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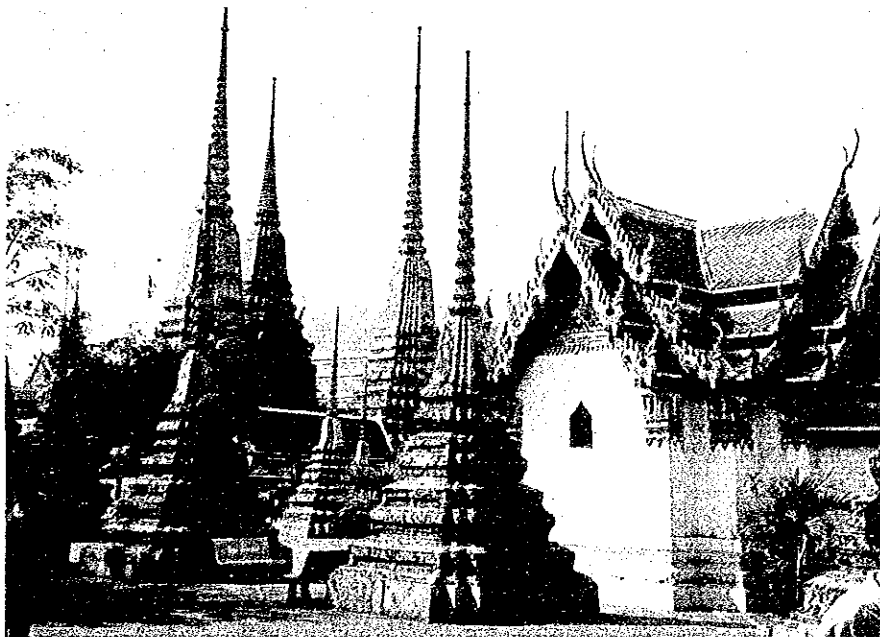
ABBREVIATIONS

B/C	: Benefit-Cost Ratio
BKK	: Bangkok
BMA	: Bangkok Metropolitan Area
BMR	: Bangkok Metropolitan Region
CBD	: Central Business District
CFS	: Container Freight Station
DOH	: Department of Highways
DSCR	: Debt Service Coverage Ratio
DTCP	: Department of Town and Country Planning
EIO	: Express Transportation Organization
FCL	: Full-Container-Load
FIRR	: Financial Internal Rate of Return
GDP	: Gross Domestic Product
GNP	: Gross National Product
GPCO	: Government & Private Corporated Organization
GRP	: Gross Regional Product
IFCT	: Industrial Finance Corporation of Thailand
IRR	: Internal Rate of Return
JICA	: Japan International Cooperation Agency
LCL	: Less-than-Container-Load
LTD	: Land Transport Department
LTL	: Less-than-Truck-Load
MOC	: Ministry of Communications
NESDB	: National Economic and Social Development Board
NPV	: Net Present Value
O/D	: Origin and Destination
OECD	: Overseas Economic Cooperation Fund
PWA	: Provincial Waterworks Authority
ROE	: Return on Equity
ROG	: Return on Government's Share Capital
ROI	: Return on Investment
SCBT	: Sub-Control Board on Truck Terminals
SPCT	: Sub-Policy Committee on Truck Terminals
SRT	: State Railways of Thailand
TPU	: Transport Planning Unit (Ministry of Communications)
TT	: Truck Terminal

PART I
BACKGROUND

CHAPTER 1

INTRODUCTION



CHAPTER 1 INTRODUCTION

1.1 Background of the Study

Reducing the gap in social services between Bangkok and regional areas is an important item among the national development objectives of the Kingdom of Thailand.

Therefore, it is the fundamental policy of the Kingdom of Thailand to create employment opportunities commensurate with the increasing labour population and to rectify the differences in both incomes and levels of living. Because of this, it is one of the most vital political objectives, among others, to achieve industrial development in local areas.

In order to plan the development of the industry and improvement of the income level, it is important to secure material supplies smoothly and yet at reasonable costs as well as the measures and means for hauling the finished products.

In recent years, road truck transport is playing the most important role in the area of freight transportation as the road improvement progresses in Thailand. In the light of this fact, it is required to establish a rational truck transportation system.

As one of the means and measures to achieve modernization and rationalization of truck transportation, the Government of Thailand has decided to plan and develop truck terminals in the core cities throughout the country, and has started its implementation in the Bangkok Metropolitan Area as the first step to be taken.

With reference to the planning and development of the truck terminals in the Bangkok Metropolitan Area, a Feasibility Study has been carried out by the Japan International Cooperation Agency (JICA) in 1978 - 1979, subsequently, the Government of Thailand is desirous to plan the improvement of truck transport in the regional core cities as well.

The Government of Thailand made a request to the Government of Japan to carry out a feasibility study on the project of the regional truck terminals to formulate its short-term solution as well as its long-term solutions.

In response to the request of the Government of the Kingdom of Thailand, the Government of Japan decided to conduct the Feasibility Study for the Project of the Regional Truck Terminals (hereinafter referred to as "the 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.

JICA, the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, has undertaken the Study in accordance with the relevant laws and regulations in force in Japan, and in close cooperation with the authorities of the Kingdom of Thailand.

1.2 Objective and Outline of the Study

1.2.1 Objective of the Study

The Study aims at conducting a Feasibility Study on the project of the regional truck terminals, and also aims at considering long-term prospects of nation-wide road transportation of cargo and investigating the roles and functions of the regional truck terminals in the course of the Feasibility Study mentioned above.

1.2.2 Outline of the Study

In order to achieve the objective mentioned above, the Study covers the followings:

1) Long-Term Prospects

To consider the long-term prospects of nation-wide road transportation of cargo.

- a) Analysis of the socio-economic conditions in Thailand
- b) Long-term forecast of the socio-economic framework
- c) Forecast of the inter-regional cargo traffic demand
- d) Investigation of the future road transportation trend of cargo, in the light of modernization and containerization
- e) Specification of the problems of road transportation of cargoes in Thailand

2) Roles and Functions of the Regional Truck Terminals

To investigate the expected roles and functions of the regional truck terminals in Chiang Mai, Khon Kaen, Nakhon Sawan, Nakhon Ratchasima and Hat Yai/Songkhla in the light of the network system of truck terminals in Thailand.

- a) Analysis of the geographical and socio-economic conditions in the area
- b) Forecast of the demand for each terminal
- c) Investigation of expected roles and functions of each terminal
- d) Selection of three typical terminals for the Feasibility Study.

3) Feasibility Study

To conduct the Feasibility Study for the project of the regional truck terminals selected in 2) d) above.

- a) Site selection of the terminal in each area
- b) Preparation of physical plans

- c) Preparation of operation and management plans
- d) Preparation of implementation programs
- e) Evaluation of the projects including economic and financial analysis.

In compliance with above mentioned study outline, the Study divided the above into the following six steps.

- Step 1: Reconnaissance Survey and Data Collection
- Step 2: Forecast of Future Commodity Flows
- Step 3: Investigation of Roles and Functions of Regional Truck Terminals and Selection of Three Terminals for the Feasibility Study
- Step 4: Preliminary Design of Three Terminals
- Step 5: Analysis of Economic, Financial, Organization and Administration Aspects
- Step 6: Preparation of Final Report.

Note: Steps 1 and 2 of the above correspond to 1) of Outline of Study, Step 3 of the above correspond to 2) of Outline of Study, and Steps 4 and 5 of the above correspond to 3) of the Outline of Study.

1.3 Conduct of the Study

The Study was carried out by the Study Team which was composed of the Japanese Consultant Staff and LTD Counterpart Staff.

LTD and Advisory Committee of JICA have acted as advisors to the Study Team. The Advisory Committee (members of the Japanese Government) held meetings in Tokyo as the need arose, observing the Team's progress and providing necessary advice. The representatives of the Advisory Committee made periodic visits to Bangkok and project sites during the period of the works in Thailand to discuss directly about the Study matters with the Study Team, and confirmed the essential points of decision with the Government.

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CHAPTER 2

PRESENT SITUATION OF INFLUENCE AREA



CHAPTER 2 PRESENT SITUATION OF INFLUENCE AREA

2.1 Physical Characteristics

2.1.1 The Country

The geography of Thailand, entirely in the tropics, has deeply affected its development. The northern part is mountainous with dense forest. The land of northeastern region is a large plateau and dry. The central part is covered by the great central plain made by the great Chao Phraya River and its estuaries. The southern region extends 800 km southward in a narrow band. Although Thailand shares 67% of its 7,938 kilometers long border with neighboring countries of Malaysia, Burma, Kampuchia, and Laos, it has succeeded in avoiding major international conflicts and in enjoying continuous social and economic development.

A large majority of people (50 million of population in 1986) is ethnic Thai. It is estimated that Overseas Chinese or their descendant population is about 4 million. There are Moslem Malay population in the south and a few other minority groups in mountains. National unity however has been kept remarkably well under the constitutional monarchy. (See Table 2.2.1)

Thailand is under monsoon climate, with relatively small rainfall (about 1,100-2,000 mm per year), except on the west coast of Malay Peninsula where annual rainfall exceeds 4,000 mm.

The country has rainy season in May through September when the southwest monsoon blows and dry season in October through February when the northeast monsoon blows, with transition period in February through April when squalls occur. Above seasons vary from one region to another. Physical conditions in the project areas are summarized as follows.

2.1.2 Topographic Conditions in Project Areas

1) Chiang Mai

This area is mostly mountainous with flat land being limited to riverside areas sloped from north to south.

Annual mean temperature is around 25°C, with annual mean maximum temperature of 36°C in April and annual mean minimum temperature of 10°C in January. Annual mean precipitation of 1,200 mm, with daily maximum precipitation of record for 30-year period after 1951 being 166.5 mm (August). Average number of days with precipitation is 120 days.

2) Khon Kaen

This area is mostly plateau sloping downwards to the Mae Khong River. Flat area exists in a part of northern area along Chi River and Phong River. Railroad and National Highway Route 2 run in relatively low land on the south.

Annual mean temperature is around 27°C, with annual mean maximum temperature of 36°C in April and annual mean minimum temperature of 16°C in January. Annual mean precipitation of 1,200 mm with daily

maximum precipitation of 140 mm (September). Average number of days with precipitation is 106 days.

3) Nakhon Sawan

This area is mostly low land, with mountains on the west and forests on the east. Chao Phraya River and its branch rivers flow through the area.

This area is generally similar to climate in Bangkok, with three seasons (dry, rainy, and cold). Annual mean temperature is 28°C, with annual mean maximum temperature of 38°C in April and annual mean minimum temperature of 17°C in January. Annual mean precipitation is 1,100 mm with daily maximum precipitation of 140 mm. Average number of days with precipitation is 103 days.

4) Nakhon Ratchasima

This area is generally plateau with Mt. Dong Phaya Yen and Mt. Dong Rak being located on the west and south respectively, which extend northward. Partially flat land which is used as paddy fields.

This area has a relatively long rainy season between April and September with annual mean precipitation of 1,100 mm. Annual mean temperature is 26°C with annual mean maximum temperature of 36°C in April and annual mean minimum temperature of 16°C in January. Average number of days with precipitation is 117 days and daily maximum precipitation is 140 mm.

5) Hat Yai/Songkhla

This area is generally flat area with forests and mountains in part. There is a plateau area on the south which slopes downward to Lake Songkhla. Flat land extends along the coast line on the east.

This area has a very mild climate throughout the year, consisting of summer season and rainy season which lasts 8 - 9 months. Annual mean temperature is 27°C with annual mean maximum temperature of 33°C in May and annual mean minimum temperature of 24°C. Annual mean precipitation is 2,000 mm which is relatively high compared to other 4 areas. Daily maximum precipitation is 330 mm (October) and average number of days with precipitation is 160 days.

2.1.3 General Conditions in Project Cities

1) Chiang Mai

a) History

Chiang Mai is the center of a narrow plain surrounded by the northern mountains. This fertile plain has long been supported by a dense population and unique culture.

Chiang Mai was founded by King Meng Rai in 1296 as the capital of the Kingdom of Lanna, which ruled the present northern Thailand until the beginning of this century. The original city was built inside of a square moat with walls of a length of 1.8 km per side, most of which still exists today. In 1935, the Municipality of Chiang Mai was established for an area of 17.5 km² with the old city as its center.

b) Present Situation

Today, Chiang Mai is a bustling city of 190,000 population growing at a rate close to 3% per annum. Within a radius of 30 km there are 9 neighboring towns, all of which have direct links to Chiang Mai Municipality. It also plays the role of the regional center for all of the Northern Region due mainly to its history.

The city can be divided into two parts;

- The old town of 2.66 km² within the square boundary of city walls and moat.
- The new town of 14.04 km² surrounding the old town, with most of the land situated to the north, east and south. The remaining 0.8 km² is made up of the Ping River channel, the city moat and other waterways.

Residential areas are scattered within and outside of the city walls. Commercial activities are concentrated along the major roads of Charoen Muang, Tha Pae and Witchayanon. An industrial area is located south of the old town. A large scale industrial estate, still vacant, built by the Government is located 20 km to the south. Some commercial and industrial establishments are also located along the routes to surrounding districts. This city is located in a strategic point of road transportation where a number of National and Provincial Routes, Nos. 107, 1001, 11, 106 and 108 converge.

Lampang, located about 100 km southeast of Chiang Mai, is also a major city of industrial growth in this region.

National Route No. 1 and No. 11 are the most important routes for cargo flow connecting the North with the Central Region of Thailand.

The National Route No. 11 "Super Highway" was constructed in order to relieve traffic congestion in the urban areas and to provide a by-pass route for through-traffic.

2) Khon Kaen

a) History

Khon Kaen was a small rural town until early 1960's, when the Khon Kaen University and other governmental institutions were started up. Residential expansion and commercial expansion since then has forced the government to change the municipal border increasing the area from 13.5 km² to 45 km² by including parts of the land of three adjoining Tambons.

b) Present Situation

The present Municipality of Khon Kaen was established in 1972 by the inclusion of parts of the three adjoining Tambons, making the total area 46 km². Population in 1986 was estimated at 137,000, growing at more than 4% per annum. Within the municipality boundary still more than one quarter are for agricultural use. The University of Khon Kaen dominates the city in terms of area, which is 21% of the total. A high density residential and commercial mixed land use occupies the center. Residential

areas are found around it and extends towards the southeast. The industrial area is located west of the railway line.

Khon Kaen's position as the geographical center and the hub of transport network for the entire Northeastern Region will continue to give it a development momentum although the Region's weak economic base may not allow it to be as robust as desired. This city is located at a strategic point of road transportation as a cross point of National Route Nos. 2, 12, 209 and 208. National Route No. 2 is the most important route for cargo flows connecting Bangkok with the Northeast. National Route No. 23 is also an important route connecting Khon Kaen area with Ubon Ratchathani which is the central city of eastern part of the country.

Since bypass routes do not exist around this city, through truck traffic crosses the city center.

3) Nakhon Sawan

a) History

Nakhon Sawan is located on the right bank of the Chao Phraya River at the point where the Nan River enters the main stream. Its strategic location has made it possible to become the center of rice trade in the upper central and the northern regions, which produce surplus rice even before the lower central plain became occupied by people. The town gained importance when the large scale export of rice started in the last century.

b) Present Situation

The town has developed along the west bank of the Ping and Chao Phraya Rivers. Virtually no development has taken place in the east bank area. High density commercial and residential developments can be seen along the only through-route paralleling the river, Sawanwithi Road on the eastern side of National Highway Route No. 1, which bi-sects the town after crossing the river from the east bank. On the western side of Route No. 1 many government institutions are located, and development density is rather low. Department of Town and Country Planning (DTCP) currently designates the southern tip of the urban area as the industrial and warehousing zone.

This city is located at a strategic point of inland waterway and road transportation as the Ping and the Nan Rivers and National and Provincial Route Nos. 1, 1118, 3004 and other local roads converge in and around the city.

National Route No. 1 which runs across the city area is the most important route connecting the North with Bangkok. The Chao Phraya River is also an important inland waterway connecting this area with Bangkok.

A transport terminal for inland waterways with road and railway accesses is under construction in the eastern part of the city at the river side.

4) Nakhon Ratchasima

a) History

Nakhon Ratchasima has been an outpost for whoever controlled the central plain against the vast northeastern plateau and beyond. During the reign of King Narai in the 17th century, a garrison town was built at site of the present Nakhon Ratchasima. By the beginning of this century the military area expanded beyond the city wall and the opening of the railway link with Bangkok, and also the opening of the Friendship Highway from Saraburi in 1960 induced the development of the commercial area between the railway station and the city gate. By 1937 the Municipality of Nakhon Ratchasima was established with a total area of 4.4 km².

b) Present Situation

The urbanized area of Nakhon Ratchasima has expanded beyond the boundary of the Municipality. Thus the Department of Town and Country Planning has defined the planning boundary well beyond the municipality boundary.

Urban population thus defined was estimated at 177,000 for 1981, growing at a rate of 3.1% per annum. Because of physical as well as institutional constraints, urban development in the past have expanded towards the north-east and south-west.

The median monthly household income for Nakhon Ratchasima was estimated at Baht 4,900 for 1981, 78% of the figure for Bangkok and 106% of the figure for all municipalities excluding those in the Central Region and Bangkok.

Nakhon Ratchasima will continue to play the role of the gateway to the Northeast.

This city is located at a strategic point of road transportation as the cross point of National and Provincial Route Nos. 2, 205, 224, 304 and 2162. National Route No. 2 which runs across the city center is the most important route for cargo flow connecting Bangkok with the Northeast.

Since a bypass route does not exist around this city, through truck traffic crosses the city center, especially heavy trucks on National Route No. 2 from Khon Kaen passing through the city area to Bangkok.

5) Hat Yai/Songkhla

a) History

By the end of the second century a settlement of traders was already in existence on the shores of the Songkhla Lake, an excellent natural port. Many trading powers, overseas and local, had successively controlled the town, but it remained one of the most important towns in this region. In the middle of the last century, King Rama IV transferred the town to the eastern shore of the lake, where it has remained to the present time.

The new town of Hat Yai developed when the railway through the Malay peninsula was built 20 km away from Songkhla with a spur to Songkhla.

Hat Yai swelled by refugees avoiding campaigns against guerillas in the late forties and early fifties. A rapid commercial expansion followed.

b) Present Situation

Urban population in 1981 was estimated at 85,000 for Songkhla and 117,000 for Hat Yai, with growth rates at 4.2% and 3.9%, respectively. Areas within the municipality boundaries are 9.6 km² and 21.6 km², respectively. However, actual urbanized areas are considerably beyond the boundaries.

Songkhla is limited on three sides by the sea and the lake. It can only expand southward. Hat Yai has been expanding eastward towards Songkhla. Both cities have been developing as a combination of two cities of complimentary characters. With the development of deep sea port in Songkhla this tendency will increase. Their role as the regional growth center will be strengthened.

Hat Yai is located at the strategic point of road transportation as a cross point of National Route Nos. 4, 407, 43 and other roads. Songkhla is the key point of coastal shipping transport interfacing with land transport. A deep sea port is under construction.

National Route No. 4 is the most important route for cargo flow connecting not only Bangkok with the South but also Thailand with Malaysia and Singapore as an international road. Route 407 is the connecting road between Hat Yai and Songkhla.

2.2 Socio-Economic Conditions

2.2.1 Past Growth and Structural Changes

Thailand achieved a remarkable economic growth during 1960's and 1970's. Average GDP growth rate was 8.4% p.a. during the 60's, and 7.2% during the 70's. In terms of the average growth rate of per capita income, 4.7% p.a. had been realized between 1960 and 1980. This record was exceeded only by Korea in this region.

This rapid economic growth was accompanied by similarly rapid transformation in the economic structure. The share of agriculture in GDP declined from 40% in 1960 to 25% in 1980, while the shares of industrial sector and service sector grew. In absolute terms, however, the growth of agricultural production was also remarkable. Thailand's economic growth in the 60's and 70's had been based on rapid expansion in all three sectors of agriculture, industry, and service, with industry growing the fastest.

The expansion of international trade also contributed to the structural changes in the economy. The percentage of imports to GDP grew by 10% to reach 30%, and that of exports by 7% to 25% in 1980. Thailand became much more sensitive to the international economic environment.

The above transformation, however, occurred without equivalent changes in population distribution. Three quarters of the labour force still remained in agriculture, and well over 80% of population remained in the rural areas. Except for Bangkok no rapid urban growth took place, and Thailand by and large remained very much an agrarian society. (See Table 2.2.1)

Table 2.2.1 Thailand, Selected Statistics

Description	1960	1970	1986
Area (000 km ²)			
Total	514.0	514.0	514.0
Agricultural	129.5	141.2	182.8 ¹⁾
GNP Per Capita (US\$)	110.0	250.0	860.0 ¹⁾
Population (000)	27,563.0	35,633.0	52,654.0
Population Growth Rate (% p.a.)	2.7	3.0	2.0
Urban Population (%)		22.5	28.2

Note: 1): For 1984

Source: NESDB and World Bank Development Project 1986, World Bank

2.2.2 Current Position and Future Prospects

The period of very high economic growth ended with the coming of the second oil shock of 1979. GNP growth rates of subsequent years are 5.8% in 1980, 6.3% in 1981, 4.1% in 1982, 5.8% in 1983, 6.2% in 1984, 4.0% in 1985 and 4.3% in 1986, a decrease of 2% from the average growth rate during 1970's, reflecting the worsened international economic environment.

Despite the slowdown in overall expansion of the economy, structural changes have continued. The share of agricultural sector in GDP has declined to 17.4% by 1985, becoming smaller than the manufacturing sector (19.8%) and the retail sector (18.2%). Table 2.2.2 and Table 2.2.3 show GDP and its components by sector in current prices and in constant prices.

Regional disparity has continued to worsen, particularly between Bangkok and the rest of the country. In 1983, 44% of GDP were produced in the Bangkok Metropolitan Region. The figure was 34% in 1970. More than half of the growth in GDP between 1970 and 1983 were provided by BMR. Economic development of provinces has been recognized as a top priority task by policy planners.

In order to maintain appropriate economic growth and to coordinate harmonious development in all sectors and regions of the Kingdom, the Government has proclaimed 5-year plans several times in the past, in which strategies and policies are announced to achieve the goals and objectives of the plan. Currently, the Sixth 5-Year Plan (1987-1991) is starting. This identifies among others such major problems as unstable external financial position, creation of employment opportunities, variety of agricultural productions for marketing, use of private enterprise and giving priority to small or intermediate scale projects, etc.

The National Economic and Social Development Board (NESDB) made macro-economic projections during the course of the preparation of the Sixth Plan. Table 2.2.4 summarizes their forecasts. Thai economy is expected to grow at a rate of 4.6% per annum till 1991 and at 4.3% thereafter.

At least for the short term these projected growth rates seem achievable as there are several favorable conditions for Thailand. They are:

- a) Competitiveness of Thai products which seem to gain strength in the international market, and the export sector would serve to lead the economy;
- b) Investment climate in Thailand has come to be seen as one of the best in the region in comparison with other countries. This coupled with Japanese manufacturer's relocation effort to escape the burden of highly appreciated yen, substantial foreign investments are expected;
- c) Energy cost are expected to remain low for some time;
- d) The Government's prudent external debt and other fiscal policies are expected to continue.

Table 2.2.2 Gross National Product and National Income at Current Market Prices by Industrial Origin

(Millions of Baht)

Industrial Origin	1981	1982	1983	1984	1985
Agriculture	187,886	188,742	204,443	193,438	182,279
Crops	138,886	139,852	149,973	141,690	132,557
Livestock	24,727	23,608	28,840	26,328	23,906
Fisheries	13,183	14,150	14,466	13,146	12,651
Forestry	11,090	11,132	11,164	12,274	13,165
Maning and quarrying	13,373	14,807	16,480	21,291	29,279
Manufacturing	158,272	164,659	176,200	196,793	207,691
Construction	42,008	43,040	47,129	52,772	53,758
Electricity and water supply	10,743	14,454	16,319	18,884	21,645
Transportation and Communication	57,281	63,133	73,708	83,588	96,254
Wholesale and retail trade	150,293	159,849	165,812	181,993	190,676
Banking, insurance and real estate	52,025	61,021	71,722	80,577	89,751
Ownership of dwellings	8,411	9,912	11,210	12,337	13,706
Public administration and defence	30,645	37,349	42,551	43,182	47,058
Services	75,229	89,170	98,680	106,704	115,467
Gross domestic product, (GDP)	786,166	846,136	924,254	991,559	1,047,564
Plus: Net factor income from the rest of the world	-21,787	-26,376	-25,370	-31,776	-37,081
Gross national product, (GNP)	764,379	819,760	898,884	959,783	1,010,483
Less: Indirect taxes less subsidy	79,879	83,904	100,947	-111,397	114,246
Provision for consumption of fixed capital	59,259	65,649	73,386	81,773	89,679
National income, (NNP)	625,241	670,207	724,551	766,613	806,558
Per capita GNP (BAHT)	16,096	16,906	18,174	19,044	19,697

Source: NESDB

Table 2.2.3 Gross National Product at 1972 Prices by Industrial Origin

Industrial Origin	(Millions of Baht)				
	1981	1982	1983	1984	1985
Agriculture	77,701	78,502	81,449	85,902	87,897
Crops	58,528	59,904	61,919	65,518	66,696
Livestock	9,500	9,897	10,332	10,781	11,088
Fisheries	6,777	6,019	6,568	6,862	7,290
Forestry	2,896	2,682	2,630	2,741	2,823
Maning and quarrying	4,623	4,431	4,414	5,415	6,011
Manufacturing	64,490	67,317	72,252	77,081	78,921
Construction	15,500	15,097	15,927	17,680	17,603
Electricity and water supply	6,330	6,755	7,348	8,088	8,875
Transportation and Communication	20,209	21,715	23,290	24,605	26,242
Wholesale and retail trade	51,103	52,789	55,076	57,430	59,497
Banking, insurance and real estate	19,197	21,396	24,238	26,994	29,388
Ownership of dwellings	4,723	4,936	5,178	5,369	5,594
Public administration and defence	13,192	13,833	14,498	14,106	14,873
Services	34,202	37,261	39,276	41,536	43,854
Gross domestic product, (GDP)	311,270	324,032	342,946	364,206	378,756
Plus: Net factor income payment from the rest of the world	12,986	14,910	14,080	17,372	17,702
Gross national product, (GNP)	298,284	309,122	328,866	346,834	361,054
Per capita GNP (BAHT)	6,281	6,375	6,649	6,882	7,038

Source: NESDB

Table 2.2.4 GDP Forecasts 1986 - 2001

1972 Prices: Billion Baht

	Billion baht 1972 prices			% growth per annum	
	1986	1991	2001	1986-91	1991-2001
Agriculture	88.4	100.9	129.8	2.7	2.6
Manufacture	82.1	109.4	188.8	5.9	5.6
Services	45.3	59.4	97.3	5.6	5.1
Other sectors	179.1	224.8	337.5	4.7	4.1
Total GDP	394.9	494.5	753.4	4.6	4.3

Source: NESDB

2.3 Transport System

2.3.1 Road Transport

The impressive economic growth of Thailand since 1960 has been matched by the improvements in its highway network. The total length of paved roads expanded rapidly from an estimated 8,500 km in 1962 to 130,000 km in 1980, consisting of 14,000 km of national highways, 30,000 km of provincial highways and 85,000 km of rural roads. The vehicle fleet has also grown from 300,000 to about 2 million over the same period. Today, all major cities are interconnected by primary highways with a design speed of 80-100 km/h, and remaining provincial capitals connected by secondary highways with a design speed of 70-90 km/h. Fig. 2.3.1 shows the national and provincial road networks in Thailand.

2.3.2 Rail Transport

The State Railways of Thailand (SRT) runs 3,735 km-route of rail operations, all of which, except for 90 km, are on single track. Electrification has not been made for any of the sections. Passenger fares and freight rates are subsidized and SRT has accumulated heavy losses in recent years. Fig. 2.3.2 shows the railway network.

2.3.3 Waterway Transport

The inland waterway transport, once the only transport means of significance, has lost its importance to railways and then to highways. However, inland waterways are still used up to 500 km upstream from the sea. Work is underway to maintain the depth of waterways and to construct an inland port at Nakhon Sawan. Fig. 2.3.3 shows the navigable waterways.

Coastal shipping is important to the Southern Region. A deep seaport is under construction in Songkhla and another in Phuket. Fig. 2.3.4 shows the important ports. Ocean shipping is primarily handled by the Bangkok Port. A deep seaport at Sattahip has not been fully utilized. Ports in the South handle certain amounts. Fig. 2.3.4 shows important ports and shipping routes. A deep seaport at Laem Chabang was recently approved for construction. Another industrial port at Mab Ta Phud (Rayong) has not been given official approval.

2.3.4 Air Transport

Thailand maintains 4 international airports at Bangkok, Chiang Mai, Hat Yai, and Phuket, and 30 domestic airports throughout the country. Domestic aviation is primarily carried by Thai Airline. It has shown two digit growth rates in recent years. Fig. 2.3.5 shows locations of airports.

2.3.5 Current Situation in Freight Transport

Investment in the road transport sector has been heavy despite the Government's re-emphasis on energy saving since the oil shock of 1979. The central government's investment alone amounted to 8 billion Baht per year in the last 5 years. Private sector must have spent around 5 billion Baht in purchasing new trucks. Both combined, the road transport sector must have received more than 10 times of investment than the government investment in the State Railway of Thailand, which constitutes all investments in the rail sector. Thus the road sector has come to dominate the competition on a national scale. Table 2.3.1 shows preliminary estimates of freight tonnage and ton-km figures for each mode. The road transport sector share at present is 84% in

tonnage and 70% in ton-km. The rail transport sector share, in contrast, is only 12.5% in tonnage and 22% in ton-km. Figures for the road transport include only freight in and out of Bangkok. Actual share of the road sector could well be higher.

These national figures, however, hide important transport characteristics for individual commodities or for particular corridors. For example, figures for coastal shipping are entirely for the corridor between Bangkok and the South. For this corridor coastal shipping is quite important.

Fig. 2.3.1 Highway Map of Thailand

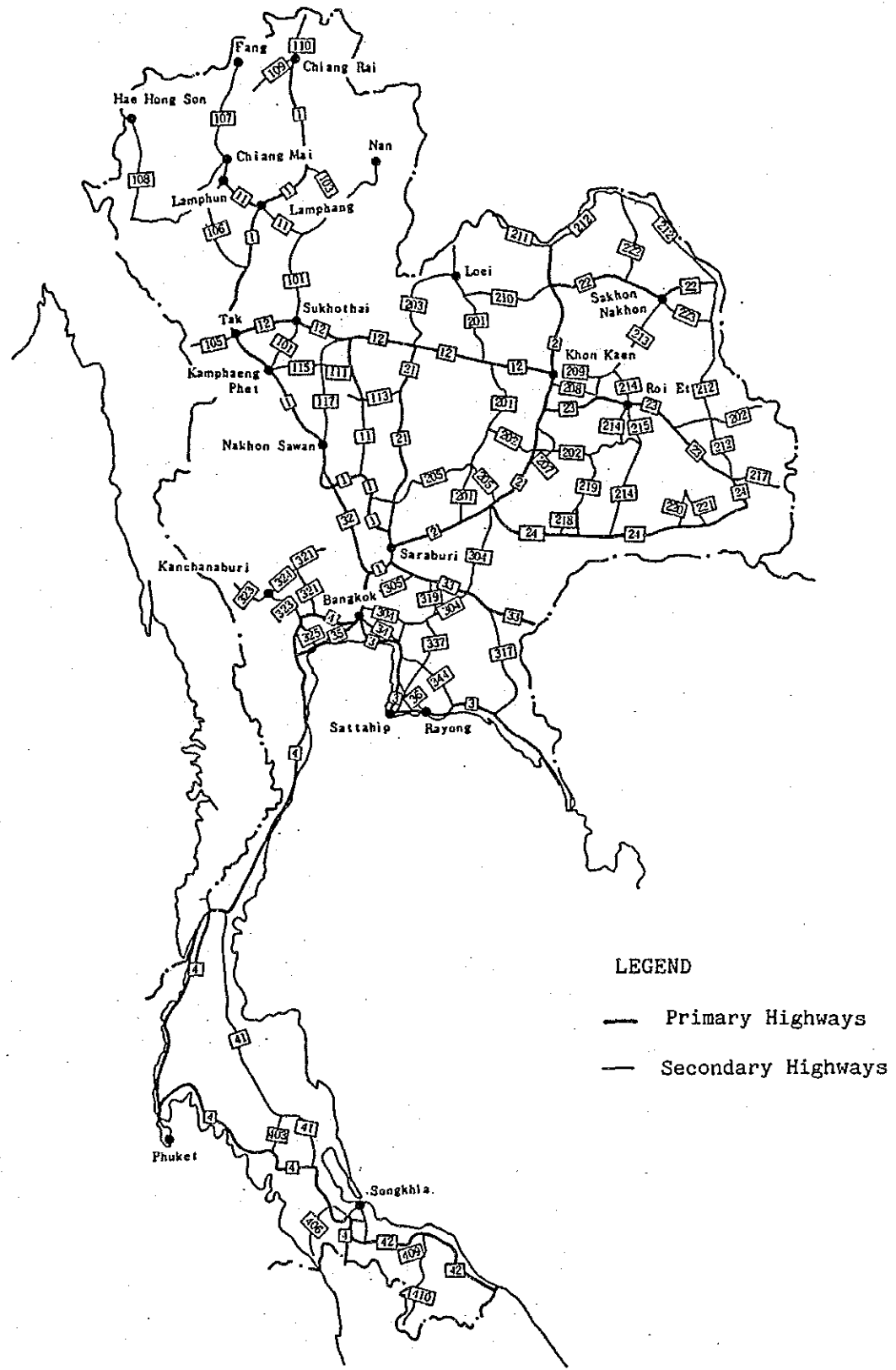


Fig. 2.3.2 Map of the State Railways of Thailand

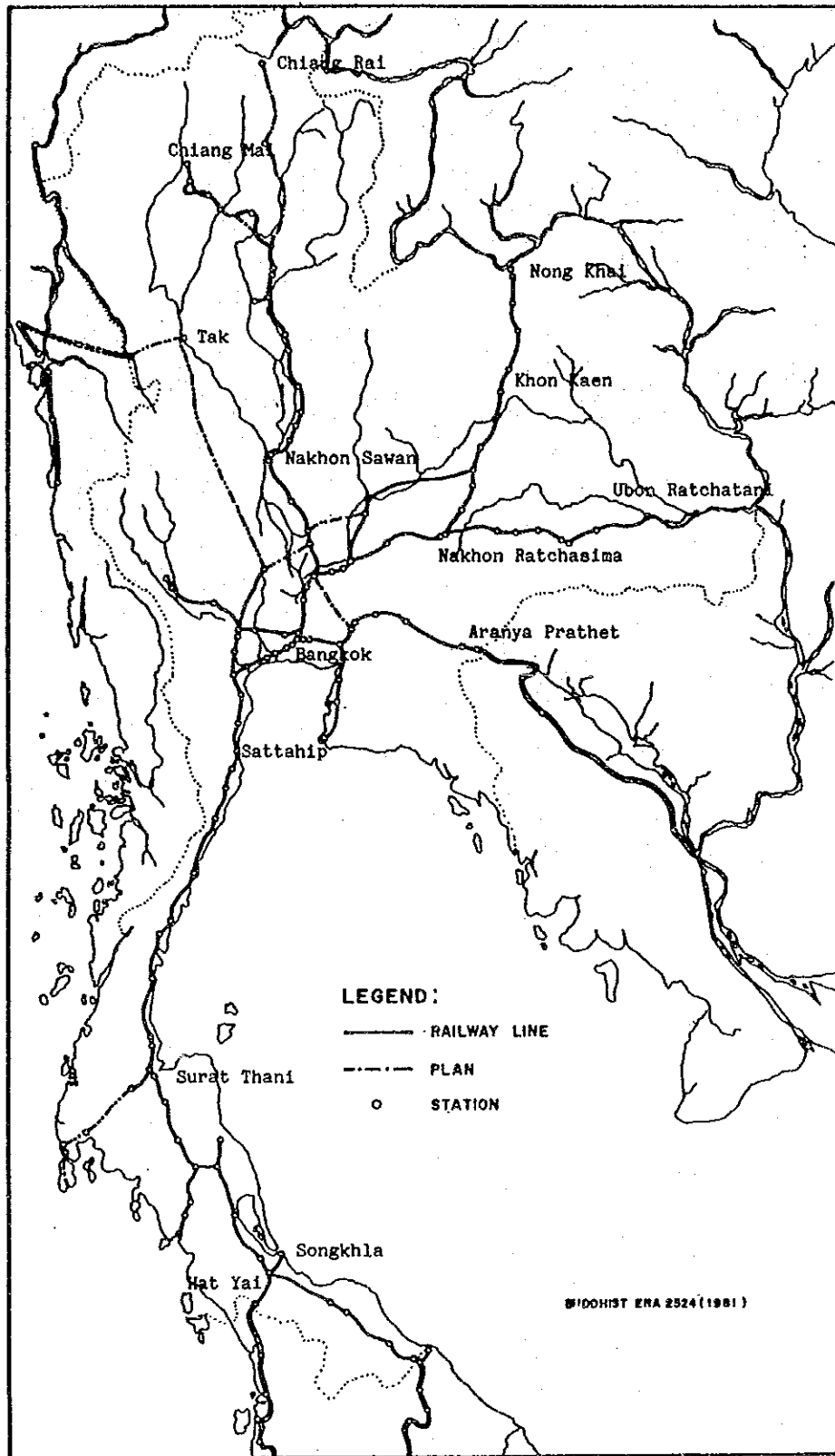
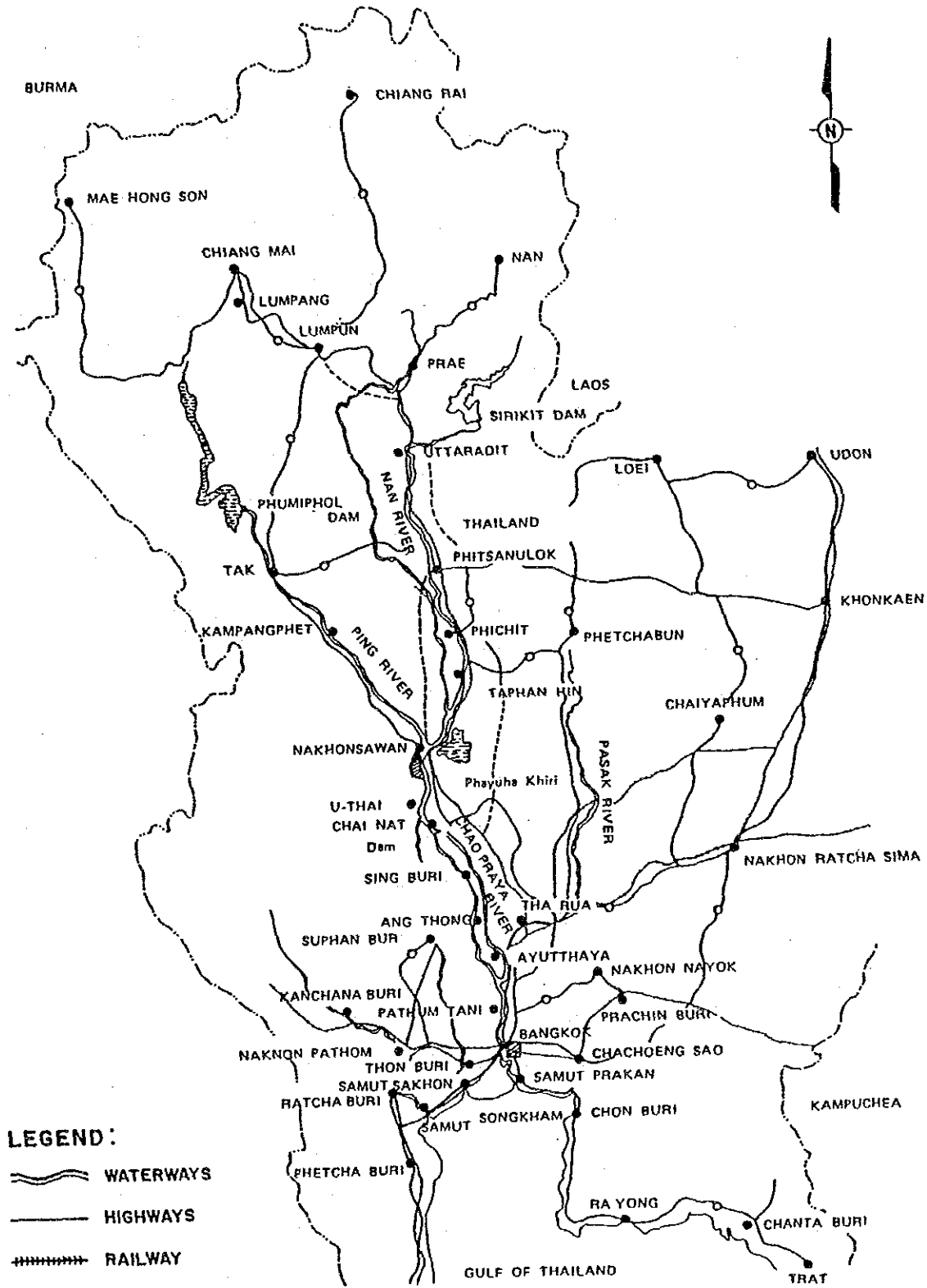


Fig. 2.3.3 Location Map of Inland Waterways



Source: Harbour Department

Fig. 2.3.4 Maritime and Coastal Port Network

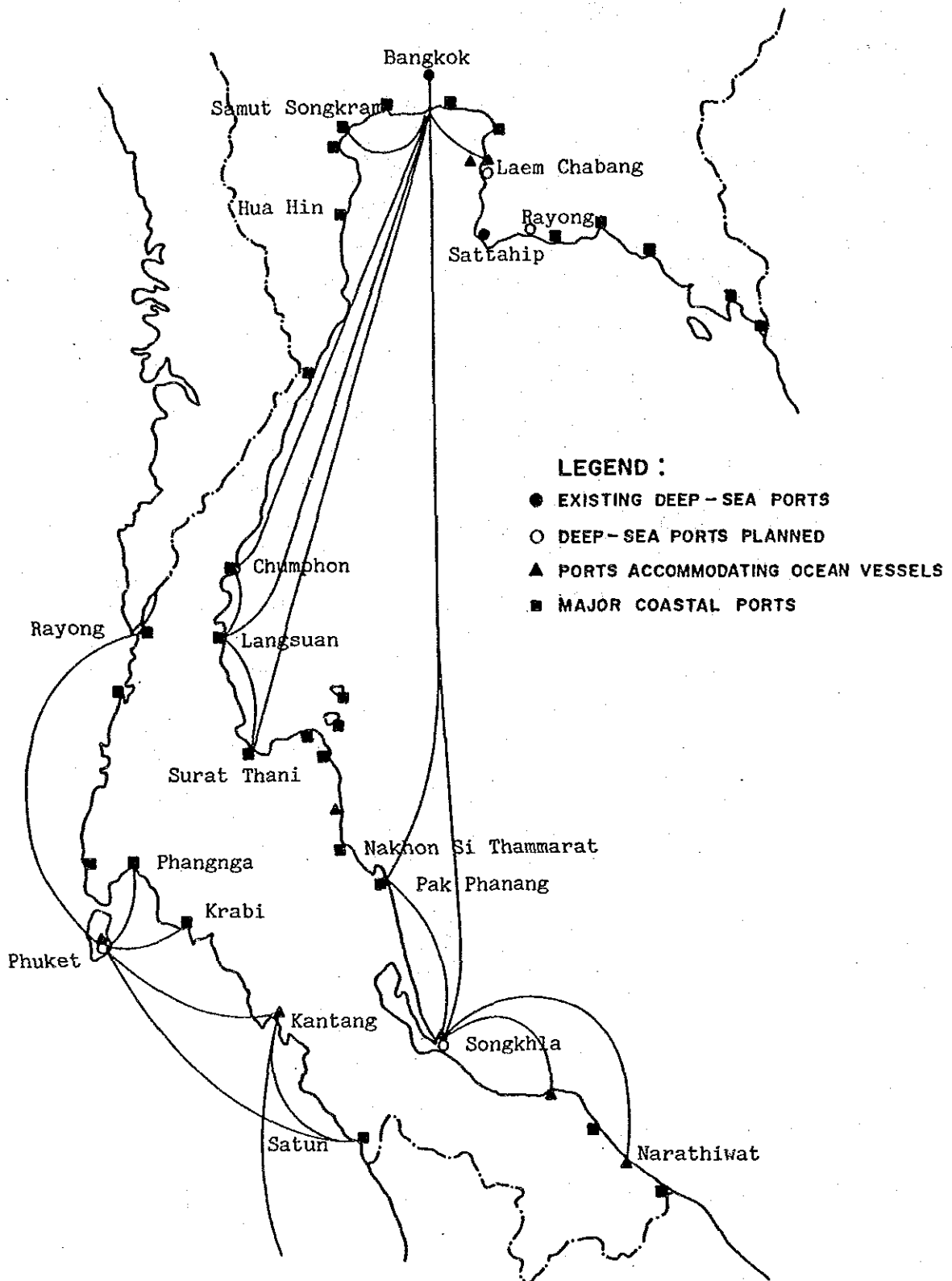


Fig. 2.3.5 Location Map of Airports

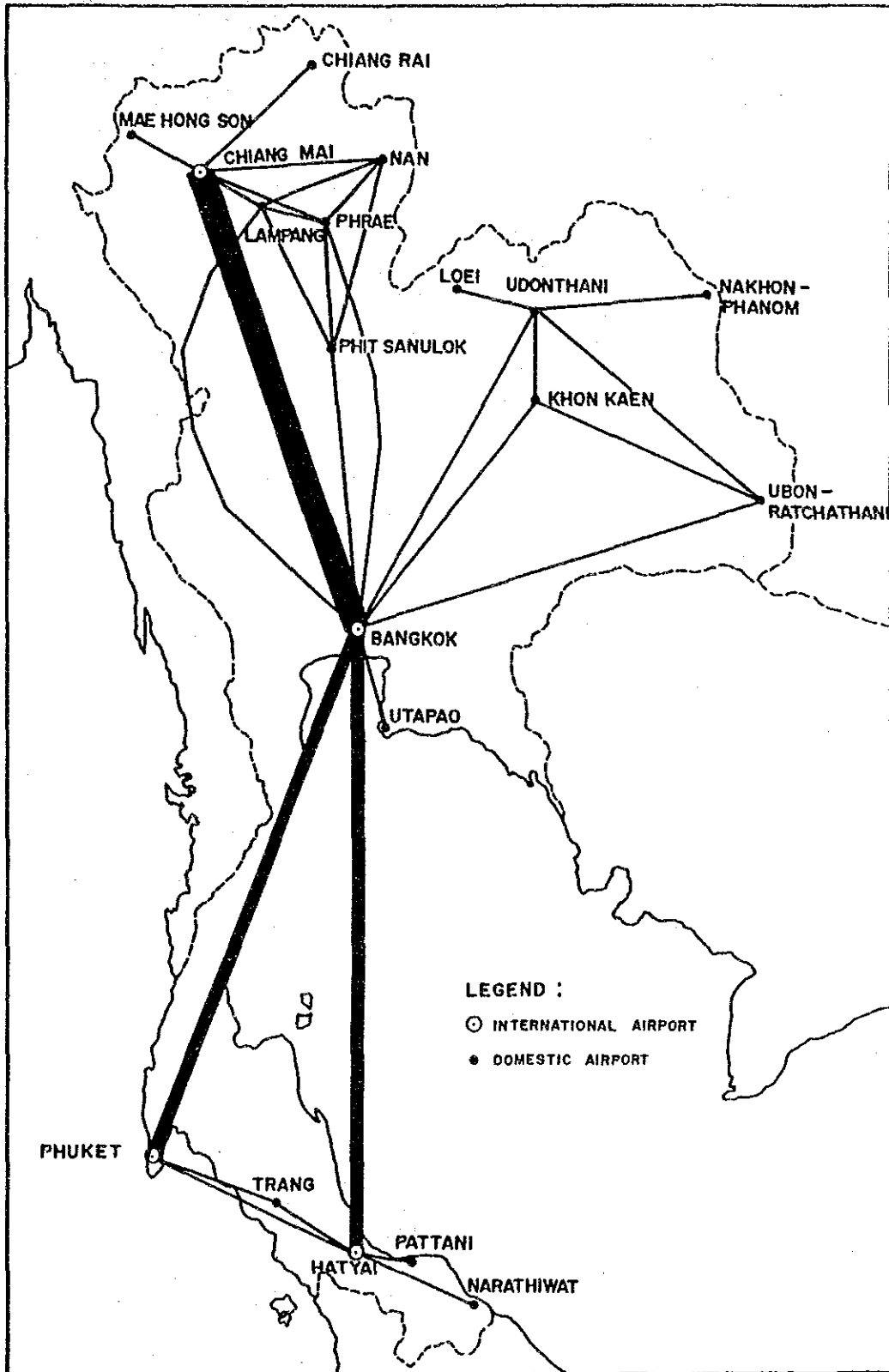


Table 2.3.1 Freight Transport Modal Split

	1] Road	2] Rail	3] Inland Waterway	4] Coastal Shipping	5] Domestic Air	Total
Tons (000)	38375	5726	166	1475	4	4574
(%)	83.4	12.5	0.4	3.2	.0	100.0
Ton-km (million)	8982	2869	17	960	2	1283
(%)	70.0	22.4	0.1	7.5	.0	100.0
Average Haul (km)	234	501	105	650		

- NOTE:
- 1] In and out of Bangkok only, 1984
 - 2] Whole System, 1984
 - 3] Average of estimates from surveys in 2 seasons, average haul estimated in 1983
 - 4] 1982, average haul estimated
 - 5] 1984

Aource: Annual Transport Statistics, 1985, Transport and Communications Economics Division, Ministry of Communication

CHAPTER 3

SUMMARY OF FINDINGS OF COMMODITY FLOW SURVEYS



CHAPTER 3 SUMMARY OF FINDINGS OF COMMODITY FLOW SURVEYS

3.1 General

The Study Team conducted two kinds of survey in the Project Cities in order to obtain the existing situation of commodity transport and companies which were in charge of actual cargo transportation in the five Project Cities. One of them was the interview survey for private companies to get qualitative cargo flow of each Project City conducted in January and February, 1987. Summary of results of this survey are presented in Section 3.2. And another is the road side origin and destination survey (O/D survey) of cargo to get quantitative cargo flow of whole Thailand and each Project City. Summary of results of this O/D survey is presented in Section 3.3.

These surveys and analysis results are reflected in the studies of commodity flow characteristics in Thailand and demand for regional truck terminals described in Chapters 5 and 6.

3.2 Interview Surveys

This Section focuses to summarize the results of the interview surveys which the Study Team had conducted on private companies such as shippers, trucking companies and warehousing companies in the five Project Cities.

The details of results of the interviews are included in Chapter 3 of Progress Report I.

3.2.1 Introduction

1) Outline of the Interview Surveys

a) The Purpose of the Interview Surveys

The purpose of the interview surveys is to observe the actual situation and activities of the private companies regarding cargo transportation, and also to examine characteristics of their activities and the problems they face in cargo transportation and handling.

b) Choice of the Interviewees

Each interviewee was selected and arranged to hold interviews by each local LTD office, on condition that the interviewees were typical and of representative companies in the respective Changwats.

The number of interviewed companies are shown in Table 3.2.1.

Table 3.2.1 Number of the Interviewees

Company	Chiang Mai	Khon Kaen	Nakhon Sawan	Nakhon Ratchasima	Hat Yai	Total
Shipper	4	3	3	1	1	12
Trucking Company	6	2	2	5	4	19
Warehousing Company	-	1	-	-	1	2
Total	10	6	5	6	6	33

The interview itinerary is shown in Table 3.2.2 below.

Table 3.2.2 Interview Itinerary

Changwat	Interview Term
Chiang Mai	Jan. 25 - Jan. 27
Khon Kaen	Feb. 2 - Feb. 4
Nakhon Sawan	Feb. 5 - Feb. 6
Nakhon Ratchasima	Feb. 6 - Feb. 7
Hat Yai/Songkhla	Feb. 9 - Feb. 11

Interview items and the list of the interviewees are shown in Appendices 3.1 through 3.12. The interviewees' locations are shown in Appendices 3-1 through 3-5 of Progress Report I.

3.2.2 Results of Interview Surveys

In this Sub-Section, the results of the interview surveys are described regarding both characteristics of activities and problems of transportation of the companies.

1) Shippers

a) Chiang Mai

The four shippers interviewed are a wholesaler, a wholesaler/maker, and two makers. The shippers are described in Table 3.2.3. The following summarize characteristics and problems which the shippers have.

i) Characteristics

The characteristics of the four shippers are summed up into three points as follows:

The first point is that the shippers in Chiang Mai handle agricultural products, such as fruits and vegetables, and some manufactured goods such as handicrafts, ready-made garments and wooden antiques.

Table 3.2.3 indicates that over 90 percent of the total cargo are transported to Bangkok, and some of the manufactured goods are subsequently exported to Japan and European countries.

Secondly, export products, such as handicrafts, wooden antiques and ready-made garments seriously require to be handled by experienced international forwarders because those products are relatively high-priced and fragile.

Thirdly, the makers are principally maintained by employing skilled labors at a cheap cost.

Table 3.2.3 Description of the Shippers in Chiang Mai

Company	Type of Business	Principal Commodities	Destination	Volume (tons/year)	Remarks
A	Wholesaler	Fresh & Dried Garlic	Wholesaler in BKK	4,000 (100%)	
B	Wholesaler /Maker	Ready-made Garment	Exporter in Bangkok	450 (50%)	to Japan
			Local Consumption in Bangkok	225 (25%)	
		Handicraft	Local Consumption in Chiang Mai	225 (25%)	
			Exporter in Bangkok	900 (100%)	
C	Maker	Celedonwares	Bangkok	200 (100%)	
D	Maker	Wooden Antiques	Exporter in Bangkok	1,000 (50%)	to Europe
			Retailer in Bangkok	600 (30%)	
			Local Distribution	300 (15%)	
			Retailer & Factory in Chiang Mai	100 (5%)	

ii) Problems on Transportation

The problems on transportation which the shippers seriously face are as follows:

- Although, a fresh garlic which is a perishable commodity, needs quick and punctual delivery, it is sometimes forced to be delayed due to the restriction of truck operation in Bangkok.
- Some shippers seem to consider that door-to-door services can prevent their products from breakage because the shippers are suffering from breakage of their products caused by frequent rehandling during transportation, especially in the case of manufactured goods.
- High level transportation services are required for the export-oriented manufactured goods.

b) Khon Kaen

The Study Team interviewed three shippers concerning a tapioca pellet mill, a tapioca flour mill, and a rice mill, which are considered as typical industries in this Region.

i) Characteristics

The characteristics of the shippers in Khon Kaen are generally as follows:

Firstly, the principal product items are tapioca pellet and tapioca flour. As shown in Table 3.2.4, approximately 80% of the total cargo volume consists of tapioca pellet and flour, of which 60% is tapioca pellet and 20% is tapioca flour.

Table 3.2.4 Description of the Shippers in Khon Kaen

Company	Type of Business	Principal Product	Destination	Volume (tons/year)	Remarks
A	Tapioca pellet mill	Tapioca pellet	Ayutthaya Bangkok	40,000 10,000	Tapioca pellet is mainly exported to Europe as cattle feed.
		Maize & others	Ayutthaya Bangkok	8,000 2,000	
B	Rice mill	Tapioca pellet	Ayutthaya Pathumthani	16,000 4,000	
		Rice	Khon Kaen Bangkok	2,400 600	
		Jute	Udonthani Pathumthani	4,000 1,000	
C	Tapioca flour mill	Tapioca flour	Bangkok	20,000	70% (14,000 t) for export to Europe
		Rice	Bangkok	5,000	
			Hat Yai	2,000	

Secondly, the shipping volume of the shippers has seasonal fluctuation. As shown in Table 3.2.5, the peak season of the shipment is in the dry season, while off-season is usually longer during rainy season.

Table 3.2.5 Seasonal Fluctuation

Period	Shipper		
	A	B	C
Peak Season	Oct. - Mar.	Sep. - Apr.	Oct. - Dec.
Off Season	Apr. - Sep.	May - Aug.	Jun. - Aug.

Third characteristic is that the shippers' own trucks are used to transporting their tapioca products to Bangkok, and sometimes these trucks carry general cargo from Bangkok to Khon Kaen when return-haul cargo is arranged or found.

ii) Problems on Transportation

The shippers are suffering from a big volume gap caused by the seasonal fluctuation because they cannot provide sufficient number of trucks for hauling of the large volume of their products in the peak season.

c) Nakhon Sawan

i) Characteristics

The characteristics of the shippers which treat a rice mill, a soft drink bottling factory and a fish sauce factory are summarized as follows:

First, as shown in Table 3.2.6, rice produced in the rice mill amounts 20,000 tons per year and 90% of that is transported to Bangkok not only by trucks of common carriers but also by barges down the Chao Phraya River.

The soft drink bottling factory delivers the products of 33 truckloads to more than 20 Changwats in the Northern Region, such as Chiang Mai, Lampang etc., by its own trucks everyday.

Table 3.2.6 Description of the Shippers in Nakhon Sawan

Company	Type of Business	Principal Product	Destination	Volume (tons/year)	Remarks
A	Rice mill	Rice	Bangkok Nakhon Sawan	18,000 2,000	By trucks and barges
B	Bottling company	Soft drink	More than 20 Changwat in the Northern Region (ex. Chiang Mai, Lampang etc.)	33 trucks/day	
C	Fish sauce factory	Fish sauce	Chiang Mai Chiang Rai Bangkok etc.	3-4,000 dozens/day (750cc/bottle)	Mostly delivered to the Northern Region

The bottled fish sauce are mainly transported to customers in the Northern Region, and the empty bottles are collected back by the factory's own trucks as well.

ii) Problems on Transportation

As for the problems on transport, the three shippers disclosed that they did not have any serious problems.

d) Nakhon Ratchasima

In Nakhon Ratchasima, the Study Team interviewed only one shipper, a tapioca processing factory, which may be one of the typical industries in the Northeastern Region. It produces 100 truckloads of tapioca pellets and tapioca chips per day. The characteristics of the shipper are as follows:

Almost all tapioca pellets are carried to the tapioca silo in Ayutthaya which is owned by one of their family companies.

And the products of tapioca pellets and tapioca chips are transported from the factory using more than 100 chartered trucks. The reasons that the chartered trucks are used may be; 1) the difficulty in operating over 100 trucks with the limited number of staff for economical reasons, and 2) to prevent occasional accidents and related costs.

e) Hat Yai

The Study Team interviewed a fish export company which exports fresh fish and salted fish to Malaysia and Singapore.

Export of fish seems to be one of the typical business in the Southern Region as well as vegetables and fruits.

Characteristics of the shipper are described as follows:

First, fish packed with crushed ice in wooden boxes is mainly trucked to major cities in Malaysia and Singapore, such as Kuala Lumpur, Singapore, and Ipoh.

Secondly, because the shipper is engaged in international trade, it requires both well-qualified agents and good drivers with international drivers licence for the smooth operation of crossborder transport. Therefore, these shippers take out contracts with well experienced agents for these kind of jobs.

Table 3.2.7 Profile of the Shipper in Hat Yai

- Main Outbound Cargo:	<u>64 tons/day</u> (Total)
Fresh Fish	61 tons/day
Salted Fish	3 tons/day
- Own Trucks:	<u>20 vehicles</u> (Total)
Refrigerated Trucks	9 vehicles
Normal Trucks	11 vehicles

2) Trucking Companies

a) Chiang Mai

The Study Team interviewed six trucking companies. Profiles of the companies are shown in Table 3.2.8.

Table 3.2.8 Profiles of the Trucking Companies in Chiang Mai

Descriptions	Company					
	A	B	C	D	E	F
- Head Office or Branch	Head Office	Branch	Head Office	Branch	Branch	Branch
- Number of Employees	160-210	15	62	12	17	20
- Number of Operating Trucks	130-180	55	32	17-22	27	10
Own trucks:	30	35	6	-	27	10
4-wheel	-	-	2	-	-	-
6-wheel	30	-	-	-	7	-
10-wheel	-	35	4	-	20	10
Chartered:	100-150	20	26	17-22	-	-
4-wheel	-	-	-	2	-	-
6-wheel	100-150	-	-	-	-	-
10-wheel	-	20	26	15-20	-	-

i) Characteristics

The characteristics of the trucking companies are discussed as follows:

Two of the six companies are operated as their head office in Chiang Mai, and the others are branches which have their head offices in Bangkok and Chiang Rai. The four branches have main function as Chiang Mai side distributors of the cargo from Bangkok.

As shown in Table 3.2.8, Company A which is the largest trucking company in Chiang Mai uses 6-wheel trucks for delivery service in town as well as for transportation to/from Bangkok. The trucks number 130 to 180 consisting of 30 own trucks and 100-150 chartered trucks.

As shown in Table 3.2.8, chartered trucks play an important role in the trucking business. Especially in the cases of Companies A, C and D, the number of chartered trucks are more than their own trucks.

Cargoes to and from Chiang Mai have different features. Cargo from Chiang Mai comprises mainly of agricultural products such as fruits, vegetables and maize, which are transported principally to Bangkok. On the other hand, cargo to Chiang Mai consists of consumer goods, fertilizer and construction materials as shown in Table 3.2.9.

Table 3.2.9 Cargo Transport to Chiang Mai

Company	Cargo Item	Volume (tons/year)
A	Spare Parts Fertilizer Feedstuff Oil Miscellaneous	18,000
B	Construction Materials Consumer Goods Electrical Appliances	24,000
C	Clothes Electronic Appliances	16,000
D	Consumer Goods	n.a.
E	Shoes Clothes Miscellaneous	12,000
F	Consumer Goods	n.a.

ii) Problems of Trucking Companies

The problems pointed out by the companies interviewed are as follows:

- Low freight rates due to strong competition of trucking companies,
- High wages of drivers,
- Damage to cargo during transport,
- Cargo pilferage,
- Limitation of delivery time of heavy trucks due to traffic restriction time (6:00-9:00 & 15:00-18:00) in Bangkok

b) Khon Kaen

The Study Team had interviews with two trucking companies in Khon Kaen. Table 3.2.10 shows the profiles of the two companies. Characteristics and problems of the companies are described as follows:

Table 3.2.10 Profile of the Trucking Companies in Khon Kaen

Descriptions	Company	
	A	B
Head Office or Branch	Head Office	Head Office
Number of Employees	32	9
Number of Operating Trucks:	<u>72</u> (Total)	<u>30</u> (Total)
Own truck (10-wheel)	12	5
Chartered (10-wheel)	60	25

i) Characteristics

Characteristics of the companies are summarized as follows:

Table 3.2.10 shows that chartered trucks play an important role in the trucking business in this area because the number of chartered trucks operated by both companies is more than their own trucks.

The companies depend heavily on manpower in handling cargo as one of the companies has only one forklift and another has no handling machines. That is because they can employ cheap labor.

The trucking company has two different types of contracts with shippers. One is a yearly based contract with manufacturers such as sugar and cement factories which give the trucking companies daily and regular transport assignments throughout the year. Another contract is a shipment contract on irregular schedules with shippers of agricultural products, such as for tapioca pellets.

ii) Problems of Trucking Companies

One of the two companies complains that freight rates are too low to reinvest in the trucking business due to competition among trucking companies.

c) Nakhon Sawan

Two trucking companies were interviewed in Nakhon Sawan. Table 3.2.11 shows the profile of the two companies.

Table 3.2.11 Profile of the Trucking Companies in Nakhon Sawan

Descriptions	Company	
	A	B
Head Office or Branch	Branch	Head Office
Number of Employees	55-65	25
Number of Operating Trucks:	<u>37</u> (Total)	<u>13</u> (Total)
- Own truck		
4-wheel	5	13
10-wheel	32	-

Note: Company B has 3 front-load tricycles.

i) Characteristics

The typical characteristics of the trucking companies are as follows:

Table 3.2.11 mentions that the trucking companies operate their own trucks for transport and use no chartered trucks. It is different from the trucking companies interviewed in other project Changwats.

The companies employ front load tricycles for delivery within the city.

As shown in Table 3.2.12, main cargo transported from Nakhon Sawan to Bangkok are agricultural products, while the return-haul cargo from Bangkok are general cargo and electrical appliances.

A distribution pattern of general cargo is different from that of electrical appliances. General cargo from shippers are transferred from heavy trucks to light trucks for delivery at the trucking companies and delivered to shops in Nakhon Sawan during the same day. On the other hand, electrical appliances are first transported from factories by the trucking company and stored in the godown of the trucking companies. And then, they are picked up by the consignees.

ii) Problems of Trucking Companies

The problems pointed out by the trucking companies are as follows:

- Low freight rates
- Necessity to employ skilled drivers for careful transport of expensive electrical appliances (Company A)

Table 3.2.12 Cargo Volume between Nakhon Sawan and Bangkok

Descriptions	Company	
	A (tons/year)	B (tons/year)
from Nakhon Sawan:		
Rice	8,500	} 12,000
Maize	n.a.	
Beans	-	
Sugar	8,500	
Tapioca	8,500	
to Nakhon Sawan:		
General Cargo	} 60,000	12,000
Electrical Appliances		

d) Nakhon Ratchasima

The Study Team interviewed five trucking companies in Nakhon Ratchasima. Table 3.2.13 shows the profile of the companies.

Table 3.2.13 Profile of Trucking Companies in Nakhon Ratchasima

Descriptions	Company				
	A	B	C	D	E
Head Office or Branch	Head Office	Head Office	Head Office	Head Office	Head Office
Number of Employees	7	19	40	8	4
Number of Operating Trucks:					
(Total)	29	26	97	16	41
Owned:	29	26	17	16	7
4-wheel	4	4	-	1	-
10-wheel	25	22	17	15	7
Chartered:	-	-	80	-	34
4-wheel	-	-	-	-	-
10-wheel	-	-	80	-	34

i) Characteristics

As shown in Table 3.2.13, these companies use mainly 10-wheel trucks but the type of chartered trucks are different from one company to another.

Table 3.2.14 shows that cargo from Nakhon Ratchasima, principally tapioca pellets and tapioca flour, are transported for the major part to Bangkok and partially to Ayutthaya. On the contrary, cargoes transported to Nakhon Ratchasima comprise construction materials, agricultural products and consumer goods from Bangkok and Saraburi.

Table 3.2.14 Cargo from and to Nakhon Ratchasima

Company	from Nakhon Ratchasima			to Nakhon Ratchasima		
	Item	Destination	Volume (tons/year)	Item	Origin	Volume (tons/year)
A	Tapioca pellet Tapioca flour Miscellaneous	Bangkok	6,000	n.a.	n.a.	n.a.
B	Tapioca pellet Tapioca flour	Bangkok	28,000	Consumer goods Steel	Bangkok	1,800
C	Tapioca pellet Tapioca flour	Bangkok, 50,000 Ayutthaya		Cement Steel	Saraburi	60,000
D	Tapioca pellet Tapioca flour Maize Jute	Bangkok	n.a.	Consumer goods	Bangkok	n.a.
E	Tapioca pellet Tapioca flour Rice Crops	Bangkok, 36,000 Ayutthaya		Fertilizer Feedstuff Consumer goods	Bangkok	n.a.

ii) Problems of Trucking Companies

All of these companies point out low freight rates as their main problem.

e) Hat Yai

The Study Team interviewed four trucking companies in Hat Yai, which are described below.

Table 3.2.15 Profile of the Trucking Companies in Hat Yai

Descriptions	Company			
	A	B ^{1),2)}	C ²⁾	D
Head Office or Branch	Head Office	Head Office	Head Office	Head Office
Number of Employees	200	87	33	163
Number of Operating Trucks:				
(Total)	72	17	65	72
Own Trucks:	72	7	45	37
4-wheel	-	-	1	8
6-wheel	6	-	2	1
10-wheel	66	7	42	28
Chartered: (10-wheel)	-	10	20	35

Notes: 1) Company B's trucks are refrigerator trucks.
2) Companies B and C are owned by same owner.

i) Characteristics

Characteristics of the trucking companies in Hat Yai are given as follows:

Two of the four companies, such as companies A and C, carry out business as agents of ETO. The former engages in transporting government issued goods such as government-supplied fertilizers to farmers as one of the agricultural policies. The latter engages in international transport to Malaysia. (See Table 3.2.16)

As shown in Table 3.2.16, the trucking companies also transport large amounts of fish and agricultural products to Singapore and Malaysia.

Company B uses refrigerator trucks for transport of perishables, fish, fruits and vegetables in order to keep the fresh condition of the cargo to Singapore because it takes about 18 hours from Hat Yai to Singapore.

Table 3.2.16 Cargo from and to Hat Yai

Company	from Hat Yai			to Hat Yai		
	Item	Destination	Volume (tons/year)	Item	Origin	Volume (tons/year)
A	Fish	Malaysia Singapore	7,500	Fertilizer	Bangkok	80,000 - 170,000
	Agricultural Chemical	Bangkok	160			
	Rubber	Export	20			
	Others	Bangkok	20			
B	Fish	Bangkok Singapore	350 2,200	Fish	Singapore	50
	Fruit	Singapore	3,600			
	Vegetable	Singapore	1,400			
C	Rubber	Bangkok	30,000	Painting ink	Malaysia	250
	Crops	Malaysia	60,000	Flour	Malaysia	250
	Machinery	Malaysia	14,000			
	General cargo	Malaysia	18,000			
D	Rubber	Bangkok	12,000	Textile	Bangkok	22,500
	General cargo	Lower South	21,000	General cargo	Bangkok	7,500
				Const. materials	Bangkok	7,500

Another characteristic is that the wages of drivers and assistants engaged in international transport, as those of companies B and C shown in Table 3.2.17, are considerably higher than those of drivers and assistants in charge of domestic transport in Hat Yai, and those of drivers (B1,000 - 2,800/month) and assistants (B600 - 1,500/month) in other Project Cities.

Table 3.2.17 Labor Wages of Trucking Companies in Hat Yai

	A	B	C	D
Driver	1,000 B/month plus 60 B/trip	5,000 B/month plus 1,500 B/ trip	5,000 B/month plus 600 B/ trip	1,500 B/month plus 600 B/ trip
Assistant	700 B/month plus 40 B/trip	3,500 B/month plus 1,500 B/ trip	3,500 B/month plus 600 B/ trip	1,000 B/month plus 600 B/ trip

ii) Problems of Trucking Companies

The problems the companies stated are as follows:

- The companies operating international transport have to pay high wages to their drivers who engage in international transport since they have strong bargaining power over wage settlement.
- Decreasing freight rates because of the strong competition among the trucking companies.

3) Warehousing Companies

The Study Team had interviews with warehousing companies in Khon Kaen and Hat Yai.

a) Khon Kaen

One warehousing company was interviewed in Khon Kaen and its character is as follows:

- i) The main storage items are agricultural products such as rice, jute, maize and tapioca.
- ii) The warehousing company interviewed is considered as one of the typical warehouses in rural areas, and this company keeps commodities temporarily until their prices become attractive enough for the company to sell to dealers or exporters in Bangkok.

b) Hat Yai

The warehousing company interviewed in Hat Yai is a sister company of the trucking company A in Hat Yai mentioned above.

Principal business of the company is to store the government-supplied fertilizer which are brought into the warehouse and afterwards delivered by the trucking company A.

The company now uses no handling machines and depends entirely upon manpower in handling cargo. They, however, are planning to install belt conveyers in the future.

3.3 Commodity Flow Surveys

This Section describes the summary of the Commodity Flow Surveys.

The purpose of commodity flow survey is not solely to determine the pattern and volume of commodities transported but also to detail the flows that would use the regional truck terminals.

Commodity flows to and from Bangkok have been regularly surveyed by LTD and the results are available in the form of annualized figures. Therefore, in this study, the commodity flow survey was especially conducted to collect data on commodity flows around each project city.

The commodity flow survey comprised "Roadside Interview" and "Manual Traffic Counts". The survey covered a longer survey hours for locations where many long distance haulages were expected.

3.3.1 Field Surveys

1) Survey Location and Period

After field reconnaissance, survey points were determined taking items below into consideration.

- Traffic volumes (DOH Records)
- Highway network (linkage to other Changwats)

Twenty two survey points were established as shown below.

Table 3.3.1 Number of Survey Points

Changwat	Number of Survey Points
Nakhon Sawan	3
Chiang Mai	6
Khon Kaen	4
Nakhon Ratchasima	4
Hat Yai/Songkhla	5
Total	22

Survey locations are shown in Appendices 3.13 through 3.15 and the survey period is given in Appendix 3.16.

2) Interview Items

Questioned items for roadside interviews were determined taking the following into consideration.

- Usage of vehicles in Thailand
- Registration and License in Thailand
- Commodity Flow Surveys by LTD

Table 3.3.2 Interview Items

General:

Date
 Period (Time)
 Location
 Direction (in, out)

Vehicle:

Type (No. of Axles) : 4 wheel-truck, 6 wheel-truck, 10 wheel-truck,
 trailer-truck (over 10 wheels)
 *Pick-up truck (truck use)

Make : Hino, Benz, Isuzu, Toyota, Fuso, etc.

Engine Capacity : Hp, displacement

Permitted Payload : Ton (Legal gross weight minus unladen
 weight)

Ownership : Driver, Producing Company, Trucking
 Company, other agencies

Assignment of Consignment : Driver, Producer, Trucking Company,
 Trucking Association

Registration : Changwat

Age of Vehicle : Year

License : Non-Fixed Route, Private, Small Vehicle

No. of Assistants : Persons

Commodity:

Origin & Destination : Truck or Commodity, Changwat, Amphoe

Payload : Ton, Volume

Type of Commodity : See LTD category

Type of Packaging : Bulk, Bag, Container (Steel, Wooden, Carton,
 Basket)

* If necessary

3.3.2 Data Processing for Estimation of Annual Commodity Flow

Survey results were processed in order to obtain annual commodity flow data and characteristics of road transport, according to procedures shown in the flow chart. (See Fig. 3.3.1)

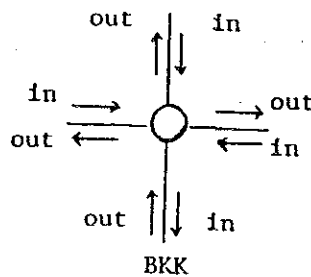
In data processing expansion factors and seasonal factors were taken into consideration to estimate annual figures. The expansion factors were applied for expansion of sampled data to daily figures and the seasonal factors were used for adjustment of seasonal variations.

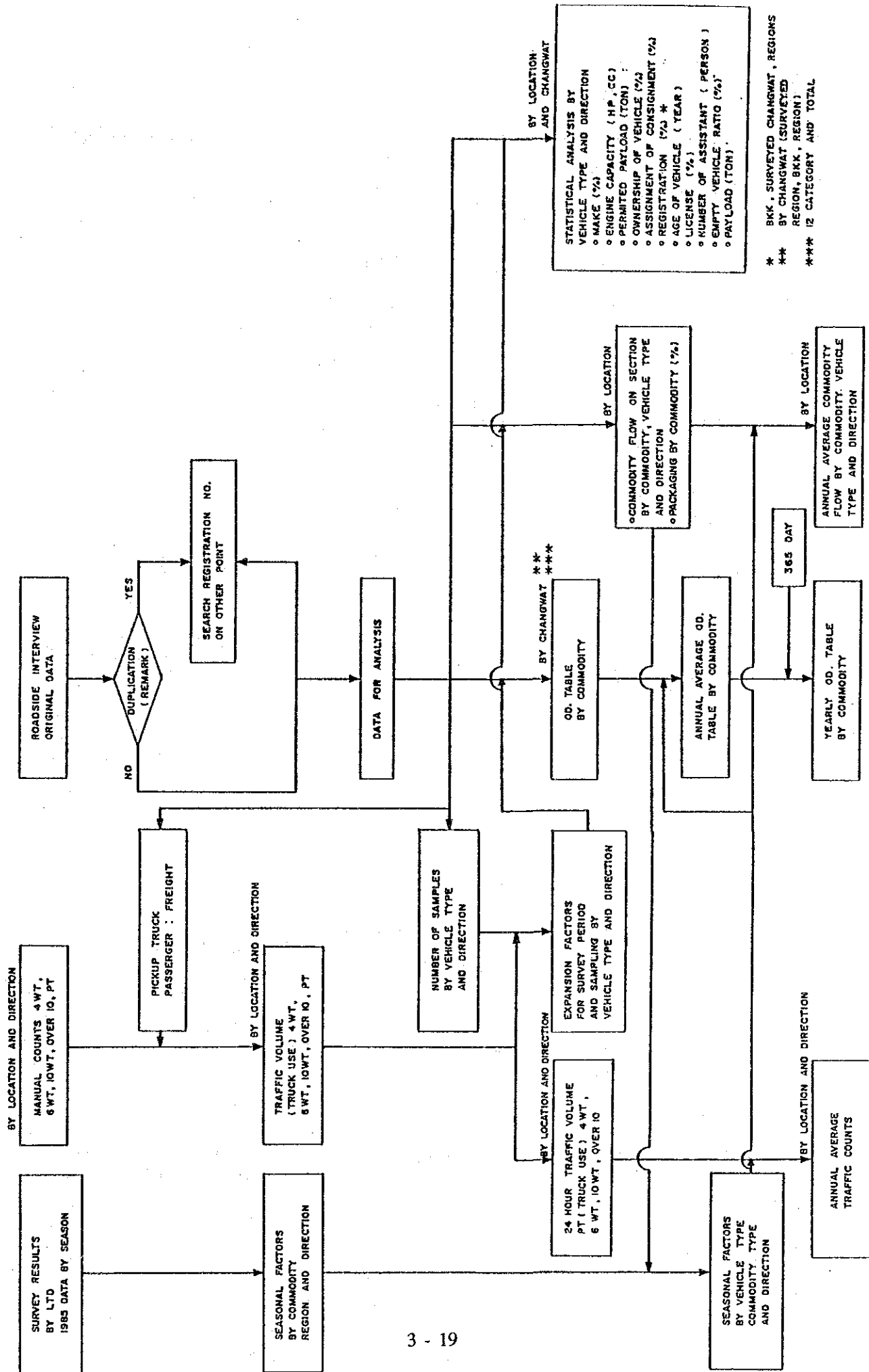
1) Expansion Factors

Expansion factors by survey points and direction (Envj) consist of survey period factor (EPnvj) and sampling factor (ESnvj).

$$\begin{aligned} Envj &= EPnvj \cdot ESNvj \\ EPnvj &= VM^*vj (24h)/Vn^*vj \text{ (Interviewed period)} \\ ESNvj &= VCnvj/VInvj \end{aligned}$$

where; Vn*vj : Traffic count at 24h surveyed point
 VCnvj : Traffic count
 VInvj : Interviewed count
 n : Survey points (*24h counts)
 v : Vehicle type
 j : Direction (BKK base)





* BKK, SURVEYED CHANGWAT, REGIONS
 ** BY CHANGWAT (SURVEYED REGION, BKK, REGION)
 *** 12 CATEGORY AND TOTAL

Fig. 3.3.1 Flow of Data Processing

2) Seasonal Factors

LTD conducts commodity flow surveys 4 times a year. The number of data records processed by season are shown below.

Table 3.3.3 Number of Data for Commodity Flow by Season (1985)

Season	Number of Record
1	218,935
2	198,504
3	204,526
4	196,512
Total	818,477

Source: LTD

Seasonal commodity flows in tonnage and percentage are shown in Appendices 3.17 through 3.22.

Seasonal factors by region and commodity type were thus prepared.

$$FQ_{rij} = Q^{T}_{rij} * 0.25 / Q^1_{rij}$$

- FQ_{rij} : Seasonal factor for commodity
- Q^T_{rij} : Yearly commodity flow quantity
- Q¹_{rij} : Commodity flow quantity in season
- r : Region
- i : Commodity type
- j : Direction

Seasonal factors for vehicle counts were also established.

$$FV_{nvj} = \frac{\sum_{i=1}^{23} IQ_{nvij} * FQ_{rij}}{\sum_{i=1}^{23} IQ_{nvij}}$$

- FV_{nvj} : Seasonal factor for vehicle counts
- IQ_{nvj} : Commodity flow by vehicle type and commodity type
- FQ_{rij} : Seasonal factor for commodity
- n : Survey points
- v : Vehicle type
- o : Commodity type
- j : Direction
- r : Region

3.3.3 Analysis of Survey Results

In this Sub-Section, the results of sampling rates, manual traffic count survey and commodity flows are discussed. (As for other items surveyed, refer to Progress Report I.)

1) Sampling Rates

Sampled vehicles were stopped on the roadside of interview survey stations. Totally, 18,129 samples were collected during the survey. The number of samples by Project Cities and vehicle type is summarized below.

Table 3.3.4 Number of Samples

City	Vehicle Type					Total
	4 WT	6 WT	10 WT	Over 10 WT	PT	
Chiang Mai	122	1,024	534	86	2,020	3,786
Makhon Sawan	39	618	1,680	192	229	2,758
Khon Kaen	168	1,024	1,662	203	555	3,612
Nakhon Ratchasima	107	899	2,926	216	211	4,359
Sangkhia	45	518	653	40	630	1,886
Hat Yai	13	553	790	77	293	1,726
Total	494	4,636	8,245	814	3,938	18,129

Table 3.3.5 shows sampling rates by survey point, vehicle type and direction. Sampling rates of heavier vehicle were rather high because survey was designed to obtain accurate data for longer distance haulage and of total tonnage transported by road transportation.

2) Traffic Counts

Manual traffic count surveys were conducted at each survey station. In case of pickup trucks in Thailand, a vehicle is purchased for the principal purpose of either passenger use or truck use. Usages of pickup trucks cannot be identified by observation at roadside. Therefore, manual count figures of pickup trucks were adjusted by roadside interview results.

Table 3.3.5 Sampling Rates of Each Survey Station

STATION	SURVEY POINT	INTERVIEWED SAMPLES					TRAFFIC COUNTS					SAMPLING RATES					
		AVT	AVT	LOVT	LOVT	PT	AVT	AVT	LOVT	LOVT	PT	AVT	AVT	LOVT	LOVT	PT	
CHANGHAI	CH1 : IN	10	93	36	4	188	46	210	56	4	1069	0.217	0.443	0.443	0.667	0.173	
	: OUT	15	133	43	6	198	46	197	80	9	1674	0.227	0.475	0.538	0.667	0.118	
	CH2 : IN	11	36	21	0	133	36	138	73	0	436	0.306	0.261	0.288	ERR	0.291	
	: OUT	8	57	13	1	158	48	129	73	1	501	0.280	0.442	0.179	1.000	0.315	
	CH3 : IN	5	58	15	3	122	53	153	32	9	929	0.094	0.379	0.469	0.556	0.131	
	: OUT	3	48	26	0	139	32	164	46	3	851	0.094	0.293	0.365	0.000	0.162	
CHANGHAI	CH4 : IN	7	30	3	0	305	26	69	8	3	826	0.269	0.435	0.375	0.000	0.369	
	: OUT	7	49	5	7	232	25	60	8	9	893	0.280	0.817	0.625	0.778	0.263	
	CH5 : IN	21	118	21	2	130	54	214	38	3	1403	0.389	0.551	0.553	0.667	0.093	
	: OUT	18	105	24	1	122	103	206	53	1	1743	0.175	0.525	0.453	1.000	0.070	
	CH6 : IN	9	140	164	24	113	56	370	216	47	1761	0.161	0.378	0.759	0.511	0.064	
	: OUT	8	157	163	36	181	40	433	183	54	1736	0.200	0.363	0.891	0.667	0.104	
KATMON SAWAN	KS1 : IN	3	97	170	17	27	141	234	295	31	1144	0.021	0.415	0.596	0.548	0.024	
	: OUT	5	111	273	26	52	172	237	410	62	1169	0.029	0.468	0.666	0.419	0.044	
	KS2 : IN	19	159	642	81	49	43	394	982	128	1279	0.442	0.404	0.654	0.633	0.038	
	: OUT	7	132	351	42	55	25	311	823	82	1176	0.280	0.424	0.426	0.512	0.047	
	KS3 : IN	5	67	118	11	19	28	112	153	13	547	0.179	0.598	0.771	0.816	0.035	
	: OUT	0	52	126	15	27	17	95	213	16	404	0.000	0.567	0.592	0.938	0.067	
KATMON	KR1 : IN	22	148	873	78	34	191	647	1828	165	2302	0.115	0.229	0.478	0.473	0.015	
	: OUT	19	179	892	59	46	208	628	1591	134	2203	0.091	0.285	0.561	0.410	0.021	
	KR2 : IN	5	66	193	24	36	52	243	312	48	643	0.096	0.272	0.619	0.600	0.056	
	: OUT	9	63	374	28	27	44	218	376	63	451	0.205	0.289	0.619	0.444	0.060	
	KR3 : IN	20	52	64	6	11	100	270	185	11	620	0.280	0.193	0.346	0.545	0.018	
	: OUT	12	63	91	4	19	90	235	204	7	642	0.133	0.268	0.446	0.571	0.030	
KATMON	KR4 : IN	13	163	221	8	24	30	298	367	13	504	0.433	0.547	0.682	0.615	0.048	
	: OUT	7	165	218	9	14	26	314	399	17	418	0.269	0.525	0.546	0.529	0.033	
	RI1 : IN	16	203	414	56	42	85	307	500	89	857	0.188	0.661	0.828	0.629	0.055	
	: OUT	22	191	414	70	125	71	321	569	117	913	0.310	0.593	0.723	0.598	0.137	
	RI2 : IN	25	97	43	2	157	62	168	88	2	702	0.483	0.577	0.489	1.000	0.224	
	: OUT	31	181	66	5	163	69	193	92	6	767	0.449	0.523	0.717	0.833	0.212	
KATMON	RI3 : IN	21	171	236	34	28	124	298	282	41	1597	0.169	0.574	0.837	0.829	0.018	
	: OUT	14	113	306	27	33	63	294	385	47	569	0.222	0.384	0.795	0.574	0.058	
	RI4 : IN	20	79	98	6	104	69	144	129	8	888	0.290	0.549	0.760	0.750	0.117	
	: OUT	19	69	83	3	72	53	170	139	7	896	0.358	0.406	0.612	0.429	0.080	
	SONGTHLA	SI1 : IN	10	78	51	7	196	16	133	72	12	639	0.625	0.586	0.708	0.583	0.307
		: OUT	13	115	113	6	206	44	173	116	16	716	0.295	0.665	0.974	0.375	0.288
SI2 : IN		4	55	86	2	54	8	90	181	4	387	0.500	0.611	0.851	0.500	0.139	
: OUT		3	52	95	5	92	8	73	183	7	405	0.375	0.712	0.922	0.714	0.225	
SI3 : IN		8	99	133	10	39	48	300	270	27	1893	0.167	0.330	0.493	0.370	0.036	
: OUT		7	119	175	10	43	50	335	284	17	1880	0.140	0.355	0.616	0.588	0.023	
KAT YAI	SI3 : IN	8	99	133	10	39	48	300	270	27	1893	0.167	0.330	0.493	0.370	0.036	
	: OUT	7	119	175	10	43	50	335	284	17	1880	0.140	0.355	0.616	0.588	0.023	
	SI4 : IN	2	135	153	19	78	30	420	307	44	1628	0.067	0.321	0.498	0.432	0.048	
	: OUT	3	140	144	14	76	30	404	381	20	1613	0.100	0.347	0.478	0.700	0.047	
	SI5 : IN	4	132	251	18	79	41	359	388	47	947	0.066	0.368	0.647	0.383	0.083	
	: OUT	4	146	242	26	60	47	346	381	54	377	0.085	0.422	0.635	0.481	0.159	

Results of the manual count survey are shown in Table 3.3.6. Data for Songkhla and Hat Yai have been separately processed. And survey locations of SK3, SK4 and SK5 were referred as HY1, HY2 and HY3 respectively.

The annual average traffic counts, which were developed by applying seasonal factors, are shown in Table 3.3.7. The seasonal factors are shown in Appendix 3.23.

3) Commodity Flows

Surveyed data were processed and yearly OD volumes by the Project City and commodity type were estimated and listed out.

Appendices 3.24 through 3.29 show the summary of OD volumes. These summary tables show the annualized volumes of:

- Total volume,
- Volume of through traffic to/from Bangkok,
- Volume of traffic to/from Changwat concerned and Changwats other than Bangkok,
- Between Bangkok and Changwat concerned, and
- Between Changwats excluding Bangkok and Changwat concerned.

a) Chiang Mai

In Chiang Mai, 12 million tons of cargo was transported and almost all transported cargoes had one or both trip end(s) in Chiang Mai. Only 8% of the total were transported between Chiang Mai and Bangkok. Some 58% of the total were transported within Chiang Mai.

b) Nakhon Sawan

In Nakhon Sawan, 30 million tons of cargoes were transported. Between Nakhon Sawan and Bangkok, 1.3 million tons of cargoes were transported and 8.2 million tons were transported to/from Bangkok through Nakhon Sawan and this portion was 28% of the total. Also, another 30% were transported between other Changwats through Nakhon Sawan.

c) Khon Kaen

In Khon Kaen, 20 million tons of cargoes were transported. Some 15.6 million tons of transported cargoes had one or both end(s) in Khon Kaen, and this portion was 76% of the total. The portion of cargo between other Changwats through Khon Kaen was 1.9% of the total.

d) Nakhon Ratchasima

In Nakhon Ratchasima, 77 million tons of cargoes were transported and this quantity was the largest among the Project Cities. Cargoes transported to/from Nakhon Ratchasima were 57 million tons, 74% of the total. Cargoes transported between Nakhon Ratchasima and Bangkok were 3.3 million tons and this portion was only 4% of the total.

e) Songkhla

Songkhla is the smallest city from the view point of road transportation among the Project Cities. Some 3.8 million tons of cargoes were transported, and out of this, 14% were transported to/from Bangkok. The portion of cargo transported between Bangkok and Songkhla was only 5%.

f) Hat Yai

In Hat Yai, 12 million tons of cargoes were transported. Some 88% of cargoes transported had one or both trip end(s) in Hat Yai and 11% of the total were transported between Hat Yai and Bangkok. Also 12% of cargoes were transported between other Changwats through Hat Yai.

Table 3.3.6 Average Daily Traffic Volume

CHANGWAT : CHIANGMAI

SURVEY		TRAFFIC COUNT						
STA	DIR	4 WT	6 WT	10 WT	OVER 10 WT	SUB-TOTAL	P/T	TOTAL
CH1	I	221	1,037	304	84	1,646	7,134	8,779
CH1	O	259	609	469	84	1,421	14,362	15,783
CH1	I&O	480	1,646	772	168	3,067	21,496	24,563
CH2	I	157	1,760	678	0	2,595	5,098	7,693
CH2	O	295	930	1,415	56	2,696	4,799	7,495
CH2	I&O	452	2,690	2,093	56	5,291	9,897	15,188
CH3	I	509	1,210	416	101	2,236	11,078	13,314
CH3	O	629	1,404	446	3	2,482	6,476	8,958
CH3	I&O	1,138	2,614	862	104	4,718	17,554	22,272
CH4	I	119	193	27	3	342	3,077	3,419
CH4	O	100	84	16	12	212	4,573	4,784
CH4	I&O	219	277	43	15	553	7,650	8,203
CH5	I	124	832	353	34	1,343	16,096	17,439
CH5	O	338	782	557	112	1,788	26,333	28,121
CH5	I&O	462	1,614	910	146	3,131	42,428	45,559
CH6	I	367	1,085	333	110	1,894	29,827	31,721
CH6	O	240	1,267	218	84	1,809	17,624	19,433
CH6	I&O	607	2,352	551	194	3,704	47,451	51,154

CHANGWAT : NAKHON SAWAN

SURVEY		TRAFFIC COUNT						
STA	DIR	4 WT	6 WT	10 WT	OVER 10 WT	SUB-TOTAL	P/T	TOTAL
NS1	I	1,504	955	1,955	288	4,702	57,178	61,881
NS1	O	2,140	1,010	2,915	811	6,875	34,515	41,390
NS1	I&O	3,644	1,964	4,870	1,099	11,578	91,693	103,271
NS2	I	115	1,158	2,064	269	3,606	37,760	41,366
NS2	O	114	935	2,728	308	4,085	28,051	32,136
NS2	I&O	230	2,093	4,792	577	7,691	65,811	73,502
NS3	I	179	662	1,512	187	2,539	43,749	46,288
NS3	O	17	853	2,281	181	3,333	20,792	24,125
NS3	I&O	196	1,515	3,793	368	5,872	64,541	70,413

Table 3.3.6 Average Daily Traffic Volume (cont'd)

CHANGWAT : KHON KAEN

SURVEY		TRAFFIC COUNT						
STA	DIR	4 WT	6 WT	10 WT	OVER 10 WT	SUB-TOTAL	P/T	TOTAL
KK1	I	499	556	897	213	2,164	17,794	19,959
KK1	O	236	615	922	240	2,013	7,520	9,534
KK1	I&O	735	1,171	1,819	454	4,178	25,315	29,492
KK2	I	181	633	1,377	96	2,288	4,684	6,971
KK2	O	209	703	1,033	161	2,106	5,104	7,209
KK2	I&O	390	1,336	2,410	257	4,393	9,788	14,181
KK3	I	432	638	804	174	2,047	67,616	69,662
KK3	O	423	958	932	233	2,546	7,688	10,234
KK3	I&O	854	1,596	1,735	407	4,593	75,304	79,897
KK4	I	300	411	240	28	980	10,142	11,122
KK4	O	198	583	298	37	1,117	14,564	15,681
KK4	I&O	498	994	539	65	2,097	24,706	26,802

CHANGWAT : NAKHON RATCHASIMA

SURVEY		TRAFFIC COUNT						
STA	DIR	4 WT	6 WT	10 WT	OVER 10 WT	SUB-TOTAL	P/T	TOTAL
NR1	I	1,979	3,409	5,072	452	10,912	176,535	187,446
NR1	O	2,628	2,622	3,978	533	9,762	118,414	128,175
NR1	I&O	4,607	6,031	9,051	985	20,673	294,949	315,622
NR2	I	2,496	2,751	3,613	392	9,251	51,419	60,671
NR2	O	1,115	2,699	3,738	479	8,031	39,364	47,395
NR2	I&O	3,611	5,450	7,351	871	17,282	90,783	108,066
NR3	I	1,200	3,880	6,460	431	11,971	160,989	172,960
NR3	O	1,710	2,909	5,441	373	10,433	106,251	116,684
NR3	I&O	2,910	6,789	11,901	804	22,404	267,240	289,644
NR4	I	554	1,365	3,710	382	6,011	58,162	64,173
NR4	O	847	210	4,441	402	5,900	87,641	93,541
NR4	I&O	1,401	1,575	8,151	784	11,911	145,802	157,714

Table 3.3.6 Average Daily Traffic Volume (cont'd)

CHANGMAT : SONGKHLA

SURVEY		TRAFFIC COUNT						
STA	DIR	4 WT	6 WT	10 WT	OVER 10 WT	SUB-TOTAL	P/T	TOTAL
SK1	I	32	291	158	26	506	2,591	3,098
SK1	O	155	278	140	45	618	3,033	3,651
SK1	I&O	187	569	298	71	1,125	5,624	6,749
SK2	I	92	302	160	34	588	4,155	4,743
SK2	O	53	239	122	21	435	2,799	3,234
SK2	I&O	145	541	281	55	1,023	6,954	7,977
SK3	I	276	561	275	46	1,158	14,145	15,304
SK3	O	143	479	182	26	829	40,388	41,218
SK3	I&O	419	1,040	457	71	1,988	54,534	56,521

AHPHOE : HAT YAI

SURVEY		TRAFFIC COUNT						
STA	DIR	4 WT	6 WT	10 WT	OVER 10 WT	SUB-TOTAL	P/T	TOTAL
HY1	I	348	1,173	869	157	2,547	17,020	19,567
HY1	O	465	1,065	764	88	2,382	44,957	47,339
HY1	I&O	813	2,238	1,633	245	4,929	61,978	66,907
HY2	I	870	1,205	860	134	3,069	21,011	24,081
HY2	O	650	1,095	984	31	2,760	21,489	24,249
HY2	I&O	1,520	2,300	1,844	165	5,829	42,501	48,330
HY3	I	991	1,031	730	136	2,888	12,152	15,040
HY3	O	682	917	672	121	2,391	2,956	5,347
HY3	I&O	1,673	1,948	1,402	256	5,279	15,108	20,387

Table 3.3.7 Average Annual Daily Traffic Volume

CHANGMAT : CHIANGHAI

SURVEY		TRAFFIC COUNT						
STA	DIR	4 WT	6 WT	10 WT	OVER 10 WT	SUB-TOTAL	P/T	TOTAL
CH1	I	206	1,026	315	62	1,609	6,827	8,436
CH1	O	351	706	441	106	1,604	17,608	19,212
CH1	I&O	557	1,732	756	167	3,213	24,435	27,648
CH2	I	113	1,994	772	0	2,878	4,593	7,472
CH2	O	398	910	760	76	2,143	5,817	7,960
CH2	I&O	510	2,903	1,532	76	5,021	10,410	15,432
CH3	I	773	1,297	476	0	2,547	11,721	14,268
CH3	O	923	1,433	427	0	2,784	7,700	10,484
CH3	I&O	1,697	2,731	903	0	5,331	19,421	24,752
CH4	I	57	255	37	0	349	3,967	4,316
CH4	O	94	82	17	8	201	4,193	4,395
CH4	I&O	151	337	54	8	551	8,160	8,710
CH5	I	115	821	352	24	1,312	15,323	16,635
CH5	O	546	859	507	158	2,070	32,494	34,565
CH5	I&O	662	1,679	859	182	3,382	47,818	51,200
CH6	I	316	1,280	439	135	2,171	35,315	37,486
CH6	O	239	1,350	216	80	1,885	16,513	18,399
CH6	I&O	555	2,631	655	216	4,057	51,828	55,885

CHANGMAT : NAKHON SAWAN

SURVEY		TRAFFIC COUNT						
STA	DIR	4 WT	6 WT	10 WT	OVER 10 WT	SUB-TOTAL	P/T	TOTAL
NS1	I	1,026	930	1,543	259	3,758	58,208	61,966
NS1	O	2,309	1,261	3,621	1,133	8,323	44,076	52,399
NS1	I&O	3,335	2,191	5,163	1,392	12,081	102,283	114,364
NS2	I	153	1,467	2,937	367	4,924	50,033	54,956
NS2	O	168	955	2,428	335	3,886	32,398	36,285
NS2	I&O	321	2,423	5,365	702	8,810	82,431	91,241
NS3	I	175	649	1,527	207	2,557	34,999	37,556
NS3	O	17	1,035	2,904	206	4,162	26,926	31,088
NS3	I&O	192	1,683	4,431	413	6,719	61,925	68,644

Table 3.3.7 Average Annual Daily Traffic Volume (cont'd)

CHANGWAT : KHON KAEN

SURVEY		TRAFFIC COUNT						
STA	DIR	4 WT	6 WT	10 WT	OVER 10 WT	SUB-TOTAL	P/T	TOTAL
KK1	I	624	645	1,088	190	2,547	23,720	26,267
KK1	O	227	697	1,088	267	2,279	7,784	10,062
KK1	I&O	852	1,342	2,176	457	4,826	31,503	36,329
KK2	I	179	811	1,890	78	2,959	5,785	8,743
KK2	O	336	987	1,504	112	2,939	7,258	10,197
KK2	I&O	515	1,798	3,394	190	5,898	13,042	18,940
KK3	I	521	770	862	196	2,348	101,153	103,501
KK3	O	520	1,484	1,180	238	3,422	10,349	13,771
KK3	I&O	1,041	2,253	2,042	434	5,771	111,502	117,272
KK4	I	318	460	326	47	1,152	11,045	12,196
KK4	O	269	648	407	46	1,369	20,113	21,482
KK4	I&O	587	1,108	733	93	2,521	31,157	33,678

CHANGWAT : NAKHON RATCHASIMA

SURVEY		TRAFFIC COUNT						
STA	DIR	4 WT	6 WT	10 WT	OVER 10 WT	SUB-TOTAL	P/T	TOTAL
NR1	I	2,224	4,561	5,194	476	12,455	254,563	267,018
NR1	O	3,098	3,028	4,503	612	11,243	159,503	170,746
NR1	I&O	5,323	7,589	9,698	1,088	23,698	414,067	437,764
NR2	I	3,365	2,811	4,090	406	10,671	66,074	76,745
NR2	O	1,404	3,527	4,011	550	9,493	46,371	55,864
NR2	I&O	4,769	6,339	8,101	956	20,164	112,445	132,609
NR3	I	1,375	4,442	7,940	515	14,272	178,698	192,970
NR3	O	3,158	8,405	10,566	395	22,525	151,514	174,039
NR3	I&O	4,534	12,847	18,505	910	36,797	330,212	367,009
NR4	I	603	1,602	4,419	438	7,062	79,798	86,860
NR4	O	1,130	276	5,560	612	7,578	114,108	121,686
NR4	I&O	1,733	1,878	9,979	1,050	14,640	193,906	208,546

Table 3.3.7 Average Annual Daily Traffic Volume (cont'd)

CHANGNAT : SONGKHLA

SURVEY		TRAFFIC COUNT						
STA	DIR	4 WT	6 WT	10 WT	OVER 10 WT	SUB-TOTAL	P/T	TOTAL
SK1	I	46	422	173	26	666	3,807	4,473
SK1	O	152	214	104	35	505	2,175	2,680
SK1	I&O	198	636	276	61	1,171	5,982	7,153
SK2	I	82	232	148	31	493	3,083	3,576
SK2	O	52	334	129	27	542	3,648	4,189
SK2	I&O	133	565	277	59	1,034	6,730	7,765
SK3	I	125	453	241	44	863	11,231	12,094
SK3	O	137	356	214	43	751	57,432	58,183
SK3	I&O	262	810	455	86	1,613	68,663	70,277

AMPHOE : HAT YAI

SURVEY		TRAFFIC COUNT						
STA	DIR	4 WT	6 WT	10 WT	OVER 10 WT	SUB-TOTAL	P/T	TOTAL
HY1	I	157	948	760	150	2,015	13,514	15,529
HY1	O	445	1,261	901	148	2,756	63,929	66,685
HY1	I&O	603	2,209	1,661	297	4,771	77,443	82,214
HY2	I	1,128	1,179	799	180	3,286	17,292	20,579
HY2	O	684	1,125	1,123	57	2,990	23,918	26,907
HY2	I&O	1,812	2,304	1,922	237	6,276	41,210	47,486
HY3	I	1,308	1,216	869	167	3,561	11,836	15,397
HY3	O	596	921	638	162	2,317	2,752	5,069
HY3	I&O	1,905	2,137	1,507	329	5,878	14,588	20,466