KINGDOM OF THAILAND
MINISTRY OF TRANSPORT AND COMMUNICATIONS
DEPARTMENT OF LAND TRANSPORT

THE STUDY ON GREATER BANGKOK TRUCK TERMINAL IN THE KINGDOM OF THAILAND

FINAL REPORT

VOLUME 2
MAIN TEXT

SEPTEMBER 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

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Preface

In response to a request from the Government of the Kingdom of Thailand, the Government of Japan decided to conduct a feasibility study on Greater Bangkok Truck Terminal and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Thailand a study team headed by Mr. Masamitsu Toriyama, Pacific Consultants International, three times between December 1991 and September 1992.

The team held discussions with the officials concerned of the Government 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.

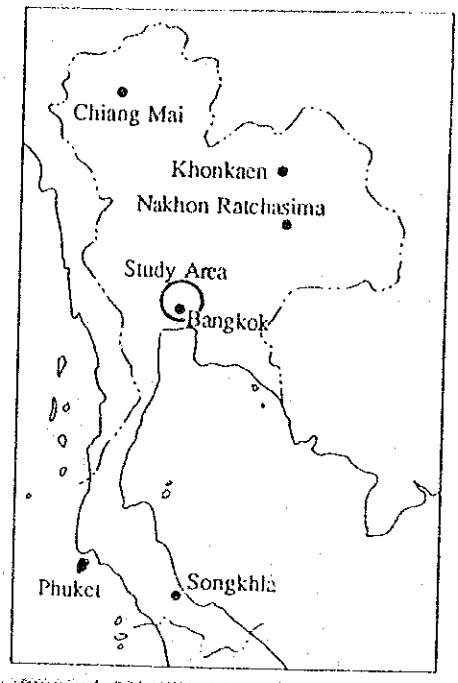
I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

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

September 1992

Kensuke Yanagiya
President
Japan International Cooperation Agency

Study Area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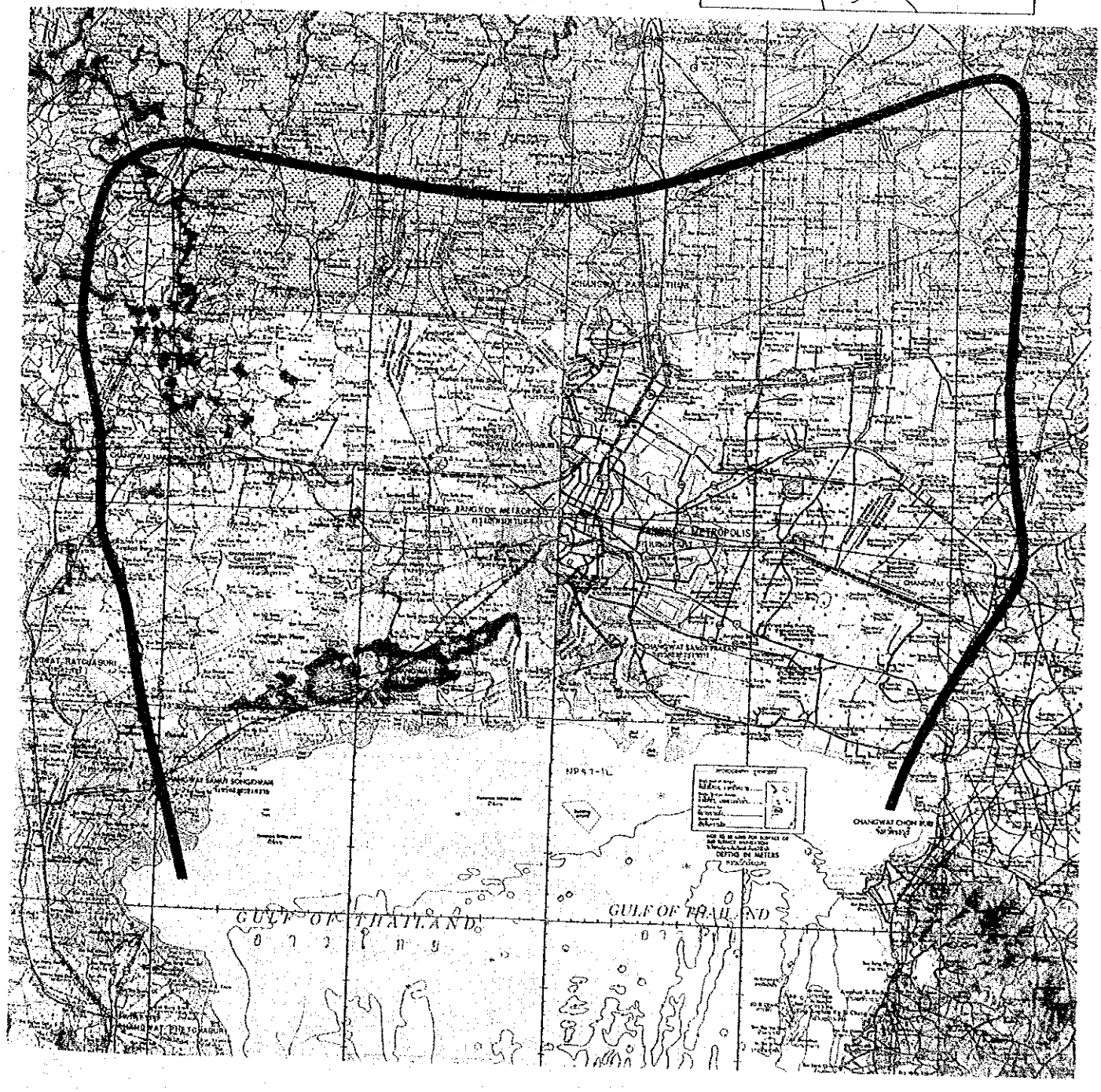
METROPOLIS
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TABLE OF CONTENTS

PART II FEASIBILITY STUDY OF THE HIGHEST PRIORITY TRUCK TERMINAL

Page

Page

CHAPTER 14 CONCLUSIONS AND RECOMMENDATIONS

List of Figures

List of Tables

Part 1 SCREENING STUDY

CHAPTER 1

GENERAL

PART I SCREENING STUDY

1 GENERAL

1.1 Introduction

The Government of Japan, in compliance with the request of the Government of Thailand, has decided to conduct "The Study on Greater Bangkok Truck Terminal in the Kingdom of Thailand". Based on this decision, the Japan International Cooperation Agency (JICA), and official agency responsible for the execution of technical assistance programs for the Government of Japan, has been assigned to carry out the study.

JICA dispatched a preliminary study mission in April 1991 headed by Mr. Teiji Iwasaki to Thailand for concluding the scope of work (S/W) for the study. The S/W together with the study schedule was agreed upon between the Department of Land Transport (DLT), Ministry of Transport and Communications and the Preliminary Study Mission.

The Department of Land Transport shall act as a counterpart agency to the JICA Study Team including coordination with related agencies for effective performance of the study. Advisory Committee of JICA have acted as advisors to the Study Team. The Advisory Committee (members of the Japanese Government) held the meetings in Tokyo as the need arose, observing the Team's progress and providing necessary advice. The representative of the Advisory Committee made periodic necessary advice. The representative of the Advisory Committee made periodic visits to Bangkok during the period of the works in Thailand to discuss directly about the study matters with the Study Team, and confirmed the essential point of decision with the government. The Study was also coordinated by JICA Bangkok office and JICA Expert to DLT.

1.2 Background

A. Project Formation and Implementation Efforts in the Past :

The origin of the construction plan of truck terminal in Bangkok traces back to the early 1970s. In 1971, the Government of Thailand established the Express Transportation Organization (ETO) to be responsible for the freight transportation operation in the whole land of Thailand. In alignment with this new organization, the Government had interest on the truck terminal.

First formal document that recommended the installation of truck terminal in Bangkok was the study conducted by the Ministry of Transportation and Communication in 1973. This report was followed by the two preliminary feasibility studies by TURA in 1974 and SEATAC in 1978.

1. "Report of the Working Group Concerning Truck Routing," 1973, MOTC.

2. "Preliminary Feasibility Study of the Installation of the System of Truck Terminals', 1974, Thai University Research Associates (TURA).

3. "Study for the Establishment of Truck Terminal," 1978, SEATAC.

In the 1980s, the Government of Thailand recognized the significance of the national truck terminal network and made efforts to implement its early construction. Therefore three feasibility studies related to the truck terminals, were carried out in the past. Those are:

1. Feasibility Study of Bangkok Urban Truck Terminal, 1980 (hereinafter called "1980 Report"),

2. Study of Trucking Industry, 1988, and

3. Feasibility Study of the Regional Truck Terminal (hereinafter called "1988 Report").

The first and the third studies were carried out by JICA Teams and the second study by KAMPSAX Consultant Team, both in close cooperation with the Land Transport Department of the Government of the Kingdom of Thailand.

The 1980 Report recommended the construction of four (4) truck terminals in Bangkok Metropolitan area (later one was canceled) while 1988 Report recommended the construction of additional five (5) regional truck terminals.

B. Actions taken by the Government of Thailand and Delay of Project Implementation:

The Government of Thailand had assigned the Express Transportation Organization as an execution body of the recommendations of the 1980 Report and afterward Department of Land Transport replaced it and taken an initiative in carrying out the truck terminal project. However a little progress has been achieved up to now and the project stands now at bay.

Causes of the delay in the truck terminal construction, it is said, were attributable to the following conditions :

1. Financial feasibility had been worsened because of extra-ordinary price hike of land,

2. Effective and/or sufficient promotion policies for truck terminal project had not been formulated nor in effective, and

3. Know-how on public administration and operation/management concerning the truck terminal had not been sufficient for the actual implementation.

C. Worsening Traffic Congestion and Growing Necessity of Truck Terminals:

Thai economy had experienced the prosperous expansion at the 1980s and consequently remarkable increase in freight volume aggravated the

road traffic, especially in Bangkok. This serious traffic congestion will be bottlenecked for growth of Thai economy if the government cannot solve the situation.

Nowadays, increase of long distance truck transport, mass transport by large sized trucks and the aggravation of urban traffic congestion make the use of truck terminal more advantageous from both national and private business view points. Construction of truck terminal shall enable to separate inter-regional transport from intra-city transport by transshipping into small vehicles. The lack of truck terminals becomes pressing the recent rapid growth of Thai economy.

D. Strong Willingness of the Government to Implement Truck Terminal Construction Plan:

The Government decided to introduce a ban that prohibits truck from intruding into the center of the capital for the whole day, and to construct the truck terminals for transshipping the freights from inter-regional transport to intra-city transport by small vehicles and vice versa. This combination of policies aims at inducing the modernization of the freight flow systems and consequently relieving the traffic congestion in Bangkok.

Japan International Cooperation Agency had assisted the Government of Thailand twice in formulating the truck terminal plans in the past. Thus, in extension its cooperation, the Government of Thailand requested the Government of Japan to formulate the truck terminal plan appropriate to today's conditions and the Government of Japan had decided to extend its services.

1.3 Objectives of the Study:

A. to select the highest priority truck terminal, to conduct the feasibility study for the selected project, and to formulate the implementation plan of truck terminal in the Greater Bangkok area for the purpose of relieving traffic congestion in Bangkok and inducing the transformation of physical distribution flows into more efficient and systematic one,

B. to formulate administration guideline including operation and management manual, and facilities standard of truck terminal, and

C. to facilitate technical transfer in depth to Thai counterparts to implement other truck terminal plans.

Overall structure of the Study is shown in Figure 1.1.1.

1.4 Study Approach

A. Unique Three Characteristics of this Study:

1. This is the second study that has almost same purposes as the Study in 1980. Therefore proposals and recommendations on how to implement the results or how to make the plan more practical, form more significant implications than usual study.

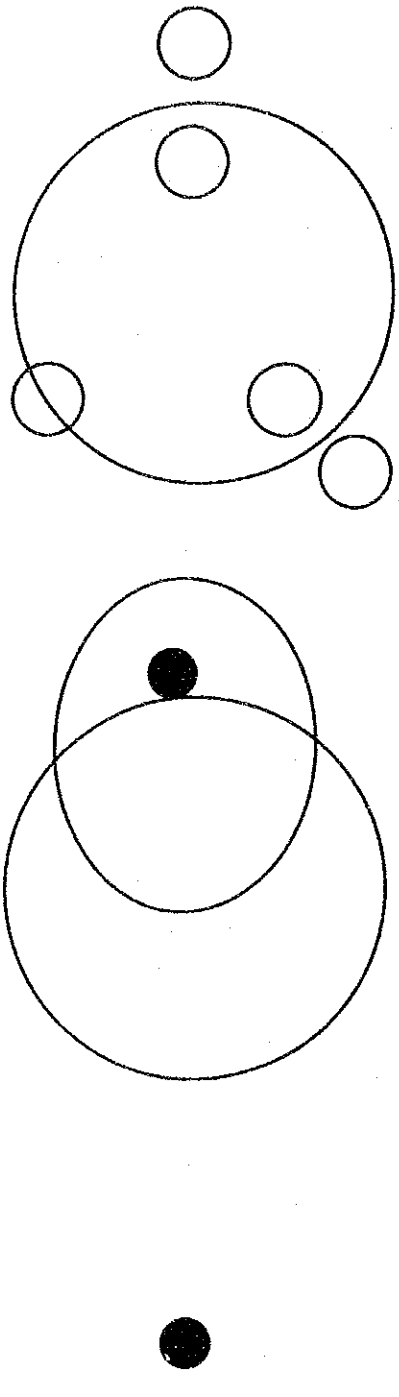
2. Construction of the recommended truck terminal forms one of the most effective national policies to relieve traffic congestion in the Greater Bangkok area. For this purpose, policy co-ordinations with other fields are indispensable.

3. Truck terminal project is of public interest and consequently its financial feasibility is featured to be low by its nature. Some rationale measures will be proposed to cope with this problem, which may relate to various ministries and authorities.

B. Truck Terminal Construction as an Urgent Countermeasure to Cope with Traffic Congestion:

Truck terminal has dual purposes: the first is to modernize the physical distribution system for the long term perspective, the other is for the short term perspective to relieve the traffic congestion caused by the high composition at heavy route trucks in the urban area. This study emphasizes more the latter purpose as project's purpose since the target year is set at 2000.

Fig. 1.1.1 Overall Structure of the Study



Screening Study

- Analyses of the present commodity flow
- Demand forecast
- Selection of location spot
- Selection of the highest priority of truck terminal

Feasibility Study

- Preliminary design
- Cost estimation
- Operation and management plan
- Economic evaluation
- Financial evaluation
- Implement programme

Policy and Guideline

- Investor's guidelines
- Operation and management guidelines
- Policy and administration guidelines

Thus study will proceed with an emphasis on how to make the truck terminal more effective in reducing the stagnating traffic on the main streets in Bangkok. Clear implications of these purpose-setting results in policy measures that suggests the land acquisition commence at earliest timing.

C. More Emphasis on Software Aspect and Less Emphasis on Hardware Aspect :

Apparently reasons for the delay in implementation of the 1980 Study's recommendations lie on software aspect of the project. Therefore this study will pay more attention to cope with these weaknesses of the previous study are to promote the construction of truck terminal.

Major issues will fall on the followings :

1. Guarantee of profitability (including land acquisition problem).
2. Provision of project promotion measures, and
3. Provision of operation/management know-how.

D. The Earlier Land Acquisition is Suggested for Easier and More Smooth Implementation:

Rapid decline of profitability of the truck terminal project suggested by the 1980 Study was attributable to remarkable price hike of land. This caused the necessary investment cost doubled tripled or more and kept the private sector apart from the project. Land price shows still rising tendency now and therefore earlier land acquisition might be a key to guarantee the profitability of the project.

Thus this study will suggest the commencement of land acquisition soon after the selection of location will complete. This mean is the only one way to cut off the vicious circle of price hike of land, worsening of profitability, and further delay of project implementation.

E. Suggestion on Legislative Measures and Project Promotion Policies of the Government based on Actual Implementation Premise :

For the financial viability of the project, various policy measures will be suggested such as ban that prohibits the heavy vehicles intruding into urban area for the whole day, formulation of truck terminal law, provision of infrastructure, terminal facilities, and equity participation.

These will be presented in relation with the measures to make the truck terminal more effective in relieving the traffic congestion.

F. Selection of the Highest Priority Truck Terminal by Socioeconomic Indicators :

The 1980 Report proved that all four terminals have high internal rate of return both economically and financially. It is considered that this situation has not been changed at present when commodity flow increased even more. This Study will select the terminal of the highest priority out of three or four alternative projects.

The ordinary method of internal economic rate of return and internal financial rate of return will not be used here and instead socioeconomic indicators will be applied to select the project.

For this purpose, six socioeconomic indicators will be planned to be used. Those are :

1. traffic congestion relieving index,
2. first operational year's return index,
3. land acquisition cost index,
4. environmental impact index,
5. accessibility index, and
6. urban development index.

1.5 Study Organization

With the intention of effective completion of the study, the Advisory Committee of JICA, the JICA Study Team and the Thai Counterparts work together :

Thai Officials and Counterpart

Mr. A. Prakorb	:	Director of Technical and Planning Division (DLT)
Mr. J. Silpachai	:	Chief of Technical and Plan Sub-Division (DLT)
Miss P. Suwanna	:	Transport Technical Officer (DLT)

Advisory Committee of JICA

Mr. M. Kamiko	:	Ministry of Transport of Japan
Mr. Y. Ohtani	:	Ministry of Transport of Japan
Mr. M. Sugai	:	Ministry of Transport of Japan
Mr. N. Amaya	:	Ministry of Transport of Japan

JICA Study Team

Mr. M. Toriyama	:	Team Leader/Physical Distribution Planner
Mr. K. Yasukawa	:	Physical Distribution Planner
Mr. A. Nakamura	:	Traffic/Economic Analyst
Mr. H. Utsumi	:	Facility Planner
Mr. H. Kikuta	:	Implementation Specialist/Cost Estimator
Mr. T. Matsumura	:	Operation/Management Expert
Mr. A. Kojima	:	Financial Planner

Coordinator

Mr. Nishiwaki	:	JICA Bangkok Office
Mr. T. Nagura	:	JICA DLT Expert

1.6 Organization of Reports

In the course of the study, five (5) kinds of reports were submitted to the Department of Land Transport. Those are listed below:

1.	Inception Report	:	submitted on December 1991.
2.	Interim Report	:	submitted on February 1992.
3.	Progress Report	:	submitted on April 1992.
4.	Draft Final Report	:	submitted on July 1992.
5.	Final Report	:	this volume.

Final report consists of five (5) volumes as listed below;

Volume 1	:	Executive Summary
Volume 2	:	Main Text
Volume 3	:	Investors' Guide
Volume 4	:	Operation and Management Guideline
Volume 5	:	Policy and Administration Guideline

CHAPTER 2

PUBLIC TRUCK TERMINAL

CHAPTER 2 Public Truck Terminal

2.1 Physical Distribution Facilities

Physical distribution system has been developed to meet the demand for a door-to-door transport of the freight, which is the most speedy and efficient system for commodity distribution, and it has also cost minimizing effect if in a large scale.

Physical distribution is the flow of goods: that is, transporting, storing, handling and packing. This chain of activities can be divided into two major working segments: "Line Part" which corresponds to the transportation means, and "Nodal Part" which connects these means of transport. This nodal point is called "Physical Distribution Facilities". An integrated operation and management system of these "Line Part" and "Nodal Part" is called a physical distribution system.

The function of physical distribution facilities can be summarized in the following way:

A. reloading
B. mixed loading
C. storing
D. processing, and
E. communication.

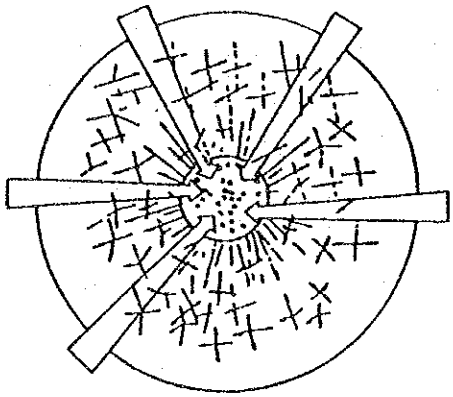
Improvement of distribution facilities must be carried out along with the improvement of "Line part" facilities.

"Public Truck Terminal" is in general a part of these physical distribution facilities. The operational pattern of a truck terminal is:

A. pick-up and delivery service
B. freight handling on platforms according to the destination, and
C. operation of line-haul trucks.

Figure 2.1.1 Idea of Public Truck Terminal

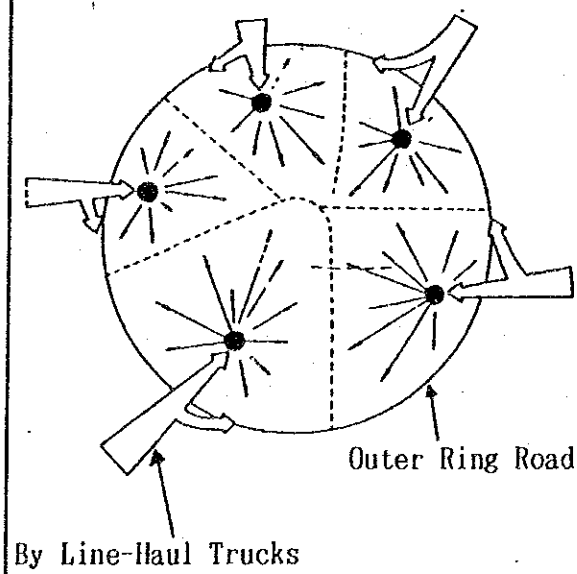
Without Public Truck Terminals



Natural Flow of Commodity and Trucks

- Heavy traffic congestion
- Under utilization of land
- Delay of commodity delivery
- Some small scale of private truck terminals

With Public Truck Terminals



Adjusted by Public Truck Terminal

- Grouping of collection and delivery area
- Consolidation of smaller cargo into truck load cargo
- Need large size of land
- Need big capital investment
- Public character being increased

Figure 2.1.1 shows the idea of a public truck terminal. It is very simple idea that the pick-up and delivery areas are grouped by zones. Number and size of zones vary according to the size of city.

2.2 Differences Between Private and Public Truck Terminals

The definition of private and public truck terminal are related to the government's administrative policies. Especially, in regard to licensing, design standard, construction standard, level of fare and safety.

Figure 2.2.1 shows the difference between private and public truck terminal.

In the case of private truck terminal:

One company may use, for example, up to 80% of the berth facilities and the rest are used by Trucking companies B and C if there is extra space.

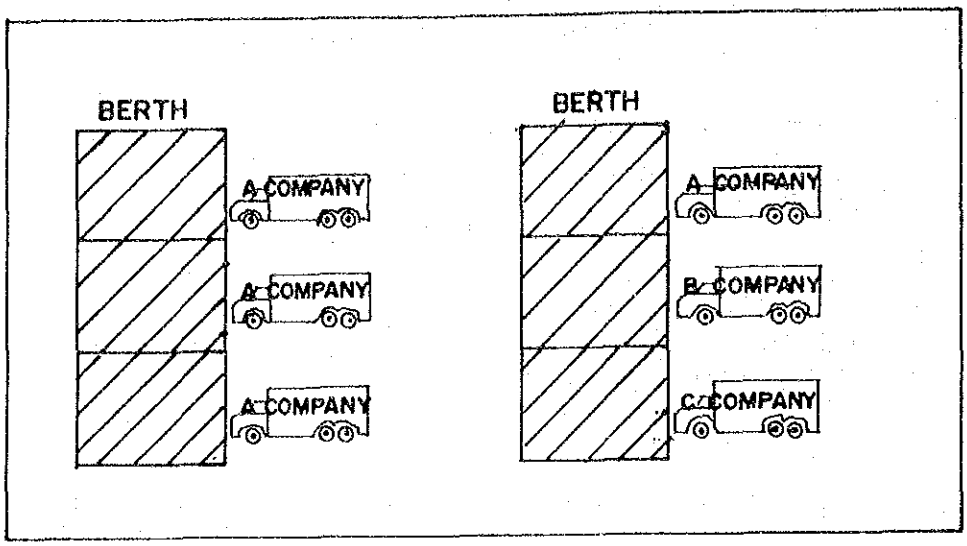
In the case of a public truck terminal:

The owner or operator of the facility is sometimes a trading company "W", real estate company "X", local government "Y", joint venture "Z' " or a trucking company "A". But berths may be leased to many trucking companies A, B, C, D etc.

The difference between private and public truck terminals is not the ownership of facilities but usage of facilities, especially, the usage of berths. This difference must be defined in the relevant terminal laws and regulations.

The large trucking companies may be able to build their own private truck terminals with their own capital on the outskirt of a big city. Since public truck terminals will be large, it will be beneficial if they are utilized not only by large trucking companies but especially also by small trucking companies who may not have enough capital to build their own truck terminals.

1. PRIVATE TRUCK TERMINAL



2. PUBLIC TRNCK TERMINAL

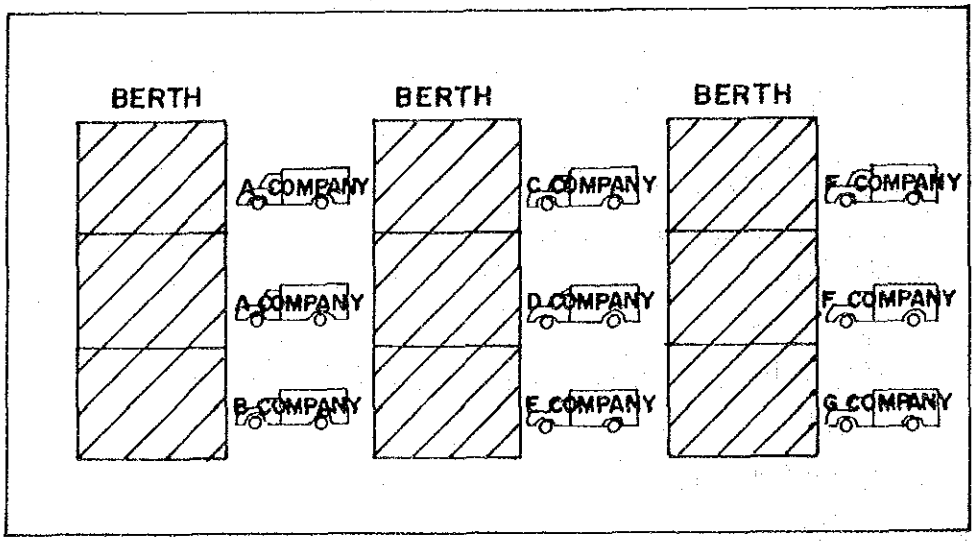


Fig. 2.2.1 Difference Between Private and Public Truck Terminal

2.3 Alternative Physical Distribution Facilities

There are several types of physical distribution facilities as summarized below. The following paragraphs are based on discussions with private investors, trucking associations, university scholars and government officials.

A. Freight centers,
B. Physical distribution zone,
C. Ordinary public truck terminal,
D. Mixed area development, and
E. Dual transfer system.

There are another two concepts of physical distribution facilities beside those five (5) mentioned above. One is to build "many small truck terminals within certain areas". The other is to make "a large open space for truck parking without any loading/unloading facilities".

The former can be constructed and managed by trucking companies individually as their own truck terminals. This is a category of a private truck terminal as mentioned in the previous section. Public truck terminals are necessary because many private truck companies have no capability to build their own terminal because of shortages of capital, management know-how.

The latter can be the first stage towards a era of a public truck terminals. This is too primitive to consider as the basis for modernization of the physical distribution system.

To solve both physical distribution modernization and road traffic congestion, the different type of commodity distribution facilities shown in Figure 2.3.1 are indispensable.

2.3.1 Alternative 1 : Freight Center

The term "Freight Center" comes from the report of the Seventh Plan Urban and Regional Transport (SPURT) commissioned by NESDB. As Figure 2.3.2 shows, the priority development areas for freight centers are proposed in the North, the East and the South-West. This is an intermediate stage towards the 1997 situation.

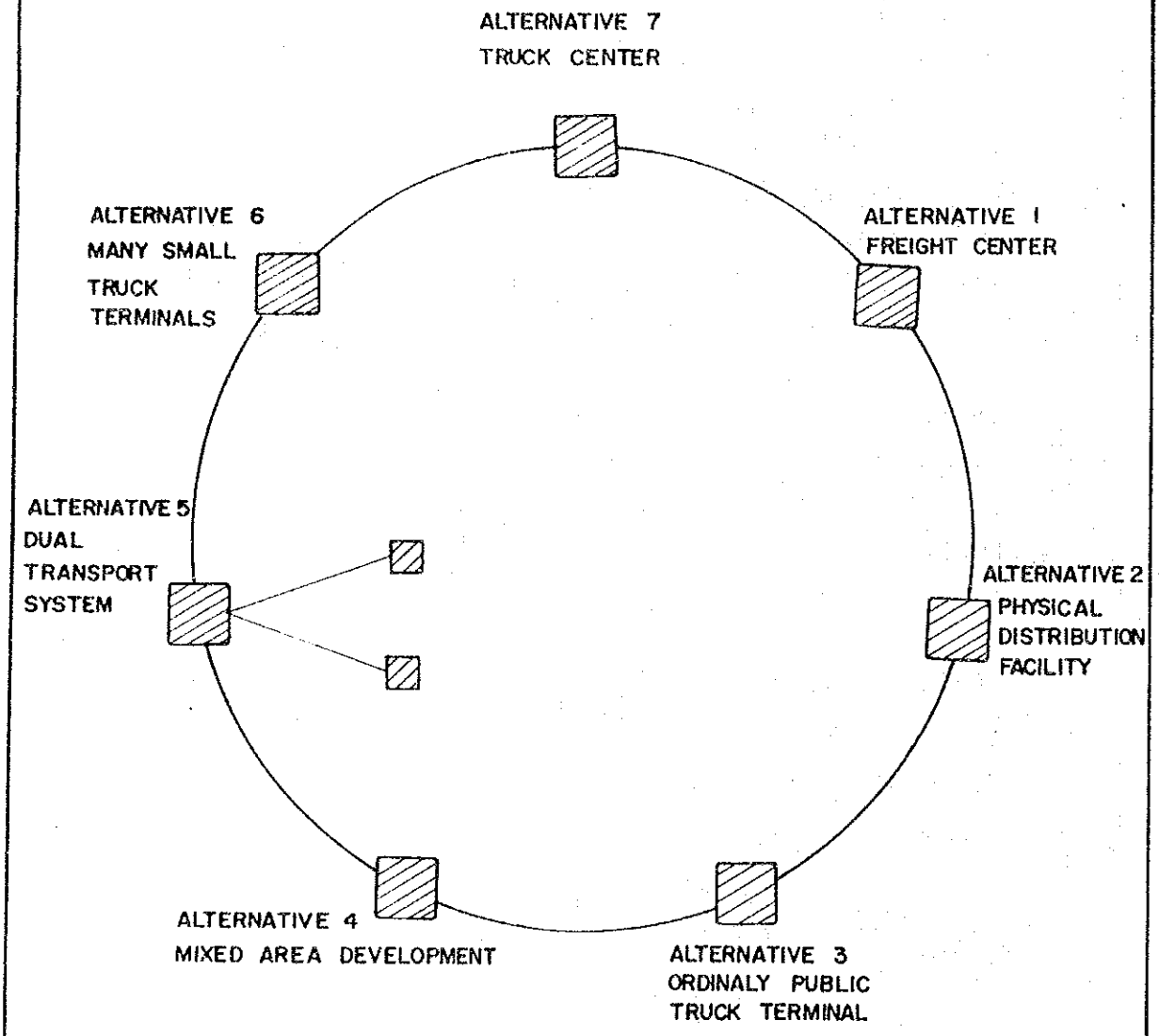
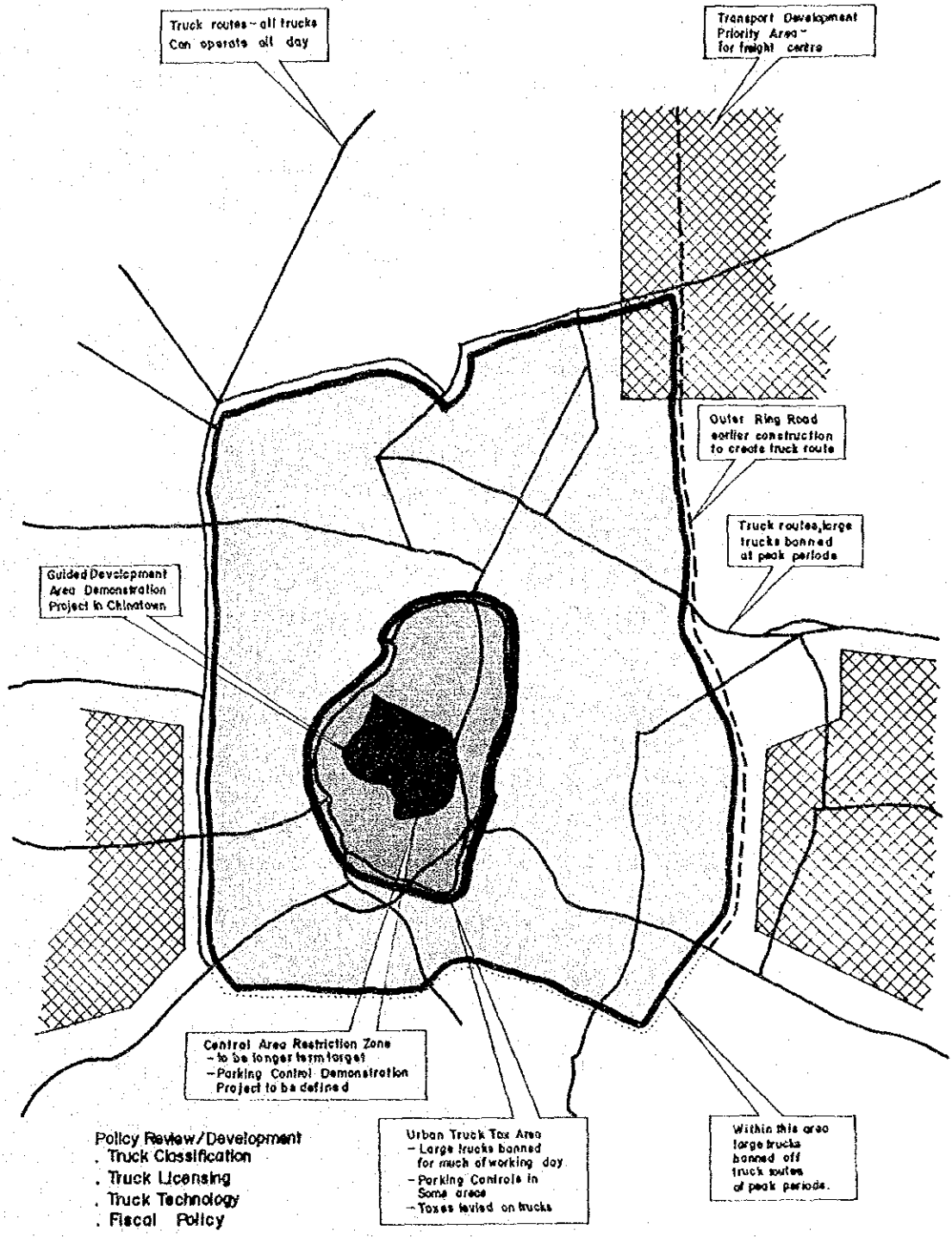


Figure 2.3.1 Types of Physical Distribution Facility



SOURCE : SEVENTH PLAN URBAN AND REGIONAL TRANSPORT 1991 NESDB

Figure 2.3.2 Urban Road Freight Plan 1994

The SPURT Report describes the characters of the freight center as follows;

A. it must cater for breakbulk, general cargo, and

B. it must provide the following services;
freight forwarding, "for-hire" services, wholesale distribution, vehicle maintenance/fuelling services, and secure parking.

The SPURT Report also recommends that a private management company be established to operate and manage the freight center. The selection of site and a design of access roads to the integrated transport network in the metropolitan area should be carried out under the control of the government.

One way of achieving this would be for the government to acquire land and provide site services, and integrates its site into the road network in future and to its road development programme. The land with kinds of 'value added' accruing to the site servicing and accessibility to major road networks, could then be sold on, or be leased to the management company, enabling the government to finance its equity share in the management company (Ref : SPURT, Final Report, pp.13-16)

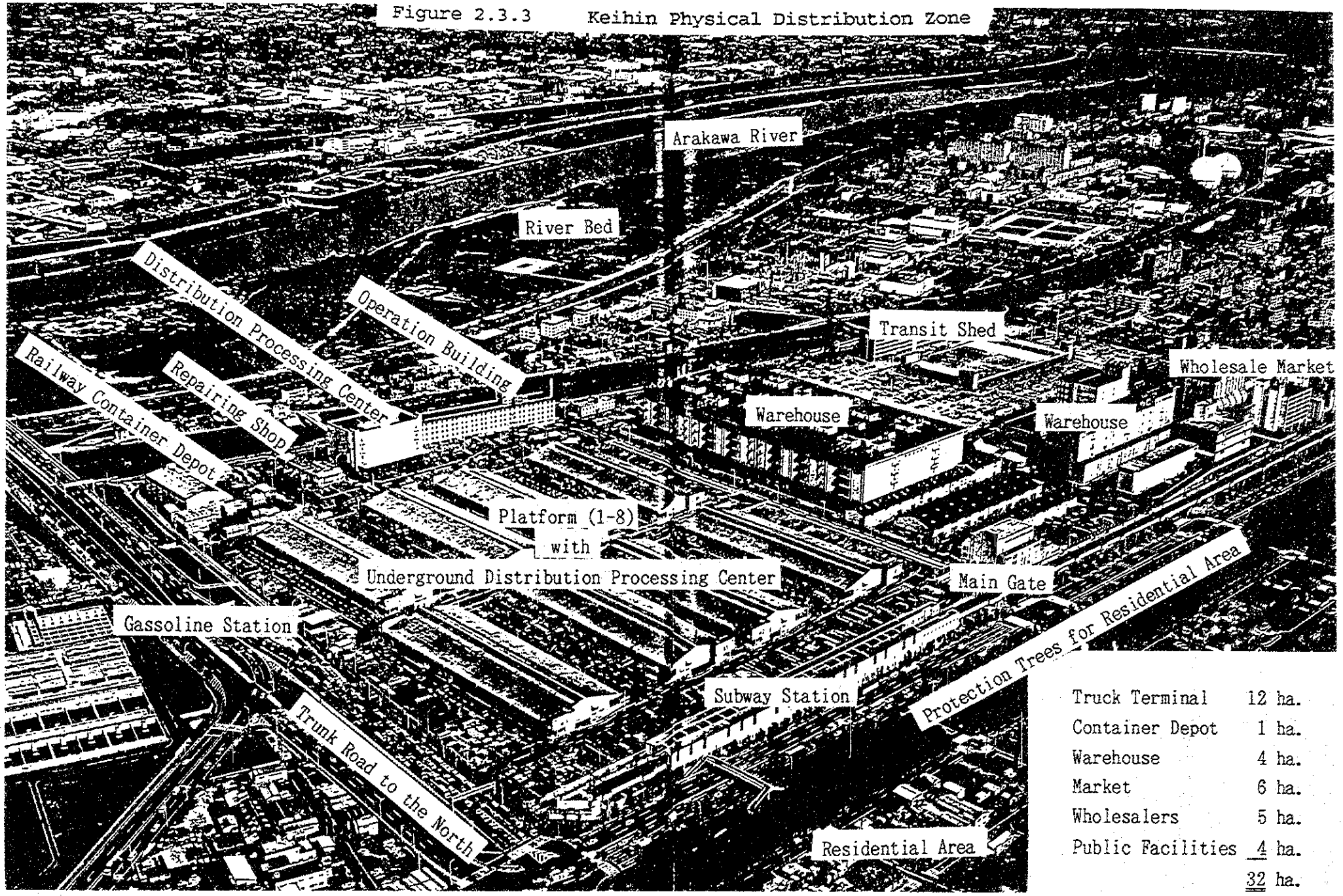
Type of physical distribution facilities, the SPURT Report also recommends, take the form of a "commodity distribution complex." The freight center is a wider concept than that of a public truck terminal which mainly consists of platforms and berths as core facilities.

2.3.2 Alternative 2 : Physical Distribution Zone.

Figure 2.3.3 shows Tokyo North Physical Distribution Zone, which is open to public since December 1965, for reference.

There are four (4) physical distribution zones in Tokyo metropolitan area as of 1992. Beside a public truck terminal, many other physical distribution facilities are concentrated in one specific zone. Size of each zone is usually equivalent to 400-500 Rai.

Figure 2.3.3 Keihin Physical Distribution Zone



Truck Terminal	12 ha.
Container Depot	1 ha.
Warehouse	4 ha.
Market	6 ha.
Wholesalers	5 ha.
Public Facilities	4 ha.
	32 ha.

This physical distribution zone is a more advanced concept than public truck terminal alone. This zone aims at:

A. refining urban functions,

B. improvement of commodity flow, and

C. smoothing road traffic by transferring distribution facilities such as store-house, wholesale facilities, market, freight forwarders near the public trucks terminal.

Land use in this zone is very strictly controlled and the zone is exclusively used by the physical distributors alone. For example, the qualifications for the land acquisition is limited an given only to:

A. those who operate commodity distribution business,

B. those who have enough fund and trust to build and operate commodity distribution facilities, and

C. those who have the ability to pay the land cost.

Priority criterion for selection of the applicants are set as follow;

A. those who supplied land for the zone site,

B. those who transfer commodity distribution facilities from the inner city area, and

C. those who plan to build the same kind of business facilities in the inner city.

2.3.3 Alternative 3 : Ordinary Public Truck Terminal

"Ordinary Public Truck Terminal" aims at starting from a smaller scale terminal and at expanding its size and operation at latter stages. This is attributable to scarce management skills and experiences available for this specific purpose in this country. For physical distribution zone previously explained requires the sophisticated and complicated management skills to

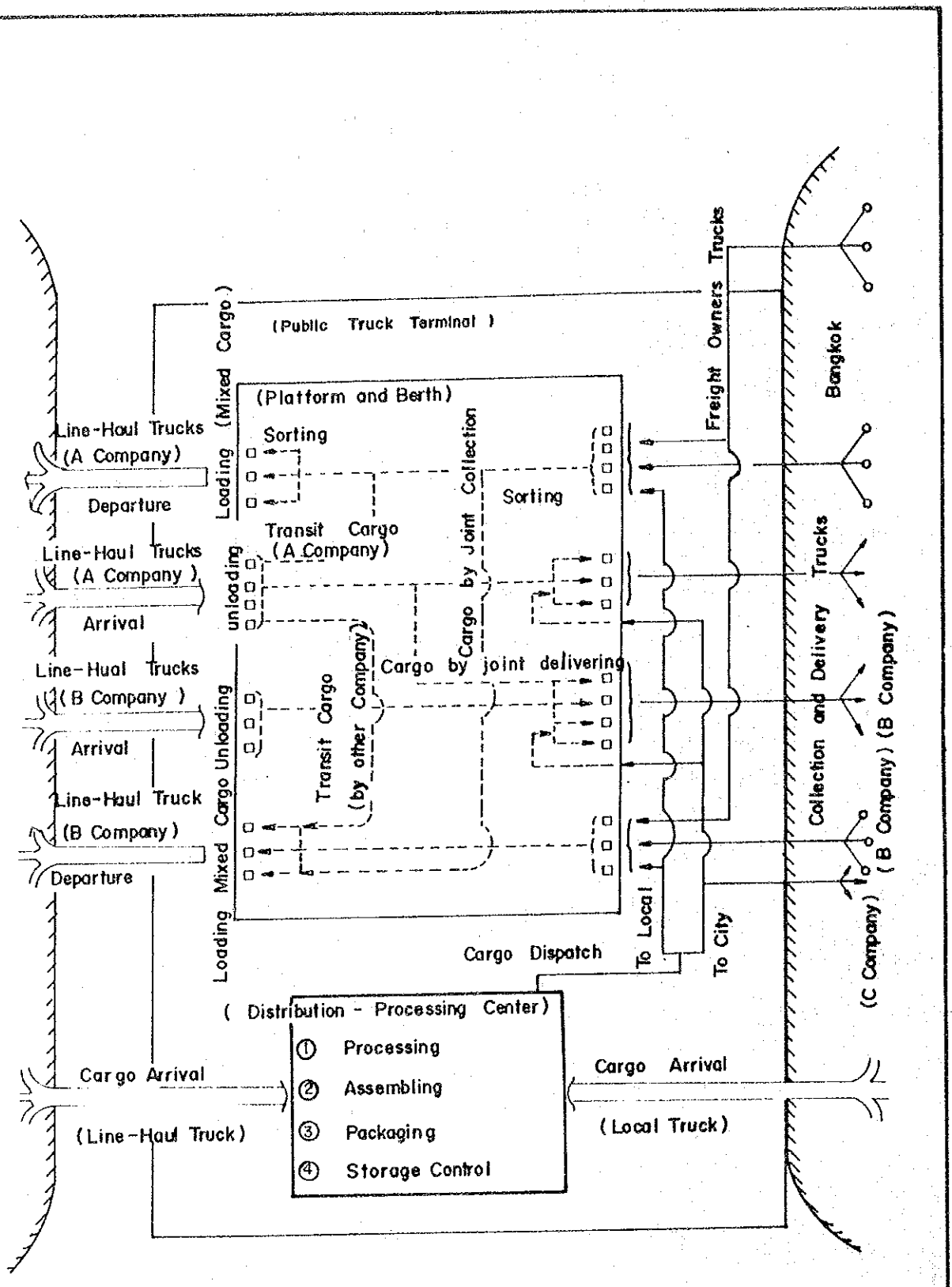


Figure 2.3.4 Freight Movement in Public Truck Terminal

operate such a large scale facilities, however necessary management skills are scarce since this country would have not a sufficient experience in this field.

This will need a land area of about 100 Rai with 200-300 berths and the related facilities such as parking spaces, fuel stations, temporary warehouse and others.

An advanced public truck terminal facilitates a processing center in the adjacent area to the terminal. Its function is getting more important as the modernization of physical distribution has progressed. Nowadays, many public truck terminals in the advanced countries have expanded by additionally constructing the processing facilities.

The main purpose of this center is :

A. processing
B. assembling
C. packing and storage controls.

For example, bicycle tires from Saraburi and bicycle tubes from Bangpoo may be assembled at the center to be transported to Maptapoot. Figure 2.3.4 shows the process of freight movement in public truck terminal.

2.3.4 Alternative 4 : Mixed Land Development

This type of land development is sometimes suggested in the case that the original truck terminal project will, it is anticipated, face the financial difficulties to guarantee minimum investment return. Investors aim at gaining the high return accruing from the other facilities such as shopping center to offset the deficiency of the truck terminal project.

When one private land owner who may have a huge land will plan to put a public truck terminal as part of his land development programme. He may plan also to build a bus terminal, shopping center, department store and condominiums adjacent to the public truck terminal.

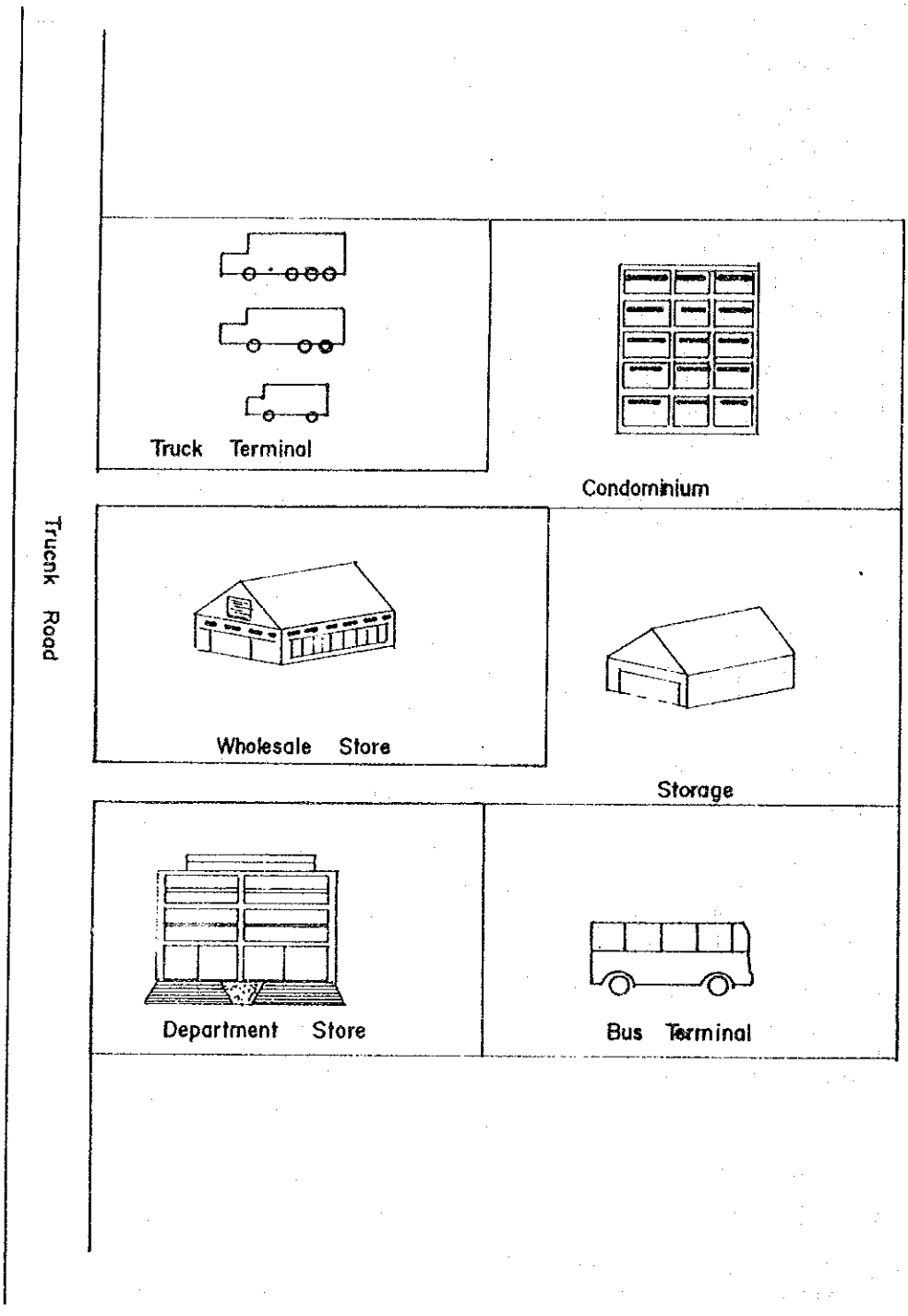


Figure 2.3.5 Mixed Land Development

This situation can occur under government control by giving business licences to private developers when the government do not find public land for public truck terminal. Private developers will try to find the most profitable way of land development since public truck terminal operation is not generally a profitable business. (See Fig. 2.3.5)

2.3.5 Alternative 5 : Dual Transfer System

This system is advocated by people who believe that traffic congestion become worse after completion of a truck terminal because the number of pick-ups and delivery trucks will increase inside the city to handle the same amount of freight which have been managed by a less number but bigger size of trucks.

Figure 2.3.6 shows the idea of "Dual Transfer System". One main truck terminal will be built on the outskirt of the city, while another two or three smaller scale of sub-truck terminals will be build in the city. The transportation between main and sub-truck terminal is handled by large trucks with full commodities which have license from the government. This allow heavy truck operate in the CBD but its numbers are assume to be reduced, and consequently to relieve traffic congestion.

2.4 Comparison of Alternatives.

Five (5) alternatives of physical distribution facilities are compared and evaluated against several factors. Each alternative has merits and demerits. The followings are the main items to be set for comparison.

A. Possibility of land acquisition,
B. Modernization of physical distribution system,
C. Contribution to urban renewal,
D. Relief of traffic congestion,
E. Security of the public interest,
F. Possibility of capital raising, and
G. Degree of management difficulty

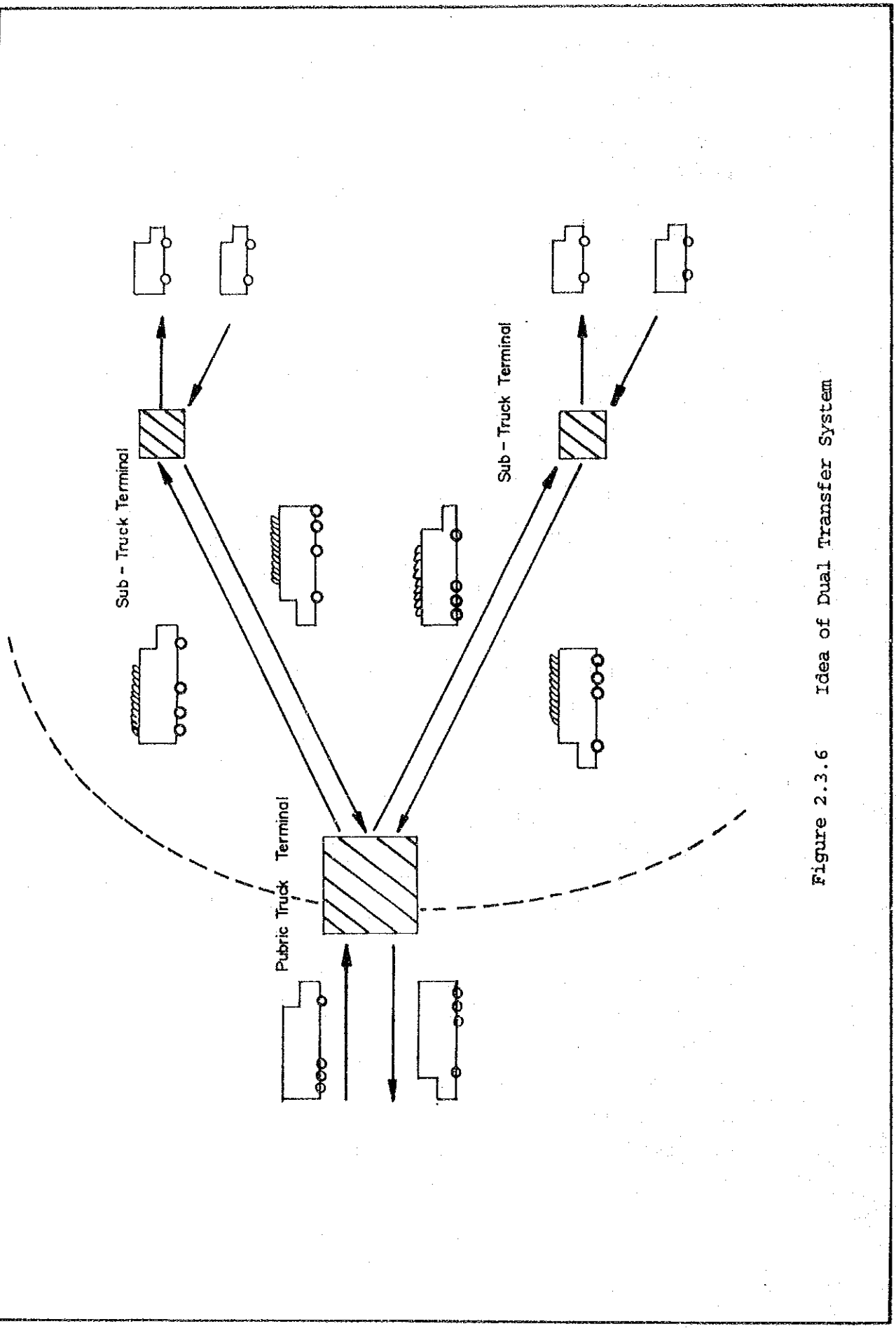


Figure 2.3.6 Idea of Dual Transfer System

Table 2.4.1 shows the results of comparison among five (5) alternatives.

Ordinary public truck terminal (Alternatives 3) gets the highest scores. Items such as possibility of land acquisition, possibility of capital raising and degree of management skill received high scores because of its size and compactness.

From the point of contribution to urban renewal, freight center (Alternatives 1) and physical distribution zone (Alternative 2) get high scores. For they make it possible to enforce movement of physical distribution facilities from central congested areas to outskirt of city, and consequently makes it possible to form a kind of a physical distribution core.

Securing of the public interest (Item 5) means the ease of use of a truck terminal by small scale trucking companies and keep a law rate of facility charges so as to avoid increasing transportation costs.

2.5 Public Truck Terminal To Be Constructed

The most recommendable pattern of physical distribution facilities can be summarized as follows :

A. to start from ordinary public truck terminal (Alternative 3) which is a rather smaller scale than alternatives.

B. to aim at achieving a physical distribution zone which is alternative 2 as the final target.

C. to consult with private investors for implementation of mixed land development (Alternative 4) which can provide land and capital under conditions of securing of the public interest and of contribution to urban renewal.

Dimensions of public truck terminal is described in the first part of Chapter 6.

Table 2.4.1 Comparison of Physical Distribution Feasibility Pattern

Items for comparison	Alternative 1 Freight Center	Alternative 2 P.D. Zone	Alternative 3 O.P.I Terminal	Alternative 4 M.L Development	Alternative 5 D.T System
1.Possibility of land acquisition	1	2	3	3	1
2.Modernization of physical distribution system	2	3	2	2	1
3.Contribution of urban renewal	3	3	2	1	2
4.Relief of Traffic congestion	2	2	2	1	3
5.Securing of the public interest	3	2	2	0	2
6.Possibility of capital raising	1	2	3	3	1
7.Degree of management difficulty	2	1	3	2	1
Total score	14	15	17	12	11
order	3	2	1	4	5

0 : not good
1 : Fair
2 : good
3 : very good

CHAPTER 3

ANALYSIS OF COMMODITY FLOW

CHAPTER 3 ANALYSES OF COMMODITY FLOW

3.1 Socio-economic Framework

3.1.1 Past Trend and Existing Conditions

A. Population

Population data are summarized in Table 3.1.1. Population of the Kingdom of Thailand was about 47 million in 1980 and it reached 56 million in 1990. North-eastern Region, in 1990, has 19 million one third of the total population. And the population of BMR, 9 million occupies 16 % of the total population.

The population density indicates that BMR has a remarkable high density as much as 4,000 populations/km^2 and that other regions have far lower density of 60 to 450 persons/km^2.

Population growth rates by region clarify that annual growth rates show a declining tendency to 1.8% p.a. in the period 1985 to 1990 from around 2.0% p.a. in the period 1980 to 1985 year.

The following three regions have different regional population trends:

1. BMR

This region shows the highest growth rate of population in the Kingdom of Thailand. Especially the six (6) changwats in the vicinity area of Bangkok city have remarkable annual growth rates as much as 3.3% during the latest five years (1986-1991).

2. Eastern and Southern Regions

These two regions have higher growth rates than average of whole Kingdom because these had absorbed a population influx from the other regions as BMR has experienced.

Table 3.1.1 Population, Share, and Growth Rate

(Unit : 1,000 person)

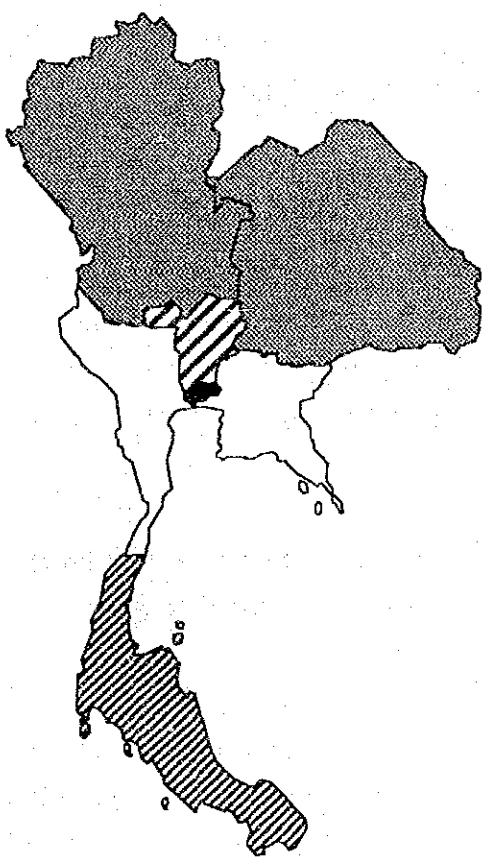
Region	1980		1985		1990		Annual Growth Rate	
	Population	Ratio (%)	Population	Ratio (%)	Population	Ratio (%)	1980-1985	1985-1990
Whole Kingdom	46,718	100.0	51,579	100.0	56,083	100.0	2	1.84
Bangkok Metropolitan	4,870	10.4	5,557	10.8	6,162	11.0	2.67	2.38
Vicinity Provisions	2,025	4.3	2,416	4.7	2,808	5.0	3.59	3.32
Central	2,470	5.3	2,608	5.1	2,755	4.9	1.01	1.09
Eastern	2,804	6.0	3,144	6.1	3,491	6.2	2.31	2.22
Western	2,814	6.0	3,055	5.9	3,254	5.8	1.02	1.46
North-Eastern	16,434	35.2	17,982	34.9	19,321	34.5	1.81	1.63
Northern	9,427	20.2	10,154	19.7	10,804	19.3	1.49	1.37
Southern	5,874	12.6	6,663	12.9	7,488	13.4	2.55	2.46

Source : National Statistical Office

3. Central, Western, North-eastern and Southern Regions

Annual growth rates of these regions show lower figures than that of whole Kingdom, reflecting a net outflow of the labor forces.

Increase in regional population reflects population concentration on BMR, industrial and residential development in Eastern Region, and independence of Southern Region far from Bangkok. And this is supported by other regions which play a role of labour suppliers.



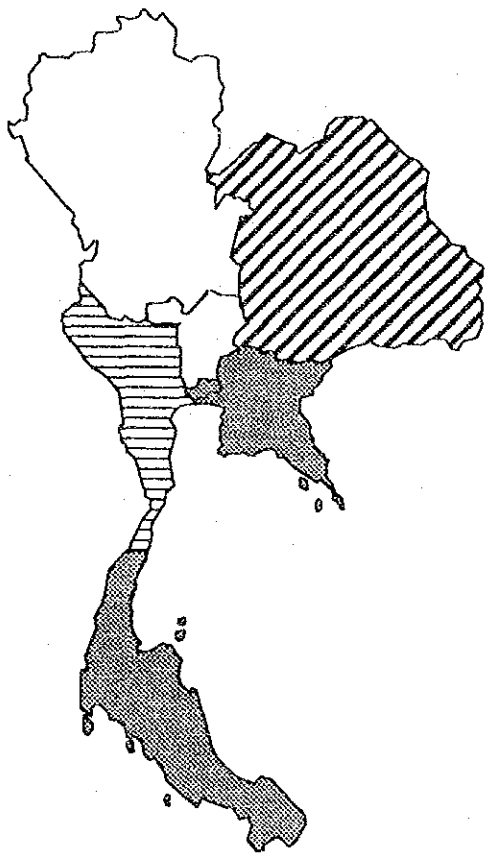
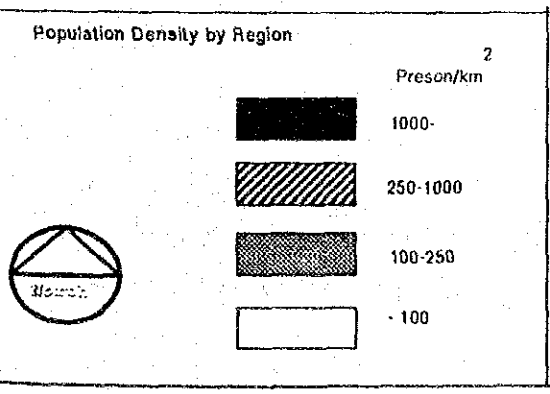
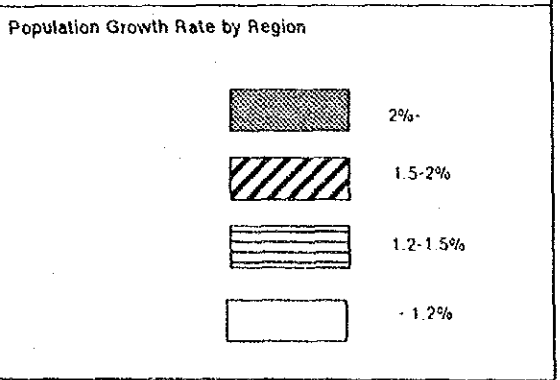


Figure 3.1.1 Population Density by Region
Population Growth Rate by Region





B. Gross Domestic Product

1. Whole Kingdom

Gross Domestic product data is summarized by sector in Table 3.1.2.

Manufacturing sector marks the highest figure of 25.6% and has played a dominant role in the economy of the Kingdom of Thailand. Wholesale and Retail sector of 15.4% ranked at the second on list, followed by the Agricultural sector of 15.0%.

With respect to a change in composition, Bank/Insurance sector marked a remarkable gain of 11.9% (=20.9 - 9.0) in the period 1985 to 1989, followed by Manufacturing and Electricity/Water Supply sectors.

Figure 3.1.2 shows the relationship between composition ratios and growth rates by sector. The major findings in this relationship are summarized below:

a) Manufacturing sector occupies a major position and has the largest composition ratio, gaining its share at a stable growth rate.

b) Agricultural sector has been losing its composition ratio.

c) The composition ratios of construction, electricity/water supply and transport/communication sectors keep stable due to national land development although the ratios are not so large.

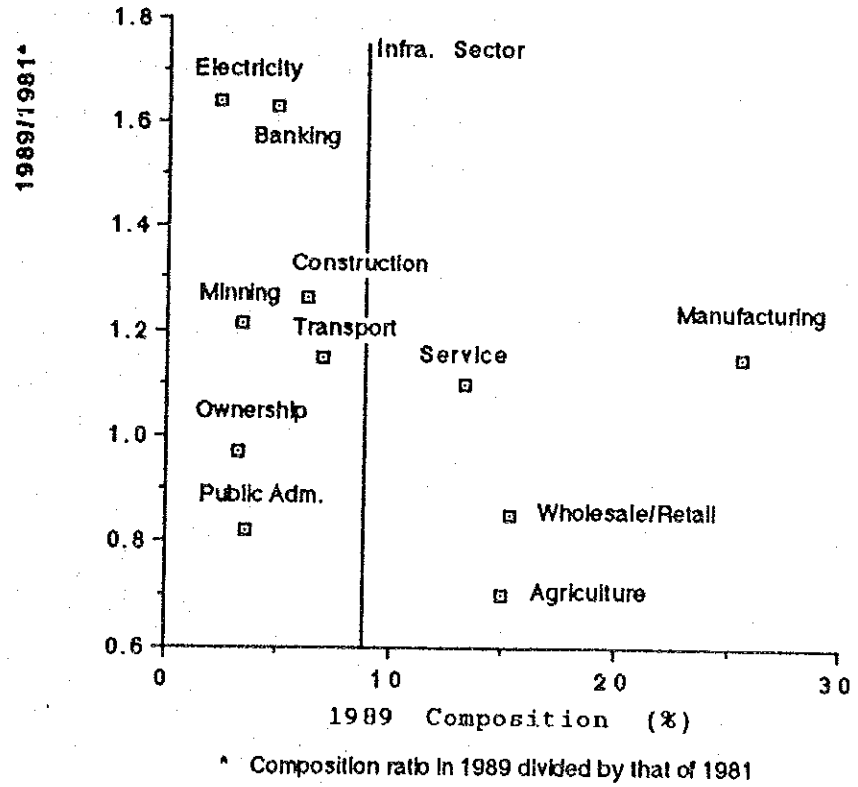
d) The growth rate of banking/insurance sector shows remarkable expansion in spite of tiny share in the total economy.

e) The growth rate of wholesale/retail sector is low at present but it is expected to gain larger share as the development of urbanization and industrialization progresses further in future.

Table 3.1.2 Economic Growth Rate by Sector in 1985-1989

	Gross Domestic Product by Sector (1972 Price)			Growth Rate by Sector		
	1981	1985	1989	81-85	85-89	89/81
Agriculture	65.1 (20.4%)	78.5 (19.9%)	92.4 (16.1%)	4.8	4.1	(78.7)
Mining/Quarrying	7.6 (2.4%)	9.9 (2.5%)	15.1 (2.6%)	6.7	11.1	(110.2)
Manufacturing	69.1 (21.7%)	81.4 (20.7%)	137.3 (23.9%)	4.2	13.9	(110.2)
Construction	14.3 (4.5%)	16.6 (4.2%)	26.9 (4.7%)	3.9	12.8	(104.3)
Electricity/Water Supply	6.6 (2.1%)	9.9 (2.5%)	16.5 (2.9%)	10.8	13.6	(138.6)
Transport/Communication	20.6 (6.5%)	28.2 (7.2%)	40.6 (7.1%)	8.1	9.6	(109.3)
Wholesale/Retail	55.1 (17.3%)	64.2 (16.3%)	101.0 (17.6%)	3.9	12.0	(101.6)
Banking/Insurance	8.4 (2.6%)	11.8 (3.0%)	25.2 (4.4%)	9.0	20.9	(166.4)
Ownership of Dwellings	14.9 (4.7%)	17.4 (4.4%)	21.4 (3.7%)	3.9	5.4	(79.6)
Public Administration	16.8 (5.3%)	21.4 (5.4%)	23.7 (4.1%)	1.6	2.6	(78.2)
Services	39.9 (12.5%)	54.8 (13.9%)	74.1 (12.9%)	8.3	7.8	(103.0)
GDP				5.5	9.9	
Total	318.4	394.1	574.2			

Source : National Statistical Office



* Composition ratio in 1989 divided by that of 1981

Figure 3.1.2 Relationship between Share and Growth Rate

2. Regional Characteristics

Growth rates by sector and by region are summarized in Table 3.1.3 and the top three sectors at the list of growth rate for each region are shown in Figure 3.1.3. This table clarifies the regional characteristics on economic growth. Those are summarized as follows:

a) In BMR, Banking/insurance sector recorded the highest growth, followed by the sectors of construction and mining/quarrying.

b) In many regions, Banking/insurance, electricity/water supply and manufacturing sectors show the dominant position.

c) In Northern Region, Wholesale/retail section positions at the second highest.

d) In Eastern Region, Construction sector shows the highest growth rate of 33.0%. A trend of dynamic development in this region can be envisaged from the fact.

e) In North-eastern Region, Electricity/ water supply sector occupies the top of the position with high growth rate of 25.7%.

Table 3.1 3 Economic Growth Rate by Sector in 1985-1989

(Unit : Percent)

Sector	Whole Region	BMA	Central Region	Eastern Region	Western Region	N-E Region	Northern Region	Southern Region
Agriculture	4.13	2.29	3.03	3.24	3.69	2.08	5.88	7.07
Mining/Quarrying	11.09	18.92	17.77	11.27	4.82	5.88	4.18	17.94
Manufacturing	13.92	15.00	10.43	11.62	17.54	9.73	8.93	5.53
Construction	12.80	19.82	0.12	33.03	7.37	3.31	1.44	6.51
Electricity/Water Supply	13.56	14.08	18.53	14.72	11.88	25.74	0.96	12.75
Transport/Communication	9.60	9.72	10.54	20.37	7.47	5.65	6.76	11.22
Wholesale/Retail	12.01	13.23	10.24	16.05	10.96	10.13	9.96	12.47
Banking/Insurance	20.92	21.68	18.26	26.38	17.53	16.97	17.82	21.27
Ownership of Dwellings	5.40	5.46	3.01	6.12	4.11	7.02	3.69	5.84
Public Administration	2.62	0.52	2.15	8.95	2.87	3.38	3.03	3.28
Services	7.83	8.27	6.09	9.33	6.16	6.78	7.02	7.91
G.R.P	9.87	12.84	8.39	11.34	7.59	5.95	6.78	9.05

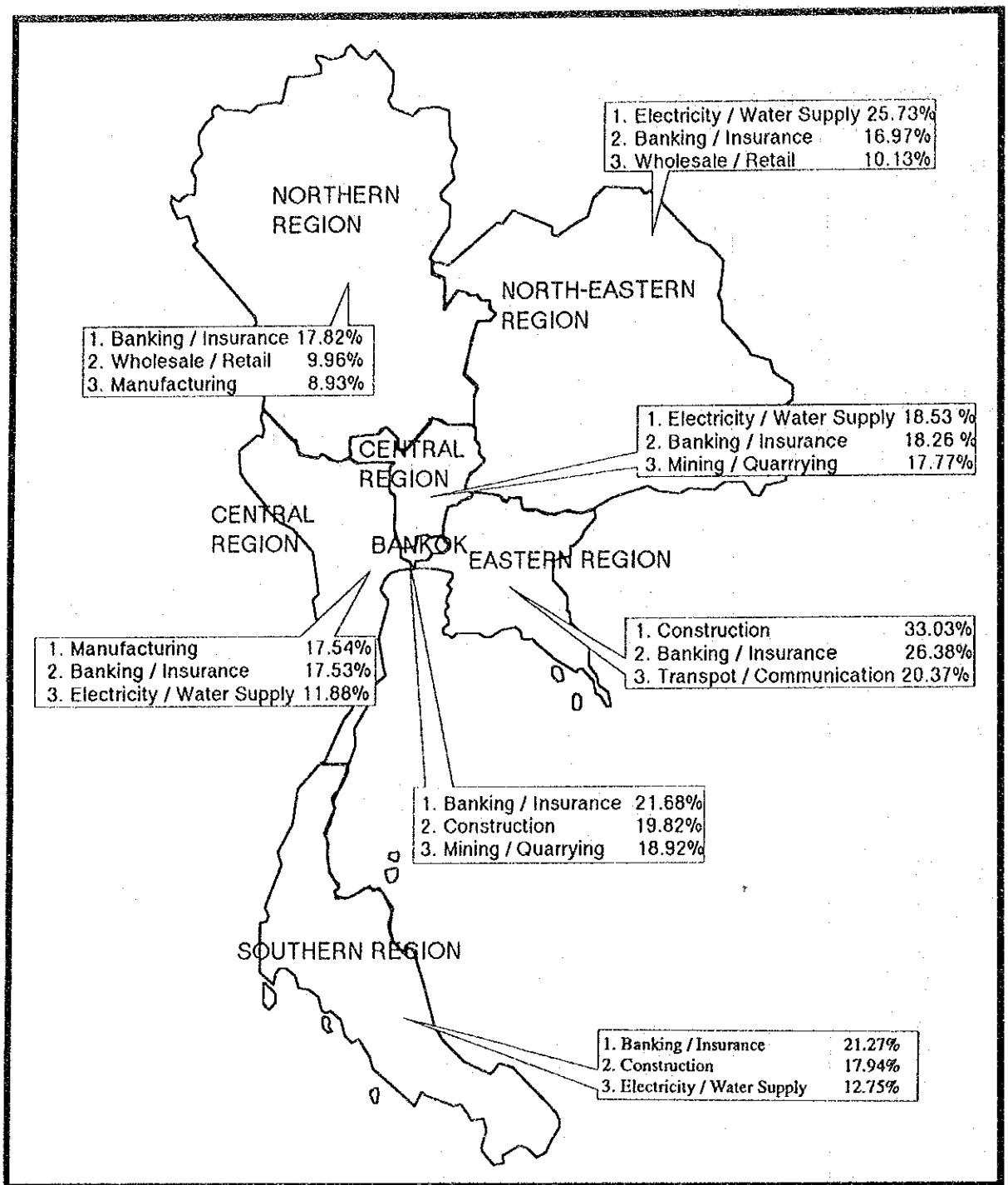


Fig. 3.1.3 Top Three Sectors with High Economic Growth Rate

C. Registered Number of Trucks

1. Trucks by Land Transport Act

The Kingdom of Thailand have conducted the registration of vehicles under the jurisdiction of two kinds of law: Motor Vehicle Act and Land Transport Act.

Trucks are registered mainly under the jurisdiction of Land Transport Act and are classified into private truck and common carrier truck by this law. Table 3.1.4 shows the registered number of trucks by type in the period of latest ten (10) years. This table shows that the total number of trucks in 1990 had grown as much as two times than that in 1980, recording 330 thousand vehicles. The ratio between the vehicle of private and common carrier shows the dominant share of private vehicles, indicating a higher growth rate compared with that of common carrier vehicles.

In regional point of view, BMR has a large share of total trucks as much as more than 30 percent. Especially, the ratio of common carrier vehicles of BMR reaches around 50% of the whole Kingdom. It means that BMR has played an overwhelming role in commodity transportation based on its dynamic economic activities. This is shown in Table 3.1.5.

In addition, Table 3.1.6 shows the registered number of trucks and passenger cars, and those growth rates. This table indicates high annual growth rate of trucks of 7.5%, reflecting the remarkable economic performance of the Thai economy. However the growth rate of registered trucks recorded less than that of passenger vehicles.

2. Classification of Trucks

The type of trucks is classified by the number of wheels such as 4 wheels, 6 wheels and 10 wheels or others. Table 3.1.7 shows the trend of the registered number of vehicles by this classification. Some special features on this registration are summarized below:

Table 3.1.4 Registered Number of Trucks by Region

(Unit : Vehicles)

Region	1980			1985			1990		
	Common Carrier	Private	Total	Common Carrier	Private	Total	Common Carrier	Private	Total
BMA	5,530 (0.27)	37,921 (0.27)	43,451 (0.28)	8,104 (0.42)	55,811 (0.27)	63,915 (0.30)	18,840 (0.51)	89,266 (0.30)	108,106 (0.33)
Central	395 (0.02)	10,944 (0.08)	11,339 (0.07)	261 (0.01)	13,441 (0.07)	13,702 (0.06)	945 (0.03)	20,491 (0.07)	21,436 (0.06)
Eastern	669 (0.03)	20,565 (0.15)	21,234 (0.13)	628 (0.03)	21,237 (0.11)	21,865 (0.10)	1,218 (0.03)	34,545 (0.12)	35,763 (0.11)
Western	3,997 (0.19)	14,269 (0.10)	18,266 (0.11)	3,332 (0.17)	22,691 (0.12)	26,023 (0.12)	3,427 (0.09)	32,348 (0.11)	35,775 (0.11)
North-Eastern	3,870 (0.19)	28,331 (0.20)	32,201 (0.20)	2,218 (0.11)	44,390 (0.23)	46,608 (0.22)	4,006 (0.11)	58,513 (0.20)	62,519 (0.19)
Northern	2,966 (0.14)	17,476 (0.13)	20,442 (0.13)	2,478 (0.13)	26,168 (0.13)	28,646 (0.13)	3,754 (0.10)	38,535 (0.13)	42,289 (0.13)
Southern	3,414 (0.16)	9,517 (0.07)	12,931 (0.08)	2,600 (0.13)	12,918 (0.07)	15,518 (0.07)	4,852 (0.13)	19,771 (0.07)	24,623 (0.07)
Whole Kingdom	20,841 (1.00)	139,023 (1.00)	159,864 (1.01)	19,621 (1.01)	196,656 (0.99)	216,277 (1.00)	37,042 (1.00)	293,469 (1.00)	330,511 (1.00)

Source : LTD

( ) Ratio by Region

Table 3.1.5 Composition Ratio of Trucks by Region

(Unit : Percent)

Region	1980	1985	1990
BMA	0.28	0.30	0.33
Central	0.07	0.06	0.06
Eastern	0.13	0.10	0.11
Western	0.11	0.12	0.11
North-Eastern	0.20	0.22	0.19
Northern	0.13	0.13	0.13
Southern	0.08	0.07	0.07
Whole Kingdom	1.00	1.00	1.00

Table 3.1.6 Registered Number of Trucks and Passenger Cars

(Unit : Vehicle)

	1980	1985	1990	Growth Rate (1980-1990)
Truck *1	159,864 (1.00)	216,277 (1.35)	330,511 (2.07)	7.50%
Passenger Car *2	300,983 (1.00)	539,561 (1.79)	777,345 (2.58)	10.00%

( ) is growth indicator when 1.0 in 1980

* 1 by Land Transport Act
* 2 less than 7 passenger, by Motor Vehicle Act

Table 3.1.7 No. of Trucks by Type

(Unit : Vehicles)

	1987			1988			1989			1990		
	BKK/ Vicinity	Others	Total	BKK/ Vicinity	Others	Total	BKK/ Vicinity	Others	Total	BKK/Vicinity	Others	Total
4 wheels	9,993	30,379	40,372	24,571	32,268	56,839	12,743	37,797	50,540	13,492	41,443	54,935
	(0.147)	(0.187)	(0.175)	(0.308)	(0.185)	(0.224)	(0.149)	(0.197)	(0.182)	(0.125)	(0.186)	(0.166)
6 wheels	39,516	69,379	108,895	33,600	73,946	107,546	41,804	76,673	118,477	48,144	89,912	138,056
	(0.581)	(0.427)	(0.472)	(0.421)	(0.424)	(0.423)	(0.490)	(0.400)	(0.427)	(0.445)	(0.404)	(0.418)
10 wheels	16,330	61,033	77,363	15,427	60,568	75,995	18,380	65,286	83,666	23,515	71,981	95,496
	(0.240)	(0.375)	(0.335)	(0.193)	(0.347)	(0.299)	(0.215)	(0.340)	(0.302)	(0.218)	(0.324)	(0.289)
Trailer	2,172	1,869	4,041	6,248	7,616	13,864	12,463	12,007	24,470	22,955	19,099	42,054
	(0.032)	(0.011)	(0.018)	(0.078)	(0.044)	(0.055)	(0.146)	(0.063)	(0.088)	(0.212)	(0.086)	(0.127)
Total	68,011	162,660	230,671	79,846	174,398	254,244	85,390	191,763	277,153	108,106	222,435	330,541
	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)

Source : LTD

( ) Ratio by Type

a) The share of 4 wheel truck is decreasing.
b) The shares of 6 wheel and 10 wheel trucks against the total vehicles have been constant.
c) The share of trailers has remarkably increased although its total number is rather small.
d) The number of trailers in BMR are considerably increasing, marking more than 20% in annual growth rate in 1990.

Phenomenon described above reflects the structural change in transport commodities. This change corresponds to an increase in commodity traffic which has been induced by the concentration to BMR.

3. Existing Features

Table 3.1.8 shows a change of the BMR status in share of population, gross domestic products and number of trucks in BMR over the period 1980 to 1990.

Table 3.1.8 Change in BMR Status

Items	1980	1990
Population	14.3	16.0
G.D.P.	43.1 *1	47.0 *2
Population	14.3	16.0
No. of Trucks	28.0	33.0

*1 Share of real price (1981)
*2 Share of real price (1989)

This table clarifies that the share of each item has grown up in all cases in BMR. Especially BMR, which has a share of around 15% in the total physical acreage, produces almost one-second in G.D.P., and possesses one-thirds of trucks in number in the Kingdom of Thailand. This indicates that Thailand economy depends largely on the activities in BMR.

This concentration can be observed as one of the causes of prevailing traffic congestion in BMR, and it is an important and crucial point to formulate a appropriate future land use plan and to provide integrated transportation facilities based on the future plans so as to tackle and solve these problems.

3.1.2 Future Framework

A. Land Use Planning

All cities in the Kingdom of Thailand follow the city planning law which consists of land use plan and transportation plan. The plan for the BMR has been prepared for several years, but the plan has not been approved by the cabinet, yet.

In the draft land use plan for BMR, 14 different land uses are specified to regulate bulk, density, and use of a structure.

The points being mentioned in the draft plan are summarized below:

1. The CBD locates at the center of the present urbanized area.

2. The currently urbanized towns in small size, which are placed at surrounding area of Bangkok city, are identified as a commercial core and serve to neighborhood. These cores locate in the approximate 5-10 kilometer interval.

3. The space between the currently urbanized towns mentioned above is designated as a residential area.

4. The agricultural preservation and promotion area which function as green belt, are located at the eastern and the western parts of the Bangkok city.

5. Two major industrial areas are allocated in the center of the city.

The draft land use plan is based on the current land use pattern and the trend of current development activities.

The draft plan has a status as a master plan and more specific plans are to be prepared in future. Any specific plans have not been established legally so far.

B. Population

Table 3.1.10 shows a population projection of basic case of the economic and social frame. Its outline figures are adopted in this study.

In its plan, future population reaches 6.4 million in 2000 in the whole Kingdom of Thailand and 71.1 million in 2010.

Table 3.1.11 shows average growth rate. It is forecasted that the whole Kingdom shows decreasing tendency, and its annual growth rate is 0.96%, slightly below 1.0%, during the period 2000 to 2005.

As for the population growth by region, BMR, the Eastern and the Southern Regions have rather higher growth rates in comparison with those of other four regions.

This means that inflow and outflow of population is active among regions shown below:

Table 3.1.9 Population Movement Pattern

Outflow	Inflow
Central	BMR
Western	Eastern
North-eastern	Southern
Northern	

The change in BMR's population share against the whole kingdom is observed in Table 3.1.12.

It is forecasted that the population share of BMR reaches 16.9% in 2000 and 17.6% in 2010 against 16.0% in 1990. This means that the Kingdom

Table 3.1.10 Population Projection by Region

(Unit : 1,000 persons)

Region	1990	1995	2000	2005	2010
Whole Kingdom	56,083	60,205	64,111	67,789	71,117
Bangkok/Vicinity	8,970	9,899	10,804	11,684	12,552
Central	2,755	2,900	3,039	3,163	3,270
Eastern	3,491	3,833	4,185	4,534	4,871
Western	3,254	3,433	3,609	3,775	3,918
North-Eastern	19,321	20,507	21,641	22,681	23,516
Northern	10,804	11,364	11,845	12,244	12,575
Southern	7,488	8,269	8,988	9,708	10,415

Source : NESDB

Table 3.1.11 Annual Growth Rate of Population

(Unit : Percent)

Region	1995/1989	2000/1995	2005/2000	2010/2005
Whole Kingdom	1.43	1.27	1.12	0.96
BMR	1.99	1.77	1.58	1.44
Central	1.03	0.94	0.80	0.67
Eastern	1.87	1.77	1.61	1.44
Western	1.08	1.00	0.90	0.75
North-Eastern	1.20	1.08	0.94	0.73
Northern	1.02	0.83	0.66	0.53
Southern	2.00	1.68	1.55	1.42

Source : NESDB

of Thailand will lead to the further gravitation of the population toward BMR even in the future.

Table 3.1.12 Population Share of BMR against Whole Kingdom.

(Unit : Percent)

Year	1990	1995	2000	2005	2010
Ratio	16.0	16.4	16.9	17.2	17.6

C. Economic Growth

Table 3.1.13 shows the planned real economic growth (Basic Case) in the Seventh Five Year Plan. Agricultural sector is set to have same growth rate as that in the Sixth Five Years Plan. As far manufacture, construction and others, higher growth rates are set up than those in the previous plan. An comparatively high growth rate of 8.8% is, as a whole, anticipated during the period 1992 to 1996 to maintain the past prosperous economic level of activities continuously.

BMR is to play an important role as a leading region of dynamic economic activities in the Kingdom of Thailand in the anticipated future.

Table 3.1.13 Real Economic Growth Rate (Base Case)

Sector	Average in Sixth Plan Period	Average 1987-1991	1997-2000
Agriculture	3.5	3.4	3.4
Non-Agriculture	12.1	9.2	7.2
- Manufacture	13.7	9.9	7.2
- Construction	18.7	9.4	7.2
- Others	11.0	8.9	7.2
Gross Domestic Products	10.5	8.8	6.8

The growth rates of BMR and other regions are shown in Table 3.1.14.

Table 3.1.14 Real Economic Growth by Region

(Unit : %)

Region	1990-1995	1995-2000
Whole Kingdom	9.1	7.5
BMR	11.5	9.0
Central	7.3	6.8
Eastern	12.8	9.6
Western	8.2	6.9
North-eastern	4.7	4.3
Northern	4.1	4.0
Southern	6.0	5.1

D. Number of Trucks in Future

The number of trucks up to the year 1995 is forecasted by Department of Land Transport according to the truck classification of Land Transport Act, which is shown in Table 3.1.15. The projection was extended up to the year 2000 by the Study Team based on this data. Table 3.1.15 summarized the results

Table 3.1.15 Number of Trucks in the Future

Item	1991			1995			2000		
	Com-mon Carrier	Private	Total	Com-mon Carrier	Private	Total	Com-mon Carrier	Private	Total
Whole Kingdom	37.0	293.5	330.5	52.0	387.6	439.6	72.9	511.9	584.8
Bangkok	16.6	51.4	68.0	22.8	59.9	82.7	31.1	70.0	101.1
Vicinity of Bangkok	2.2	37.9	40.1	3.2	51.3	54.5	4.5	69.4	73.9
Other Regions	18.2	204.2	222.4	26.0	276.4	302.4	37.3	372.5	409.8

According to this projection, the total number reaches 580,000 vehicles in the year 2000 against 330,000 in 1990 and 440,000 in 1995. The growth rate is approximately 5.9% during the period 1995 to 2000.

The breakdown figures by truck type are tabulated in Table 3.1.16. Growth rates of trailers are rather high, resulting in the share of 21.5% in 2000 against 12.7% in 1990 in the whole Kingdom.

On the other hand, share of trailers in BMR occupies around 34% in 2000 as much as almost one-half (1/2) of the total against 21.2% in 1990

Table 3.1.17 shows a maximum legal pay loads of larger than 6 wheel truck, which will become major means of physical distribution in the future.

The total cargo transportation capacity by 6 wheel truck and larger truck is shown in Table 3.1.18, indicating that its capacity in 2000 reaches almost twice as much as that in 1990.

Table 3.1.16 Estimated Number of Trucks by Type

(Unit : Vehicles)

	1990			1995			2000		
	BMR	Others Regions	Total	BMR	Others Regions	Total	BMR	Others Regions	Total
4 wheels	13,492 (0.125)	41,443 (0.186)	54,935 (0.166)	16,255 (0.118)	55,927 (0.185)	72,182 (0.164)	18,904 (0.108)	75,383 (0.184)	94,287 (0.161)
6 wheels	48,144 (0.445)	89,912 (0.404)	138,056 (0.418)	55,154 (0.402)	119,146 (0.394)	174,300 (0.396)	57,500 (0.329)	155,680 (0.380)	213,180 (0.365)
10 wheels	23,515 (0.218)	71,981 (0.324)	95,496 (0.289)	29,015 (0.212)	91,729 (0.303)	120,744 (0.275)	39,112 (0.223)	112,555 (0.275)	151,667 (0.259)
Trailer	22,955 (0.212)	19,099 (0.086)	42,054 (0.127)	36,750 (0.268)	35,594 (0.118)	72,344 (0.165)	59,484 (0.340)	66,182 (0.161)	125,666 (0.215)
Total	108,106 (1.00)	222,435 (1.00)	330,541 (1.00)	137,174 (1.00)	302,396 (1.00)	439,570 (1.00)	175,000 (1.00)	409,800 (1.00)	584,800 (1.00)

Table 3.1.17 Mazimum Legal Payload by Type

(Unit : Ton)

Truck Types	Payload
6 wheels	7.0
10 wheels	13.0
Trailer	24.0 *

* Average of semi-trailer and full-trailer

Table 3.1.18 Total Payload by Truck in BMR

(Unit : 1,000 vehicle ton)

Truck Types	1990	2000
6 wheels	337	403
10 wheels	306	508
Trailer	551	1,428
Total	1,194	2,339

E. Features of BMR in Future

Features of BMR in future are summarized below:

1. Gravitation toward BMR

The Kingdom of Thailand consists of 72 changwats and approximate 140 cities. BMR has been placed as a center of socio-economic and political activities since 20%-30% of activities have been concentrated in BMR.

Policies concerning urban and regional planning in operation induce further gravitation of various urban functions toward BMR in the future.

2. Subjects on Land Use Plan

In case of further concentration to BMR, it can be said that a big central city with more than 10 million population will emerge at the year 2000 .

Judging from world-wide experiences, the following subjects can be listed up to make such a large metropolis function as a city:

a) High integration of central urbanized area and development of Central Business District (CBD).

b) Development of surrounding sub-core towns as satellite town.

c) Providing transportation facilities such as mass transit, ring roads, streets, terminal.

Identification of land use such as residential, commercial, industrial and others should be conducted more in detail. In addition, re-development of old industrialized area is necessary. The latter includes a reallocation of those facilities to outskirts of a city.

As far as truck terminal is concerned, the followings will become major subjects to be solved in BMR.

a) Reallocation of the forwarders' facilities, which are under use for transferring cargoes from large trucks to small delivery vehicles, to outside of BMR in order to make the traffic movements more smooth and to make the central area more integrated.

b) Reallocation of the industrial and physical distributing facilities at the outskirt of BMR along the Outer Ring Road.

3.2 Physical Distribution

3.2.1 Results of the Physical Distribution Survey

A. Outline of the Survey

Department of Land Transport (DLT) carries out the physical distribution survey every year, and its data are available for this study. In addition, the JICA Study Team had conducted the supplemental physical distribution surveys to get more detailed information. They are:

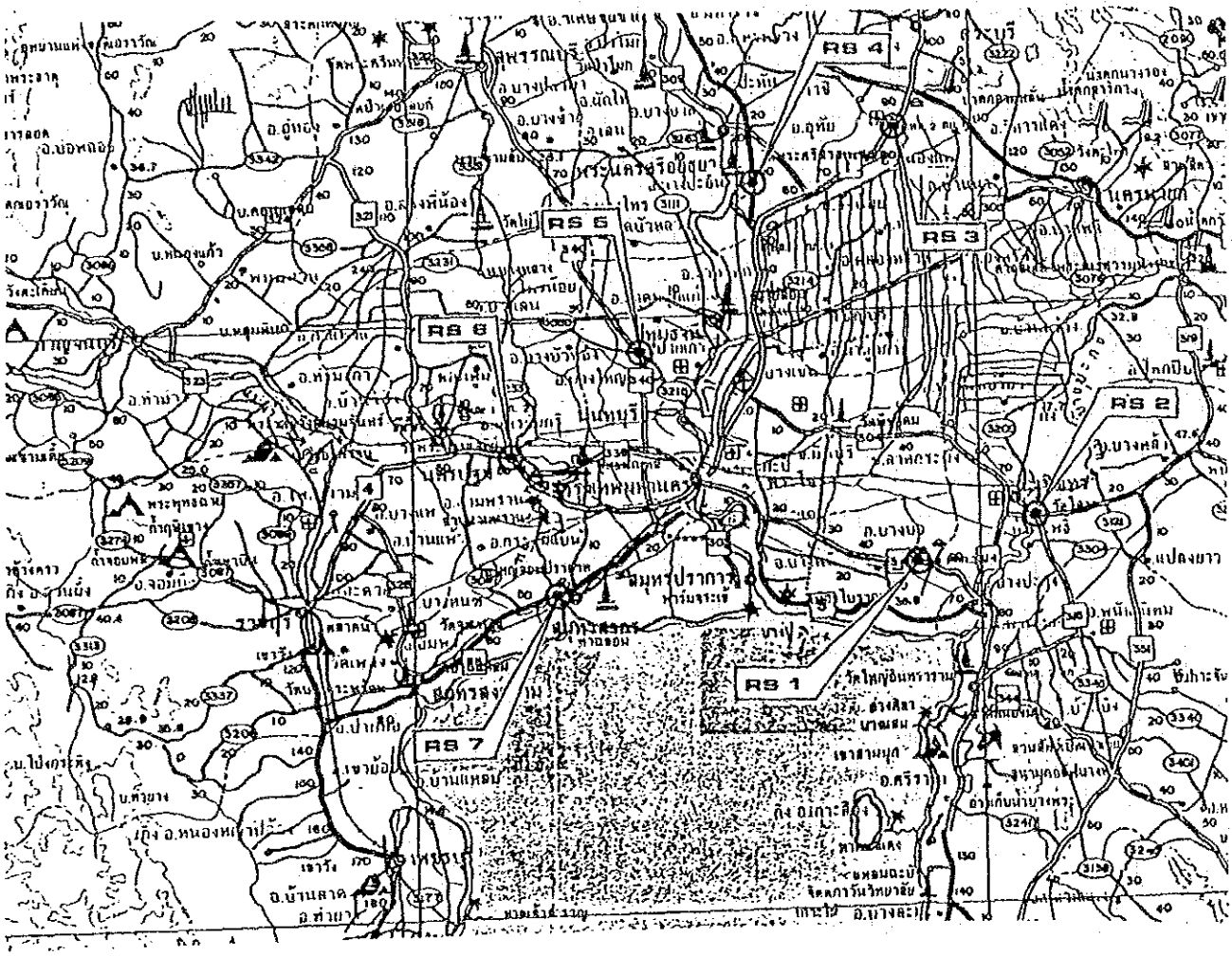
1. Roadside Heavy-Truck Drivers and Interview Survey.

2. Roadside Traffic Counting Survey.

Interview survey was carried out only for sampled trucks and their drivers were questioned on several items such as origin and destination of their trips. This survey lasted one week from Monday to Friday.

Traffic counting survey was also carried out, aiming at getting the basic data to estimate the overall truck volume by type.

Survey locations are shown in Figure 3.2.1. The zoning map are shown in Chapter 4.



LEGENED:
⊙ Location

Figure 3.2.1

Location Map of Roadside
Interview Survey Spots

B. Roadside Traffic Counting Survey

1. Traffic Counting Survey

The average daily traffic volume Monday through Friday is shown by survey point in Table 3.2.1.

Roads that have a large traffic volume are Route No.1 (connecting to the Northern), Route No.4 (connecting to the Western and Southern Regions), and Route No.34 (connecting to the Eastern Region).

Survey results show that Route No.4 (RS6) has the biggest traffic volume of about 17,000 vehicles per day, followed by Route No.1 (RS3) and Route No.34 (RS1). The traffic volumes on other survey points were approximately 6,000 vehicles per day or less.

In respect to the traffic volume by direction, the traffic volume to/from the northern direction records 20,000 vehicles per day since the routes on RS3 and RS5 merges on the southern part of Route No.1. This volume is the biggest than those of other directions.

2. Composition Ratio of Trucks

The ratio of 10-wheel trucks was dominant on every survey points. This truck occupies about 45% of all truck volume on every survey points, and that of pick-up ranked at the second of the list, showing roughly 31%. These two types of truck alone occupy almost three fourth (3/4) of the total. The ratio of trailer is rather low, less than 10%.

It can be considered that 10-wheel trucks play an overwhelming role in commodity transportation in Thailand at present.

C. Commodity Flow

The outflow and inflow at BMR (Zones No. 01-12) is tabulated in Table 3.2.2. This table clarifies that the truck volume of outflow is approximately one half of that of inflow.

Table 3.2.1 Results of Traffic Counting

(Unit : Vehicle)

SURVEY POINT	AVERAGE 12-HOUR TRAFFIC VOLUME (VEH/12 HRS)														
	IB : TO BANGKOK					OB : FROM BANGKOK					TOTAL				
	PICK-UP	6-WHEEL	10-WHEEL	TRAILOR	TOTAL	PICK-UP	6-WHEEL	10-WHEEL	TRAILOR	TOTAL	PICK-UP	6-WHEEL	10-WHEEL	TRAILOR	TOTAL
RS-1	1,442	1,238	2,397	453	5,530	1,673	1,408	2,489	489	6,059	3,115	2,646	4,886	942	11,589
RS-2	853	315	1,555	178	2,901	1,152	374	1,416	223	3,165	2,005	689	2,971	401	6,066
RS-3	1,770	665	3,033	1,067	6,535	1,238	821	2,791	1,054	5,904	3,008	1,486	5,824	2,121	12,439
RS-4	1,008	398	748	167	2,321	1,050	342	810	186	2,388	2,058	740	1,558	353	4,709
RS-5	1,145	720	852	227	2,944	1,409	810	1,606	340	4,165	2,554	1,530	2,458	567	7,109
RS-6	3,148	1,028	4,109	475	8,760	2,408	1,045	4,366	565	8,384	5,556	2,073	8,475	1,040	17,144
RS-7	590	380	1,432	174	2,576	1,235	504	1,637	194	3,570	1,825	884	3,069	368	6,146
TOTAL	9,956	4,744	14,126	2,741	31,567	10,165	5,304	15,115	3,051	33,635	20,121	10,048	29,241	5,792	65,202

Table 3.2.2 Inflow and Outflow of Commodity

Commodity Item No.	Tonnage (Ton)														
	Inbound Direction					Outbound Direction					Both Direction				
	Pick-up	6-wheel Truck	10-wheel Truck	Trailor	Total	Pick-up	6-wheel Truck	10-wheel Truck	Trailor	Total	Pick-up	6-wheel Truck	10-wheel Truck	Trailor	Total
1	10	134	17,434	2,756	20,334	5	111	4,610	861	5,587	15	245	22,044	3,618	25,921
2	3	131	1,625	1,696	3,455	13	164	731	632	1,540	16	296	2,356	2,328	4,995
3	24	109	480	281	894	16	154	396	262	827	40	264	876	543	1,722
4	9	113	385	81	587	11	98	197	44	349	20	211	581	126	937
8	8	111	948	123	1,190	10	61	526	126	723	18	173	1,474	249	1,913
6	6	63	276	28	372	7	60	136	0	203	13	123	412	28	576
7	14	41	1,102	599	1,756	6	96	1,460	895	2,457	20	136	2,562	1,494	4,212
8	0	0	119	193	312	0	0	0	4	4	0	0	119	197	316
9	7	89	3,923	300	4,320	28	42	600	42	711	35	131	4,523	342	5,031
10	223	299	778	24	1,324	49	147	196	12	404	272	446	974	36	1,728
11	5	22	2,344	878	3,248	2	20	591	143	755	7	41	2,935	1,021	4,003
12	1	18	324	111	454	0	3	217	53	272	1	21	540	158	720
13	1	24	615	141	780	3	6	212	111	331	4	30	826	252	1,112
14	3	8	63	0	74	0	0	10	30	40	3	8	73	30	115
15	0	0	0	0	0	0	3	0	0	3	0	3	0	0	3
16	30	127	410	272	839	19	171	385	157	732	49	298	796	429	1,570
17	26	219	1,404	209	1,858	36	166	671	57	930	62	384	2,075	266	2,787
18	20	91	287	0	397	12	135	112	0	260	32	227	399	0	658
19	43	75	417	95	630	49	82	332	0	462	92	156	749	96	1,093
20	25	102	997	90	1,213	15	186	1,532	267	2,000	39	288	2,529	359	3,215
21	55	364	960	530	1,909	56	311	621	122	1,110	111	675	1,581	652	3,018
22	36	159	276	89	560	23	190	297	41	550	59	349	573	129	1,109
23	47	216	1,111	464	1,838	34	347	643	362	1,387	82	563	1,754	828	3,227
TOTAL*	595	2,513	36,278	8,959	48,344	391	2,551	14,473	4,220	21,635	986	5,064	50,751	13,179	69,979

* Remark : excluding empty truck

Table 3.2.3 shows the results of interview O-D survey on commodity flow. The truck volume transporting between the Upper Center (Zone No. 20) and Eastern Region (Zone No.30) are remarkable except BMR.

On the other hand, construction materials indicate remarkable share more than 40% in the volume of inflow, and agricultural products such as rice and cassava (tapioca) occupy large share. As for the materials of outflow, construction materials occupy the biggest share exactly same as observed in inflow materials. Petroleum products occupy the second position.

Major features of commodity transport by types of truck are summarized below:

1. Vegetable and fruits are transported by comparatively small vehicles such as pick-up, 4-wheel and 6-wheel trucks.

2. 10-wheel trucks are the major means of transportation for any commodities.

3. The ratio of trailer is rather large only in cements transportation.

3.2.2 Present Commodity Flow in Bangkok

A. Characteristics of Commodity Flow

1. Commodity Flow in Bangkok

The results of Department of Land Transport's (DLT's) commodity flow survey in Bangkok are shown in Table 3.2.4. Its major features are as follows:

a) Total volume of tonnage of inflow and outflow reach 40 million tons per year. Of which, construction materials such as sand, soil and gravel occupy about 63% of the total volume, equivalent to 2.5 million tons.

b) Rice and Sugar is placed at the second group of the inflow.

Table 3.2.3 O-D Table of Commodity

ORIGIN	DESTINATION																				
	01	02	03	04	05	06	07	08	09	10	11	12	20	30	41	42	51	52	61	62	70	TOTAL
01	11.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	239.9	135.6	76.0	65.0	21.8	14.5	118.1	76.8	25.2	791.4
02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	103.5	139.9	49.5	225.0	12.5	13.0	0.8	36.4	78.5	659.1
03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.0	98.0	24.3	41.5	21.0	0.0	12.0	20.0	4.0	316.8
04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.5	24.0	28.6	11.0	0.0	0.0	3.0	0.0	0.0	108.1
05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	555.1	1505.8	378.8	568.7	178.0	122.0	81.2	47.8	25.0	3462.4
06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.8	72.6	48.0	0.9	0.0	0.0	0.0	25.0	16.0	227.3
07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.5	6.2	18.0	27.5	0.0	0.0	0.0	2.0	3.0	85.2
08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.9	96.2	9.5	19.3	0.0	0.0	8.2	3.0	2.0	210.1
09	0.0	12.0	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	111.4	108.5	97.5	190.9	2.0	14.0	10.0	8.0	21.0	587.3
10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.0	28.0	49.1	31.4	0.4	0.0	15.0	0.0	0.0	165.9
11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	63.0	352.9	9.0	12.0	41.0	33.0	0.0	1.0	0.0	521.9
12	6.0	0.0	0.0	0.0	0.8	0.0	0.0	6.0	6.0	0.0	4.5	0.0	362.6	155.9	393.1	609.3	1.3	20.0	21.5	4.0	68.2	1659.2
20	1118.1	104.4	246.2	133.5	586.7	216.0	371.2	89.3	193.0	207.3	389.3	437.4	7985.2	935.1	1326.5	789.9	95.5	84.0	125.8	80.5	47.0	15561.9
30	76.0	22.0	218.0	13.0	2817.5	117.0	60.0	181.5	124.7	3.4	2493.3	119.0	1001.6	10813.6	518.3	893.4	376.5	261.7	175.5	81.7	150.8	20518.5
41	91.6	12.2	129.4	11.0	297.0	56.4	66.2	13.0	115.0	67.4	69.0	732.5	2410.9	431.3	876.1	812.2	32.0	50.0	18.3	12.0	10.0	6313.5
42	195.3	173.6	46.5	1.0	999.6	25.5	18.5	38.0	211.8	117.6	173.7	646.4	837.2	604.0	386.3	1198.3	22.4	50.8	19.6	1.0	47.5	5814.6
51	538.9	244.0	39.0	13.3	309.4	0.0	26.0	78.0	168.5	20.6	31.0	16.3	698.4	967.8	163.2	129.9	0.0	0.0	13.0	0.0	19.8	3477.1
52	663.1	89.0	84.0	39.0	414.6	26.0	12.0	23.0	63.5	48.0	107.0	24.0	1484.0	1542.5	116.9	91.0	0.0	0.0	0.0	0.0	19.0	4846.6
61	49.7	16.0	9.0	0.0	77.0	0.0	69.0	0.0	13.0	0.0	15.0	32.0	515.9	269.1	74.5	2.1	0.0	0.0	9.8	0.0	0.0	1152.1
62	117.5	0.0	8.0	0.0	216.0	0.0	4.5	0.0	31.0	6.5	0.0	0.0	200.4	286.5	45.0	154.8	0.0	0.0	5.0	18.5	19.0	1112.7
70	75.9	102.0	15.0	13.0	670.0	36.0	13.3	45.2	167.3	11.0	27.0	176.8	284.3	473.7	38.0	145.7	23.0	47.0	0.0	13.0	10.0	2387.2
TOTAL	2943.1	775.2	801.1	223.8	6400.6	476.9	640.7	474.0	1093.8	481.8	3309.8	2195.9	17198.1	19047.2	4726.2	6019.8	827.4	710.0	636.8	430.7	566.0	69978.9

c) The volume of outflow shows about 11 million tons and Miscellaneous Goods occupies around one-third of the outflow, equivalent to 3 million tons.

d) Petroleum Products (fuel) ranked at the second of outflow lists, showing 2.3 million tons.

Table 3.2.4 also shows that the total volume of inflows is almost four times as large as that of outflow, and that the inflow of construction materials and agricultural products occupy a dominant share. The former reflects a construction boom in BMR, and the latter the gravitation of the population toward BMR.

On the other hand, the major outflow commodities are various industrial products such as personnel effects and miscellaneous goods. All of which are carried out to upcountry because there are few industries to produce such products there at present.

2. Flows between Regions

Inter-regional flow of commodities from/to BMR is shown in Table 3.2.5. This shows that the volume in Western Region is dominant, indicating 51% of inflow and 43% of outflow. This remarkable share of the Western Region is attributable to mainly an influx of construction materials

Volumes of personnel effects and miscellaneous goods are shown in Table 3.2.6. Many of those goods are suitable for a truck terminal. The Northern Region shows the biggest volume of 981,000 tons in the aggregated figure of inflow and outflow.

Table 3.2.4 Commodity Flow in Bangkok by DLT

Unit : Ton/Year

Commodity Type	Total			Inbound			Outbound		
	Volume (Ton)	No. of Trip (Trip)	Transport Volume (Ton-Km)	Volume (Ton)	No. of Trip (Trip)	Transport Volume (Ton-Km)	Volume (Ton)	No. of Trip (Trip)	Transport Volume (Ton-Km)
1. Rice	3,793,400	345,228	1,012,697,420	3,651,882	330,960	980,510,102	141,518	14,268	38,187,318
2. Sand & Gravel	25,011,350	2,125,162	2,312,562,226	24,960,078	2,119,988	2,308,910,268	51,272	5,174	5,651,958
3. Cement & Products	2,339,272	179,426	318,222,260	1,851,538	135,330	223,303,992	487,734	44,096	154,916,268
4. Steel	680,784	69,472	204,482,304	217,568	21,294	54,845,934	463,216	48,178	149,636,370
5. Other Construction	615,602	66,144	88,482,134	524,030	54,964	60,125,832	81,572	11,180	28,356,302
6. Timber	1,158,196	111,670	606,954,582	891,878	85,046	540,654,452	266,318	26,624	66,300,130
7. Firewood	226,616	25,766	126,515,324	194,220	20,436	122,626,478	32,396	5,330	3,888,846
8. Petroleum Products	2,463,656	206,180	680,801,784	75,270	6,176	13,910,962	2,388,386	199,004	666,890,822
9. Minerals	252,434	19,058	82,122,066	212,706	16,224	76,270,376	39,728	2,834	5,851,690
10. Vegetable & Fruit	1,040,884	200,824	352,100,736	886,160	167,518	299,017,576	152,724	33,306	53,083,160
11. Tapioca	558,258	50,154	165,645,194	539,084	48,178	162,313,710	19,214	1,976	3,331,484
12. Maize	407,134	39,364	112,010,496	389,922	37,570	108,295,174	17,212	1,794	3,715,322
13. Sugar	1,319,214	114,790	237,952,572	1,305,408	113,308	234,100,986	13,806	1,482	3,352,186
14. Beans	162,370	15,782	61,479,678	152,074	14,716	59,268,560	10,296	1,066	2,211,118
15. Jute & Products	92,066	11,128	23,454,834	72,410	8,190	17,260,648	19,656	2,936	6,194,188
16. Beverages	546,754	62,998	136,824,010	101,712	12,636	20,710,326	445,042	50,362	116,113,684
17. Processed Foods	974,246	113,698	317,656,898	843,570	93,132	275,892,318	130,676	20,566	41,764,580
18. Animals	237,198	75,608	32,927,830	212,056	67,522	26,590,252	25,142	8,086	6,337,578
19. Fish	471,848	69,446	208,364,286	427,960	60,632	193,606,062	43,888	8,814	14,758,224
20. Fertilizer & Animal Feeds	2,310,750	228,878	876,759,676	518,102	55,404	203,592,116	1,792,648	173,394	673,165,560
21. Personal Effects	731,978	110,292	173,579,614	426,582	58,370	99,478,938	305,396	51,922	74,100,676
22. Other Manufactures	3,597,230	433,036	1,586,527,826	364,754	71,006	92,434,368	3,232,476	362,030	1,494,093,458
23. All, Others	1,255,072	130,008	530,360,324	600,522	64,506	333,663,538	654,550	73,520	196,696,786
Total	50,246,352	4,812,912	10,308,484,074	39,421,484	5,663,206	6,507,382,368	10,794,868	1,148,722	3,810,547,706