 ~ 18,000
- College/university	-	-	-

(1) Kindergarten

Independent kindergartens and kindergartens attached to primary schools should be set up.

(2) Primary school

Basically increase of students should be facilitated by extension of the existing schools as the site areas have room for expansion.

New schools should be constructed in the central area of Jomtien to cover the area.

Primary schools in Phatthaya City

		1989	1996	2006
Population		100,000	140,000	200,000
No. of pupil in public and private primary school		10,300	14,000	20,000
No. of primary school	Public	10		
	Private	11		
	Total	21	23	26
School	Site area (ha)	NA	42	60
	Floor area (ha)	NA	14	20

(3) Secondary school

Secondary school education will become more popular as the standard of living rises.

The number of secondary schools is not sufficient at present. New secondary schools should be prepared in the South Phatthaya and Jomtien area.

(4) Vocational school

For development of tourism in Phatthaya, high level service is essential. To enhance the level of service, more education and training are required. A tourism vocational school will provide a place to those who are to get job in tourism or who are to work in tourism related industry.

(5) College/University

As the center of the ESB region, a university should be established in the Phatthaya area.

5) Medical/Health Facilities

(1) Hospital

After completion of the two new hospitals, 4 hospitals will have more than 200 beds, which would be sufficient for the residents. Considering the inflow of tourists, however, new hospitals should be set up in the future, preferably public ones considering the level of medical expenses.

(2) Public health center

The present facilities should be expanded to provide adequate service.

For high level service for health, maternity, disease prevention, etc., more public health centers should be established.

6) Park and recreational facilities

At present, there are few parks and no sports facilities for citizens. It is desirable that park and recreational facilities should be reinforced based on the following standards.

Park and recreational	Standard Area (m ²)	Service distance (m)	Service population	Calculated Number in 2006
- Play ground	1,000	300	500	(400)
- Neighbourhood park	16,000	500	2,000	(100)
- District park	40,000	900	8,000	(25)
- Comprehensive park	80,000	-	50,000	(4)
- Sports field	50,000	-	10,000	(20)

Efforts should be made to realize parks of good quality one by one. Priority should be placed to childrens' playground and comprehensive park with sports facilities. The comprehensive parks should be constructed in "open space for entertainment and environmental quality" zone.

In the related sea reclamation projects, spot parks and green belts will be constructed along the beach.

7) Slaughterhouse

The existing facility is poor and waste water is discharged to the stream without treatment.

A new slaughterhouse should be constructed according to the following guidelines.

- (1) The site should be located in "rural and agriculture areas".
- (2) There should be no residential areas, schools, hospitals or religious buildings in the vicinity.
- (3) Assessment and measurement of noise and odor should be carefully carried out.
- (4) The site should be convenient for transportation and accessible to a main road.
- (5) The main transportation routes should not pass through residential areas or central business districts.
- (6) An appropriate sewerage system should be provided.

The site should have a parking area and a reserved area for extension and minimum size would be 2 rais (3,340 m²).

8) Cultural facilities

(1) Library

More small libraries should be set up in residential area in the long run.

(2) Cultural hall, Theater/Cinema, Museum

These facilities should be enhanced to reinforce cultural background of the Phatthaya area as an international resort as well as for increasing amenity of the residents.

9) Administrative facilities

(1) Fire station

The present fire station has easy access to Sukhumvit road and by this way it is possible to reach the south end of the city in about 10 minutes.

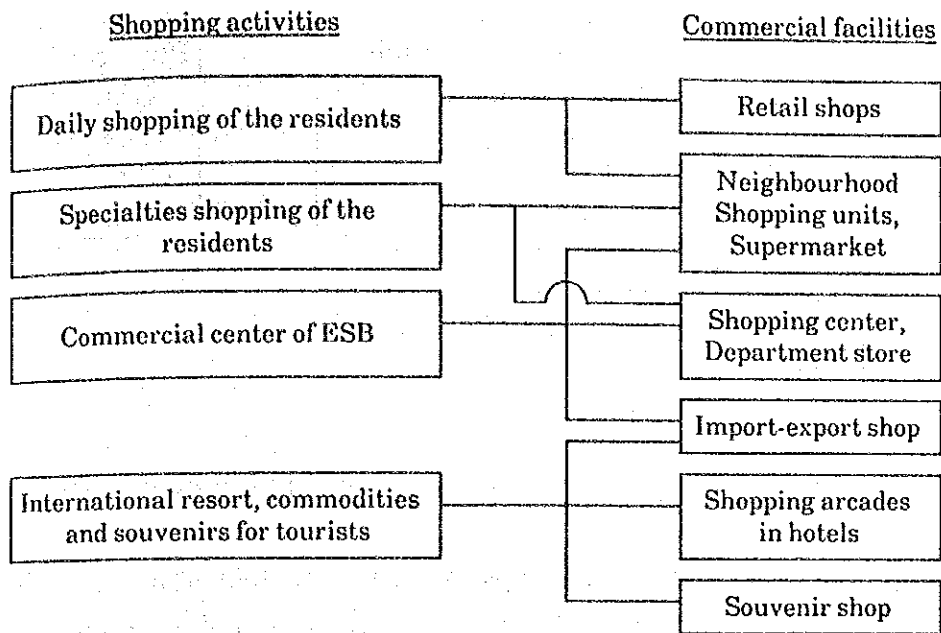
To cope with the development of Jomtien area, a new fire station should be located in Jomtien area.

(2) Police station

In order to enhance security of tourists, police stations, tourist police stations and marine police stations should be reinforced, especially in Phatthaya beach area and Jomtien beach area.

10) Commercial facilities

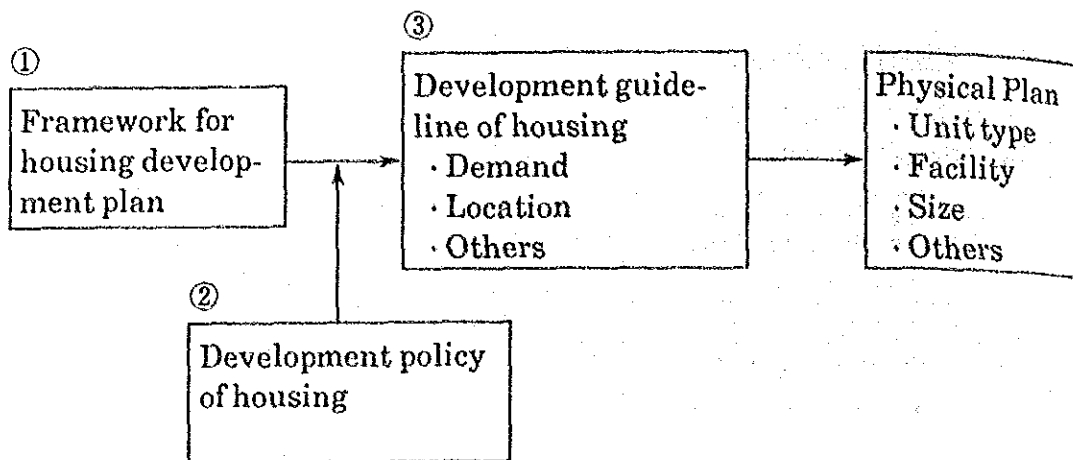
Commercial facilities should be prepared to satisfy the following shopping activities:



11) Public Housing

(1) Preface

Due to the expected drastic increase of population in and around Phatthaya city, the housing development plan should be studied and developed. In this section, basic principles concerning the housing development are analyzed based on the following study flow.



(2) Framework for Housing Development Plan

Family number in the Study Area will be reached more than double after 15 years and the demand of new housing development will be increased by new families.

	1989	1996	2006
Population in the Study Area	100,000	161,000	220,000
Household in the Study Area ^{/1}	39,000	63,000	86,000
Family in the Study Area ^{/2}	18,000	29,000	40,000
— High Income Family ^{/3}	5,000	8,700	14,000
— Medium Income Family	4,500	8,700	14,000
— Low Income Family	2,200	4,400	8,000
— Lowest Income Family	6,300	7,200	4,000

- Remarks :
- ^{/1} Future Population/Household size of Phatthaya city (2.55 persons : 1987)
 - ^{/2} Future population/Family size of Phatthaya city (5.55 persons : 1989)
 - ^{/3} Assumption of income composition (%)

Class	Present	1996	2006	Remarks
High Income	28 ^{/a}	30 ^{/b}	35 ^{/c}	7,500Bahts/family • month~
Med. Income	25	30	35	4,500~7,500
Low Income	12	15	20	3,500~4,500
Lowest Income	35	25	10	~3,500

Remarks : ^{/a} Central region municipal area : 1986

(Household-Socio-Economic survey, 1986,NSO)

^{/b} Numbers drawn from present statistic of Bangkok metropolis are assumed as the middle year target for Phatthaya city.

^{/c} Predicted by linear trend.

(3) Development policy of housing

According to "Plan for developing housing projects and for remedying the congested communities during the sixth National Plan (1987~1991)" NHA, the executing bodies for housing development are allotted as follows.

Type	Income	Main executing body
① House for high income class	7,500Bahts/ family • month	Private sector (NHA for special projects)
② House for medium income class	4,500~7,500	NHA and private sector
③ House for low income class	3,500~4,500	NHA
④ House for lowest income class	~3,500	Slum improvement by NHA and the government

NHA and Phatthaya city has to deal with the construction of housing for low income and medium income families to satisfy a strong demand for housing.

At the same time, NHA and/or Phatthaya city are requested to take a part aggressively in the slum improvement projects which are needed for the lowest income families who can not afford their houses by themselves.

Furthermore, Phatthaya is suitable for high grade housing for high income group, ie. - managers, technical experts and foreigners who work in Laem Chabang complex and Map Ta Phut complex. Introduction of high grade housing has already active by the private sector's - especially of condominiums.

(4) Development guidelines for housing development

Housing development demand in Phatthaya city during 1989 and 2006 is projected approximately 30,000 houses as follows :

	Demand Increase (Houses)				
	1989 ~1996	1989 ~2006	Executing body (%)		
			NHA	Private	Others
① House for High Income Family	3,700	9,000	--	100	--
② House for Med. Income Family	4,200	9,500	50	50	--
③ House Low Income Family	2,200	5,800	100	--	--
④ House Lowest Income Family	900	--	--	--	100
⑤ House for the executives work in ESB ^{/1}	850	2,500	--	100	--
⑥ Total	18,150	30,800	--	--	--

Remarks: /1 Number of manager of industrial estate and/or related industries are predicted based on the master plans of Laem Chabang Complex and Map Ta Phut complex.

	Laem Chabang	Map Ta Phut
1996	600	250 managers
2001	2,000	500

New Construction by NHA

A half of houses of medium income family and 100% of the Low income family are proposed to be supplied by NHA project.

	(Units)		
	1989~1996	1997~2006	1989~2006
Medium Income Family	2,100	2,700	4,800
Low Income Family	2,200	3,600	5,800
Total	4,300	6,300	10,600

Necessary area for the new town is 160 ha between 1989~2006 based on the assumption of the unit house area of 90 m² and the public area ratio of 40%.

	1989~1996	1997~2006	1989~2006
(ha)	65	95	160
(Rai)	406	594	1,000

NHA is developing housing projects in Jomtien area and selling at the price of 1,300~2,000 Bahts/m² including 130~140 Bahts/m² as land acquisition cost.

That land price can be presently found only at inland area more than 1 km apart from Sukhumvit road because of drastic price escalation in Phatthaya city. On the other word, NHA new town project could be introduced only in inland area behind Sukhumvit road in Phatthaya City from the present.

Slum Improvement

The lowest income family who can not afford their houses by their own income tend to form illegal slums.

Nine slums in which 477 families with 2,002 population live in Phatthaya city as shown in Chapter 2 must be improved urgently.

Since slum families can not pay any for housing, housing rental fee must be almost zero in order not to enforce them to get out from the new houses and form slum again.

In that sense, the housing for the relocation of slum family must be developed by the low cost considering following possibilities.

- Land acquisition cost ... Inland area is only suitable
- Construction cost for ... A quarry which supplies soil to land infrastructure and reclamation in south Phatthaya could be a land preparation housing site utilizing implemented roads, flats, land and others.

The location of the new town must be analyzed carefully based on those items and their job opportunities and communication.

(5) Physical Plan

Planning Framework

It is aimed to prepare the 100% of low income housing and 50% of medium income housing

	1989~1996		1997~2006	
	Unit	Population /1	Unit	Population
Low Income Family	2,200	12,000	3,600	19,800
Medium Income Family	2,100	11,500	2,700	14,800
Total	4,300	23,500	6,300	34,700

Remarks: /1 1 household : 5.5 persons

Location

As the inland area where land price is low should be developed, the following two candidate sites are marked considering topography, location of reservoir and other conditions (See Fig. 4.2.33).

Site A is along the new Chonburi-Phatthaya highway in the distance of 5~10 km from the center of the city. It has quick access to the center of Phatthaya City by the new Chanburi - Phatthaya highway.

Site B is 2~3km east of Sukhumvit road and approximately 1 km further inland from the existing local road. An access road will have to be constructed. The distance to the city center is quite short, yet the land cost is expected low.

Housing Type

To avoid high utilization and density as well as living amenity, total 64 ha (400 rai) should be developed for 4,300 units. A schematic plan is shown in Table 4.2.23.

The half of housing are to be sold and the other half will be rented.

Facilities

The following facilities are to be provided.

		Number	
		1989~1996	1997~2006
① Educational	Kindergarten	4	6
	Primary school	2	3
	Secondary school	1	1~2
② Park	Playground	22	30
	Neighborhood park	2	3
	Sports park	1	1
③ Community center		1	1
	(shops, clinics, health center, post office, police station, fire station, library, small hall etc.)		
④ Utilities	Water supply		
	Electricity		
	Drainage		
	Road and parking, bus stop		
⑤ Access road from main road			

Land use

The following land use is planned of which the schematic plan is shown in Fig. 4.2.34.

		Unit area (m ²)	No.	Area			
				ha	Rai	(%)	
1989~ 1996	Residential	-	4,300	30.6	191.3	48.0	
	Road	-	-	13.0	81.3	20.3	
	Open Space	Buffer	-	-	2.1	13.1	3.3
		Play Ground	800	22	1.7	10.3	2.7
		Neighborhood Park	16,000	2	3.2	20.0	5.0
		Sports Park	48,000	1	4.8	30.0	7.5
	School	Kindergarten	1,600	4	0.6	4.0	1.0
		Primary School	8,000	2	1.6	10.0	2.5
		Secondary School	32,000	1	3.2	20.0	5.0
	Community	Center	32,000	1	3.2	20.0	5.0
	Total				64.0	400.0	100.0

12) Electricity and Telecommunication

(1) Electricity

The objectives of electricity supply set in this Study for 2006 are as follows,

- 100% Coverage ... Meeting all the electricity demand
- Reliability No interruption
- High quality Stability in voltage

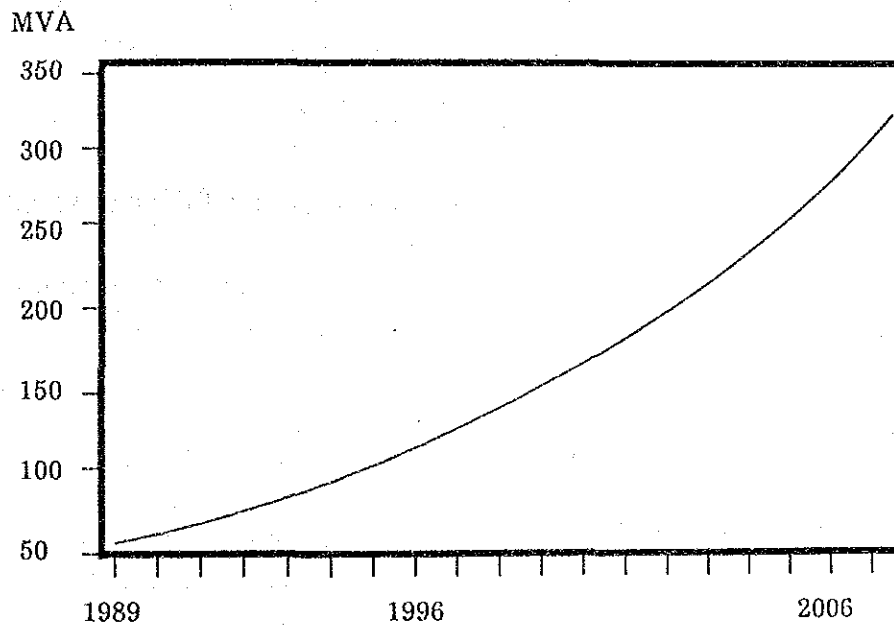
Power will be supplied by EGAT for Eastern Seaboard region including the Study Area, in which two 600 MW power plants is to be completed toward 1990.

PEA has the plan to construct Jomtien substation (25 MVA) and Phatthaya Tai substation (2×40MVA) to meet the increasing demand especially of Jomtien and South Phatthaya area.

Efforts will be concentrated to expansion meeting to increasing requirement, however in the long run, improvement of reliability and quality should be worked out such as underground installation of main circuits and loop line system etc.

Electricity demand has been forecasted based on the load forecast of PEA's substation and the population forecast in the study area.

	1989	1996	2006
Population	120,000	160,000	220,000
Demand per capita (KVA)	0.508	0.846	1.052
Maximum demand (MVA)	61.0	135.4	231.1



Electricity Demand Forecast

The increase of power demand in accordance with business or commercial development is considered to be included in the above increase.

On condition that the projects of EGAT and PEA be implemented, the power demand is likely to be satisfied for several years.

A schematic plan of electricity supply main is shown in Fig. 4.2.35.

Reliability and quality of electricity supply should be improved.

(2) Telecommunications

From the view point of the basic directions of Phatthaya City as commercial, information and business center, telecommunication system will play more and more important role. With week telecommunications, no company would like to place their office in Phatthaya. Basic telecommunication system may be telephone system, and various communication methods are expected to be developed.

Telephone

The service area will be the whole Study Area and the following objectives are set as follows:

- Reliance : No breakdown
- High quality : Clearness, accuracy
- Quick service : No waiting time

The telephone demand is forecasted as shown as follows based on the following conditoin:

Number of telephones per capita

$$= 3,961 \times 10^{-6} \times \left(\frac{\text{GRP}}{\text{Population}} \right)^{1.2758}$$

Annual increase rate of GRP = 5%

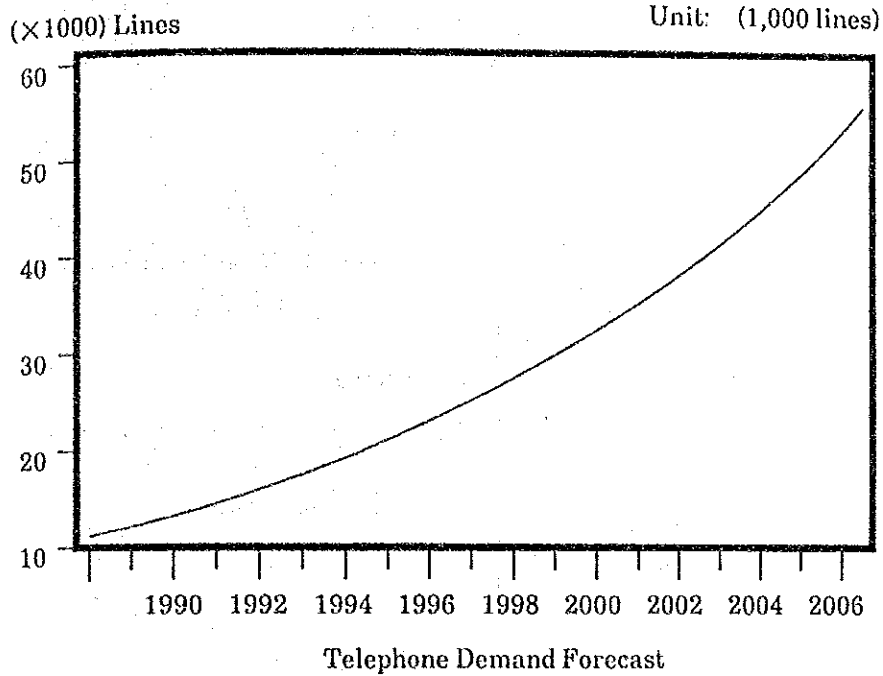
The demand for tourists is included in the above unit.

TELEPHONE DEMAND FORECAST

Year	1989	1996	2006
Populatoin	120,000	160,000	220,000
Lines per capita *	0.0893	0.1381	0.2574
No. of Lines	10,720	22,100	56,600

* Base year 1989, Increase rate 10% per year

TELEPHONE DEMAND



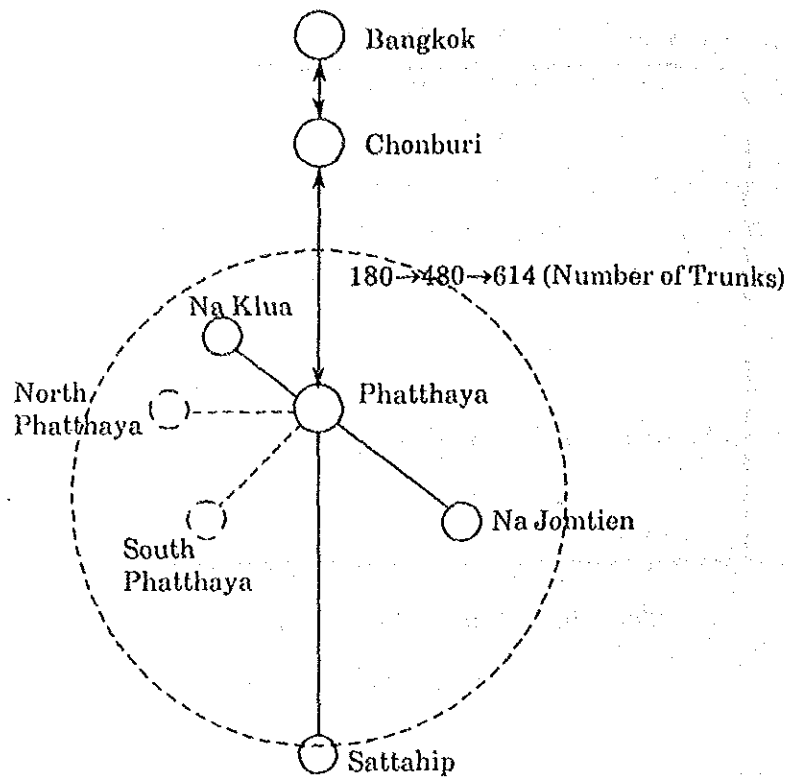
According to TOT's plan, Phatthaya local exchange is connected to Chonburi, having remote subscriber units of Na Klua, Na Jomtien and Sattahip etc. Two remote subscriber units of North Phatthaya and South Phatthaya will be provided.

The following table shows preliminary plan of TOT in 1992.

PLANNED LINE CAPACITY AND PRIMARY PAIRS IN 1992 BY TOT

	System	Line Capacity	Primary Pairs
Phatthaya	MSU	13,312	14,060
Na Klua	RSU	1,536	2,000
Na Jomtien	RSU	2,048	2,400
North Phatthaya	RSU	1,024	NA
South Phatthaya	RSU	2,048	NA

MSU: Digital Exchange, RSU: Remote Subscriber Unit

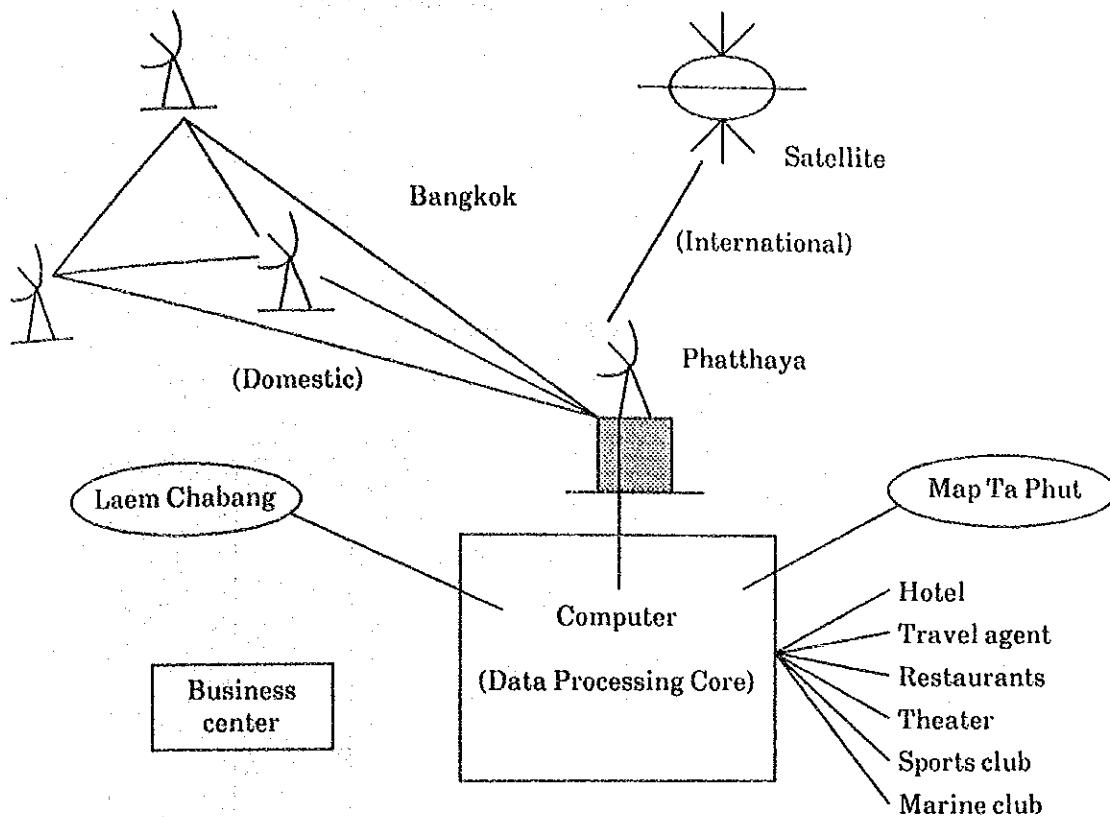


Telex

The number of telex lines is 200 at present according to CAT's plan, while the forecasted number of customers in 1992 will be 110. It will be sufficient in view of increasing use of facsimile.

Teleport and tourism information system

As a tourism and business center, a comprehensive communication and information system should be formed. Computerized tourism information and booking system for tickets, hotels, restaurants etc. linked with international and domestic system would be systematized in the teleport as shown in following figure.



13) Na Klua Market Renovation

(1) Present Condition

In the Na Klua market, a various commodities such as sea foods, vegetables, fruits, cereals and miscellaneous goods are available in a low price. This market is convenient and essential for the residents. It, however, has a followings problems to be renovated immediately.

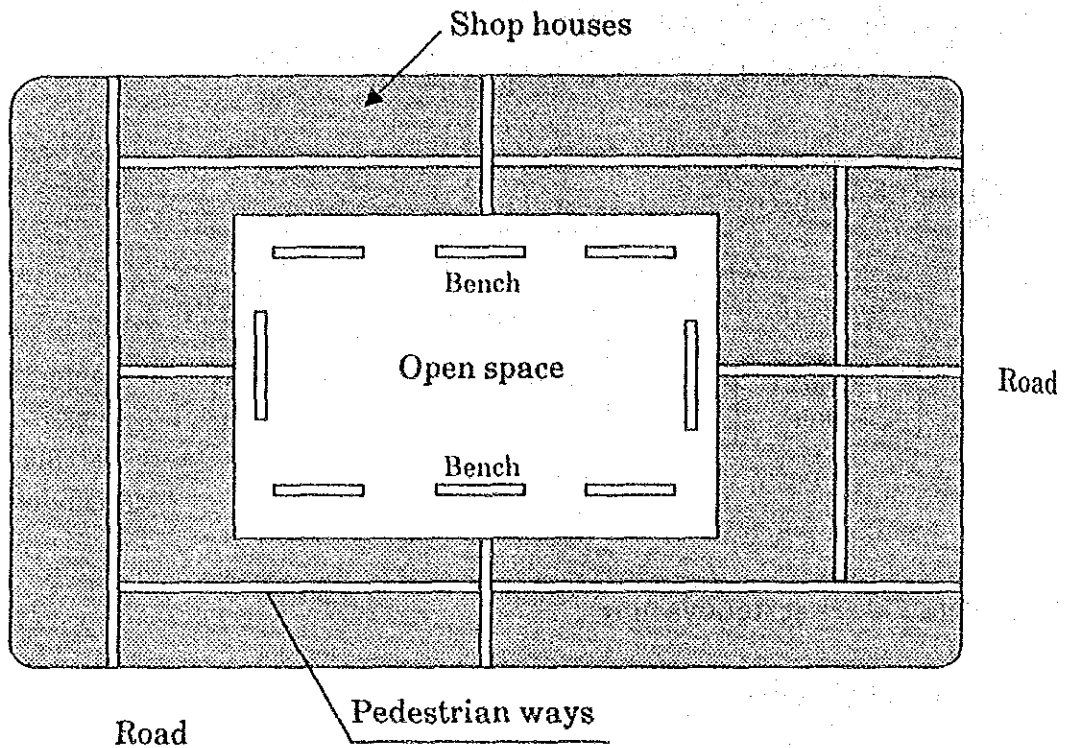
- Facilities are scattered too dense to be safe from the fire disaster.
- Foul water smells offensively.
- Not only road capacity but car parking spaces are insufficient.

(2) Development Direction

Renovation and/or renewal not relocation is the optimum method of the development of Na Klua market thinking of the indispensability for the daily life of the residents.

Following facilities are proposed for the renovation.

- a. Shop houses
- b. Open space (event space)
- c. Pedestrian ways



In addition, the infrastructures such as sewers, can parkings, roads, etc. must be developed in Na Klua market in order to induce the tourists.

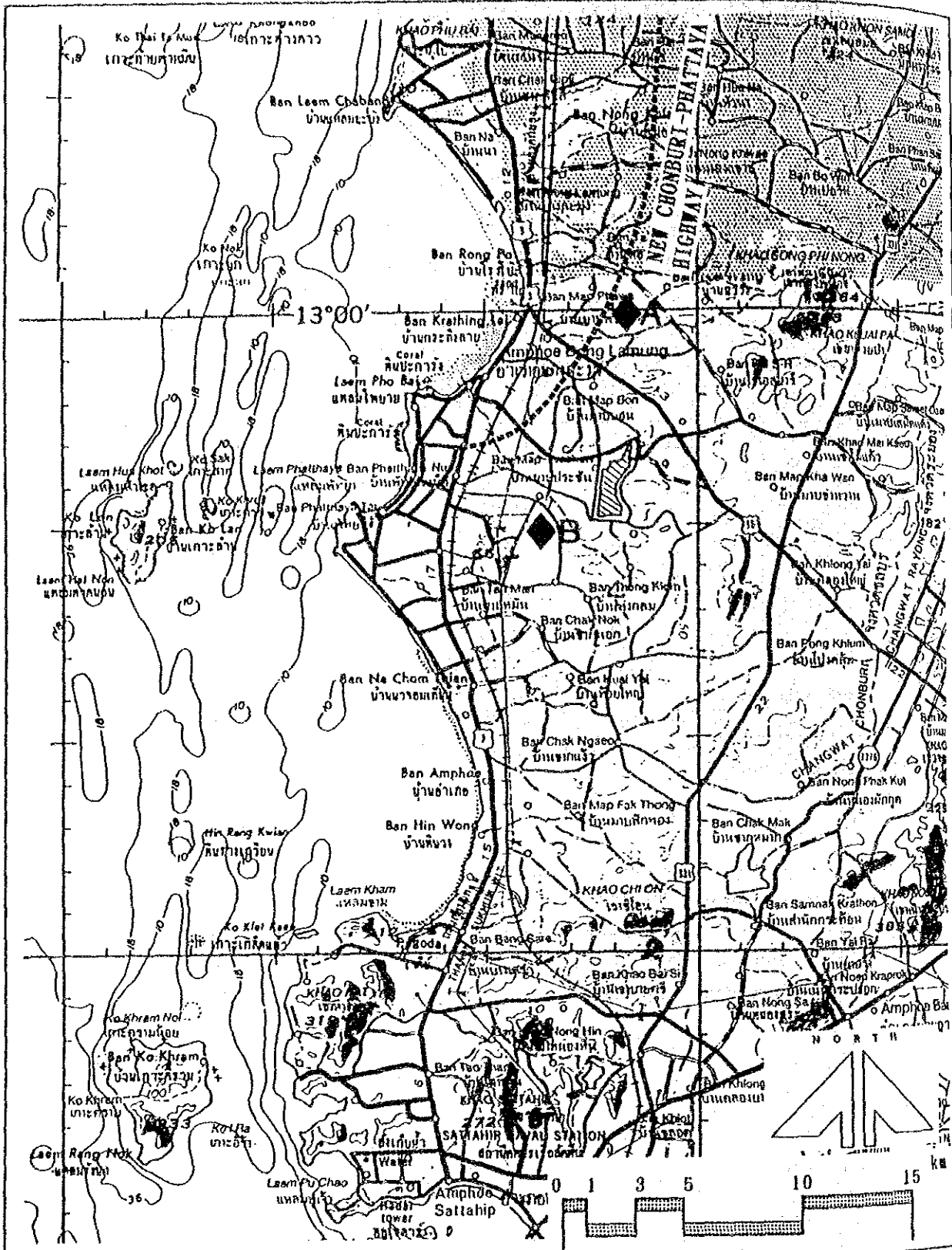
Table 4.2.23 SCHEMATIC PLAN OF HOUSING TYPE

	Type	Unit	Type	Site area (ha)	Floor area (m ²)	
1989~1996	A	Sale	1,100	Town house	7.7	38,500
	B	Rental	1,100	Medium rise	3.9	38,500
	C	Sale	1,000	Town house	12.0	60,000
	D	Rental	1,000	Medium rise	6.0	60,000
	E	Sale	100	Town house	1.0	20,000
Total			4,300		30.6	217,000

	Type	Unit	Type	Site area (ha)	Floor area (m ²)	
1997~2006	A	Sale	1,800	Town house	12.6	63,000
	B	Rental	1,800	Medium rise	6.3	63,000
	C	Sale	1,200	Town house	14.4	72,000
	D	Rental	1,200	Medium rise	7.2	72,000
	E	Sale	300	Town house	3.0	60,000
Total			6,300		43.5	330,000

Remarks: Typical Unit Type

Type	Group	Site Area (m ²)	Floor Area (m ²)
A	Low income (Sale)	70	35
B	Low income (Rental)	35	35
C	Medium income (Sale)	120	60
D	Medium income (Rental)	60	60
E	Row house with shop	100	200



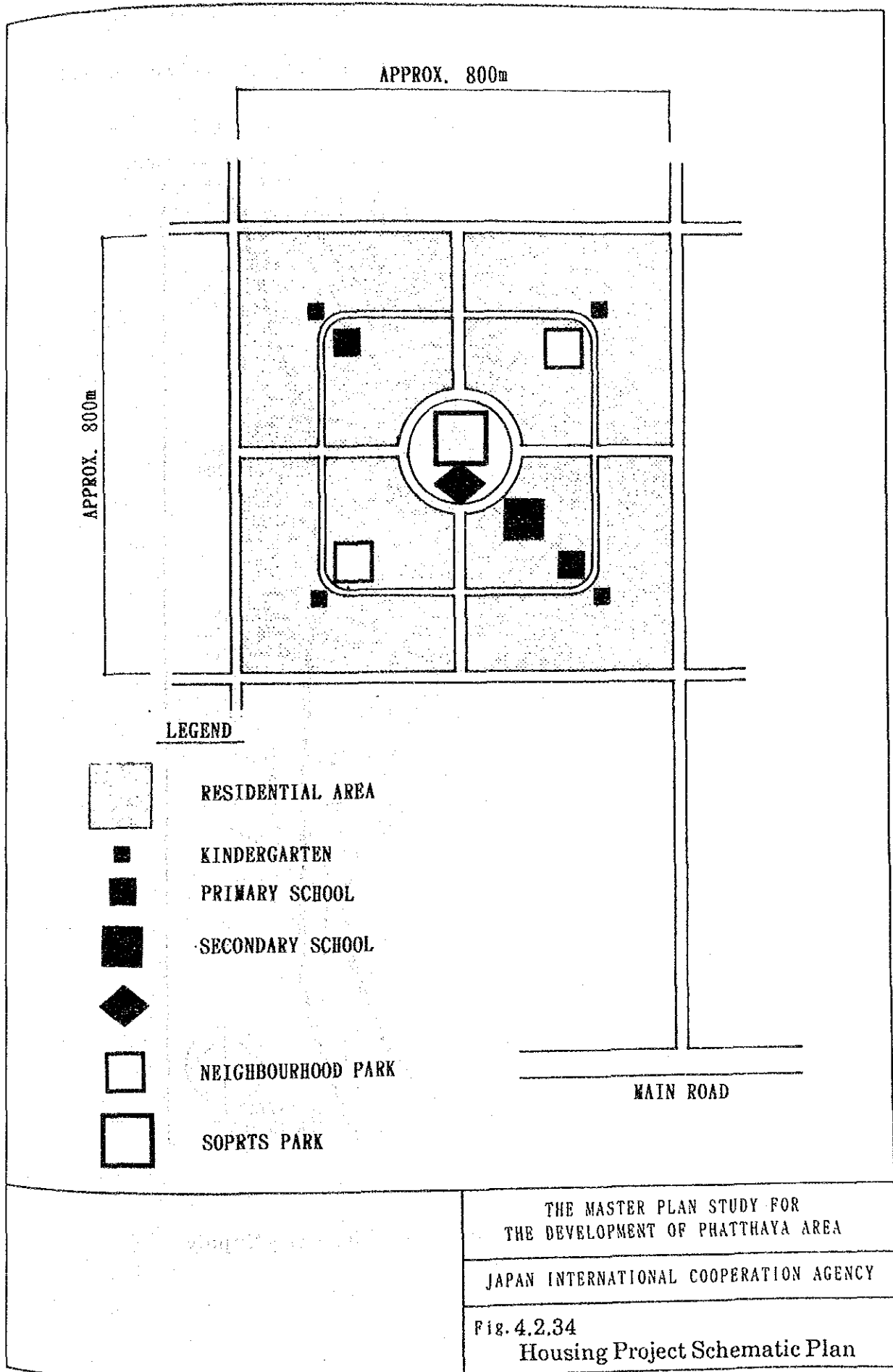
LEGEND

◆ CANDIDATE SITES OF HOUSING PROJECT

THE MASTER PLAN STUDY FOR
THE DEVELOPMENT OF PHATTAYA AREA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 4.2.33
Candidate Sites of Housing Project



APPROX. 800m

APPROX. 800m

LEGEND



RESIDENTIAL AREA



KINDERGARTEN



PRIMARY SCHOOL



SECONDARY SCHOOL



NEIGHBOURHOOD PARK



SOPRTS PARK



MAIN ROAD

THE MASTER PLAN STUDY FOR
THE DEVELOPMENT OF PHATTHAYA AREA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 4.2.34
Housing Project Schematic Plan

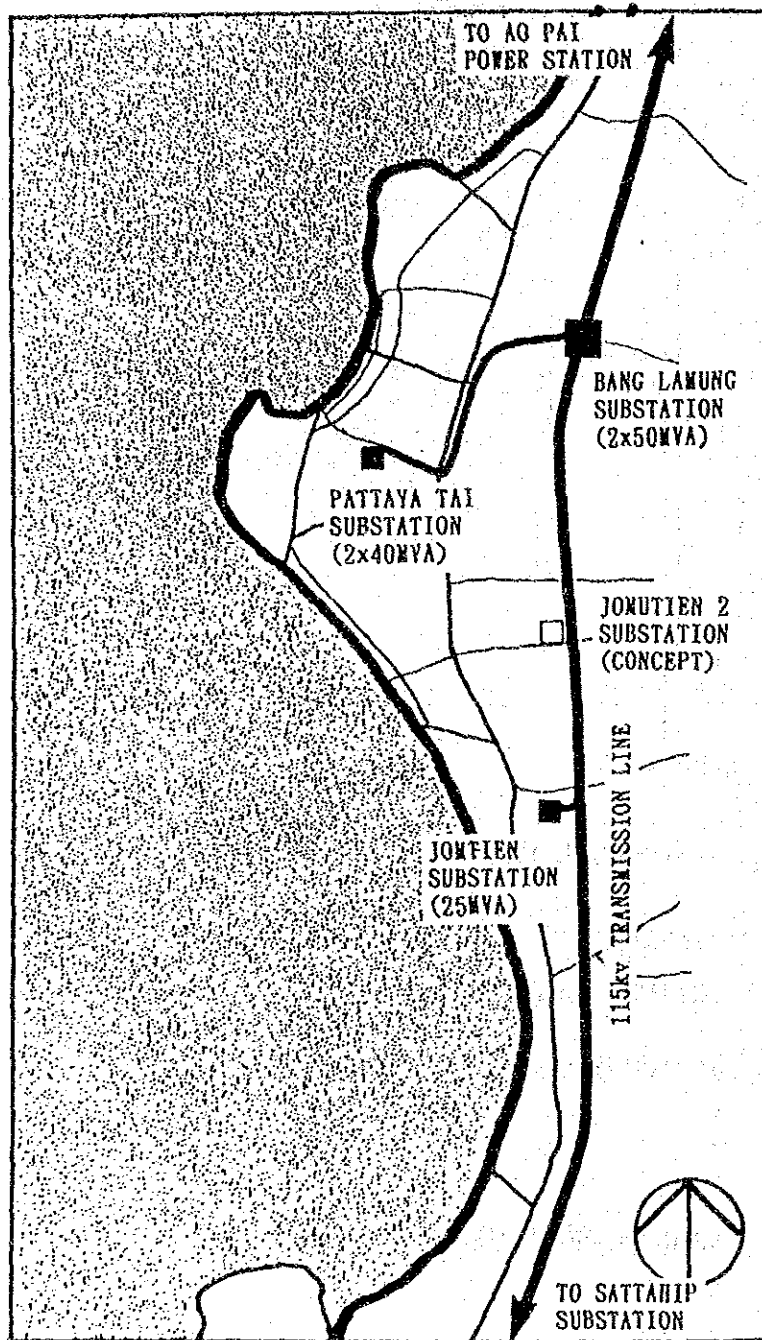


Fig. 4.2.35 Schematic Plan for Electricity Supply

4.3 Impacts of the Integrated Development Plan

4.3.1 Effects of Long List Projects

Beneficial effects to be realized by materializing the long-list projects including short-list ones are tabulated hereunder:

1) Water Supply

Beneficial effects	Area	1989	1996	2006
Increase of Population served by piped water	Na Klua*	24,900	38,600	56,500
	Phatthaya town	26,000	46,500	77,400
	Jomtien	5,300	15,500	33,300
	Tha Farang and Bang Sare	-	8,200	12,400
	Total	56,200	108,800	179,600
Improvement of Service ratio (%)	Na Klua*	49	64	77
	Phatthaya town	49	64	77
	Jomtien	49	64	77
	Tha Farang and Bang Sare	-	42	62
	Total	42	62	76
Widening of Service Area (km ²)	Na Klua*	8.8	12.0	12.5
	Phatthaya town	8.4	14.6	16.0
	Jomtien	6.3	8.8	16.8
	Tha Farang and Bang Sare	-	4.2	9.2
	Total	23.5	39.6	54.5

Remarks * : Figures for Ban Rong Po and Nong Preo are included in those of Na Klua.

2) Rain water Drainage

Beneficial effects	Area	1996
Incremental drainage area (km ²)	Na Klua	2.6
	Phatthaya town	12.1
	Jomtien	12.5
	Total	27.2
Improvement of protection level in the existing city area (km ²)	Na Klua	0.14
	Phatthaya town	1.32
	Jomtien	1.20
	Total	2.66
Creating new safety zone in the lower area (km ²)	Na Klua	0.79
	Phatthaya town	1.55
	Jomtien	4.38
	Total	6.72

Remarks 1. At present, drainage facilities are partially equipped, however, in general, drainage condition is still in low level.

3) Sewerage

- Population served by sewerage system

<u>Area</u>	<u>1989</u>	<u>1996</u>	<u>2006</u>
Na Klua*	-	44,300	56,200
Phatthaya town / <u>1</u>	8,000 / <u>2</u>	51,700 / <u>3</u>	79,500 / <u>3</u>
Jomtien / <u>4</u>	-	24,200	43,300

Remarks /1. Exclusive for Ko Lan

/2. Population served by existing sewerage system

/3. Exclusive for the population served by existing and current planning sewerage system

/4. Area in the city boundary

- BOD load discharged into water bodies including the rivers and the sea.

<u>Area</u>	<u>Comparison</u>	<u>1989</u>	<u>1996</u>	<u>2006</u>
Na Klua	①	1,200	200	270
	②	1,200	2,000	2,700
Phatthaya town	①	1,500*	550	800
	②	1,500*	3,160	5,660
Jomtien	①	100	200	420
	②	100	2,000	4,200

Remarks ① : With projects condition

② : Without projects condition

unit : Kg/day for average day flow during peak tourist season.

* : Including the effect of existing and current planning sewerage

4) Solid waste disposal

- Disposal quantity

<u>Area</u>	<u>Quantity, Service for</u>	<u>1989</u>	<u>1996</u>	<u>2006</u>
Phatthaya*	Population (10 ³)	100	140	200
	Turist (10 ³ /y)	1,609	2,281	3,241
	Quantity (ton/d)	107	172	289
Tha Farang and Bang Sare	Population (10 ³)	20	20	20
	Quantity (ton/d)	14	17	21
Total quantity disposed (ton/d)		121	189	310

Remarks * Including Na Klua, Phatthaya town and Jomtien.

5) Sea transportation

	<u>1989</u>	<u>2006</u>
- Numbers of passengers through the jetties*. (Peak daily total)	0	5,200

Remarks * : TAT tourist jetties at Phatthaya.

6) Land transportation

	<u>Reclamated land (1996)</u>		<u>Jemtien (2006)</u>	
- Incremental parking area (m ²)	29,200		40,000	
	<u>New</u>		<u>Widenning</u>	
	Length (km)	Lane	Length (km)	Lane Widening from 2 to
- Incremental road capacity	14.4	4	30.8	4

- 10 intersections will be improved.

7) Housing

- Number of families accommodated.

<u>Income Group</u>	<u>1989~1996</u>	<u>1997~2006</u>	<u>1989~2006</u>
Medium income family	2,100	2,700	4,800
Low income family	2,200	3,600	5,800
Total	4,300	6,300	10,600

Remarks : Housing project is aiming at accommodating 100% of low income families and 50% of medium income families.

4.3.2 Environmental Impact Evaluation

Environmental impact of any project developments consist of both negative and positive effects. Beneficial effects involve mostly regional and national economic growth while adverse effects may occur in various ways eg. on land use, on physical feature of the developed area and on social lifestyle of local people.

In this section, an evaluation of environmental impact caused by each component of Phatthaya area development is made, on a preliminary level because details studies should be carried out in either the feasibility study or detail design phase.

Table 4.3.1 summarizes the environmental effects of Phatthaya area development. The evaluation is carried out in comparison among each project component. The evaluation method follows the NEB's guidelines on environmental impact assessment which define environmental component into 4 items, ie., physical resources, biological resources, human use values and quality of life.

1) Sewerage Projects

Sewerage projects would generate substantial benefits on sea water quality, public health and long term a esthetic value of recreation area. If major establishments would be about to discharge their generated wastewater to the central treatment system, instead of having their own waste treatment plants, this would give another beneficial economic effect interns of less investment and operation cost.

Appropriate sewerage project at Ko Lan will help preserve newly marine ecosystem particularly the existing coral communities. Septage which is at present, being happazardly dispose of, will be handled by the proposed sewerage system thus reducing a health risk and at the same time help solving a part of solid waste. In the long-run, treated wastewater may be pumped to hinterland and used for irrigation purpose or, after land-treatment may become groundwater or surface water which could be recycled.

The sewerage projects are considered as a component which improve the living standard of the local people, thus positive social effect to all Phatthaya residents.

2) Coastal Development Project

Coastal Development Project which includes restoration and widening of the existing Phatthaya beach would reduce beach erosion along Phatthaya bay. However, as the proposed reclamation would cover an area of 18 ha, this solid encroachment into the natural bay may give unfavorable effects in terms of beach erosion/sedimentation at certain locations. Therefore, mathematical simulation or modeling experiment may be required in the detail design of this project to reduce the risk.

Since marine facilities (tourist port, jetty, small boat yard) are parts of this coastal development as well as car parking and bus terminal, the project would contribute beneficial effect to the presently congested sea and land traffic. The project includes a large park or open space which is rare in Phatthaya public land. This is considered a social benefit.

Aesthetic value of Phatthaya bay shall be degraded by the project implementation, both during construction and operation phases. Nevertheless if the proposed reclaimed land would restore illegal buildings at South Phatthaya water front, the aesthetic effect would not be too negative.

Another beneficial effect is economic status, this large scale project will consequently generate large job opportunity both during construction and operation periods.

3) Solid Waste

Sanitary land fill will pose adverse effect to groundwater quality, if not properly managed. There are many evidences as such in many provinces including Phatthaya City. Additionally the solid waste project should not at all concentrate only at dumping site because collection system is another major problem to be solved. If both areas are properly managed, it would give substantial beneficial effects to public health, aesthetic value, surface water quality and even sea water quality because solid waste is also associated with pollution load in street drains and natural drains.

4) Water Supply

Water supply projects mostly deal with upgrading and extension works of distribution and transmission systems. With regards to long-term source of water supply the studies rely solely on the inter-basin water diversion. It is

known that water supply shortage is severe and chronic problem. If this could be solved, great beneficial effects would be on economic, social and public health of the local people and entire tourism - related business.

5) Development of Jomtien Beach Area

With Jomtien Beach area development, many infrastructure will be upgraded eg. water supply, beach road which will induce commercial and tourist facilities and thus foreign growth in Jomtien area. Although environmental controlling facility such as sewerage work is introduced, the sea water quality in the area will be gradually degraded because of increasing pollution load. With the change of existing beach road into pedestrian mall and/or promenade, aesthetic value of the area could be positive. The economic of business along the Jomtien Beach area will be increased due to the development while some facilities eg. telecommunication and solid waste handling may be overloaded.

6) Roads

Proposed Road projects involve construction of new road and intersection improvement and existing road widening. Major beneficial effects are better traffic. Economic aspect is also substantial because the projects contribute a lot of job opportunity.

7) Rainwater Drainage

Improvement on rain water drainage will reduce economic loss due to floodings occurred in rainy season. Traffic difficulties due to floods will also be solved.

8) Housing

Low-income Housing project will be a measure to solve a social problem occurred in the Phatthaya area. A portion of low income group which accounts for three tenths of the total residents in Phatthaya squats in swamp or slum area, with health-risk environment. The housing project will help to reduce this threat. However, the project will result in increasing needs for water supply, and subsequently solid waste and wastewater generation. Other facilities, eg. electricity, telecommunication and appropriate transportation network are to be provided according.

4.3.3 Environmental Quality Plan (EQP)

Up to now, natural settings in Phatthaya have been exploited to serve economic growth. This is also reflected in previous 5-year National Development Plans which concentrated only in socio-economic aspect. Only in the Sixth Plan that environmental consideration was mentioned to a limit extent. So far no Environmental Quality Plan (EQP) has been initiated. Therefore it is not surprising that environmental degradation has been very rapid, to an alarming level.

Phatthaya area in particular, EQP would prove its vitality to the service business of Phatthaya because EQP would involve multi-disciplinary approach to the city environmental improvement. Therefore EQP for Phatthaya area is proposed in this study. The plan would cover most environmental aspects in one scheme and its tentative extent is given in Figure 4.3.1. Proposed EQP for Phatthaya is separated into 3 aspects i.e. physical and biological, human uses, and Environmental Promotion. Their respective functions are discussed as follow:

It should be noted that existing legal, institutional and financial problems for Phatthaya city are equally important as the technical matters. Without proper development institutional and financial situation of Phatthaya, it is foreseen that EQP would be a failure from long-term view.

1) Physical & Environmental Aspect

Physical and biological management of water quality, coral communities and noise and air pollution are included in this section.

In view of least impact to Phatthaya environmental resources, minimal discharge of urban waste should be allowed into sea environment.

Although Phatthaya city will eventually constructed additional sewerage system, the final effluent will be discharged into the sea. Total pollution load by discharge into marine environment would be increased according to growth of Phatthaya. In the long-term concept, all of treated wastewater should be pumped towards hinterland, where water could be recycled for irrigation or other purposes. This would be also beneficial in terms of conservation of water consumption.

(1) Water Quality of Drains:

Since most pollution load generated by urban activities in Phatthaya would be desposed into street or natural drains in liquid form. Monitoring program of drain water quality shall be established to frequently assess the environment situation. This will help the decision as to what immediate and long-term measures should be taken to alleviate the deterioration of the sea environment.

This monitoring program will be conducted separately or together in accordance with ground and sea water monitoring programs. It is understood that adequate and qualified manpower are needed to satisfy this objective. Well-equipped laboratory is also required.

(2) Ground Water Quality:

Phatthaya area used to be entirely depend on shallow wells at the onset of the tourism development. Although groundwater has been degraded, it is still contributing to raw water supply for some hotels and household uses. In the situation when raw surface water is scarce, shallow wells water may add the gap. Survey on seasonal quality and quantity of groundwater in Phatthaya area would be proved to be beneficial. Implementation of proper public sewerage system might also improve the water quality of shallow well.

Although many studies made on surface water quality within the Study Area, there has been no systematic study on groundwater quality. Thus, no assessment has been done as to what extent groundwater has been polluted by tourism and human activities.

Extensive use of groundwater in the area is implying inadequate or inaccessible for piping of water supply. It is therefore important that information on this valuable resource is acquired through field observation. This investigation should cover the seasonal changes upon which groundwater quality depend.

The findings will contribute greatly to the water management within the Study Area.

Monitoring program will be established at some key stations particularly those in vicinity downstream of existing and abandoned

solid water dumping sites, where the only water source of the local people has been deteriorated.

(3) Sea Water Quality:

According to implementation of second stage sewerage work, existing seawater quality will be improved to an extent at least at the Phatthaya beach area.

However there are existing and growing communities, along the coastal zone, discharging waste into sea environment, activities at fish landing piers are included. No public waste treatment facility is provided so far. Fishing vessels and leisure-related boats shall have some pollution-control measures as well.

Monitoring program for sea water quality test shall be established to obtain the information on marine environmental management particularly on coral communities. The findings will be useful also for the environmental impact study of the proposed reclamation area to be located at South Phatthaya.

(4) Coral Reef:

Within the project area coral reef is seen only at Ko Lan and its neighbouring areas. It will be a valuable tourist resource of the area and a great effort for preservation shall be required necessary. It is advised that a research study and development for detailed management program shall be initiated. Detailed zoning and enclosure of zones where precious corals is growing shall be made, if necessary, through proper legislation.

As a consequence annual monitoring/inspection of coral areas will be carried out to assess their treatment (recovering or damage), in parallel with sea water quality program.

(5) Noise:

Control and monitoring of exhaust pipe of the vehicles shall be conducted to reduce noise nuisance. Air pollution control measure may be also required.

2) Human Uses

In this human uses aspect, it would enhance and monitor the use of the resources, including water supply, wastewater treatment system and solid water management.

(1) Water Supply:

The major role of this sector is to initiate programs to private sector, to save the use of water e.g. introducing of small sanitary fixture which would reduce water consumption.

- Small sanitary fixture:

As sewerage system in Phatthaya is not a separate system type which use a large amount of water to transport solids. Because of the shortage of water supply sanitary fixtures using small amount of water should be recommended. This may involve proper cooperations with the manufacturers of sanitaryware.

- Recycled wastewater:

Recycle of wastewater or treated wastewater should be enhanced to reduce the water consumption, appropriate control shall be required to reduce the health risk.

- Rain water:

Some first-class hotels already make uses of this natural resource. Limited supply of pipe water interests the active use of rain water collection. In fact collection of rain water could be integrated into building design with less investment than wastewater treatment system.

(2) Waste Treatment System:

City sewerage and private wastewater treatment systems are to be monitored on regular basis. Systematic monitoring and assessment of various wastewater treatment systems, used by hotels in Phatthaya, may be lead to conclusions that could be applied to other areas of Thailand.

(3) Solid Waste Management:

In order to increase efficiency of garbage collection, private sector should be recruited either as contractor or concessionaire basis. The city, on the other hand would play a role as the administration.

Proper solid waste disposal is effective to reduce public health problems to surrounding communities. Due to limited capacity of the existing dumping site, selection of new site is necessary whether the proposed Huai Chak Nok reservoir downstream is implemented or not. The site selection process has to be started urgently otherwise land cost tends to increase rapidly. Another alternative is to use Laem Chabang solid water facility. Negotiation with Industrial Estate Authority shall be made.

Because of its potential hazard, disposal of solid waste has to be cautiously operated. Toxic wastes shall be separately disposed. Operation of solid waste dumping site may be contracted out or given to on private concession with closed monitoring by Phatthaya City.

Regular monitoring of groundwater surrounding solid waste dumping site is strongly recommended which is emphasized under "Groundwater Quality" section.

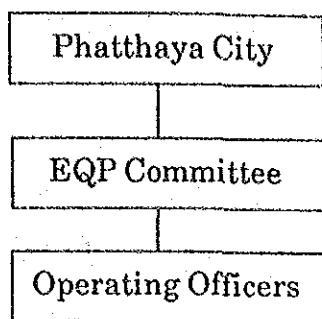
3) Organization Chart

Environmental Quality Plan (EQP) should be established to cover all environmental issues in one plan.

The EQP should be organized and monitored under Phatthaya City. Due to inadequacy of qualified personnel, however, NEB may play a major role at least at the commencement of the EQP implementation

As the EQP covers multi-disciplinary functions, the governing body should be a committee with members selected from relevant sectors, eg., hotel owners, tour operators, restaurant owners, mass media, representatives from PWD, NEB, while Phatthaya City maintain the secretary of the committee.

Proposed EQP organization chart shall be as follows.



If qualified personnel for operating officers are not available from government officer, they may be recruited from private sector on the contract by project basis.

4) Function of EQP

Extent of the proposed Phatthaya EQP is given in Figure 4.3.1. In this section, tentative functions of EQP is detailed into 3 programs:

- Laboratory and water/wastewater monitoring programs
- Research program
- Environmental promotion program

(1) Laboratory and water/wastewater monitoring program

At present a laboratory has been set up at Phatthaya wastewater treatment plant to monitor the plant efficiency. With its own laboratory in proper operation, some water/wastewater monitoring programs could be achieved, i.e.

- street drains and major natural drains
- wastewater treatment systems of private establishment
- water supply in hotel & other service business

These programs could be regarded as routine duty. Only additional qualified personnel are to be recruited to perform this functions.

(2) Research Program

There are many environmental aspects deserving a research in Phatthaya area. All of which require extensive input in terms of manpower and qualified staff. Therefore these research are beyond the capability of Phatthaya City staff, and should be assigned to private consultant or educational institute with EQP operating officers serving

as coordinator. All research should be presented and approved by EQP committee.

In this program, Phatthaya City would retain all environmental information of the area. As a data bank, these information shall be very important in future decision makings of environmental issues.

At least following research program are proposed:

- Sea water monitoring program and coral studies. Management program for coral communities is expected at the end of the study.
- Seasonal quality and quantity of ground water in Phatthaya area. Emphasis shall be made on the impact of solid waste dumping site on groundwater quality, and subsequent effect on the proposed reservoirs in the Phatthaya area.
- Air pollution and noise nuisance study in the Phatthaya area, particularly in the Phatthaya downtown.

(3) Environmental Promotion Program

This sector of Environmental Quality Plan is aimed at promotion and exhibition of environmental issues within Phatthaya area. It is obvious that environmental issue in Phatthaya has raised a great deal of public concerns with limited support on 'real' condition in terms of scientific study. This sector would try to clarify this issue into public, to tourists as well as to local residents. Public relations is thus major role of this sector.

Examples of tentative functions:

- Promotion of existing environmental issues in Phatthaya area e.g. sea water quality, coral communities
- Data bank of all environmental information in Phatthaya area, with coordination of other research institutes.
- Education of environmental understanding as well as related public health to local residents, and visitors, e.g. introduction of small sanitary fixture, advise on proper waste treatment system.

- Public hearings for Environmental Quality Plan.

5) Rough Cost Estimate for EQP Implementation

Cost estimate for EQP implementation is given the Table 4.3.2 in accordance with EQP functions .

It is proposed that, EQP should be implemented as a pilot scheme for 16 months after which its performance be reviewed as to whether the EQP be modified. Therefore cost estimates is based on this 16-months trial assumption.

Following assumptions are also taken:

- the recruited EQP committee member shall have a monthly meeting.
- Operating officers shall be contracted for 16-month employment term. They will station at adequate office space provided by Phatthaya City. Among 4 operating officers, a senior staff shall be assigned as EQP head of staff.
- Each research program shall be contracted out to qualified private consulting firm or educational institute, with operating officers served as coordinator.

Table 4.3.1

SUMMARY OF ENVIRONMENTAL EFFECTS OF PHATTHAYA AREA DEVELOPMENT

		PROJECT COMPONENT OF PHATTHAYA AREA DEVELOPMENT								
		Sewerage	Coastal Development	Solid Waste	Water Supply	Development of Jomtien Beach Area	Road	Rainwater Drainage	Housing	
ENVIRONMENTAL COMPONENT TO BE AFFECTED	QUALITY OF LIFE	Ground Water	0	0	+2	0	0	0	0	-1
		Surface Water Quality	+1	0	+1	-1	0	0	0	-1
		Beach erosion/sedimentation	0	+2	0	0	0	0	0	0
		Sea Water Quality	+2	0	+1	0	-1	0	0	-1
	HUMAN USE VALUE	Fisheries & Coral Community	+2	0	0	0	0	0	0	0
	BIOLOGICAL RESOURCES	Land Use/Sea Use	0	-1	-1	-1	-1	-1	0	-1
		Water Supply	+1	-1	-1	+2	+1	0	0	-1
		Transportation	0	+2	0	0	0	+2	+1	-1
		Electricity	0	-1	0	0	-1	0	0	-1
		Telecommunication	0	0	0	0	-1	0	0	-1
		Solid Waste	+1	-1	+2	0	-1	0	0	-1
	PHYSICAL RESOURCES	Economic	+2	+1	0	+2	+2	+2	+2	+1
		Social	+1	+1	+1	+1	0	0	0	+2
		Public Health	+2	0	+2	+2	0	0	0	+1
		Aesthetic Value	+2	-1	+2	0	+1	0	0	0

Remarks : the scores of -2 to +2 have the following meanings

+2 = substantial beneficial effect

+1 = moderate beneficial effect

0 = no effect or very slight effect

-1 = moderate adverse effect

Table 4.3.2 ROUGH COST ESTIMATE FOR EQUIP IMPLEMENTATION

1) EQP Personnel Cost

No.	Cost item	Cost Description	Total	Remarks
1.	Committee member meeting allowance	10 person X 1,000 Bahts/ monthly meeting X 16 months	160,000	
2.	Operating Officers			
2.1	Lab. and water/wastewater monitoring program	2 X intermediate scientist/envirom. engineer X 20,000 Bahts/ month X 16 months Direct expense 20,000 Bahts/ month X 12 months 5,000 Bahts/ month X 4 months	640,000 240,000 20,000	- using existing Phalthaya Lab.
2.2	Research Program	1 X Senior Scientist/ envirom. engineer X 35,000 Bahts/month X 16 months Direct expense 10,000 Bahts/month X 16 months	560,000 160,000	- As coordinator - Each research to be contracted out
2.3	Environ. Promotion Program	1 X Senior Scientist/ Envirom. engineer X 35,000 Bahts/month X 16 months Direct expense 10,000 Bahts/month X 16 months	560,000 160,000	- As coordinator
3.	Other EQP office expense	20,000 Bahts/month X 16 months	320,000	
			<u>Total</u>	<u>2,820,000</u>

2) Contracted Research Cost

No.	Research Program	Cost Description	Total
1.	Sea water monitoring & coral study	2 X Senior scientist X 0.4 month X 60,000 Bahts/month X 12 months 2 X Junior scientist X 0.5 month X 20,000 Bahts/month X 12 months Direct expense: 30,000 Bahts/ month X 12 months Sub-total	576,000 240,000 360,000 1,176,000
2.	Groundwater study	1 X Senior scientist/engineer X 0.4 month X 60,000 Bahts/month X 12 months 1 X Junior scientist/engineer X 0.5 month X 20,000 Bahts/month X 12 months Direct expense: 50,000 Bahts/month X 12 months Sub-total	288,000 120,000 600,000 1,008,000
3.	Air/noise study	1 X Senior scientist/engineer X 0.4 month X 60,000 Bahts/month X 12 months Direct expense: 40,000 Bahts/ month X 12 months Sub-total	288,000 480,000 768,000
			<u>Total</u>
			<u>2,952,000</u>

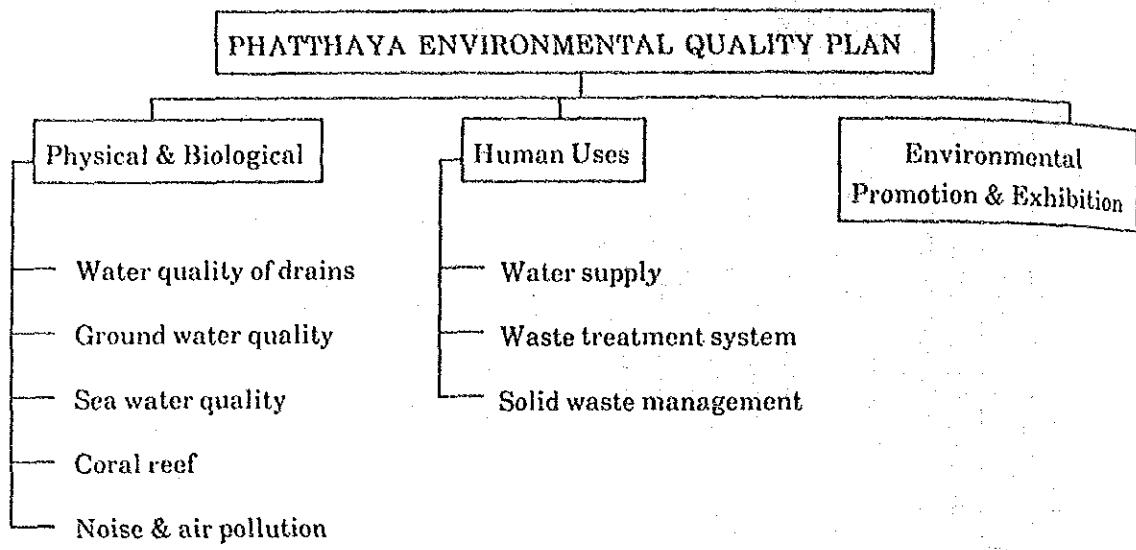


Fig. 4.3.1 Tentative Extent of Phatthaya Environmental Quality Plan

4.4 Project Program and Selection of Priority Projects

4.4.1 Criteria for Priority Judgment for Short List Projects

Projects/programs in the long-list described in former sections will be assessed of their desirability or priority from a multi-aspects viewpoints such as environmental control effect, amenity improvement effect, national and regional development impact, social well-being effects, and practicability for implementation.

Screening of projects/programs in the long-list will be made in assessing them under the criteria presented in Table 4.4.1. Projects/programs passed this screening will be categorized into "short-list-project". They will be sequenced for implementation towards the target year, taking into consideration their relative priorities and urgency.

4.4.2 Project Program and Shot List Projects

Long-list projects described in former sections are comprehensively summarized in Table 4.4.2 and Fig. 4.4.1. The distinction of short-list projects chosen based on the evaluation criteria are represented and the land use development, the environmental improvement expected in accordance with the progress of priority projects are also analyzed in the table. Main improvements and land use developments are listed hereunder.

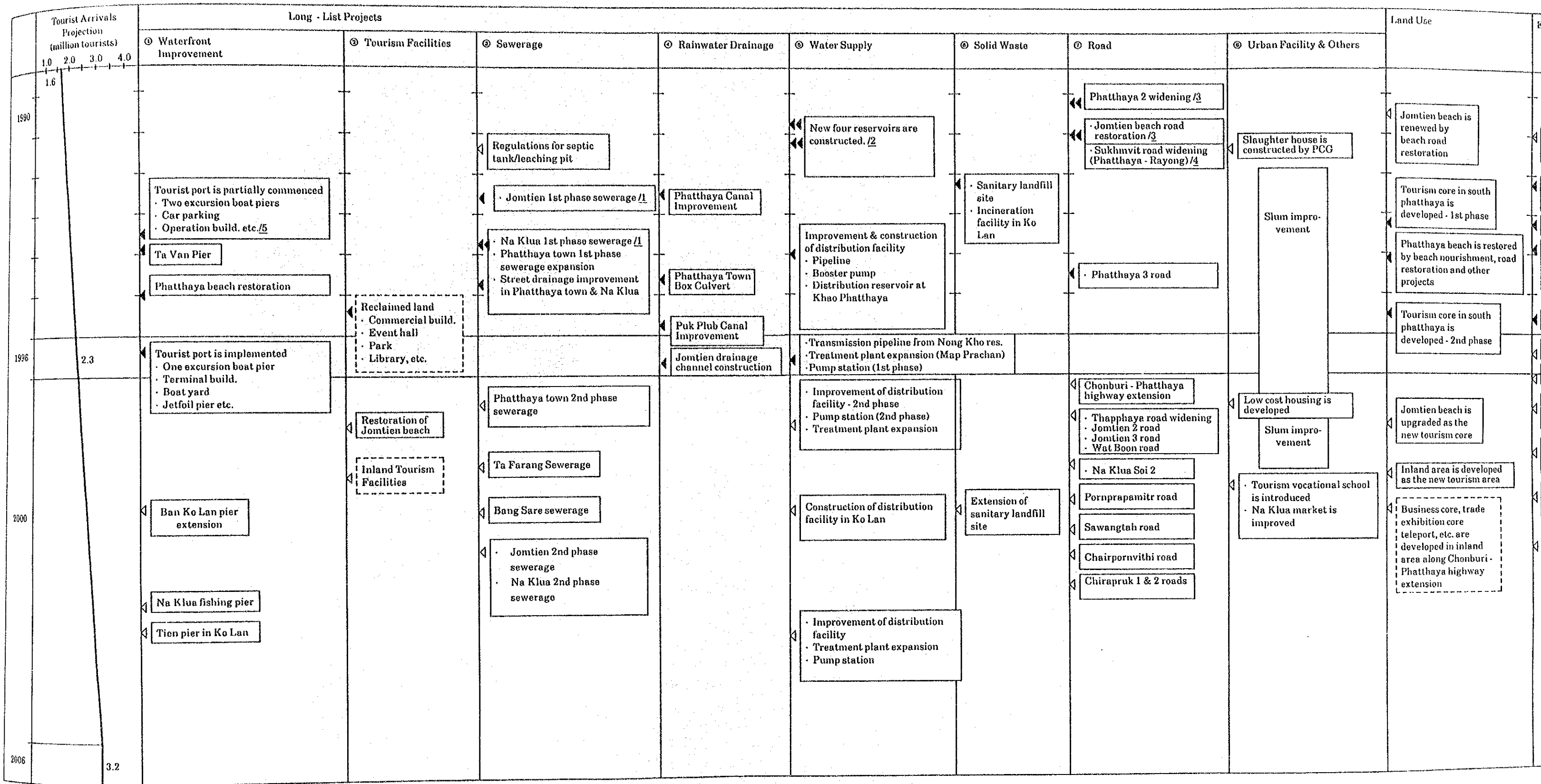
- The improvement of sea water contamination in Phatthaya Beach shall start from the year of 1992 by the improvement of street drainage and shall be accelerated by the construction of Na Klua sewage treatment facilities and the expansion of Phatthaya town sewage treatment facilities from the year of 1993.
- The water pollution in Jomtien Beach could be prevented by the construction of Jomtien sewage treatment facilities in 1992.
- Water shortage should be dissolved with the construction of four new reservoirs before the year of 1992 and the water supply will meet the demand by the construction of the transmission pipeline from Nong Kho reservoir in the end of 1995.
- The occurrence of flood disaster is expected to be minimized by the improvement of rivers and drainage facilities until the year of 1995.

- Chonburi - Phatthaya highway extension which may realize the quick link between Bangkok and Phatthaya shall be constructed in the year of 1996.
- The congestion and disorderliness in the sea use and road traffic shall be drastically improved by the tourist port project and the implementation of road networks. Tourist port is expected to be opened partially by the year of 1993 and implemented totally by the end of 1996.
- In line with the implementation of the tourist port, the reclaimed hinterland will be developed until the year of 1995. A new commercial and urban amenity area shall be supplied to Phatthaya as the supplemental tourism core.
- Jomtien Beach can be improved immediately by the beach road restoration and constructions of Jomtien 2nd, Jomtien 3rd road and Wat Boon road by the year of 1994 will make Jomtien Beach more accessible beach. After 1996, construction of Jomtien beach center will be commenced in order to deal with the increasing tourists.
- The developments of inland areas as the business functions and new tourism areas are expected in long-term period between 1997 and 2006.
- The housing shortage is expected to be improved by the low cost housing projects around before the year of 2000.
Slum improvement commenced in a few years would restore the living conditions and induce the environmental effects.

Table 4.4.1 EVALUATION CRITERIA

	<u>Marking</u>	<u>Aspects to be assessed</u>
1. Environmental Quality Control Effect	1 = Negative effect. 2 = Neutral effect or 3 = Positive effect	<ul style="list-style-type: none"> - Marine, nearshore and estuary water quality control - Water quality control for drains and rivers - Groundwater quality control - Air quality, noise and odor control - Soil conservation/erosion control - Forest conservation - Wildlife conservation
2. Amenity Improvement Effect	1 = Negative effect. 2 = Neutral effect or 3 = Positive effect	<ul style="list-style-type: none"> - Improvement of natural and urban beauties (beaches, shores, rivers, estuaries, appearance of city, etc.) - Increase of open space/green space - Preservation of historical or cultural valuables - Increase of comfortable environment, amenities and convenience for visitors
3. National/Regional Development Effect	1 = Low impact 2 = Medium impact or 3 = High impact	<ul style="list-style-type: none"> - Enhancement of tourism sector development - Increase of output in production in industries, particularly tourism-supporting industries and service industries for ESB region - Foreign exchange earnings/savings - Employment generation - Population re-distribution - Land enhancement - Reduction of disaster damage
4. Social Well-being Effect	1 = Low impact, 2 = Medium impact or 3 = High impact	<ul style="list-style-type: none"> - Public health and safety - Educational opportunities - Cultural and recreation opportunities - Income distribution - Increase of emergency preparedness - Alleviation of urban nuisance
5. Practicability and Urgency of Implementation	1 = Difficult/Negative 2 = Neutral or 3 = Easy/Positive	<ul style="list-style-type: none"> - Land acquisition - Institutional practicability - Funding/budget allocation - Legal proceedings - Coordination and cooperation - Technical practicability - Resource availability - Urgency

Table 4.4.2 LONG LIST PROJECTS ON TIME TABLE



- Legend**
- ◀ Short-list projects
 - ◁ Long-list projects & other relevant projects
 - ◀◀ Committed projects
 - ▭ Public projects
 - ▭ Private sector projects

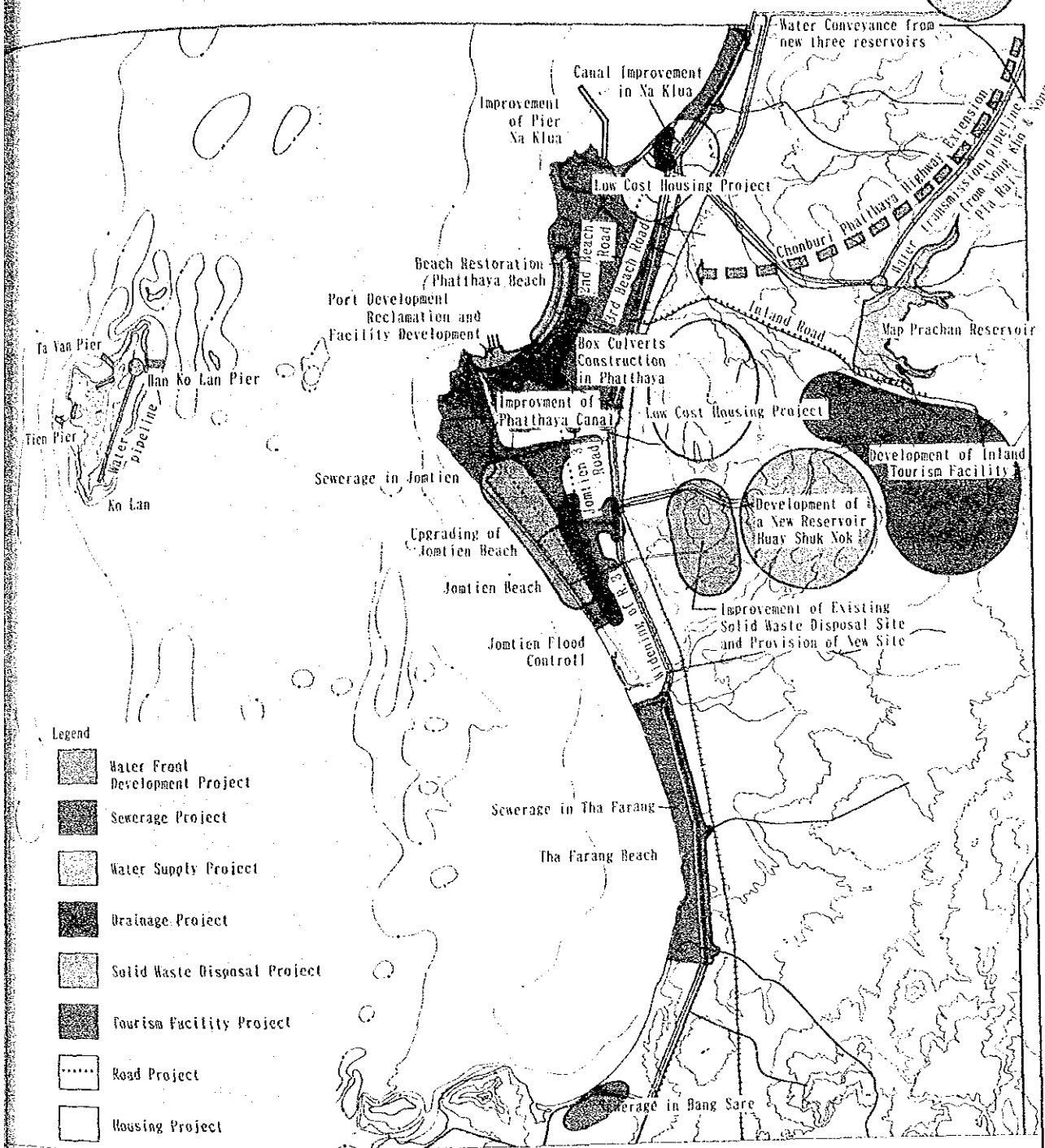
- Remarks :**
- /1 Projects already committed by PWD
 - /2 Projects already committed by PWA
 - /3 Projects already committed by PCG
 - /4 Projects already committed by DOH
 - /5 Projects already committed by TAT

PROJECTS ON TIME TABLE

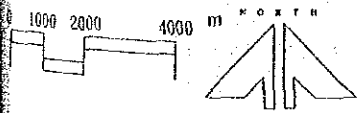
Projects							Land Use	Environmental Improvement
⊙ Tourism Facilities	⊙ Sewerage	⊙ Rainwater Drainage	⊙ Water Supply	⊙ Solid Waste	⊙ Road	⊙ Urban Facility & Others		
	<ul style="list-style-type: none"> Regulations for septic tank/leaching pit Jomtien 1st phase sewerage /1 Na Klua 1st phase sewerage /1 Phatthaya town 1st phase sewerage expansion Street drainage improvement in Phatthaya town & Na Klua 	<ul style="list-style-type: none"> Phatthaya Canal Improvement Phatthaya Town Box Culvert Puk Plub Canal Improvement Jomtien drainage channel construction 	<ul style="list-style-type: none"> New four reservoirs are constructed. /2 Improvement & construction of distribution facility Pipeline Booster pump Distribution reservoir at Khao Phatthaya 	<ul style="list-style-type: none"> Sanitary landfill site Incineration facility in Ko Lan 	<ul style="list-style-type: none"> Phatthaya 2 widening /3 Jomtien beach road restoration /3 Sukhmit road widening (Phatthaya - Rayong) /4 Phatthaya 3 road 	<ul style="list-style-type: none"> Slaughter house is constructed by PCG Slum improvement 	<ul style="list-style-type: none"> Jomtien beach is renewed by beach road restoration Tourism core in south phatthaya is developed - 1st phase Phatthaya beach is restored by beach nourishment, road restoration and other projects Tourism core in south phatthaya is developed - 2nd phase 	<ul style="list-style-type: none"> Congestion in Jomtien beach road is improved Solid waste can be disposed of entirely by sanitary disposal facilities Congestion of sea use can be improved Sea water quality in Phatthaya beach is improved Water shortage is improved. Flood problems are improved Water supply capacity meets demand Housing problems are improved Car parking problem is improved in Jomtien beach Inland area is developed as the new tourism area Sea water contamination in Ban Sare is improved. North Phatthaya & inland area grows up to the business core - New City function
<ul style="list-style-type: none"> Reclaimed land Commercial build. Event hall Park Library, etc. 			<ul style="list-style-type: none"> Transmission pipeline from Nong Kho res. Treatment plant expansion (Map Prachan) Pump station (1st phase) 				<ul style="list-style-type: none"> 1990 1996 	
<ul style="list-style-type: none"> Restoration of Jomtien beach Inland Tourism Facilities 	<ul style="list-style-type: none"> Phatthaya town 2nd phase sewerage Ta Farang Sewerage Bang Sare sewerage Jomtien 2nd phase sewerage Na Klua 2nd phase sewerage 		<ul style="list-style-type: none"> Improvement of distribution facility - 2nd phase Pump station (2nd phase) Treatment plant expansion Construction of distribution facility in Ko Lan Improvement of distribution facility Treatment plant expansion Pump station 	<ul style="list-style-type: none"> Extension of sanitary landfill site 	<ul style="list-style-type: none"> Chonburi - Phatthaya highway extension Thapphaya road widening Jomtien 2 road Jomtien 3 road Wat Boon road Na Klua Soi 2 Pornprapamitr road Sawangtah road Chairpornvithi road Chirapruk 1 & 2 roads 	<ul style="list-style-type: none"> Low cost housing is developed Slum improvement Tourism vocational school is introduced Na Klua market is improved 	<ul style="list-style-type: none"> Jomtien beach is upgraded as the new tourism core Inland area is developed as the new tourism area Business core, trade exhibition core, teleport, etc. are developed in inland area along Chonburi - Phatthaya highway extension 	

Remarks : /1 Projects already committed by PWD
 /2 Projects already committed by PWA
 /3 Projects already committed by PCG
 /4 Projects already committed by DOH
 /5 Projects already committed by TAT

Wuy Sapan Reservoir
 Nong Klong Dong Reservoir
 Huay Khun Jit Reservoir



- Legend
- Water Front Development Project
 - Sewerage Project
 - Water Supply Project
 - Drainage Project
 - Solid Waste Disposal Project
 - Tourism Facility Project
 - Road Project
 - Housing Project



THE MASTER PLAN STUDY FOR
 THE DEVELOPMENT OF PHATTHAYA AREA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 4.4.1 Long-list Projects

5. RECOMMENDATIONS ON PLAN IMPLEMENTATION

5.1 General

In this chapter, recommendations are made with regard to institutional, financial and legal settings with a view to modifying the present settings so that the Integrated Development Plan for the Phatthaya Area proposed in this Study become practicable and can be brought into reality. Implementation plan including institutional, financial and legal aspects for the priority projects is given in Chapter 7 and in this chapter recommendations are made with mid-term and long-term perspective with the target years of 1996 and 2006.

It is intended that recommendations are confined to these having direct relevance to Phatthaya. The institutional and financial as well as legal issues, however, are national in nature, involving the central and local administrations as well as private entities. The recommendations ought to, therefore, affect the overall settings. It should also be noted that the recommendations are of preliminary nature prepared based on a sectoral study of the Master Plan Study for the development of Phatthaya Area.

Detailed study and examination, therefore, should be conducted by the Thai Government and people concerned for each issues. Level of appropriate decentralization and autonomy of the local governments including PCG should also be decided as a part of the Government policies. For the purpose of the Master Plan, it is assumed that the Government policy is to further promote decentralization in the country in principle.

5.2 Institutional, Financial and Legal Aspects

5.2.1 Institutional

- (1) Clear Demarcation of Duties and Powers between PCG and Central Government.

Recommendation

Demarcation of duties/responsibilities and powers between PCG, the Central Government and State Authorities should clearly be defined and agreed among these concerned, particularly in the field of the development, operation and maintenance of the infrastructure facilities.

Explanation

i) APCA may be interpreted that duties and power for the development and operation and maintenance of all the infrastructure and utility facilities belong to Phatthaya City. In the reality, however, major portion of the above duties are fulfilled by the Central Government and State Authorities, partly due to the inadequate financial and manpower strength of PCG. It is urgently required that the demarcation should clearly defined and agreed in line with the basic governmental policy of decentralization.

ii) On possible distribution of duties may be as follows:

Field	Development	Operation/Maintenance
◦ Water supply	Central	Central
◦ Electricity	Central	Central
◦ Telecommunication	Central	Central
◦ Sewerage	Central	PCG
◦ Drainage	Central	PCG
◦ Solid waste	PCG or Central	PCG

Remarks: "Central" signifies the central government departments and the state authorities.

(2) Upgrading of Coordination and Cooperation between PCG and the Central Government Regional Offices

Recommendation

With a view to more effective and efficient planning and implementation as well as operation and maintenance of infrastructure facilities, better coordination and cooperation among PCG, regional offices of the State Authorities and the Central Government should be promoted. It may be advisable that:

i) PCG should be authorized to confer with the regional offices on the infrastructure development particularly during planning and budget preparation stages.

- ii) PCG should be authorized to give instructions to the regional offices with regard to certain matters which would not accompany direct expenditure.

Explanation

- i) At present, development and operation and maintenance of the infrastructure facilities are carried out by PCG and Central Government. In order to work out appropriate plans in concert as well as accompanied budget allocation, reflecting the needs of the local community, conference and consultation is indispensable.

(3) Strengthening of PCG Staff

Recommendation

Aiming at fulfilling the role of international tourist city and the business center of Eastern Seaboard region PCG staff should sharply be reinforced. The present system for determining the number of civil servants which is based on the size of registered population should be revised so that actual number of residents as well as number of tourists can be taken into account.

Explanation

- i) Number of PCG staff is based on its registered population, namely 410 civil servants, 238 permanent employees and 360 temporary employees in 1989, which is not sufficient to meet the increasing demand for public services of a internationally well-known city having about 100,000 population at present and more than 1.4 million tourists annually (1987).

(4) Reinforcement of Police Strength and PCG's Authority

Recommendation

Strength of the police including Tourist and Marine Polices should sharply be enhanced based on the actual population and number of tourists visiting Phatthaya. The police should directly belong to the City and should be under the direct supervision of the City Manager. They

should receive their salary from the City, though they may be appointed and transferred by the Police Departments.

Explanation

- i) Problems of public peace and security as well as frequent traffic accidents and inconveniences affect the tourist industry of Phatthaya. Police strength is determined in the similar manner as the numbers of other civil servants based on the registered population, which is far short of the requirement. The police strength should be so determined that actual number of residents and seasonal workers as well as tourists are reflected.
- ii) Though according to APCA, Phatthaya City is responsible for maintaining public order, no police power is given to the City. The police including Marine and Tourist Polices should make concerted efforts for maintaining comfortable environment under the supervision of Phatthaya City.

(5) Enhancement of Self-Government of Phatthaya City

Recommendation

At the national level, necessity and appropriateness of the enhancement and promotion of self-government of the Phatthaya City should be examined from institutional, financial and legal viewpoints.

Explanation

- i) As explained in Section 3.3.1, Phatthaya City is controlled by the Central Government and Chonburi Provincial Government, legislative, financial and personnel matters in particular.
- ii) The current composition of the City Council members, i.e., nine by election and eight by appointment by the Minister for Interior should also be examined.

(6) Amendment of City Manager System

Recommendation

As short-term measures to make the city manager system function more effectively, the following amendments may be advisable:

- i) Enhancement of the power of the City Manager including personnel authority;
- ii) Clearer definition and demarcation of the responsibilities between the Mayor and the City Manager;
- iii) Modification of the screening and appointment procedure of City Manager including establishing a Search Committee to find and propose the candidates of City Manager;
- iv) Changing the name of City Manger which is up to now called "Palad Muang (Permanent Undersecretary)" to Nayok Muang (Governor or Director) and to change the name of the presently called Mayor to Council Chairman.
- v) Extending the term of the Mayor from the current 2 years to the same as City Manager, i.e., 4 years.
- vi) Increasing the authority of the City Manager with regard to the expenditure.

Explanation

- i) Personnel Board of Phatthaya should be set up which is empowered about personnel matters without referring to the Municipal Officials Commission. The Board should be under the supervision of the City Manager.
- ii) Mayor's main duties should be the role of as the chairman of the Council and the leader of the Phatthaya City during ceremonial occasions.
- iii) Compared with the high qualification, the salary of the City Manager is rather low, particularly in case he is recruited from the private sector. Raising the salary should be considered..

(7) Examination of the Effectiveness of City Manager System

Recommendation

There have been criticisms about the effectiveness and efficiency of the present city manager system being practiced in the Phatthaya City. It may be advisable to establish an ad-hoc committee in order to examine the suitability of the city manager system and assess the necessity of reform including replacing it by another system.

Explanation

- i) The committee should possibly comprise representatives of MOI and other central departments concerned, Chon Buri Provincial Government, PCG, relevant private organizations and scholars and men of experience.
- ii) Ordinary municipal system and Bangkok Metropolitan Administration (BMA) system should be included among alternatives for examination.

(8) Organization reform of PCG

Recommendation

The organizational structure of the Phatthaya City should be revised so that an office called "Office of Permanent Undersecretary is set up which is under the supervision of the City Manager". The Permanent Undersecretary should be a permanent official and his status should be equivalent to the Municipal Permanent Undersecretary. He should be the direct supervisor of all the divisions and should screen the administrative matters for the consideration of the City Manager.

Explanation

- i) The administrative burden of the City Manager whose status is stipulated in APCA the superior official equivalent to the Mayor of the Muang municipality, should be relieved.