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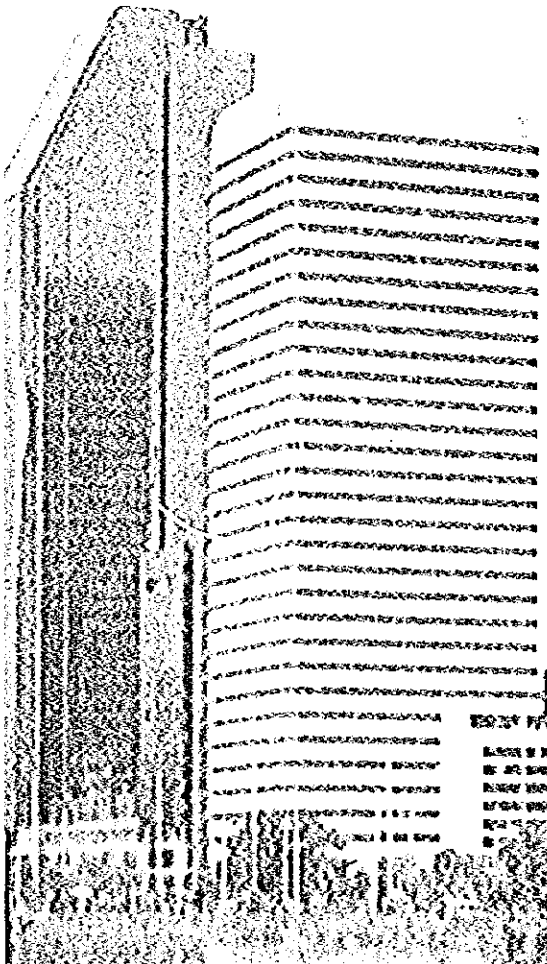
BEIP

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
BANGKOK METROPOLITAN ADMINISTRATION(BMA)
THE GOVERNMENT OF THE KINGDOM OF THAILAND

THE STUDY ON URBAN ENVIRONMENTAL IMPROVEMENT PROGRAM IN BANGKOK METROPOLITAN AREA

FINAL REPORT

VOLUME 2: MASTER PLAN



February 1997

PACIFIC CONSULTANTS INTERNATIONAL
SUURI-KEIKAKU

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The exchange rates applied in this Study are:

US$ 1.00	=	Baht 25.42
US$ 1.00	=	Japanese Yen 110.65
Baht 1.00	=	Japanese Yen 4.35

(as of September 1996)

Preface

In response to a request from the Government of the Kingdom of Thailand, the Government of Japan decided to conduct "The Study on Urban Environmental Improvement Program in Bangkok Metropolitan Area" and entrusted the Study to the Japan International Cooperation Agency (JICA).

JICA sent to the Kingdom of Thailand a study team headed by Dr. Katsuhide NAGAYAMA, Pacific Consultants International, and composed of members of Pacific Consultants International, and Suuri-Keikaku Co.,Ltd., four times between August 1995 and December 1996.

The team held discussions with the officials concerned of the Government of the Kingdom of Thailand and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Kingdom of Thailand for their close cooperation extended to the team.

February 1997

Kimio Fujita
President
Japan International Cooperation Agency

February 1997

Mr. Kimio FUJITA

President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

Dear Sir,

We are pleased to formally submit herewith the final report of "The Study on Urban Environmental Improvement Program in Bangkok Metropolitan Area".

This report compiles the results of the Study which was undertaken in the Kingdom of Thailand from August 1995 through December 1996 by the Study Team, organized jointly by Pacific Consultants International and Suuri-Keikaku Co., Ltd.

We owed a lot to many people for the accomplishment of the Study. First, we would like to express our sincere gratitude and appreciation to all those extended their kind assistance and cooperation to the Study Team, in particular, relevant officials of Bangkok Metropolitan Administration, the Thai counterpart agency.

We acknowledge all the officials of your agency, the JICA Advisory Committee, Embassy of Japan in Thailand and Ministry of Foreign Affairs.

We wish the report would be able to contribute really to appropriate polices and measures for the Bangkok environmental improvement to be formed by the Thai Government.

Very truly yours,

Dr. Katsuhide NAGAYAMA

Team Leader,
The Study Team for the Study on
Urban Environmental Improvement
Program in Bangkok Metropolitan
Area

Abstract

This Study proposes a new urban growth system and social rules for forming adequate social capitals and appropriate uses of environmental resources, seeking sustainable development of the Bangkok Metropolis with the ultimate goal of up-grading people's quality of life.

The Study recommends that Bangkok Metropolitan Administration (BMA) and relevant national agencies make integrated efforts to:

1) *re-structure the physical urban structure towards a multi-polar metropolitan system instead of the present one-center system, by emphasizing "Mass transit-driven Urbanization";*
2) *institutionalize urban planning-related systems effective for "Urban Growth Management" to materialize adequate land use;*
3) *realize strategic projects/programs based on the following 6 planning polices:*
   - *Sustainable resource utilization of vulnerable environment;*
   - *Flood-free urbanization;*
   - *Environment-initiative transportation system;*
   - *Fresh and clean air;*
   - *Water-friendly Eco-city; and*
   - *Quality of Living*
4) *Strengthen the implementability and financial absorptive capacity of BMA, improving the basis of local taxation and encouraging participation of people, communities and the business sector based on a bottom-up approach.*

THE STUDY ON URBAN ENVIRONMENTAL IMPROVEMENT PROGRAM IN BANGKOK METROPOLITAN AREA

Study Period: August 1995 - February 1997
Counterpart Agency: Bangkok Metropolitan Administration

Outline of the Study

1 Background

Thailand has been enjoying a rapid economic growth at more or less 10% p.a. since 1987, in which the Bangkok economy does and will continuously strengthen its centric and higher urban functions rather than industrial function. More information-based and more value-added types of business with international linkages will be expanded.

Despite a long-standing "Decentralization Policy", Bangkok is still accepting rural-to-urban migrants at a significant rate and will grow to be one of the largest Mega-cities over the world with more than 10 million population in 2011. The expected economical development will eventually up-lift the per capita income level to be US$13,000 in 2011, compared to US$5,600 at present as of 1995.

Under this favorable circumstances, however, the city suffers from urban environmental problems such as traffic congestion and air pollution. As being economically affluent on one hand, people will become more environment-conscious and more cultural identity-oriented on the other hand. Environmental improvement will be a further critical policy issue on both short- and long-term perspective.

2 Objective

The objective of the Study is to formulate a comprehensive master plan for the urban environmental improvement of Bangkok Metropolitan Area with the target year of 2011. This Study proposes a new urban growth system and social rules for forming adequate social capitals and appropriate utilization of the environmental resources, seeking sustainable development of the Bangkok Metropolis with the ultimate goal of up-grading people's quality of life.

3 Outline of the Program

3.1 Development Framework

Table 1 Socioeconomic Framework of BMA

	1995	2001	2006	2011	Increase 1995-2011	Avg. Growth Rate p.a. 1995-2011
Socioeconomic						
Population (,000)	8,126	9,044	9,761	10,496	2,370	1.6 %
GPP-BMA (Bill. Baht at 1988 const. Price)	1,149	1,823	2,557	3,422	2,273	7.1 %
Urbanization						
Urbanized Ratio (% as of BMA total area)	34.3	38.4	45.6	56.1	-	-
Population density (prs/ha)	150	149	136	119	-	-
Motorization						
No. of Vehicles registered (,000)	1,911	2,773	3,406	4,065	2,154	4.8 %
Vehicle Ownership per Household	0.94	1.20	1.32	1.42	-	-

3.2 Restructuring of the Bangkok Metropolis

1) From One-center to Multi-polar Urban System

Metropolitan Subcenters should be developed at five locations in suburban areas within BMA, that will function as commercial/business centers to make job-and-housing balance, thereby releasing the concentration pressure.

2) Urban Regeneration

Part of the central areas, where a number of warehouses and factories are going to be out of date and no longer economically functional, should be re-generated or re-developed. It is necessary to establish a re-generation program with a long-term perspective.

3) Sub-urbanization

Infrastructure-led urbanization should be pursued, by employing institutional tools under well-coordination between urban planning and implementation of infrastructures.

4) Mass-Rapid Transit-Driven Urbanization

Areas easily accessible to stations of the planned MRTs will induce intensive land use. Hence, such mass-transit driven urbanization is effective for management of traffic demands control. Physical urban design of transport facilities and their network systems should be made in such a way that pedestrians and public transport passengers may take advantages in services and amenities with convenient inter-modal transfer systems.

3.3 Planning Concepts for Bangkok Urban Environmental Improvement

1) Pursuance of Sound Urban Environment

Planning of urban environmental improvement pursues four (4) vital elements of human life: *Healthiness; Safeness; Comfortableness;* and *Convenience.* The city should provide with environmental conditions to assure all the elements.

2) Functioning Urban Metabolism System

The city itself is an organic system, therefore, always changes its land use and functions, in response to requirements of the times and the economy. This is called "Urban Metabolism" with two sub-systems working reciprocally:

- *Anabolism :* the urban system to provide with fresh and clean inputs sufficiently enough to maintain the organic system;
- *Catabolism :* the urban system to treat with emissions and wastes so as to minimize damages otherwise would-be-harmful.

To maintain the urban metabolism, man-made and natural environment should be co-existing. This is a vital planing issue for the environmental improvement.

3) Urban Growth Management

Bangkok needs to establish a urban growth management system. Growth shall be limited within the carrying capacity that the government can control in providing necessary public services to protect the environmental deterioration. The carrying capacity is determined by not only its spatial extent, but also authorities' managerial and economic capabilities.

3.4 Planning Issues, Targets and Macro Measures

1) Planning Issues

Deterioration of "Bangkok environment" has been reaching a critical level, which means that further worsening of the quality of environment will jeopardize the people's lives as well as sustainable socioeconomic growth. The majority of the Bangkok residents has been already aware of that substantial solutions on environmental problems should be prioritized even though they pay some cost for the economic growth ("Environment Awareness Survey for Bangkok People", IDE). To resolve problems of environmental deterioration, an integrated approach is essential and new social rules are needed for using resources of the Metropolis.

Planning issues, in this sense, are identified to be the following six:

- **Sustainable Resource Utilization in Vulnerable Environment;**
- **Flood-free Urbanization;**
- **Environment-initiative Urban Transport System;**
- **Creation of "Water-friendly Eco-city";**
- **Pursuance of "Fresh and Clean Air policy"; and**
- **Up-grading of Quality of Living Environment.**

2) Macro Measures to Achieve the Targets

For the achievement of the targets, the macro measures, including both soft and hard ones, should be pursued at the level of national as well as BMA. Some of them call for business sector's participation or people's strong involvement.

Table 2 Planning Target and Macro Measures for Environmental Improvement

PLANNING ISSUE	TARGET 2011	NUMERICAL TARGET	PROPOSED MACRO MEASURES
PLAN 1: Sustainable Resource Utilization in Vulnerable Environment	Creation of the robust urban environment against the natural disasters.		- Pursuance of energy saving and resource recycling policy. - Establishment of social rules and guidlines for stopping land subsidence. - "Green and Water Network" Development.
PLAN 2: Floof-Free Urbanization	Creation of the man-made environment for people to be free from fears and apprehensions of floods.	Keeping the drainage capacity to cope with 5 year rainfall probability.	- Formulation of a long-term master plan. - Formulation of a hierachical drainage system. - Establishment of well-functioning flood control system. - Control of environmental preserved land. - Development of guidelines regarding water retaining.
PLAN 3: Environment - initiative Urban Transport System	Re-structuring of the Bangkok Urban Transport System with a more environment oriented system, or shifting to a public transport based system; and Mitigation of road traffic congestion, providing with alternative urban public transport modes suitable for their purposes and time constraint.	Anyone can reach his/her work place or school within 45-60 minutes; and the share of public transport as a primary mode shall be 70%(excluding walk trips)	- Shift to a Mass Transit - driven Urban System - Public Transport Corridor development. - Development of hierarchical road system.
PLAN 4: Pursuance of "Fresh and Clean Air Policy"	Mitigation of air pollution up to a level that people may feel no damage on health.	Ambient air pollution levels in most of Bangkok urban areas shall satisfy the presently regulated "Thai Environment Standard"	- Strengthening of environmental administration. - Measures for mobil sources related to urban transport. - Stationary sources managed on voluntary basis.
PLAN 5: Creation of "Water - friendly Eco - city"	Restoration of the Thai water culture in association with improvement of water quality in khlongs.	BOD: less than 15mg/l in major khlongs in the Special Policy Zone (Khlong Water Quality Improvement Promotion Zone)	- Water quality improvement and restration of function of the urban khlongs. - Beautification of khlongs and river front area.
PLAN 6: Up-grading of Quality of Living Environment	Materialization of Healthy, Safe, Comfortable and Convenient Environment for all people, with social cares for urban poor, elderly and handicappers.	Solid Waste Management: reduction of per capita generation rate of solid waste by 10%. Water Supply: supply to all residents in urban areas, in association with reduction of the leakage ratio up to less than 20%	- Solid waste management for hygienic living environment. - One-more-step solution of slum problem. - Creation of pedestrian-advantageous society. - Attention to the environment for the weak.

4 Programming of Projects/Programs

4.1 A Conceptual Ground for Programming

Projects/programs to materialize the urban environmental improvement plan are categorized into one of four categories characterized as follows:

I. Public investment for local and sector solution;

II. Involvement of voluntary private activities;

III. Institutional system with guidelines, standards and regulations for urban environmental and growth management; and

IV. Strategic public investment for urban restructure.

In the short-term, intensive efforts should be made to enhance the categories of I and III; and in the medium- to long-term, emphasis should be placed on the categories of II and IV.

4.2 Proposed Projects/Programs for Bangkok Environmental Improvement

For the macro measures to achieve the planning target, 105 projects/programs are recommended as summarized in the list compiled in the end of this report.

5 Basic Rules for the Implementation

5.1 Social Rules for the Implementation

Social rules are required to manage and support the deliberate implementation of the plans, taking into account:

- A decrease of environmental resources shall be compensated with an increase of environmental inputs at the corresponding economic value. Based on this rule, **"Polluter-Pay-Principle (PPP)"** or **"User Charge System"** should be justified.
- Any type of development should minimize anticipated negative impacts on the environment, based on another rule that one's gain never results in worsening the other's welfare.
- A preventive approach is less costly than a curative approach in the long-run. Before worsening the environment, effective measures against it should be undertaken.

5.2 Institutional Arrangement for Urban Growth Management

A number of institutional arrangement for urban growth management are necessary to support the administrative power to implement the plans, including:

- **Special Policy Zoning System**, supplementing the current Land Use Zoning System, to indicate policy directions and concrete measures of the environmental improvement in accordance with the zonal attributes;
- Institutionalization of **Parks and Open-space Development Act** which stipulates guidelines of development and preservation of public parks and green areas along khlongs and other valuable open space;
- Rationalization of the current **Floor Area Ratio** (a flat system of 1,000%) to rationalize the intensity of land use reflected by locational and environmental attributes with institutional links with the Urban Planning Act;
- Enhancement of **Environment-related Acts/Regulations** with enforcement power of the responsible authorities;
- Introduction of the regulation of **Traffic Assessment Study** which is obliged to submit the local government together with the application of building permission for a large-scale projects;
- Preparation of **Local Government's Guidelines** for land and subdivision development with deliberate measures for environmental improvement and preservation in a form of Local Government Ordinance.

6 Financing for the Implementation

6.1 Financial Demarcation System

Since environmental problems likely appear at local level, BMA as of the local government has to have a chief responsibility for resolving the problems.

For the implementation of projects, the budgetary autonomy of local government is limited, and most of environmental projects are carried out under the subsidy system where about 60-65% of the total costs come from the central government. Further devolution in the budgetary power for projects/programs should be pursued in such a way that BMA can directly tackle with local environmental problems, improving the existing subsidization system.

6.2 Enhancement of BMA Financial Capability

Financial and implementing capabilities of BMA itself should be further strengthened in order to put the plans into action, through:

1) Improvement of the executing system of the current Local Taxation, including:
   - preparation of **Land and Assets Ownership Maps, or Cadastral Maps;**
   - re-evaluation of **Asset Value;** and
   - improvement of **Tax Collection System.**
2) Introduction of **PPP or User Charge System** for environmental services;
3) Utilization of **External Financial Resources** (soft loans) to initiate urgent infrastructure projects and social capital formation; and
4) Development of **Training Programs of Local Government Personnel** particularly for planners, engineers and financial staff.

6.3 Evaluation of BMA's Financial Capability for the Implementation of Environmental Projects/Programs

1) Evaluation of BMA's Financial Capability in the Short-term

During the period of the BMA 5th Development Plan (1996-2001), a number of projects/programs regarding the environmental improvement of Bangkok has been lunched by relevant government agencies. Besides the above, adding the cost for all the projects/programs termed "Urgent Actions" proposed by the BEIP Study, which are to be implemented during the same period between 1996 and 2001, the total necessary cost amounts to approximately 283 billion Baht. Of which, those to be implemented by BMA is estimated at 152 billion Baht. Given the current subsidy system from the central government, BMA itself has to share approximately 53.3 billion Baht out of the total of 152 billion Baht.

If BMA succeeded in execution of the enhancement program for financial capability as proposed in the preceding section 6.2, BMA could enlarge its revenue sources through local taxes, thereby, could bear an accumulated budget of about 22.3 billion Baht available for the environmental investment up to the year 2001. Therefore, if BMA implements all the projects/programs proposed by both the 5th Plan and the BEIP Study in schedule, a fund shortage, or a budgetary deficit, will occur at an amount of 31 billion Baht in 2001.

Two ways are conceivable to fulfill this deficit, i.e., 1) to claim a special subsidy allocation to the central government; or 2) to seek some external fund sources in a form of soft loans.

2) Evaluation of BMA's Financial Capability in the Medium- and Long-term

Out of the projects/programs proposed by the BEIP Study, those to be chiefly implemented by BMA will cost approximately 123 billion Baht for the medium-term (2001-2006), and 141 billion Baht for the long-term (2006-2011). Under the current subsidy system from the central government, BMA itself has to share 43 billion Baht in the medium-term (2001-2006), and 49.4 billion Baht in the long-term (2006-2011). On the fund supply side, BMA will bear available budgets for the environmental investment of 49.8 billion Baht for the medium-term, and 75.3 billion Baht for the long-term. As the result, obviously, BMA will be able to be affordable and manageable to implement all the projects/programs proposed by the BEIP Study. In the long-term, the deficit born in the short-time will be fulfilled with the surplus, and the balance will be all clear in 2011. The above discussed are summarized in Table 3.

3) Overall Evaluation of Project Implementability of BMA

Under two premises that the current subsidy system is workable and that BMA implements the proposed program to enhance its budgetary base, BMA is assessed to be financially capable of executing all the projects/programs stipulated by the 5th Plan and the BEIP Study, despite that BMA will suffer from a budget shortage in the short-run.

Therefore, it is critical whether or not BMA will challenge to put forth the Enhancement Program which is included in the list of the proposed projects/programs compiled in this BEIP Study.

Table 3 BMA's Financial Capability of Implementation of the Proposed Projects and Programs for Environmental Improvement

million baht

		Urgent Actions (1997-2001)	Medium-term Projects /programs (2002-2006)	Long-term Projects /programs (2007-2011)	Total
1) Required Environment Investment Costs, 1997-2011					
Investment Budget of Environment Projects in BMA Fifth Five-Year Plan	(a)	120,500			120,500
Investment Budget of MWA Five-Year Plan	(b)	114,900			114,900
Total Costs of Projects/Programs of BEIP Study	(c)	47,330	415,450	472,600	935,380
- BMA	(d)	31,740	122,730	141,140	295,610
- Central government		2,320	4,690	1,860	8,870
- State Enterprise		8,680	180,690	216,500	405,870
- Private Sector		4,590	107,340	113,100	225,030
Total Investment Cost	(a)+(b)+(c)	282,730	415,450	472,600	1,170,780
2) BMA Budget Revenue in Challenging Case					
Estimated BMA Budget Revenue	(e)	115,100	182,300	255,800	553,200
3) Require Amount for Environmental Investment of BMA					
Required Amount for Environmental Investment	(f)=(a)+(d)	152,240	122,730	141,140	416,110
- Required Investment of BMA	(g)=(f)x35%	53,280	42,960	49,400	145,640
- Required Subsidies from Central Government	(h)=(f)x65%	98,960	79,770	91,740	270,470
7) Potential Investment Budget of BMA for Environment					
Potential Investment Budget of BMA for Environment	(i)	22,300	49,790	75,320	147,410
Required Investment of BMA	(g)	53,280	42,960	49,400	145,640
Balance of BMA Budget	(j)=(i)-g)	-30,980	6,830	25,920	1,770
Percentage of BMA Total Budget	(j)/(e)	-27%	4%	10%	0%

Source: BEIP Study

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Abbreviation

BEIP	The Study on Urban Environmental Improvement Program in Bangkok Metropolitan Area
BMA	Bangkok Metropolitan Administration
BMR	Bangkok Metropolitan Region
BMTA	Bangkok Mass Transit Authority
BOD	Biological Oxygen Demand
CBD	Central Business District
CO	Carbon Monoxide
DO	Dissolved Oxygen
DOH	Department of Highways, Ministry of Transport and Communications
DTCP	Department of Town and Country Planning
EEC	European Economic Community
ERTC	Environmental Research and Training Center
ETA	Express Transit Authority of Thailand
FAR	Floor Area Ratio
FIRR	Financial Internal Rate of Return
GDP	Gross Domestic Product
GIS	Geographic Information System
GPP	Gross Provincial Product
HBE	Home Based Education Trip
HBO	Home Based Others Trip
HBW	Home Based Work Trip
IDE	Institute of Developing Economies
IPCC	Intergovernmental Panel on Climate Change
JEA	Japan Environmental Agency
JICA	Japan International Cooperation Agency
LTD	Land Transport Department
MOF	Ministry of Finance
MOH	Ministry of Health
MOI	Ministry of Interior
MOID	Ministry of Industry
MOSTE	Ministry of Science, Technology and Environment
MOTC	Ministry of Transport and Communications
MRR	Middle Ring Road

MRTA	Metropolitan Rapid Transit Authority of Thailand
MSL	Mean Sea Level
MWA	Metropolitan Waterworks Authority of Thailand
NEPO	National Energy Policy Office
NESDB	National Economic and Social Development Board
NHA	National Housing Authority
NHB	Non-Home Base Trip
NO	Nitrogen Monoxide
NO2	Nitrogen Dioxide
NOx	Nitrogen Oxides
NPV	Net Present Value
OCMRT	Office for Commission of Management for Road Transport
OEPP	Office of Environmental Policy and Planning
ORR	Outer Ring Road
PCD	Pollution Control Department
PCU	Passenger Car Unit
PM	Particulate Matter
PM-10	Particulate Matter Smaller than 10 μ
PPP	Polluter-Pay-Principle
PWD	Public Works Department, Ministry of Interior
RID	Royal Irrigation Department
SO2	Sulfur Dioxides
SOx	Sulfur Oxides
SPM	Suspended Particulate Matter
TDRI	Thailand Development Research Institute
TOE	Ton Oil Equivalent
TSP	Total Suspended Particulate
UNEP	United Nation for Environmental Program
UTDM	Urban Transport Database Management Project
VAT	Value Added Tax
WHO	World Health Organization
WMA	Wastewater Management Authority

PART I: CURRENT URBANIZATION AND ENVIRONMENTAL RESOURCES

CHAPTER 1: INTRODUCTION

1.1 Background

In response to the request of the Government of the Kingdom of Thailand, the Government of Japan decided to conduct the Study on Urban Environmental Improvement Program in Bangkok Metropolitan Area in the Kingdom of Thailand (hereinafter referred to as " the Study", or the BEIP Study), within the general framework of technical cooperation between Japan and Thailand, which is set forth in the Agreement on Technical Cooperation Between the Government of Japan and the Government of the Kingdom of Thailand, signed on November 5, 1981.

Accordingly, Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for implementation of the technical cooperation programs by the Government of Japan, undertakes the Study in close cooperation with the authorities of the Kingdom of Thailand. Department of Public Works, Bangkok Metropolitan Administration (hereinafter referred to as "BMA") shall act as the counterpart agency to the JICA study team and also as a coordinating body in relation to other relevant organizations for smooth implementation of the Study.

The Study was commenced the Study on 18 August 1995, and its progress was directed by the Steering Committee, chaired by Mr. Bampen JATOORAPREUK, Deputy Permanent Secretary, BMA.

This present report is the Draft Final Report compiling all the findings and recommendations which are subject to comments by the Steering Committee. Based on the official comments, the Study Team will prepare the Final Report as the guidelines useful for policy-building and decision-making for the Bangkok environmental improvement.

1.2 Objectives

The objective of the BEIP Study is to formulate a comprehensive master plan to improve urban environment in the area of Bangkok Metropolitan Administration through facilitating its sound urban growth with landuse control, urban restructuring for decentralization and infrastructure development on the medium- and long-term perspectives, targeting the years 2006 and 2011.

To this end, the Study aims at formulating macro and micro level master plans and policy guidelines for environmental improvement, including both institutional and physical projects/programs.

1.3 Scope of the Study

Planning of the urban environment is a task to depict a blueprint of the total urban system itself. Since all urban activities are part of the environment and elements of the environmental dynamic system, the task shall inherently cover a wide variety of socioeconomic, urban planning and energy issues, otherwise, the Plan would not be completed. However, it is almost impossible to deepen all the discussions under a

limitation of expert inputs and a time constrain. The BEIP study, therefore, focuses on a number of selected issues related to the urban planning and management as follows:

- Physical urban planning issues, including the spatial structure and land use;
- Transport sector issue;
- Air quality issues;
- Water and Water-related issues;
- Living environment-related issues, including solid waste management, housing and noise; and
- Administrative and institutional issues for the implementation of the proposed plan.

1.4 Previously Submitted Reports

The Study Team submitted four (4) sorts of the reports to the Steering Committees up to now: Inception Report in September 1995, Progress Report (1) in January 1996, Interim Report in March 1996 and Progress Report (2) in September 1996. The Interim Report was a milestone of the Study which complies preliminary findings and planning issues derived from field investigation surveys, monitoring surveys for air quality and noise level, a number of transportation-related surveys including a person trip home-interview survey and analyses of the present conditions. And the Progress Report (2) discussed new additional findings and planning implications derived from a number of simulation analyses particularly on 1) Urbanization, 2) Transportation and traffic congestion and 3) Air pollution. These are all significant basic elements for considerations of the comprehensive master plan.

Because of the logical simplicity of planning, this Draft Final Report does not compile all technical materials. Therefore, those who area interested in the detailed data/information are advised to refer to the previously submitted reports.

1.5 Regional Context and Relevance with On-going Studies

The 8th National Plan has just been officially published in October 1996. The basic framework of the regional context which has been depicted in the 8th Plan was reviewed to be incorporated into the planning framework of the BEIP Study.

There are presently on-going studies focusing on the Bangkok Metropolis. All are important inputs and/or implications to the Study. In particular, the Team has established close collaboration with Urban Transport Data-Base Management Project (UTDM) under OCMRT for building of a transport data-base (referred to as "UTDM-BEIP data base").

The Bangkok Plan proposed by MIT and EC Teams provides a number of significant planning inputs for the Study in terms of urban planning aspects in BMA. Moreover, the Metropolitan Subcenter Plan, prepared by the MIT Consultant Team in September 1996, is another input for clarification in the urban environmental context of this Study.

Thus, the BEIP Study was conducted in close coordination with the national policies and other relevant studies.

1.6 Planning Process with GIS Technique

The Study is challenging in application of GIS technique for the data-base building and data/information analyses in such a way that inter- and intra-governmental information transfer and exchange are possible and expandable for a variety of purposes after the BEIP Study. For this purpose, the basic topo-map covering BMA with the scale of 1/75,000 was created, combining the national base maps with the scale of 1/20,000 issued by Royal Thai Survey Department. This newly edited map is accurate and useful enough to be utilized by all related authorities to compile socioeconomic data as well as geographical information.

In this study, the BEIP Team employed the planning approach with the following three kinds of works:

1) To assess existing resources and environment problems objectively and scientifically;
2) To simulate and project the most-likely states in the future; and
3) To employ planner's visions to make proposals of the master plan and projects and/or programs for the environmental improvement, based on the planning implications derived from the above analyses.

It has been proved through the Study that the GIS technique is remarkably capable of undertaking the first and second works.

1.7 Structure of the Report

The Final Report consists of the following separated volumes:

Volume 1: Executive Summary;
Volume 2: Master Plan (Chapter 1 through Chapter 15); and
Volume 3: Sector Plans and Technical Studies (Chapter 1 through Chapter 14)

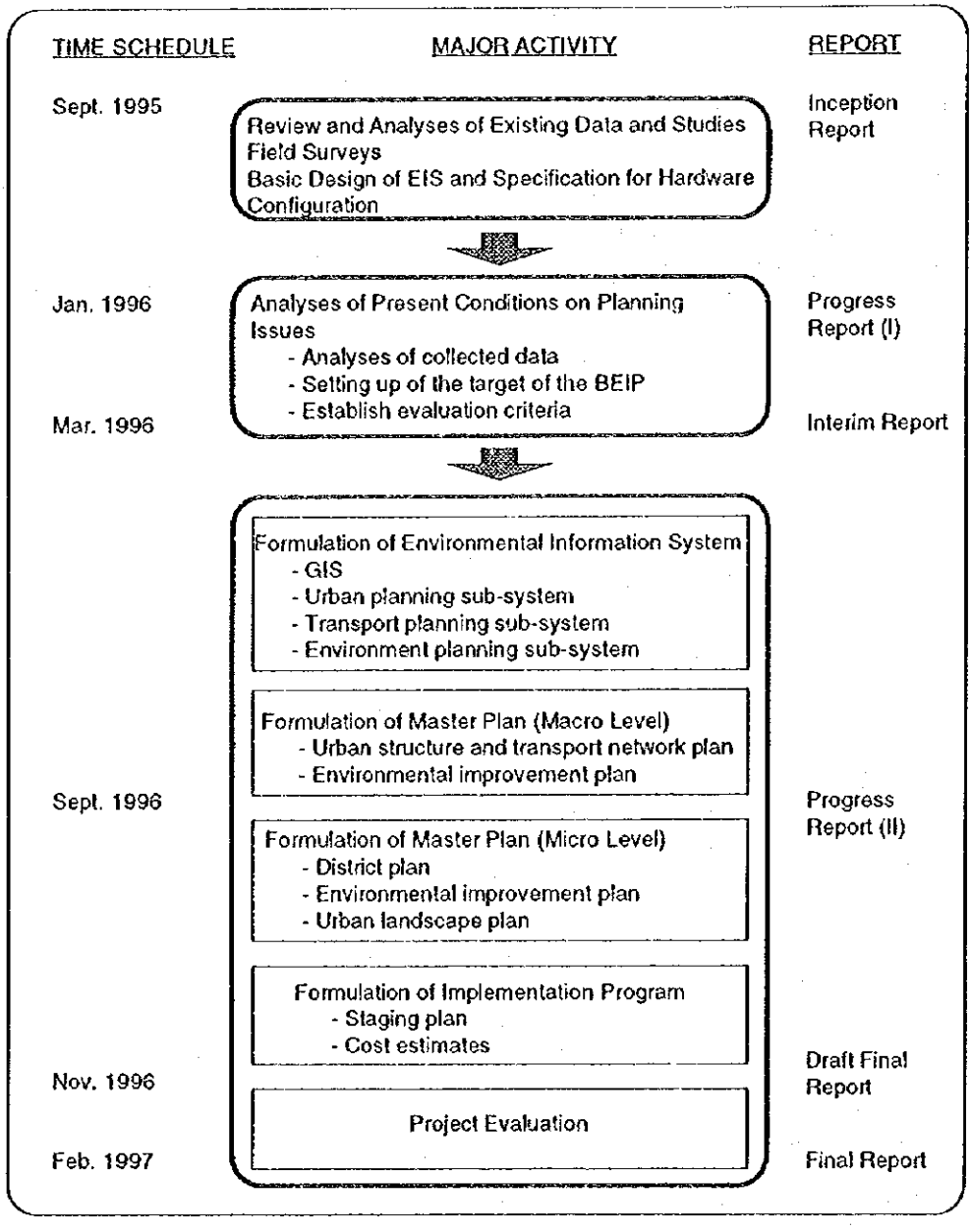


Fig. 1.1 Work Flow and Time Framework of the BEIP Study

CHAPTER 2: SOCIOECONOMIC AND SPATIAL PERSPECTIVES OF THE BANGKOK METROPOLIS

2.1 Current Economic Activities of the Bangkok Metropolis

(1) Economic Growth

Thailand has been continuously enjoying a raid economic growth since 1987 with about 10 % annual growth rate. In this favorable economic growth, Bangkok has gradually strengthened its main roles in the Thai economy. As seen in Table 2.1, Bangkok has the highest economic growth, compared to BMR and the whole nation, which shows approximately 3 points higher in the GDP annual growth rate. Looking into the sector-wise performance, the construction, banking, insurance and real estate sectors have remarkably grown up, while the growth of the manufacturing sector has no longer predominant in Bangkok, compared to the national average. It implies that Bangkok 's economy is gradually sifting from the industry-based economy to a soft and service sector-driven economy.

On the other hand, BMR is more specialized by the growth of the manufacturing sector, which shares approximately 66 % of GPP with a 14 % of annual growth rate, followed by the construction, transportation and communication, and banking, insurance and real estate sectors.

This favorable economic growth has strengthened the fixed capital formation in the Kingdom, of which the private construction sector has contributed greatly to the capital formulation, which shares approximately 36 % of the total capital formulation in 1993 with the highest growth rate of 33 %, as shown in Table 2.2.

(2) Primacy of the Bangkok's Urban Economy and Its Structural Changes

Predominant functions of economic activities of Bangkok have been shifting to the service and finance sectors. The rapid economic growth makes the primacy of Bangkok's urban economy more robust, and at the same time, this is eventually enlarging regional discrepancies in job opportunities, income levels, quality of people's living conditions between Bangkok and other provinces.

Bangkok, in fact, has recently been accumulating more information-oriented and knowledge-based activities. This can be identified from the statistical data of the following aspects:

- Employment;
- Centric Functions of Economic Activities;
- Investment;
- Information and Higher Educational Function; and
- Internationalization.

Employment

In reflection to the expansion of the service and financial sector's value added in Bangkok, administrative and managerial workers are significantly increasing, compared

to those in the other sectors, as shown in Table 2. 3. The requirements of production workers are relatively decreasing in Bangkok in terms of the share structure.

Table 2.1 Recent Economic Growth and BMA's Contribution

(Thousand Baht)

Industry	1989		1991		1993		Growth
	No.	Share	No.	Share	No.	Share	Rate
Bangkok							
Agriculture	4,475,607	0.68%	4,583,390	0.55%	4,643,612	0.45%	0.93%
Mining and Quarrying	0	0.00%	5,776	0.00%	7,252	0.00%	12.05%
Manufacturing	222,902,553	33.85%	289,107,072	34.74%	357,529,617	34.54%	12.54%
Construction	38,454,143	5.84%	56,139,963	6.75%	74,303,595	7.18%	17.90%
Electricity and Water Supply	13,596,855	2.06%	15,284,119	1.84%	16,733,201	1.62%	5.33%
Transportation and Communication	79,684,125	12.10%	99,300,186	11.93%	118,377,387	11.44%	10.40%
Wholesale and Retail Trade	132,399,529	20.11%	176,738,053	21.24%	198,219,715	19.15%	10.62%
Banking, Insurance and Real Estate	47,491,745	7.21%	70,395,731	8.46%	123,857,303	11.97%	27.08%
Ownership of Dwellings	13,890,960	2.11%	15,338,885	1.84%	17,052,302	1.65%	5.26%
Public Administration and Defence	14,999,189	2.28%	15,033,637	1.81%	17,100,396	1.65%	3.33%
Services	90,621,640	13.76%	90,314,016	10.85%	107,169,551	10.35%	4.28%
GPP	658,516,346	100.00%	832,240,828	100.00%	1,034,993,931	100.00%	11.97%
BMR except Bangkok (Samut Prakan, Nonta Buri, nakhon Pathom, Phatum Thani, Samut Sakorn)							
Agriculture	20,244,892	9.66%	20,663,342	7.75%	21,792,760	6.64%	1.86%
Mining and Quarrying	424,931	0.20%	325,147	0.12%	456,859	0.14%	1.83%
Manufacturing	128,318,672	61.26%	170,117,540	63.78%	217,550,207	66.24%	14.11%
Construction	7,392,350	3.53%	10,657,550	4.00%	11,822,056	3.60%	12.45%
Electricity and Water Supply	9,996,057	4.77%	12,391,478	4.65%	14,958,670	4.55%	10.60%
Transportation and Communication	5,697,527	2.72%	7,129,351	2.67%	9,422,471	2.87%	13.40%
Wholesale and Retail Trade	16,962,946	8.10%	19,191,293	7.20%	21,151,785	6.44%	5.67%
Banking, Insurance and Real Estate	5,960,582	2.85%	8,389,755	3.15%	9,968,118	3.04%	13.72%
Ownership of Dwellings	3,595,741	1.72%	4,353,470	1.63%	5,175,556	1.58%	9.53%
Public Administration and Defence	2,109,455	1.01%	2,480,162	0.93%	2,658,414	0.81%	5.95%
Services	8,763,845	4.18%	11,031,681	4.14%	13,464,575	4.10%	11.33%
GPP	209,466,998	100.00%	266,730,769	100.00%	328,421,471	100.00%	11.90%
Whole Nation							
Agriculture	276,568,993	15.80%	281,927,977	13.31%	288,760,985	11.68%	1.08%
Mining and Quarrying	28,226,998	1.61%	36,084,998	1.70%	40,589,370	1.64%	6.06%
Manufacturing	467,632,000	26.72%	608,777,992	28.75%	755,488,991	30.56%	12.74%
Construction	95,554,000	5.46%	132,494,000	6.26%	150,735,000	6.10%	12.07%
Electricity and Water Supply	42,259,005	2.41%	51,791,001	2.45%	62,921,774	2.55%	10.46%
Transportation and Communication	128,754,000	7.36%	157,429,013	7.43%	187,240,001	7.57%	9.81%
Wholesale and Retail Trade	296,919,000	16.97%	364,097,000	17.19%	403,953,000	16.34%	8.00%
Banking, Insurance and Real Estate	80,425,962	4.60%	113,842,991	5.38%	182,449,003	7.38%	22.73%
Ownership of Dwellings	58,213,000	3.33%	63,181,000	2.98%	67,660,000	2.74%	3.83%
Public Administration and Defence	57,276,998	3.27%	65,256,000	3.08%	69,688,005	2.82%	5.03%
Services	218,122,000	12.46%	242,700,000	11.46%	262,761,000	10.63%	4.76%
GDP	1,749,951,956	100.00%	2,117,581,972	100.00%	2,472,247,129	100.00%	9.02%

Note: at Constant 1988 prices

Source: National Account Division, NESDB

Table 2.2 Gross Fixed Capital Formation in Thailand

	1986		1992		Growth
	Value	Share	Value	Share	Rate
Construction	126,505	53.01%	569,293	51.12%	31.75%
Private	65,757	27.55%	399,985	35.92%	32.94%
Residential	44,129	(67.11%)	215,777	(53.95%)	26.14%
Non-residential	20,269	(30.82%)	125,564	(31.39%)	32.08%
Other Construction		(0.00%)	45,852	(11.46%)	
New Lands	1,359	(2.07%)	1,444	(0.36%)	-1.74%
Others		(0.00%)	11,348	(2.84%)	
Public	60,748	25.45%	169,308	15.20%	29.13%
Residential	1,756	(2.89%)	6,935	(4.10%)	41.44%
Non-residential	6,510	(10.72%)	32,474	(19.18%)	46.99%
Other Construction	52,482	(86.39%)	129,899	(76.72%)	25.60%
Machinery and Equipment	112,160	46.99%	544,398	48.88%	25.65%
Transport Equipment	38,247	(34.10%)	164,352	(30.19%)	25.04%
Road Motor Vehicles	21,251	(18.95%)	129,888	(23.86%)	25.42%
Other Equipment	16,996	(15.15%)	34,464	(6.33%)	23.65%
Machinery and Other Equipment	73,913	(65.90%)	380,046	(69.81%)	25.92%
Industrial Machinery and Appliances	39,650	(35.35%)	163,271	(29.99%)	14.78%
Office and Other Equipment	34,263	(30.55%)	216,775	(39.82%)	39.58%
Gross Fixed Capital Formation	238,665	100.00%	1,113,691	100.00%	28.59%

Source: Statistical Year Book, 1990,1994

Table 2.3 Labor Requirements by Occupation

	Occupation	Bangkok		Whole Nation		Locational
		No.	Share*1	No.	Share*1	Coefficient*2
	Year 1991					
0/1	Professional, technical and related workers	7,223	4.73%	16,075	6.38%	0.74
2	Administrative, exective and managerial workers	1,167	0.76%	1,706	0.68%	1.13
3	Clerical and related workers	28,328	18.57%	35,830	14.22%	1.31
4	Sales workers	11,172	7.32%	27,018	10.72%	0.68
5	Service workers	18,762	12.30%	32,911	13.06%	0.94
6	Agriculture, animal husbandary and forest workers, fisherman and hunters	50	0.03%	1,473	0.58%	0.06
7/8/9	Production and related workers, transport equipment operators and laborers	85,858	56.28%	136,965	54.36%	1.04
	Total	152,560	100.00%	251,978	100.00%	1.00
	Year 1993					
0/1	Professional, technical annd related workers	20,606	9.63%	31,045	8.36%	1.15
2	Administrative, exective and managerial workers	4,404	2.06%	5,296	1.43%	1.44
3	Clerical and related workers	54,318	25.38%	74,535	20.08%	1.26
4	Sales workers	24,815	11.60%	38,501	10.37%	1.12
5	Service workers	26,906	12.57%	46,616	12.56%	1.00
6	Agriculture, animal husbandary ad forest workers, fisherman and hunters	400	0.19%	1,136	0.31%	0.61
7/8/9	Production and related workers, transport equipment operators and laborers	82,564	38.58%	174,116	46.90%	0.82
	Total	214,013	100.00%	371,245	100.00%	1.00

Note: *1 Share to the total No. of labor requirement
*2 Share of Bangkok devided by the share of whole nation.

Source: Thailand Figures 1995-1996

Concentration of Pivotal Urban Functions in the Bangkok Economy

The Bangkok economy seems to be now in a transitional stage shifting towards the next generation. Economic concentration of Bangkok can apparently be observed, but its structure is gradually changing towards more information-based and more value-added type economy. This can be seen in Table 2.4, that is, the shares of BMA are:

- Headquarters of major firms listed in the Stock Market: 88%;
- Commercial banks' loans: 71%;
- Commercial banks' deposits: 61%; and
- Number of business establishments: 47%.

Compared to the Bangkok's GDP share of approximately 50%, these shares are all remarkably high. Concentration of these pivotal urban functions is one of the factors that make the Bangkok economy more competitive in the international market.

Table 2.4 Salient Indicators on Primacy of the Bangkok Economy

		Bangkok		BMR (except BKK)*1		Whole Nation	
		No.	Share*2	No.	Share	No.	Share
No. of Headquarters of Stock Market Firm	(Firm)	308	88.00%	32	9.14%	350	100.00%
No. of Commercial Bank Office	(Office)	819	28.71%	243	8.52%	2,853	100.00%
Amount of Commerical Bank Deposits	(Million Baht)	1,666,442	61.42%	255,353	9.41%	2,713,275	100.00%
Amount of Commercial Bank Loans	(Million Baht)	2,350,270	71.11%	168,939	5.11%	3,305,048	100.00%
No. of Business Establishment	(Firm)	113,390	47.31%	13,680	5.71%	239,678	100.00%
No. of Service Industries*3	(Firm)	22,678	46.38%	2,059	4.21%	48,901	100.00%

Note: *1 BMR includes Samut Prakan, Patun Thani, Samut Sakhon, Nontaburi and Nakhon Pathom.
*2 Share to the Whole Nation.
*3 Service Industry includes Financing, insurance, real estate, business services and comunity, social and personal services.

Source: Thailand Figures 1995-1996, Statistical Year Book 1994, Stock Exchange of Thailand Company Profiles

Investment

As described in the preceding subsection, labor requirements for the manufacturing workers are now decreasing in Bangkok, while they are increasing in outside Bangkok. This phenomena can be proved by looking into destinations of BOI investments, as shown in Table 2.5.

Focal areas for investments are shifting from BMR, which is designated as Zone 1 by the BOI's category, to the areas designated as Zones 2 and 3. The investment activities has been slowing down in number, and becomes smaller size in amounts of investment in Bangkok, while the Zones 2 and 3 are expanding the number of projects as well as amounts of investments, being reflected by the BOI policy of "Decentralization". This may imply that investors can no longer recognize Bangkok as a preferable industrial location.

Information and Higher Educational Function

The primacy of Bangkok is also explained by accumulation of the information and higher educational service functions, which are likely to attract a wide variety of businesses activities. Table 2.6 shows that more or less 90 % of computer software and telecommunication firms of Thailand have been concentrated in Bangkok.

Concentration of higher educational functions represents another fact of the primacy of Bangkok. There are 30 of universities and colleges in Bangkok, which is accounted for approximately 68 % of total number of universities and colleges. Looking at the share of the number of students, 86 % of the students enrolled are concentrated in Bangkok in 1992.

However, this figure is smaller than that of 1985. A new notable movement of pushing locations of universities to move out from the central area of Bangkok has emerged, for example:

- Kasetsart University in Nakhon Patom;
- Tamasart University in Patom Thani;
- Bangkok University in Patom Thani
- Mahidol University in Nakhon Patom; and
- Silpakorn University in Nakhon Patom.

Internationalization

The international gateway function of Bangkok is gradually of importance while increasing the importance of the Thai economy in the world market. The interface function between domestic and international economies are rapidly growing up in Bangkok in terms of especially international traffic of peoples and goods, transaction of money and information. In reflection to growing service economy in Bangkok, the amounts of international trade and communications have remarkably expanded during 1989 to 1993, as shown in Table 2.8.

Table 2.5 Changes in Investment Activities (BOI Promotional Privileges)

		1992		1993		1994	
		No.	Share	No.	Share	No.	Share
No. of Applications for BOI's Promotional Previleges							
Zone 1	Bangkok	60	13.76%	106	8.51%	100	6.57%
	BMR	98	22.48%	160	12.84%	162	10.64%
	Sub-total	158	36.24%	266	21.35%	262	17.20%
Zone 2		102	23.39%	178	14.29%	266	17.47%
Zone 3		176	40.37%	802	64.37%	995	65.33%
Total		436	100.00%	1,246	100.00%	1,523	100.00%
Amounts of Investment of the Applicantions							
Zone 1	Bangkok	750	37.17%	268	9.85%	221	3.77%
	BMR	131	6.49%	309	11.36%	250	4.26%
	Sub-total	881	43.66%	577	21.21%	471	8.03%
Zone 2		262	12.98%	585	21.50%	1,095	18.66%
Zone 3		875	43.36%	1,559	57.30%	4,302	73.31%
Total		2,018	100.00%	2,721	100.00%	5,868	100.00%
Amounts of Investment per Application							
Zone 1	Bangkok	12.50		2.53		2.21	
	BMR	1.34		1.93		1.54	
	Sub-total	5.58		2.17		1.80	
Zone 2		2.57		3.29		4.12	
Zone 3		4.97		1.94		4.32	

Note: Zone 1 Bangkok, Samut Prakan, Pathum Thani, Nakhon Pathom and Samut Sakhon
Zone 2 Samut Songkhram, Rachaburi, Nakhon Nayok, Ang Thong, Ayutthaya, Kanchanaburi, Chachengsao, Chon Buri and Saraburi
Zone 3 Remaining provinces outside Zone 1 and Zone 2
Source: Activity Report 1994, BOI

Table 2.6 Computer Software and Telecommunication Firms in Bangkok

	Bangkok				BMR	Other	Total
	CBD Zone	Urbanized Zone	Suburban Zone	Total		Provinces	
Number							
Computer Software	116	149	56	321	18	19	358
Telecomunication	385	310	170	865	54	11	930
Share							
Computer Software	32.40%	41.62%	15.64%	89.66%	5.03%	5.31%	100.00%
Telecomunication	41.40%	33.33%	18.28%	93.01%	5.81%	1.18%	100.00%

Source: Thailand Software Directory 1994/95, Thailand Telecommunication Handbook 1995

Table 2.7 No. of University Students in Bangkok

	1985		1990		1993	
	Number	Share	Number	Share	Number	Share
Universities in Bangkok	695,080	96%	581,252	88%	681,236	86%
Universities outside Bangkok	28,596	4%	80,494	12%	107,107	14%
Total	723,676	100%	661,745	100%	788,342	100%

Note: Universities which has a branch outside Bangkok are included by 50 % in Bnagkok 50% outside Bangkok.

Source: JICA Study Team compiles basd on the data from Statistical Year Book, NSO

Table 2.8 Selected Indicators on Internationalization

	Unit	1989	1991	1993	Annual Growth Rate
Foreign Visotors (Whole Nation)	Visitor	4,809,508.0	5,086,899.0	5,760,533.0	4.61%
Foreign Visotors in Bangkok Airport	Visitor	3,637,187.0	3,540,086.0	4,182,104.0	3.55%
Current Transfers (Whole Nation)	Million Baht		7,624.4	7,910.0	1.86%
Amounts of Export (Whole Nation)	Million Baht	515,750.9	725,448.8	940,862.6	16.22%
Amounts of Import (Whole Nation)	Million Baht	658,007.8	959,408.0	1,170,746.4	15.49%
International Air Traffic at Bangkok Airport	Arrivals	6,463,139.0	6,765,538.0	8,362,465.0	6.65%
International Shipping to/from Bangkok Port	1,000 Tonnes	60,086.0	63,620.0	62,964.0	1.18%
International Telephone Outgoing (Whole Nation)	Thousand Calls	17,990.0	32,241.0	47,400.0	27.41%
Postal Service (Whole Nation)	Thousand	92,341.0	107,225.0	121,907.0	7.19%
GDP	Million Baht	1,749,952.0	2,117,582.0	2,472,247.0	9.02%
GPP of Bangkok	Million Baht	658,516.0	832,241.0	1,034,994.0	11.97%

Source: Statistical Year Book Thailand 1994, Thailand Figures 1994-1995 and Transport Statistics Data for 1993

2.2 Social Movements and Living Environment

The primacy of Bangkok has been qualitatively and quantitatively strengthened in reflection to the recent economic growth. Such economic growth inevitably influences the social and living conditions of people of Bangkok. This was viewed from the following aspects:

- Population Increase and Urban Migration;
- Motorization; and
- Modernization of People's Living.

(1) Population Changes

The Bangkok population has been decreasing since 1990, according to the statistics of the population registration of BMA*1, as shown in Table 2.9. The CBD zone of Bangkok has decreased its population at approximately - 2,9 % p.a. during the period between 1988 and 1993, which is the largest decrease compared to the urbanized and suburban zones of Bangkok and BMR.

A drastic population decrease appeared in the CBD zone at approximately - 4.1 %, while the suburban zone and the BMR provinces have increased their population, accommodating some social increases.

Such a phenomena is also observed from a change in migration pattern, as shown in Table 2.10. The CBD zone has more "move-out" than "move-in", however, the urbanized and suburban zones have a more "move-in" tendency. This population growth pattern implies a significant planning implication regarding urbanization and land use of the Bangkok Metropolis.

(2) Motorization

Table 2.11 shows the number of registered vehicles in Bangkok and the Kingdom. Motorization is likely to be proceeding proportionally along with an increase of people's income level. The ownership in terms of the number of registered vehicles per person accounted for 0.28 in Bangkok, which is approximately 4 times bigger than national average. As for the growth rate, however, the whole nation shows a higher growth rate than that in Bangkok during the period between 1989 and 1992.

It is also noted in this table that the number of registered vehicles per GDP in Bangkok slightly decreased in 1993, compared to that in 1989. This trend should be carefully watched to avoid a misleading to future Motorization related to transport planning.

*1 As for the accurate figures of present population and its trend in Bangkok, there are several arguments, depending upon different studies and organizations such as NESDB and OCMRT. This analysis is based on the data from Statistical Profile of BMA 1994..

Table 2.9 Population Growth Pattern of Bangkok and BMR

	Population (Person)				Growth Rate (%)	
	1988	1990	1992	1993	Average G.	Social G.****
Bangkok						
CBD Zone*	2,111,460	1,933,683	1,884,952	1,825,044	-2.87%	-4.07%
Urbanised Zone**	1,825,782	1,701,540	1,653,008	1,645,070	-2.06%	-3.26%
Suburban Zone***	1,779,537	1,911,714	2,024,181	2,102,598	3.39%	2.19%
Total	5,716,779	5,546,937	5,562,141	5,572,712	-0.51%	-1.71%
Vicinity Provinces						
Samut Prakan	789,060	854,883	871,806	895,384	2.56%	1.36%
Nonta Buri	596,381	668,760	698,704	717,405	3.76%	2.57%
Nakhon Pathom	630,805	657,182	671,386	710,290	2.40%	1.20%
Phatum Thani	435,409	452,693	484,586	500,086	2.81%	1.61%
Samut Sakorn	340,952	358,155	372,605	373,464	1.84%	0.64%
Total	2,792,607	2,991,673	3,099,087	3,196,629	2.74%	1.54%
BMR Total	8,509,386	8,538,610	8,661,228	8,769,341	0.60%	-0.60%
Whole Nation	54,960,917	56,303,273	57,788,965	58,336,072	1.20%	0.00%

Note: * CBD Zone covers districts within approximately 5 Km radius, including Para Nakorn, Pom Pram, Samphanthawong, Bang Rak, Ratchthewi, Khlong Sun, Patum Wan, Dusit, Bang Kho Laem, Sathon, Bangkok Noi, Bnagkok Yai, Thon Buri and Phaya Thai.

** Urbanized Zone covers districts within approximately 10 Km radius, including Bang Sue, Chatuchak, Din Daeng, Huai Khwang, Bang Kapi, Khlong Toei, Yan Nawa, Rat Burana, Chom Thong, Phasi Charoen.

*** Suburban Zone covers districts outside approximately 10 Km radius, including Don Muang, Bang Khen, Lat Phrao, Bang Kun, Suan Luang, Prawet, Para Khanong, Min Buri, Nong Chok, Lat Krabang, Taling Chan, Nong Khaem and Bang Khun Thian.

**** (Average Growth) - (Average Growth of Whole Nation)

Source: Office for Civil-Registration, Department of Local Administration, Ministry of Interior

Table 2.10 Recent Migration Pattern of Bangkok

	1989			1991		
	Move-in	Move-out	Total	Move-in	Move-out	Total
CBD Zone*	232,850	318,340	-85,490	125,078	241,474	-116,396
Urbanised Zone*	147,260	132,175	15,085	140,837	136,592	4,245
Suburban Zone*	300,995	208,673	92,322	214,321	147,595	66,726
Total	681,105	659,188	21,917	480,236	525,661	-45,425

Note: * The division of the districts into the zone is same as Table 2.9.

Source: Office for Civil-Registration, Department of Local Administration, Ministry of Interior

Table 2.11 Changes in No. of Registered Vehicles

	1989		1991		1993		Growth Rate
	No.	Share	No.	Share	No.	Share	
No. of Vehicle Registration (Vehicle)							
Bangkok	1,076,989	45.79%	1,225,229	41.40%	1,551,023	40.38%	9.55%
Whole Nation	2,352,020	100.00%	2,959,634	100.00%	3,841,093	100.00%	13.05%
No. of Motorcyle Registration (Motorcyle)							
Bangkok	644,597	27.41%	887,289	29.98%	1,105,084	28.77%	14.43%
Whole Nation	4,153,000	176.57%	5,521,391	186.56%	7,260,665	189.03%	14.99%
No. of Vehicle per Population (Vehicle/Person)							
Bangkok	0.18		0.22		0.28		10.80%
Whole Nation	0.04		0.05		0.07		11.84%
No. of Vehicle per GDP (Car/Million Baht)							
Bangkok	1.64		1.47		1.50		-2.16%
Whole Nation	1.34		1.40		1.55		3.69%

Note: No. of Vehicle Registration excludes motorcycle.
Source: The Department of Land Transport, Ministry of Transport and Communications

(3) Modernization of People's Living

Consumption Pattern

The increase of income level and inflows of foreign information have influenced the peoples' life style as well as the Motorization. Table 2.12 shows changes in peoples' living conditions represented by the consumption pattern. In accordance with the increase of income level, the share of expenditure for the food and beverages in the total expenditure is decreased, while the shares of transport and communication ,apparel and footwear are increased. It is, accordingly, possible for peoples to afford more consumer goods. As the result, ownership of durable consumer goods is increasing, especially electric appliances, as shown in Table 2.13.

Thus, the peoples' consumption pattern seems to be based on a "mass production and mass consumption pattern", resulting in generating more environmental burdens, as seen in advanced countries.

Energy Usage and Utility Services

Modernization of people's way of living is represented by changes in the consumption patterns of energy and utilities. The consumption of water, electricity, petroleum are growing up at considerably higher growth rates than that of GNP per Capita, as shown in Table 2.14, and as illustrated in Fig. 2.1.

This fact implies that Bangkok is running on the energy-consuming economy, which is the same way of other advanced countries. Although modernization cannot be stopped and is desired by all people, the energy-saving approach should be explored to seek a sustainable urban growth while minimizing the environmental deterioration.

Table 2.12 Change of Consumption Patterns of Thai People

	Unit	1986	Share	1992	Share	1992/1986
Average Size of Household	Person	3.8		3.3		
Household socio-economic features						
Average Monthly Income	Bath	6,949.0		16,748.0		2.41
Average Monthly Expenditure	Bath	6,561.9		14,271.7		2.17
Food and Beverages	Bath	2,369.0	36.10%	4,156.0	29.12%	1.75
Alcoholic Beverages and Tobacco Products	Bath	260.0	3.96%	581.0	4.07%	2.23
Apparel and Footware	Bath	300.7	4.58%	769.5	5.39%	2.56
Housing and Household Operation	Bath	1,645.3	25.07%	3,563.5	24.97%	2.17
Medical Care	Bath	166.7	2.54%	404.4	2.83%	2.43
Personal Care	Bath	173.5	2.64%	319.9	2.24%	1.84
Transport and Communication	Bath	638.0	9.72%	2,054.8	14.40%	3.22
Recreation and Reading	Bath	209.3	3.19%	435.1	3.05%	2.08
Education	Bath	161.3	2.46%	324.7	2.28%	2.01
Miscellaneous	Bath	68.8	1.05%	82.3	0.58%	1.20
Non-consumption Ependitures	Bath	569.4	8.68%	1,580.6	11.07%	2.78

Source: Household Socio-economic Survey, NSO, 1986,1992

Table 2.13 Changes in Ownership of Durable Consumer Goods

(%)

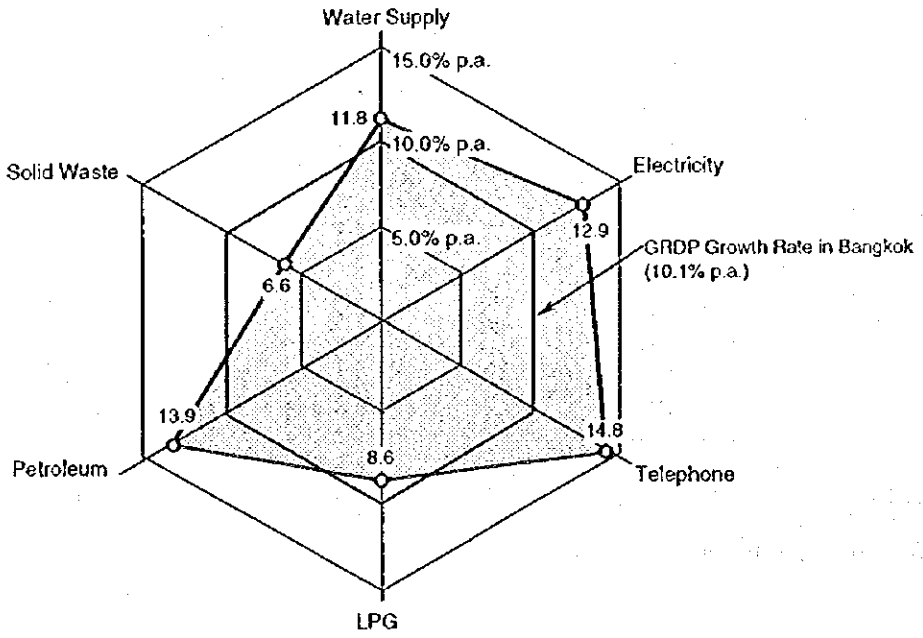
	1980		1990		Change of Points (90-80)	
	Bangkok	Nation	Bangkok	Nation	Bangkok	Nation
Radio	95.0	95.0	90.7	81.3	-4.30	-13.70
Color TV	80.1	23.4	81.5	46.2	1.40	22.80
Black and White TV			20.4	24.9	-	-
Video			41.9	12.4	-	-
Iron			91.6	54.5	-	-
Electric Rice Cooking			92.7	61.2	-	-
Electric Fan	90.1	32.0	96.1	72.1	6.00	40.10
Sewing Machine			32.6	18.7	-	-
Vacuum Cleaner			16.5	4.2	-	-
Refrigerator	61.0	17.3	74.3	36.0	13.30	18.70
Washing Machine			22.7	6.0	-	-
Air Conditioner	9.6	2.3	20.2	3.7	10.60	1.40
Telephne	22.4	3.8	38.5	8.3	16.10	4.50
Bycycle	19.6	49.0	31.7	57.1	12.10	8.10
Motor Cycle	12.0	20.4	22.3	40.0	10.30	19.60
Motor Car	19.0	7.3	26.8	11.5	7.80	4.20
Motor Boat	1.8	1.8	1.1	1.5	-0.70	-0.30
Water Pump	2.9	9.6	2.5	12.1	-0.40	2.50
Ploughing Machine	1.2	5.5	0.5	9.7	-0.70	4.20
Local farm Truck			0.2	3.0	-	-

Source: Population and Housing Census, 1980, 1990

Table 2.14 Consumption of Energy and Utilities in Bangkok

	Unit	1987	1990	1993	Growth Rate (Annual)
Amount					
Water Supply	Million m3/Year	470.8	739.2	871.9	10.82%
Electricity*1	gWh	12,464.0	18,285.7	24,468.7	11.90%
Telephone*2	Telephne	622,973.0	820,321.0	1,177,894.0	13.59%
LPG	Million Litter	713.7	873.8	1,112.5	7.68%
Petroleum	Million Litter	6,557.5	10,890.2	13,600.9	12.93%
Solid Waste	Tonnes/day	4,190.1	4,551.8	5,857.9	5.74%
Amount per Person					
Water Supply		80.29	133.26	156.46	11.76%
Electricity	gWh/1,000person	2.13	3.30	4.39	12.85%
Telephone	Telephe/person	0.11	0.15	0.21	14.75%
LPG	Litter/person	121.71	157.53	199.63	8.60%
Petroleum	Litter/person	1,118.29	1,963.28	2,440.62	13.89%
Solid Waste	g/person	714.56	820.60	1,051.17	6.64%
GDP per Capita in BKK	Baht/person	86,009	139,077	185,725	10.12%
Population	Person	5,863,883	5,546,937	5,572,712	-0.85%

Note: *1 including Nontaburi and Samut Prakan
*2 Year 1887 dat is the data in 1988.
Source: Thailand Figures 1995-1996, Statistical Profile of BMA 1997,1990,1993, Statistical Year Book 1990,1994



Notes: Indicating average annual growth rates of per capita consumption during a 1987-1993 period.
Source: Statistical Year Book, BMA

Fig. 2.1 A Comparison of Growth of Energy and Utility Usage

2.3 Urban Structural Changes of the Bangkok Metropolis

(1) Urbanization Process

The urbanization pattern of Bangkok has been analyzed in the Bangkok Plan by the MIT/EU Team Based on that, the followings can be pointed out:

- Central areas of Bangkok have experienced declines of resident population in recent years;
- Commercial and office centers have expanded along Petchaburi, Rama I, Rama IV, Sukhumvit, Asoke-Ratchadapisek Roads, Victory Monument area and Central Plaza.;
- Suburban residential growth and development are increasingly moving to the eastern and northern corridors;
- Areas within an approximately 10 Km radius from the center of Bangkok, mainly have a vertical extension of development mainly along northern and eastern corridors; and
- Area within an approximately 20 Km radius are being developed with horizontal extension towards all directions. The east bank of Chao Phraya River is predominant.

The historical expansion of urbanized (built-up) area of Bangkok is as seen in Fig. 2.2. Bangkok has expanded mainly to the northern, eastern and southeastern directions. Compared among the urbanized areas in 1971, 1981 and 1991, it is noted that the urban agglomeration in the central area has not been much expanded. Instead of it, urbanization has been taking place along major arterial roads apart from the central area. This pattern is typically called "urban sprawl" in a form of "Ribbon Development". During the past two decades, the increased population was accommodated by these corridor areas.

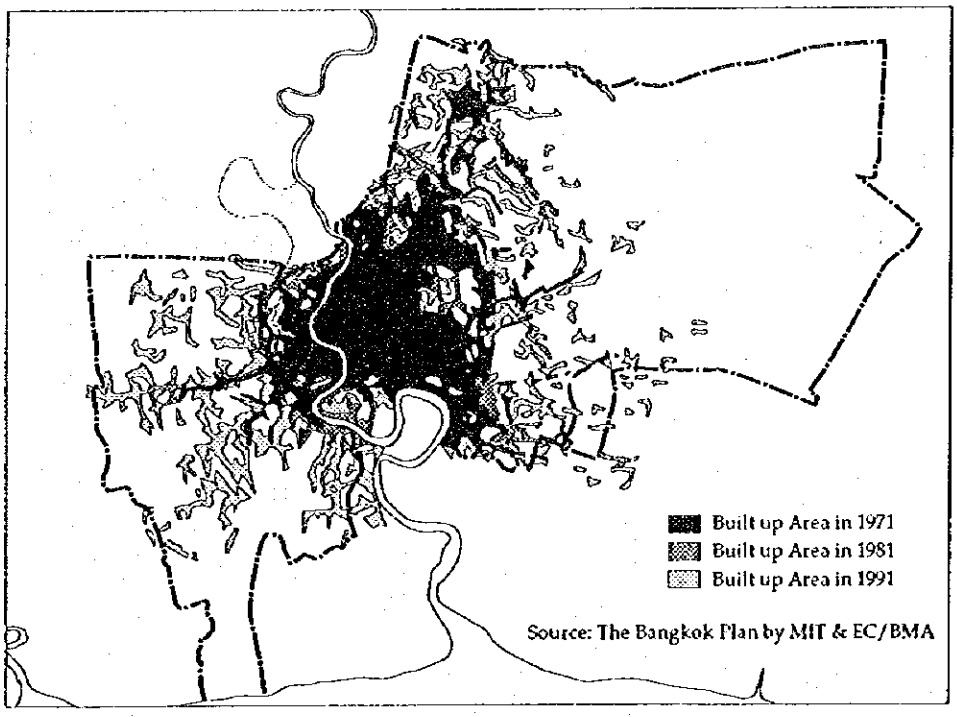


Fig. 2.2 Bangkok Urbanization Process From 1971 to 1991

(2) Land Use Changes and Current Urbanization Area

Urbanized areas of Bangkok was less than 100 sq. km only in the end of the 1950s. In the beginning of the 1970s, urban area was expanded to 200 sq. km, and it became 345 sq. km in 1980. Thus, the urbanized area in Bangkok had been doubling in each decade.

Using the GIS technique, the current land use pattern as of 1993 was examined by the BEIP Study Team. The original source of the information comes from the work done by Department of City Planning, BMA (refer to Chapter 15 for the details).

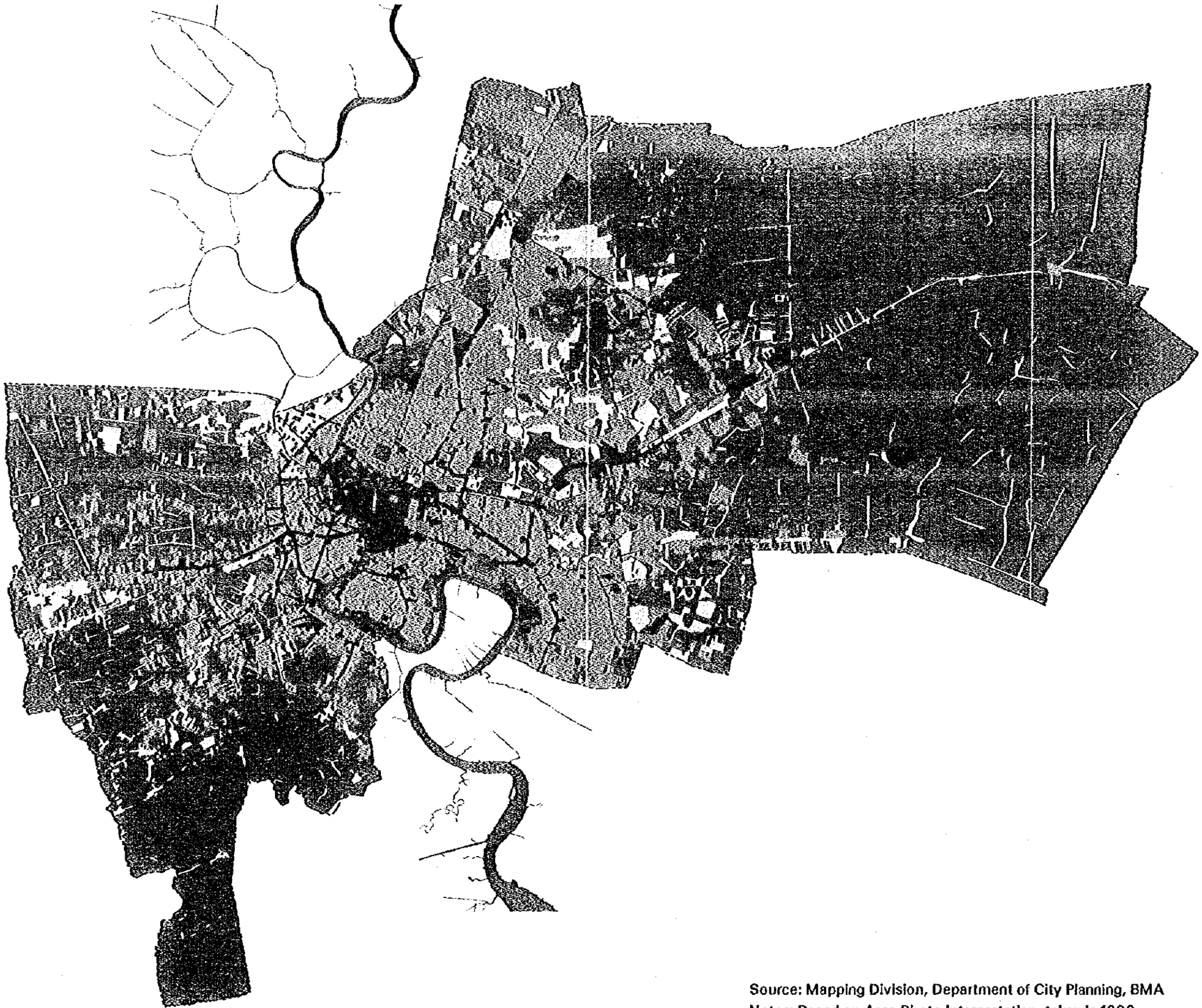
Based on the examination, the 1993 urbanized area accounted for 482 sq. km, which is equivalent to approximately 30 % of the total BMA area. It became 1.4 times of the 1980 urbanized area. Table 1.15 summarizes the 1993 land use structure, and Fig. 2.3 presents the land use pattern.

Table 2.15 A Summary of Bangkok Land Use in 1993

Type of Land Use	Area (km2)	(ha)	%
1. Low Density, All Low-rise	306.4	30,640	19.4
2. Low Density, Low-rise partially High-rise	7.4	740	0.5
3. Middle Density, Low-rise	32.5	3,250	2.1
4. Middle Density, Middle-rise	4.2	420	0.3
5. High Density, Low-rise	16.1	1,610	1.0
6. Middle Density, Low & Middle-rise	12.3	1,230	0.8
7. High Density, Middle-rise	10.3	1,030	0.7
8. High Density, High-rise	1.7	170	0.1
9. Factory & Warehouse Mixed with Residence	17.8	1,780	1.1
10. Factory & Warehouse	10.3	1,030	0.7
11. Educational & Religious	7.9	790	0.5
12. Public	48.9	4,890	3.1
13. Park & Recreational	6.5	650	0.4
14. Agricultural Vacant	1,095.0	109,500	69.4
Total	1,577.3	157,730	100.0

Source : JICA BEIP Study measures based on the land use map made by JICA & DTCP

Fig. 2.3



Existing Land Use (1993)

Legend

- Chaopraya River
- High Density Residential Area
- Middle Density Residential Area
- Low Density Residential Area
- Commercial Area
- Industrial Area
- Warehouse Area
- Governmental and Public Facilities
- Open Space/Agriculture Area
- Conservation Area
- Park
- School
- Religion
- Railways
- BMA Boundary
- District Boundary

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KILOMETERS

Source: Mapping Division, Department of City Planning, BMA
Notes: Based on Aero-Photo Interpretation, taken in 1993

THE STUDY
ON
URBAN ENVIRONMENTAL IMPROVEMENT PROGRAM
IN
BANGKOK METROPOLITAN AREA (BEIP)

BANGKOK METROPOLITAN ADMINISTRATION(BMA)
THE GOVERNMENT OF THE KINGDOM OF THAILAND

JICA JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

(3) Booming Construction Activities

The recent rapid economic growth of Bangkok has called for a construction boom. As described in the previous section, most of capital formation was stocked in the form of the construction especially by the private sector. Table 2.16 represents such a booming trend between 1987 and 1993 of building construction activities based on the building permission data.

In 1993, a total of 1,342 buildings were permitted. Compared to the number in 1987, it grew to be 4.6 times. The total building area amounted to about 12 million sq. meters in 1993, out of which residential buildings have the largest share, or 62 % with the highest growth rate. On the other hand, the share of commercial buildings increased during 1987 to 1990, but the boom seems to be calm down during the recent period between 1990 to 1993, due to investors' feeling and/or speculation of "Over-supply" in the market.

The same table also indicates that building projects have gradually been enlarged in scale; i.e., the average building area per unit in 1993 became 2 times as large as that in 1988. It is noted that such a tendency can be seem in all types of buildings..

Meanwhile, looking into the locations of building projects in 1993, a notable state can be observed, as shown in Fig. 2.4 and Table 2.17. The most active building constriction activities, or 50% of the total, took place in Suburban Zone (defined as the area with a more than 10 km radius from the center of Bangkok), followed by Urbanized Zone (defined as the area with a 5-10 km radius) and CBD Zone (defined as the area with a 5 km radius).

In particular, industrial buildings were almost none in CBD Zone, although commercial and office buildings still are being located in CBD Zone. Larger scale commercial buildings tends to locate in Suburban Zone, rather than CBD and Urbanized Zones.

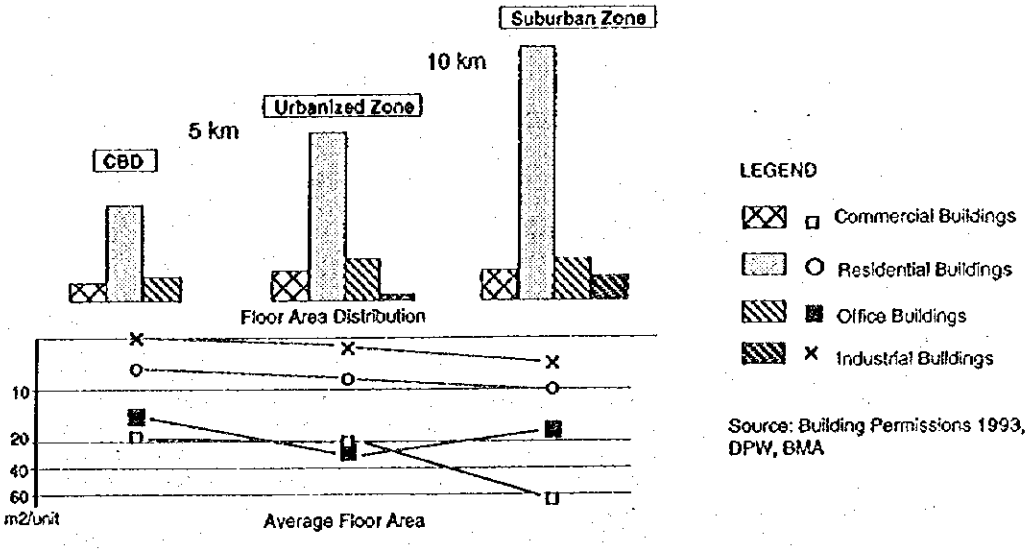


Fig. 2.4 Current Spatial Structure of Building Construction Activities

Table 2.16 Building Construction Activities in Bangkok

	1987	Share	1990	Share	1993	Share	1993/1987
No. of Permitted Building	(No.)		(No.)		(No.)		
Commercial	25	8.50%	114	17.04%	117	8.72%	4.7
Residential	61	20.75%	370	55.31%	854	63.64%	14.0
Office	41	13.95%	162	24.22%	175	13.04%	4.3
Public	55	18.71%	47	7.03%	74	5.51%	1.3
Consumption	17	5.78%	8	1.20%	17	1.27%	1.0
Industrial	52	17.69%	64	9.57%	36	2.68%	0.7
Oil & Gas	67	22.79%	14	2.09%	58	4.32%	0.9
Others	1	0.34%	4	0.60%	128	9.54%	128.0
Total	294	100.00%	669	100.00%	1,342	100.00%	4.6
Area of Permitted Building (Sq m)			(Sq m)		(Sq m)		
Commercial	475,273	35.25%	3,338,342	31.34%	5,497,498	45.79%	11.6
Residential	270,978	20.10%	3,644,391	34.21%	7,444,503	62.01%	27.5
Office	228,449	16.94%	3,187,238	29.92%	3,480,579	28.99%	15.2
Public	120,177	8.91%	254,735	2.39%	689,224	5.74%	5.7
Consumption	113,809	8.44%	4,860	0.05%	110,868	0.92%	1.0
Industrial	117,853	8.74%	211,852	1.99%	127,951	1.07%	1.1
Oil & Gas	21,496	1.59%	6,863	0.06%	44,217	0.37%	2.1
Others	298	0.02%	5,087	0.05%	107,622	0.90%	361.1
Total	1,348,332	100.00%	10,653,369	100.00%	12,004,964	100.00%	8.9
Area per Bulding	(sq m/building)		(sq m/building)		(sq m/building)		
Commercial	19,010.91		29,283.70		46,987.16		2.5
Residential	4,442.26		9,849.71		8,717.22		2.0
Office	5,571.93		19,674.31		19,889.02		3.6
Public	2,185.04		5,419.90		9,313.84		4.3
Consumption	6,694.63		607.56		6,521.65		1.0
Industrial	2,266.41		3,310.18		3,554.19		1.6
Oil & Gas	320.83		490.25		762.36		2.4
Others	298.00		1,271.72		840.80		2.8
Total	4,586.16		15,924.32		8,945.58		2.0

Source: Department of Public Works, BMA

Table 2.17 Location Characteristics of Building Development in Bangkok by Zone

	Commercial	Residential	Office	Industrial	Others	Total
No. of Permitted Building Construction in 1993						
CBD Zone*	26	151	39	1	42	259
Urbanised Zone*	49	287	68	6	66	476
Suburban Zone*	42	416	68	29	169	724
Total	117	854	175	36	277	1,459
(Share %)						
CBD Zone*	10.04%	58.30%	15.06%	0.39%	16.22%	100.00%
Urbanised Zone*	10.29%	60.29%	14.29%	1.26%	13.87%	100.00%
Suburban Zone*	5.80%	57.46%	9.39%	4.01%	23.34%	100.00%
Total	8.02%	58.53%	11.99%	2.47%	18.99%	100.00%
Area of Permitted Building Construction in 1993 (Ha)						
CBD Zone*	101	99	59	0	18	277
Urbanised Zone*	191	234	165	1	34	625
Suburban Zone*	258	412	124	12	44	849
Total	550	744	348	13	95	1,750
(Share %)						
CBD Zone*	36.36%	35.74%	21.38%	0.02%	6.49%	100.00%
Urbanised Zone*	30.56%	37.41%	26.46%	0.18%	5.39%	100.00%
Suburban Zone*	30.42%	48.52%	14.56%	1.37%	5.13%	100.00%
Total	31.41%	42.53%	19.89%	0.73%	5.44%	100.00%
Unit Area of Building Development (m2/Building)						
CBD Zone*	38,694	6,549	15,167	569	4,278	10,682
Urbanised Zone*	38,957	8,141	24,306	1,915	5,101	13,123
Suburban Zone*	61,489	9,902	18,180	3,996	2,577	11,726
Total	46,987	8,717	19,889	3,554	3,437	11,996

Note: Zonal division is same as that in Table 2.9.

Source: Department of Public Works, BMA

(4) Land Use Intensification with High-rise Buildings in Urbanized Area

Since Bangkok allows construction of buildings with as high as 1,000 % of floor area ratio (FAR) in any area, developers tend to construct high-rise buildings so as to maximize the land economy utmost.

As shown in Table 2.18, approximately 20 % of the buildings were more than 11 stories in both CBD and Urbanized Zones. However, it is noted that out of the total of 1,837 buildings permitted in 1993, 124 were high-rise with more than 20 stories, of which half were located in not CBD, but Urbanized Zone. Thus, the land intensification pressure is expanding outward.

Table 2.18 Distribution of High-rise Building Permissions

	No. of Story					Average
	1-4 story	5-10 story	11-20story	> 20 story	Total	No. of Story
CBD Zone*	33	186	30	30	279	10.1
Urbanised Zone*	73	418	77	61	629	10.0
Suburban Zone*	273	571	52	33	929	7.2
Total	379	1,175	159	124	1,837	8.6
(Share %)						
CBD Zone*	11.83%	66.67%	10.75%	10.75%	100.00%	
Urbanised Zone*	11.61%	66.45%	12.24%	9.70%	100.00%	
Suburban Zone*	29.39%	61.46%	5.60%	3.55%	100.00%	
Total	20.63%	63.96%	8.66%	6.75%	100.00%	

Note: * The division of the districts into the zone is same as Table 2.9.
Source: Department of Public Works, BMA

(5) Suburbanization Pressures Represented by Land Prices

The construction boom activated the land market, thereby consequently pushing up land prices in Bangkok, particularly in the suburban areas. In this circumstance, the land market tends to be skewed due to land speculation, which makes land procurement for public service facilities and infrastructures more difficult.

Practical information of the market land prices can be hardly obtained. According to the "Land Valuation Price Data" issued by Department of Land, land prices in Bangkok rose by as high as 6 times in the average during the period between 1986 and 1994, as shown in Table 2.19, compared to 1.42 times in the commodity index during the same period. Thus, the land market in Bangkok is not coherent to the real economy.

Looking into the average land prices by zone, the largest rise, or 6.3 times, in land prices occurred in the fringe of the urbanized areas which is encompassed with a 5 to 10 Km radius from the center of Bangkok. It is noted that the land prices in CBD Zone rose at a rather small rate than the average. Thus, the changes in land prices imply strong pressures of suburbanization in the Bangkok Metropolis.

To identify the area characteristics of land prices, the BEIP Team tried to depict rough indifferent contour lines of average land prices, based on the same data. Fig. 2.5 represents the result. The land prices seem to be higher in the East bank area than those in the West bank, or Thonburi Area, and it can be seen that the contour lines are distorted toward the North-East corridors.

Table 2.19 Changes in Land Evaluation Prices in Bangkok

(Baht/Sq.Wa*1)

District	Land Evaluation Price*2 1986	1992-94	Increase 1992-94
1 Pra Nakhon	100,000	300,000	3.00
2 Khlong Toei	24,000	270,000	11.25
3 Klong San	40,000	200,000	5.00
4 Chatuchak	25,000	128,000	5.12
5 Chom Thong	10,000	80,000	8.00
6 Don Muang	8,000	90,000	11.25
7 Dusit	65,000	130,000	2.00
8 Taling Chan	8,800	56,000	6.36
9 Thon Buri	22,000	150,000	6.82
10 Bangkok Noi	25,000	80,000	3.20
11 Bangkok Yai	22,000	120,000	5.45
12 Bang Kapi	16,000	200,000	12.50
13 Bang Khun Thian	5,500	55,000	10.00
14 Bang Khen	8,000	60,000	7.50
15 Bang Kho Laem	20,000	100,000	5.00
16 Bang Sue	15,000	120,000	8.00
17 Bang Phlat	25,000	112,000	4.48
18 Bang Rak	65,000	400,000	6.15
19 Bung Kum	60,000	160,000	2.67
20 Pathum Wan	30,000	290,000	9.67
21 Prawet	15,000	75,000	5.00
22 Pom Prap	30,000	250,000	8.33
23 Phaya Thai	40,000	150,000	3.75
24 Phra Khanong	30,000	250,000	8.33
25 Phasi Charoen	12,000	90,000	7.50
26 Min Buri	1,500	20,000	13.33
27 Yan Nawa	20,000	100,000	5.00
28 Ratchthewi	40,000	200,000	5.00
29 Rat Buruna	11,000	80,000	7.27
30 Lat Krabang	1,000	12,000	12.00
31 Lat Phrao	6,000	30,000	5.00
32 Sam Phanthawong	75,000	300,000	4.00
33 Sathon	60,000	280,000	4.67
34 Nong Khaem	4,000	50,000	12.50
35 Nong Chok	500	4,000	8.00
36 Huai Khwang	30,000	180,000	6.00
37 Din Daeng			-
38 Suan Luang			-
Average Land Evaluation Price By Zone			
CBD Zone*3	40,489	178,914	4.42
Urbanised Zone*3	16,320	118,090	7.24
Suburban Zone*3	8,522	54,039	6.34
Total	11,983	72,582	6.06

Note: *1 Sq.Wa is equivalent with 4 sq.m.
*2 The evaluation points along major roads in each districts are selected.
*3 Division of the districts into the zone is same as Table 2.9.

Source:Department of Land, MOI

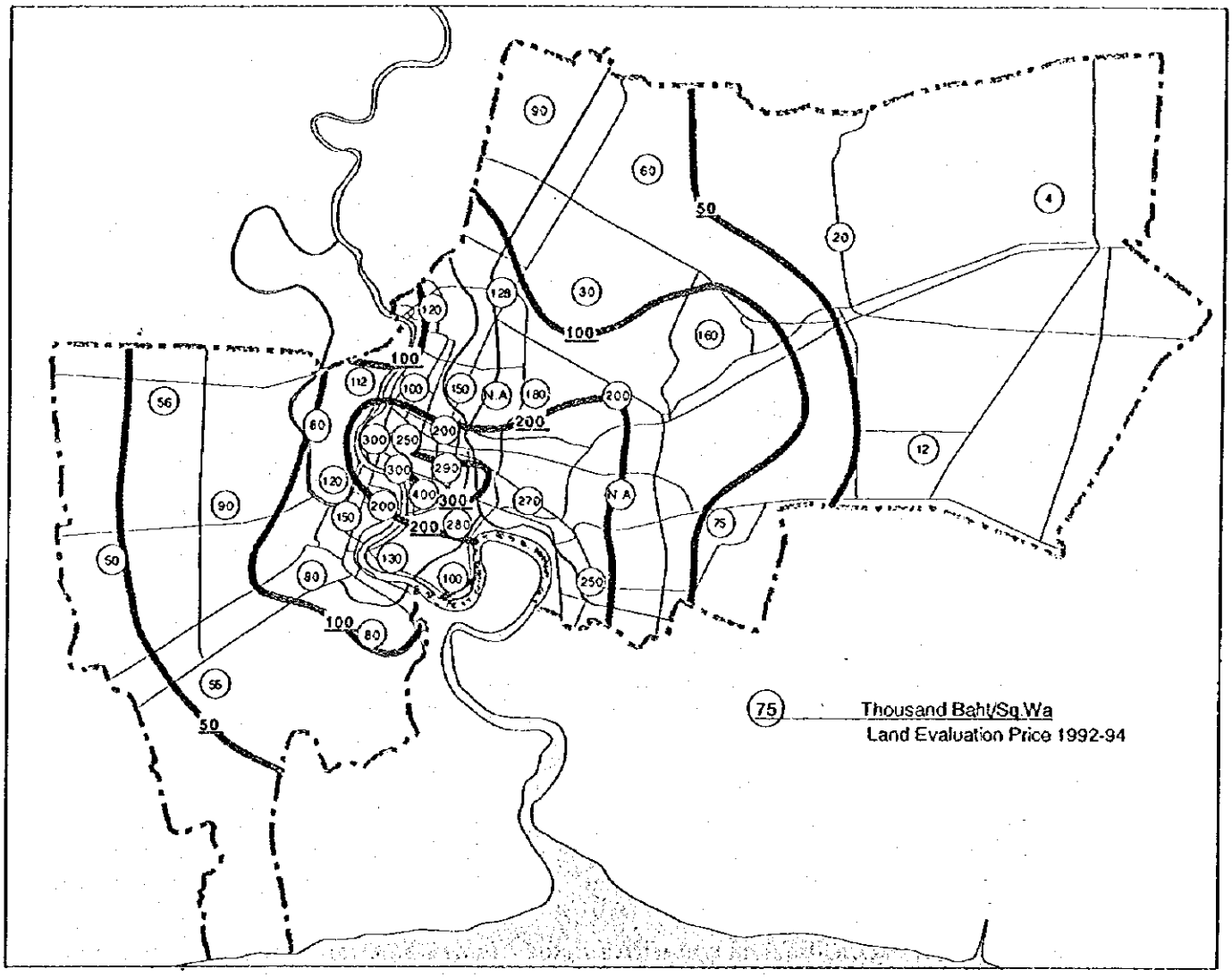


Fig. 2.5 Land Price Indifferent Contour Lines

2.4 A Physical Feature of Urban Metabolism

As discussed in the preceding sections, the vertical extension is rapidly proceeding in CBD and urbanized areas Such a spatial change is being stimulated by a "land integration process" to provide with wider piece of land for construction of higher and larger-scale building, integrating a few small pieces of land into a larger lot.

The BEIP Team surveyed such a process of so-called "Urban Metabolism", conducting a micro-level field survey [1], taking up a total of 45 blocks as shown in Fig. 2.6. The existing states of actual floor area ratios (FARs) were also identified through this survey.

(1) Land Integration in the Inner City

Fig. 2.7 shows typical examples of the land integration process from 1987 to 1995. Larger-scale and higher buildings were constructed in a scrap-and-build manner, integrating some pieces of land into some economical scale of land so as to maximize the land economic value based on the current regulation of the 1,000% FAR.

This can be seen in many blocks in the inner city at present. Based on the data of 45 survey sites, the Study Team identified that about 11 % of buildings in total were re-constructed in the scrap-and-build manner during the period between 1987 and 1995. Looking into the zonal differences, Urbanized Zone shows the highest percentage of reconstruction, or 14 %, as shown in Table 2.18. It was also observed that in a few survey sites, more than half of buildings were replaced or cleared for new buildings.

It is the notable fact that more or less 14% of buildings in the urbanized areas are subject to changes or re-construction during the 5-8 years period. This implies that there exist a great possibility to reform the present urban structure in the medium- term towards a certain direction that the government sector have deliberated. Even if the plan includes acquisition of land for new roads and parks, the plan could possibly materialize, given the proper public guidance. The "Land Readjustment System" may be applicable for this purpose. Effective measures that the public sector makes well-coordination with the private sector's development should be considered.

(2) Practical Floor Area Ratios (FARs)

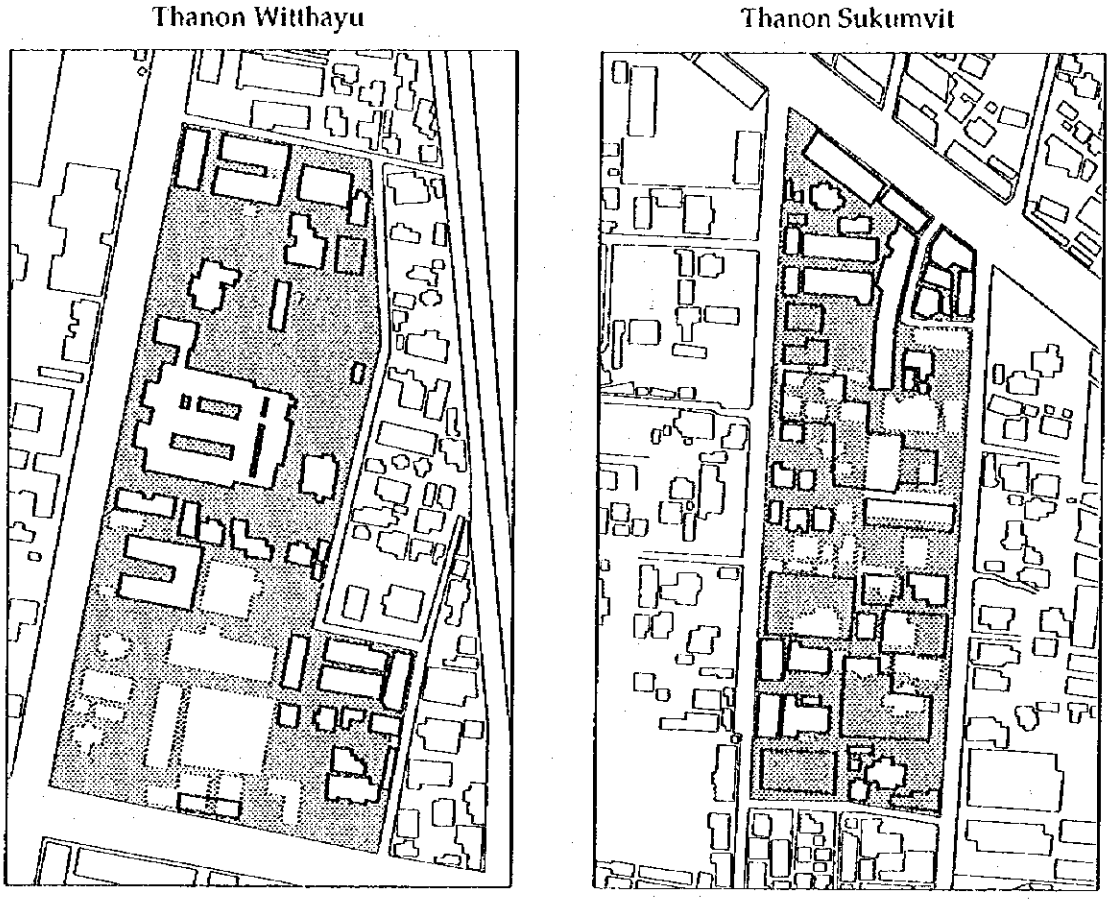
The average FAR of the 45 sample sites in Bangkok (a net ratio of block, excluding areas of the surrounding arterial roads) was identified to be 150 %, as summarized in Table 2.20. The distribution pattern of the existing FARs in Bangkok are indicated in Fig. 2.8.

The CBD Zone indicates the highest FAR in the average, accounting for 187%, while the Urbanized and the Suburban Zones indicate 134% and 118%, respectively. Furthermore, the commercial area including office and public buildings presents the highest FAR of 194 %, while the residential area is 84 %. Especially, the areas along Petchaburi, Sukhumvit, Silom Roads in the CBD Zone show the highest FARs. Thus, it should be noted that these figures of FARs at the actual ground are considerably smaller than the currently regulated FAR of 1,000%. Therefore, it must be a vital planning issue whether or not the current regulation of FAR is appropriate from the urban environment point of view. Since high-rise building itself is a great generator of environmental waste as well as traffic demands, it potentially causes environmental problems without sufficient infrastructures to deal with them.

[1] The survey was conducted in a manner that surveyors observe and investigate the lot size, the shape, the size and the number of story of existing each building in the survey site, and record those information on the 1987 topo-map. By this, changes of buildings between 1987 and 1995 can be identified.

Source: JICA Study Team

Fig. 2.6 Locations of Micro Surveys for Building Changes and FARs



Source: JICA Study Team

Fig. 2.7 Examples of Land Integration and Urban Metabolism

Table 2.20 Summary of the Results of Building Change and Existing FARs Survey

(1) Occurrence of Building Re-construction by Zone in Bangkok between 1987 and 1995

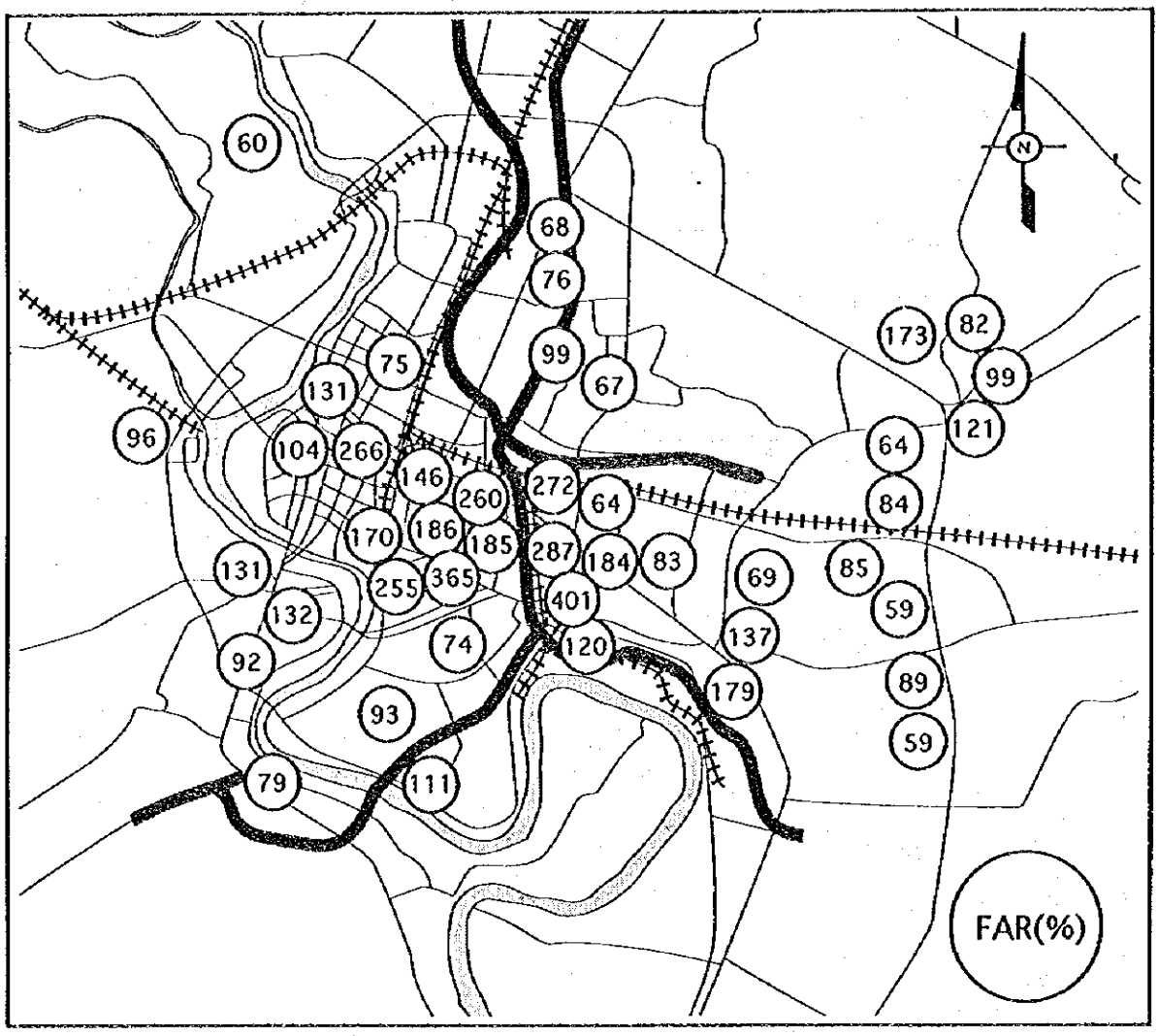
	Residential	Commercial, Business	Mixed with Comm'l & Res'l.	Total
CBD Zone	10 %	11 %	9 %	11 %
Urbanized Zone	12 %	13 %	18 %	14 %
Suburban Zone	10 %	8 %	No Sample	9 %
Total	11 %	11 %	13 %	11 %

Source: the JICA Study Team

(2) Existing FARs in Bangkok in 1995

	Residential	Commercial, Business	Mixed with Comm'l & Res'l.	Total
CBD Zone	102 %	208 %	191 %	187 %
Urbanized Zone	93 %	161 %	171 %	134 %
Suburban Zone	71 %	190 %	No Sample	118 %
Total	84 %	194 %	182 %	150 %

Source: JICA BEIP Study Team



Source : JICA BEIP Study Team

Fig. 2.8 Distribution of FARs in Bangkok in 1995