PART II

COMMODITY FLOW IN THAILAND, AND PRE-FEASIBILITY STUDY FOR FIVE REGIONAL TRUCK TERMINALS

CHAPTER 4

COMMODITY FLOW FORECASTS

CHAPTER 4 COMMODITY FLOW FORECASTS

4.1 General

This Chapter describes the methods and the results of commodity flow forecasting based on commodity flow surveys described in Chapter 3 for the purpose of planning of regional truck terminals. Discussions on the national economy were presented in Chapter 2 including courses stipulated in the Sixth National Economic and Social Development Plan (1987-1991), and forecasts thereafter. The transport network of Thailand including various modes, its present and future, were also reviewed in Chapter 2 for the country as a whole. This Chapter therefore, specifically discusses commodity flows into and out of the project areas, present and future.

4.2 Future Transport Network and Modal Split

Existing transport networks in Thailand consists of roads, railways, inland waterways, coastal shipping, and air transport. Their present conditions are summarized in Chapter 2 and, the present modal split (shares of each mode in terms of tons or ton-km) are also estimated in Chapters 2 and 3 of this Report.

No major highways are being planned for the foreseeable future, except for three new toll roads paralleling existing highways from Bangkok to the North, to the West and to the East with distances of 80 to 200 km each. Such new highways would not alter the existing flow pattern, if not strengthening them.

A railway network may be added in the future by a link by-passing the Bangkok Area for better connection of the Northern Line and the Eastern Line. When the Eastern Seaboard Development is in full operation, this link would facilitate better transport of industrial input from the Northeast and the North to the Eastern Seaboard area. Such commodities however, are of little significance to truck terminals. Nevertheless, it is possible that the enhanced marketing effort being planned by SRT will keep the railway share from falling further.

The inland waterway and the coastal shipping modes will expand, taking advantage of new facilities such as a new inland port in Nakhon Sawan and the new deep sea ports in Songkhla and Laem Chabang. Water-borne transport, however, will continue to limit themselves to bulk commodities as they do at present, and will have minimum effects on commodity flows which may use truck terminals with the exception of Songkhla.

Fig. 4.2.1 illustrates committed and likely future additions to the transport network of Thailand.

In conclusion, considering the inherent advantage of road transport in Thailand with its generally flat terrain, which has been proven by the faster growth of the road transport modes vis-a-vis other modes, it is likely that the present and forthcoming efforts in promoting other modes would only stem the tide of the growing road transport share at best, and cause the existing modal split to remain at the present level. It is unlikely that commodities which are candidates for the use of truck terminals shift their transport mode to some other mode from the road transport. In this study, therefore, only the road transport mode and its present cargoes were considered as the base for forecasts for truck terminals.

Fig. 4.2.1 Future Additions to the Transport Network

ROAD ——— EXISTING ——— ADDITION

RAILWAY —·—·— EXISTING ——— ADDITION

⚓ PORT ADDITION
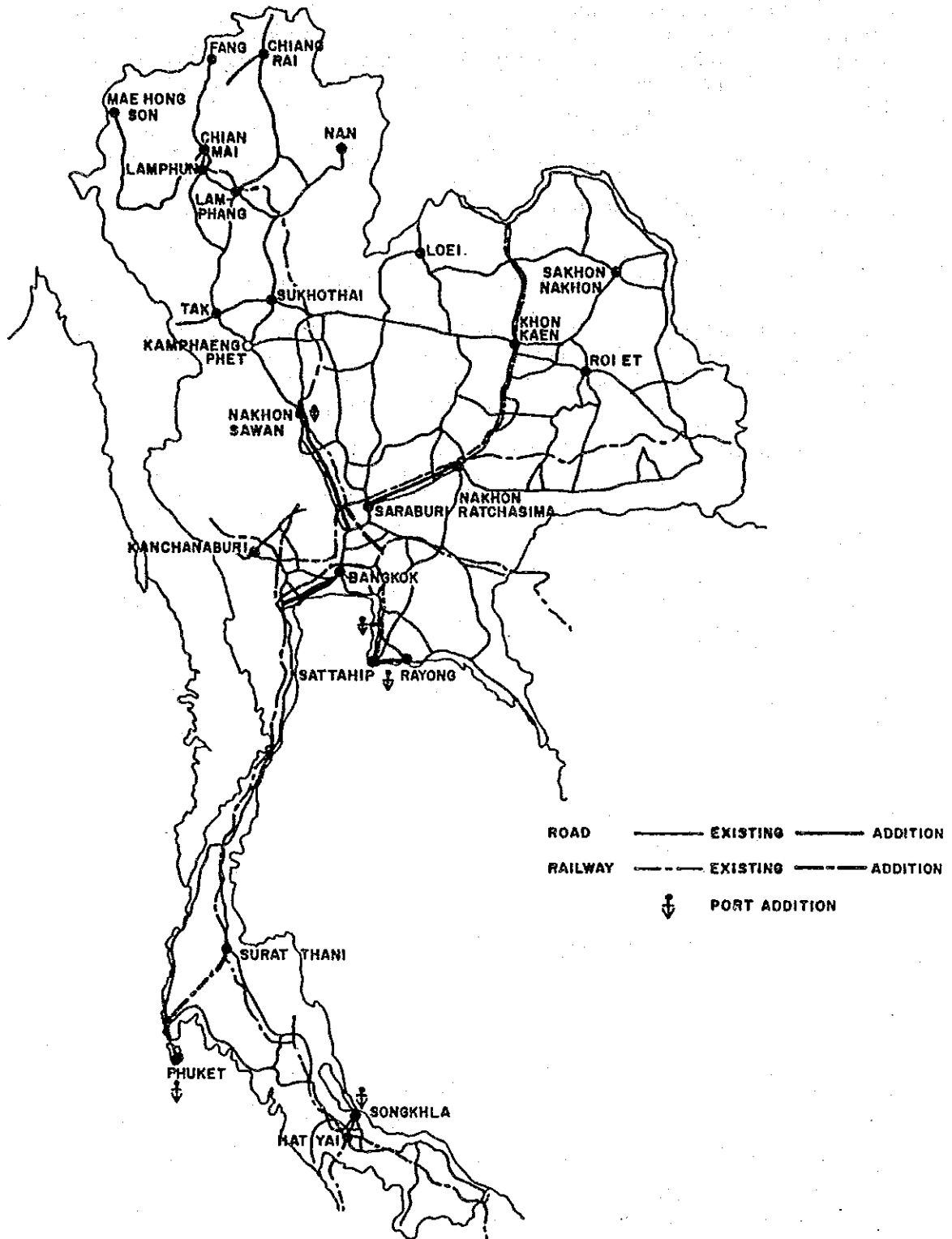
4.3 Existing Commodity Flows

4.3.1 Data Sources

Four separate sets of data were examined for the purpose of estimating the existing commodity flows to and from the five Project Cities by road transport.

1) Roadside Interview Survey Results by the Study Team

In February 1987 about 20,000 drivers of goods vehicles were stopped and interviewed at the roadside around the project cities during a period of 12 to 20 hours each. Type, origin and destination of their cargo and other information were recorded. Details of the survey were reported in Chapter 3. Origin and destination tables for each project city classified by 23 commodity groups were estimated from these results, which had been expanded to daily figures for each survey station taking into account different survey duration periods at different stations.

2) O/D Survey Results by LTD

LTD has been carrying out O/D surveys four times a year, one week at a time at 6 locations on major gateway routes around Bangkok since 1981. It was considered that commodity flows by roads could be accurately represented by the results as far as flows to and from Bangkok were concerned. Commodity O/D tables by 23 commodity groups for years 1984, 1985 and 1986 were made available to the Study Team, though the published tables include only flows to and from Bangkok. LTD provided supplementary O/D data for those flows passing through the Bangkok Area.

3) Questionnaire Survey in 1985 by LTD

LTD carried out a nation-wide questionnaire survey for trucking companies inquiring the kinds, amounts, origins and destinations of cargoes they handled in the past year. The results were compiled by LTD as internal information not released as official publication.

4) Traffic Counts and Payload Data by DOH

DOH has been carrying out a nation-wide traffic counts program. Sufficient number of traffic count stations were located near the Study Team's survey stations.

Payload information obtained by the Study Team's survey were based on the declaration by drivers. They may suffice for the analysis of general cargoes but not for heavy bulk cargoes. More accurate payload information obtained by actual measurements carried out for a DOH study in 1981 were used for the purpose of estimating the total weight of commodity flows around each city.

4.3.2 Examination of Data Validity

Total daily commodity flow tonnages were estimated by traffic counts and average payloads. Tonnage figures thus calculated by means of DOH data for each route leading to Bangkok were compared with LTD survey results. Both figures were in general agreement. However, figures from LTD survey results showed more stable changes over time than those from the DOH data, indicating a higher reliability of LTD survey results. LTD surveys have been conducted more frequently and for a much longer periods than DOH's.

The results of questionnaire survey in 1985 by LTD were compared with LTD roadside survey results. The former turned out to be in the order of one tenth of the latter. This confirmed the LTD's reason to keep the data internal because respondents did not fully report their operations.

4.3.3 Existing Road Commodity Flow O/D Tables

The O/D tables developed in 4.3.1 1) were derived from short duration surveys and contain deviations from annual average due to daily variations and seasonal variations. Each table was adjusted, therefore, so that Bangkok bound and Bangkok origin flows were equal to corresponding figures in the O/D tables developed from the LTD surveys.

Further adjustments were made on flows with neither ends in Bangkok so that the sum of all flows equals the total flow amount calculated by multiplying traffic counts and average payloads.

Results are summarized in Appendices 4.1 through 4.6.

4.3.4 Commodity Flows by Other Modes

Nationwide cargo transport estimates for various modes were reported in Chapter 3.

Commodity origin and destination tables for railways were obtained for 1986. In the tables origins and destinations of railway cargoes were classified into TPU zones, each of which comprises one or several Changwats. Table 4.3.1 shows commodity tonnages transported by rail to and from TPU zones which include the project cities. Due to the dominant position of the Project Cities in each of the respective regions, and the fact that there are few exclusive sidings in the railway system in Thailand outside of the Bangkok Area, the figures shown in the table can be regarded as a fair representation of actual tonnages to and from the project cities by rail. Cargoes from Bangkok outweigh cargoes to Bangkok in all cities although both amounts are close in Nakhon Sawan and in Songkhla. Bangkok is the dominant origin and destination in Chiang Mai, Khon Kaen and Nakhon Sawan, but in Songkhla the share of Bangkok as cargo origin and destination is about 25%. Songkhla attracts the highest amount of rail cargoes among the five, followed by Khon Kaen as the second. The figures confirm the railway's competitiveness in long distance haul.

Table 4.3.1 Commodity Flows in Project Cities by Railways, 1986

(tons)

Project Area	In-Flow			Out-Flow			Grand Total
	Bangkok*	Other	Total	Bangkok*	Other	Total	
Chiang Mai (TPU Zone 2)	205,857	41,780	247,637	35,706	16,093	51,799	299,436
Khon Kaen (TPU Zone 7)	355,349	53,802	409,151	45,372	38,263	83,635	492,786
Nakhon Sawan (TPU Zone 5)	70,429	27,227	97,656	62,401	44,391	106,792	204,448
Nakhon Ratchasima (TPU Zone 9)	96,837	64,756	161,593	7,084	27,940	35,024	196,617
Songkhla	153,298	557,447	710,745	142,994	324,621	467,615	1,178,360

Note: 1. * includes Bangkok Metropolitan Area, Nonthaburi and Samut Prakarn

2. Each TPU zone includes the following Changwats:
Zone 2 - Chiang Mai, Mae Hong Son, Lamphun
7 - Khon Kaen, Loei, Nong Khai, Udon Thani
5 - Nakhon Sawan, Tak, Kamphaengpet, Uthai Thani
9 - Nakhon Ratchasima, Chaiyaphum
19 - Songkhla, Patthalung, Satun, Pattani, yala, Narathiwat

Data on inland waterway transport is hard to obtain. The latest origin and destination information readily available was derived from two surveys carried out in late 1982 and mid-1983 for one month each. The results of the two surveys were averaged and expanded to represent annual figures. Table 4.3.2 summarizes cargo volumes into and out of TPU zone 5 by inland waterways which include the Project City, Nakhon Sawan. Volumes for TPU zone 6 which lies immediately north of TPU zone 5 are also shown for reference. There is little evidence that cargo volumes by inland waterway transport has increased since 1983.

The latest available transport statistics published by the Ministry of Communications contain cargo volumes by coastal shipping by TPU zone and by port. Table 4.3.3 shows volumes in tons for the only relevant city among the five Project Cities, Songkhla.

Close to half a million tons of cargo were transported by coastal shipping from Bangkok to Songkhla ports, whereas, only 10 thousand tons were transported in the reverse direction. Not much growth has taken place in coastal shipping between Songkhla and Bangkok in recent years.

Table 4.3.2 Inland Waterway Transport to and from Nakhon Sawan, 1983

TPU Zone 5 Origin	Total	679	tons
TPU Zone 6 Origin		7,333	
TPU Zone 5 Destination	Total	31	
TPU Zone 6 Destination		0	
From Northern Region	Total	8,012	
	Rice	1,633	
	Maize	5,684	
	Other Construction Materials	682	
	Others	12	

Note: 1. TPU Zone 5 consists of the Changwats of Tak, Kamphaengpet Nakhon Sawan and Uthai Thani.
2. TPU Zone 6 consists of the Changwats of Sukhothai, Pisanulok, Pichit and Petchabun.
3. Above figures in tons/yr were derived from the average of the results of two short (about one month each) surveys carried out in 1982 and 1983.

Source: Annual Transport Statics, 1985, Ministry of Communications

Table 4.3.3 Coastal Shipping to and from Sangkhla, 1982

To TPU Zone 19		488,244	tons
From TPU Zone 19		10,272	
To Sangkhla Port	Total	487,402	
	Domestic	437,529	
	Maize	15,861	
	Sugar	1,850	
	Other Farm	105	
	Rubber	1,065	
	Petroleum Products	195,222	
	Other Manufactured Products	73,042	
	All Other	150,382	

Source: Annual Transport Statics, 1985, Ministry of Communications

4.3.5 Existing Cargo Transport for the Project Cities

Table 4.3.4 summarizes the existing cargo transport into and out of the five Project Cities. Volumes for rail and inland waterway transport, as shown, are slightly higher than actual tonnages into and out of the cities because of subject area boundaries being those of TPU zones for rail and inland waterway transport.

The dominance of road transport is clear. Except for Chiang Mai and Songkhla/Hat Yai, the share of road transport is over 94%. Railways take a significant share only in Songkhla and in the in-flow to Chiang Mai. Songkhla also gives a significant share of 15% to coastal shipping in transport from Bangkok.

Table 4.3.4 Estimated Existing Cargo Transport Modal Split in Project Areas

(In thousand ton/year for volumes and % for shares)

Area	Direction	Total	Road[1]/ 1987	Rail[2]/ 1986	Inland[2]/ Water-way 1983	Coastal Ship-ping 1982
Chiang Mai	In-Flow	1,325	1,077	248	-	-
	(share)	(100)	(81)	(19)	-	-
	Out-Flow	853	801	52	-	-
	(share)	(100)	(94)	(6)	-	-
Khon Kaen	In-Flow	4,283	3,874	409	-	-
	(share)	(100)	(90)	(10)	-	-
	Out-Flow	1,718	1,634	84	-	-
	(share)	(100)	(95)	(5)	-	-
Nakhon Sawan	In-Flow	2,072	1,974	98	0.03	-
	(share)	(100)	(95)	(5)	(0.0)	-
	Out-Flow	2,355	2,247	107	0.7	-
	(share)	(100)	(95)	(5)	(0.0)	-
Nakhon Ratchasima	In-Flow	5,431	5,269	162	-	-
	(share)	(100)	(97)	(3)	-	-
	Out-Flow	3,322	3,287	35	-	-
	(share)	100)	(99)	(1)	-	-
Songkhla - Hat Yai	In-Flow	3,169	1,971	711	-	487
	(share)	(100)	(62)	(23)	-	(15)
	Out-Flow	1,633	1,155	468	-	10
	(share)	(100)	(71)	(28)	-	(1)

Note: 1. Road transport volumes
2. Rail and inland waterway volumes are those for TPU zones including surrounding Changwats. See the footnote of Table 2.3.7.

4.4 Economic Forecasts

4.4.1 Data Sources

1) <u>Changwat Sectoral Gross Products, 1975-1985</u>

NESDB compiled gross provincial product by 11 sectors for each Changwat. The Study Team obtained time series data from 1975 through 1985 for all Changwats from NESDB.

2) <u>Gross Domestic Product Forecasts</u>

NESDB developed GDP forecasts by 11 sectors up to the year 2001 by means of SIAM-2 macro econometric model. The Study Team obtained the latest forecasts.

3) <u>Changwat Sectoral Gross Products, 1986-2001</u>

NESDB made forecasts of Changwat sectoral gross products up to the year 2001. The Study Team reviewed the methodology and the results and found them to be sound.

4.4.2 Gross Provincial Product Forecasts

Forecasts of gross provincial products by NESDB and by the Study Team were made in the following manner:

1) <u>Analysis of Changes in Sectoral Share</u>

Changes in the share of each province to the national total were examined for each of the 11 sectors of the economy for which historical data were available for the period of 1975-1985. Long term trends were established for each province and for each sector. The changes were classified into two components, one representing the national trend and the other differences from the national trend particular to each province.

2) <u>Gross Provincial Product up to 2001</u>

Sectoral gross product figures for Thailand as a whole were given by the results of the projections by NESDB by means of SIAM-2. The long term trends established in 1) above were applied to each province in such a manner that the total of all provinces equaled the given national total. The trend in sectoral change was recalculated year by year to be applied to the subsequent year. The process was repeated up to the year 2001.

3) <u>Forecasts beyond 2001 up to 2006</u>

Forecasts by SIAM-2 were available only up to 2001. Forecasts were made by means of extrapolation for years beyond 2001. Extrapolations were made for each sector in each province and then adjusted so that the sum across all provinces match corresponding extrapolated national totals.

4) Economic Forecasts

Economic forecasts obtained by the above-mentioned process are summarized in Appendices 4.7 through 4.9 for each region. GDP of the whole Thailand is expected to grow 2.5 times by the year 2006 at an average growth rate of 4.5% p.a. Manufacturing sector would grow faster at an average rate of 5.8%, while the agricultural sector is the slowest at 2.5% p.a. The share of manufacturing sector would increase from 21% in 1985 to 25% in 2006.

Among Changwats, for which proposed truck terminals may be constructed, Khon Kaen would have the fastest growth at 5.3% p.a. and the size of its economy would be 2.9 times larger than that for 1985 by the year 2006. Manufacturing sector would grow fastest also in Khon Kaen at a rate of 6.4% p.a. In terms of the total size of the provincial economy, the order among the five Project Changwats in 2006 would be Nakhon Ratchasima, Chiang Mai, Khon Kaen, Songkhla and Nakhon Sawan.

4.5   Commodity Flow Forecasts for the Project Areas

Existing commodity flows established as described in Section 4.3 were compiled in the form of origin and destination tables, one for each of the 23 commodity groups. The tables could be regarded fairly complete as long as flows to and from the Bangkok Area is concerned. For the project areas, except for flows to and from the Bangkok Area, information was based on one day surveys. For other areas no information exists. In any case the resulting tables show extreme concentration of flows to and from the Bangkok Area relative to other areas. Even when complete information could be obtained for all areas in Thailand, the concentration of flows to and from the Bangkok Area would not be much different from those obtained in this Study.

Any projection of nation-wide O/D table necessarily involves an adjustment process in which row totals and column totals are matched. When an O/D table contains an extreme concentration to one zone, such as the case for Thailand with the Bangkok Area, the adjustment process does not work since a minor change for the Bangkok Area could result in an unrealistically large change to other areas relative to their original levels. It was therefore, decided that commodity flow forecasts be made for each project area separately rather than attempting to produce nation-wide forecasts O/D tables. The following describes the methods and the results of commodity flow forecasts.

4.5.1 Relationship between Commodity Flows and Gross Regional Products

The results of LTD's surveys of commodity flows to and from the Bangkok Area were compiled as flows between the Bangkok Area and each of the four regions of Northern, Northeastern, Central and South for years 1981 through 1985, for each of the 23 commodity groups. Sectoral gross regional products were obtained by means of summing up sectoral provincial products for those provinces included in each region. Regression analyses were made against commodity flow volumes between the Bangkok Area and a region for selected sectoral gross regional products. Linear relationships were assumed considering that the results would have to be used in long term projections for later years.

Ten commodity groups were selected as having some possibility of being handled at regional truck terminals. They are, other construction materials; vegetables and fruits; beverages; processed foods; animals; animal meat; fishes; fertilizers; household appliances; other manufactured products; and all others remaining. Regression analyses were applied for the ten commodity groups, and future growth trends were determined.

Tables 4.5.1 through 4.5.4 summarize the results. Flow of manufactured goods generally showed a high level of correlation with manufacturing sector gross products. Flow of consumer goods also showed a high level of correlation with the total gross regional products. Predictably the road transport of agricultural commodities showed a poor correlation with corresponding sectoral gross products.

For the remaining ten commodity groups future growth trends were determined on a commodity by commodity basis. For those flow figures of which since 1981 showed a good correlation with relevant regional gross products, future growth trends were determined in the same manner as the above. For those showing a poor correlation with relevant regional products growth rates were determined considering the future prospects of each commodity group. The following describes the methods and growth assumptions adopted in this Study for the remaining mostly bulk commodities.

1) Rice: A flat growth rate of 2.4% p.a. was assumed considering the past trend and future prospects.

2) Sand and Gravel: A regression analysis was carried out against gross product of construction sector for Bangkok and the Central Region, and the amount of sand and gravel transported through the six LTD survey points surrounding Bangkok. The following results were obtained.

$$Y = 886.1X - 5.80 \times 10^6 \qquad R^2 = 0.648$$

where Y is the flow total in tons, and X is the construction sector gross product in million Baht, and R^2 is the indicator of goodness of fit. The coefficient for increment, 886.1 tons per million Baht, was applied.

3) Cement and Cement Products: Average growth rates of flows for this group in recent years are higher than 5%. Correlation with construction sector gross product was found to be low. A flat growth rate of 5% was assumed.

4) Steel: The following regression equation was obtained in the same manner as in 2) above. The coefficient for the increment adopted is:

$$Y = 67.4X - 0.446 \times 10^6 \qquad R^2 = 0.560$$

5) Timber: A flat growth rate of 1% p.a. was applied considering dwindling forestry resources throughout the country.

6) Firewood: Similarly a rate of 1% p.a. was adopted.

Table 4.5.1 Commodity Flows vs. Sectoral Regional Products, 1981 - 1985, Northeastern Region

| Commodity type | Gross Regional Products Coefficient | | | | Constant | $\bar{R}^2$ | Remarks |
	Agricul.	Manuf.	Constr.	All items			
Other constr.	-	-	13.409	-	-20834.2	0.514	
Veget. & fruit	17.323	-	-	-	-310487.7	0.471	1983-85
Beverage	-	-	-	3.598	-135580.0	0.809	
Processed food	9.082	139.441	-	-	-510296.2	0.999	
Animal	4.975	-	-	-	-52179.6	0.738	
Fish	-	-	-	0.024	12189.5	0.003	
Fertilizer	50.392	-	-	-	-792278.7	0.636	
Household appl.	-	-	-	2.946	-105413.3	0.777	
Other manuf.	-	-	-	17.668	-164200.2	0.458	
All others	-	60.636	-	-	-97701.1	0.967	

Table 4.5.2 Commodity Flows vs. Sectoral Regional Products, 1981 - 1985, Northern Region

| Commodity type | Gross Regional Products Coefficient | | | | Constant | $\bar{R}^2$ | Remarks |
	Agricul.	Manuf.	Constr.	All items			
Other constr.	-	-	42.535	-	-60311.1	0.820	
Veget. & fruit	10.007	-	-	-	-157640.4	0.649	
Beverage	-	-	-	2.959	-95765.3	0.863	
Processed food	1.546	-	-	-	-17751.0	0.416	
Animal	67.445	-	-	-	-1177073.5	0.622	1981-83
Fish	-	-	-	0.435	-8094.6	0.518	
Fertilizer	52.464	-	-	-	-831279.6	0.701	
Household Appl.	-	-	-	4.597	-145969.2	0.971	
Other manuf.	-	-	-	28.089	-523603.5	0.867	
All others	29.425	3.233	-	-	-407825.7	0.947	

Table 4.5.3   Commodity Flows vs. Sectoral Regional Products, 1981 - 1985, Southern Region

Commodity type	Gross Regional Products Coefficient				Constant	R^2	Remarks
	Agricul.	Manuf.	Constr.	All items			
Other constr.	-	-	1.525	-	9099.4	0.011	cut 1984
Veget. & fruit	5.242	-	-	-	12978.2	0.733	1981-84,
	-	-	-	-	-		cut 1983
Beverage	-	-	-	6.236	-177419.5	0.770	
Processed food	0.814	8.042	-	-	-17907.5	0.862	
Animal	0.338	-	-	-	-3277.1	0.547	
Fish	15.413	-	-	-	18088.1	0.054	1981-84
Fertilizer	9.769	602.343	-	-	-797867.2	0.868	
Household appl.	-	-	-	3.264	-89118.0	0.921	
Other manuf.	-	-	-	48.287	-1169522.6	0.886	
All others	24.687	519.901	-	-	-913512.0	0.872	

Table 4.5.4   Commodity Flows vs. Sectoral Regional Products, 1981 - 1985, Central and Northern Region

Commodity type	Gross Regional Products Coefficient				Constant	R^2	Remarks
	Agricul.	Manuf.	Constr.	All items			
Other constr.	-	-	33.585	-	-206159.0	0.393	
Veget. & fruit	14.996	-	-	-	-228339.8	0.222	
Beverage	-	-	-	1.460	-218285.4	0.985	
Processed food	-	1.490	-	-	45580.1	0.226	
Animal	3.983	-	-	-	-31963.1	0.901	1981-84,
	-	-	-	-	-		cut 1983
Fish	-	-	-	0.081	5003.6	0.374	
Fertilizer	40.653	-	-	-	-576346.1	0.575	
Household appl.	-	-	-	1.412	-196580.0	0.972	
Other manuf.	-	-	-	7.025	-427895.4	0.822	
All others	51.432	0.751	-	-	-883050.7	0.831	

7) Petroleum Products: A good correlation between the flow and gross regional product was found for all regions as shown below:

North and Central Regions
$$Y = 8.72X - 1.184 \times 10^6 \qquad R^2 = 0.977$$

North Region
$$Y = 32.8X - 1.19 \times 10^6 \qquad R^2 = 0.988$$

Northeast Region
$$Y = 15.2X - 0.438 \times 10^6 \qquad R^2 = 0.719$$

South Region
$$Y = 7.15X - 0.158 \times 10^6 \qquad R^2 = 0.766$$

where Y is the total flow tonnage for the region in tons, and X is the gross regional product for the region in million Baht.

8) Tapioca: No growth was assumed for the transport of tapioca considering the limited market expansion potential.

9) Maize: A flat rate of 1.5% p.a. was adopted following the production forecasts made elsewhere.

10) Sugar: In the past the growth of sugar transport by road has been high except in the South. Considering the limited market expansion potential, however, a rate of 1% p.a. was adopted.

11) Beans: The total production is not expected to increase significantly. No growth was assumed for beans transport.

12) Jute: Long term market expansion for jute is limited although growth was observed except in the South. A rate of 3% p.a. was assumed except for the South, for which no growth was assumed.

4.5.2 Influence Area

The influence area of each proposed truck terminal was determined by means of examining the existing pattern of commodity flows to and from the Project Cities. Example flow maps by commodity group prepared for this purpose are shown in Appendices 4.10 through 4.15. No major change in the future road network was assumed as no such plan exists affecting inter-regional commodity flows. Table 4.5.5 summarizes the resulting influence areas in terms of the names of Changwat included in each influence area.

4.5.3 Commodity Flow Forecasts

Commodity flow forecasts were made separately for each of the Project Cities for reasons mentioned before.

Forecasts of sectoral gross products for the influence areas were obtained by means of summing up relevant sectoral regional products of Changwat included in each of the influence areas. Appendices 4.16 through 4.21 summarize these results. In terms of the growth of gross regional product by influence area, which was related to the growth of commodity flows to and from each of the five regional centers, Nakhon Ratchasima was the highest with 4.5% p.a., followed by

Khon Kaen with 4.3% p.a., Nakhon Sawan with 4.1% p.a., Chiang Mai and Hat Yai/Songkhla with 4% p.a. each.

Table 4.5.5   Influence Area

1. Chang Mai

   Chang Mai, Chiang Rai, Rhayao, Mac Hong Son, Lamphun, Lampang, Phrac, Uttaradit, Nan, Sukhothai, Tak, Phitsanulok.

2. Nakhon Sawan

   Nakhon Sawan, Tak, Kamphaeng Phet, Sukhothai, Phitsanulok, Phichit, Uthai Thani, Chai Nat, Singburi, Lopburi, Saraburi, Ayutthaya, Ang Thong, Suphan Buri.

3. Nakhon Ratchasima

   Nakhon Ratchasima, Khon Khaen, Burirum, Surin, Si Sa Kct, Ubon Ratchathani, Chaiyaphum, Maha Sarakham, Saraburi.

4. Khon Khaen

   Khon Khaen, Nakhon Ratchasima, Kalasin, Maha Sarakarm, Roi Et, Sakhon Nakhon, Udon Thani, Chaiyaphum, Nong Khai, Loei.

5. Songkhla & Hat Yai

   Songkhla, Pattani, Narathiwat, Patthalung, Nakhon Si Thammarat, Satun, Surat Thani, Yala, Trang, Krabi, Phuket, Chumphon, Ranong.

The linear relationships established in 4.5.1 above were developed against time series data on commodity flows between the regions and the Bangkok Arca and sectoral gross products of each region.   In order to apply the relationships to sectoral gross products of influence areas the linear relationships were converted to those having their starting points at the combination of existing flow tonnage and existing total gross product of each project area.

Tonnage forecasts for each commodity group and for each project area were calculated from sectoral gross product forecasts.

Forecasts were made for the ycar 2006, and for the year 1996 for each of 23 commodity groups, and for each of the five project areas.   Actual projections were made in terms of origin and destination tables.   Tables 4.5.6 through 4.5.11 summarize the results for the year 1996, and Tables 4.5.12 through 4.5.17 for the year 2006.

By 2006 it was estimated that Nakhon Ratchasima would be handling 63.1 million tons of cargo per year, Nakhon Sawan 27.0 million tons, Hat Yai/Songkhla 26.1 million tons, Khon Kaen 22.6 million tons and Chiang Mai 10.6 million tons, all by road transport.   In comparison with amounts in 1987, the estimated growth rate of the total cargo flow were 5.7% p.a. for Hat Yai/Songkhla, 5.4% p.a. for Nakhon Ratchasima, 5.1% p.a. for Khon Kaen, 4.3% p.a. for Chiang Mai, and 3.7% p.a. for

Nakhon Sawan. The total cargo flow to and from each of the five regional centers by road transport is expected to increase from 2 to 3 times of the existing level in 20 years.

(UNIT : THOUSAND TONS)

Table 4.5.6 Road Commodity Flow Projections Summary, 1996, Chiang Mai

COMMODITY TYPE	TOTAL	THROUGH TO/FROM BANGKOK			CHANGWAT : CHIANGMAI				BANGKOK TO CM	CM TO BANGKOK	BANGKOK AND CM	OTHER CHANGWATS
		TO	FROM	SUBTOTAL	INTO	FROM	INTRA	SUBTOTAL				
1 Rice	657	0	0	0	40	111	482	633	1	18	19	4
2 Sand & Gravel	757	0	0	0	63	56	634	754	1	2	3	0
3 Cement & Products	358	4	0	4	210	23	93	325	33	0	33	0
4 Steel	100	0	0	0	16	9	48	73	17	5	21	1
5 Other Construction	130	4	0	4	17	12	53	82	36	6	42	6
6 Timber	134	0	0	0	78	6	43	128	4	3	6	0
7 Firewood	95	0	0	0	6	12	74	92	0	2	2	0
8 Petroleum Products	420	0	0	0	22	74	192	288	114	19	133	0
9 Minerals	165	0	0	0	64	6	69	140	0	15	15	1
10 Vegetable & Fruit	291	0	0	0	52	61	146	259	11	20	31	1
11 Tapioca	10	0	0	0	0	0	4	4	0	6	6	1
12 Maize	90	3	0	3	31	5	35	70	0	19	19	0
13 Sugar	1	0	0	0	1	0	0	1	0	0	0	0
14 Beans	27	0	0	0	15	2	5	23	0	5	5	0
15 Jute & Products	14	0	0	0	1	2	11	14	0	0	0	1
16 Beverages	301	0	0	0	40	26	197	263	30	7	37	1
17 Processed Foods	1042	2	0	2	136	313	523	972	6	49	56	12
18 Animals	259	0	0	0	28	23	205	256	1	2	3	0
19 Fish	28	0	0	0	5	7	7	19	8	0	8	0
20 Fertilizer & Animal Feeds	209	0	0	0	47	17	102	166	34	4	37	6
21 Personal Effects	188	0	4	4	34	41	67	142	25	12	37	5
22 Other Manufactures	815	0	0	0	42	38	422	502	289	16	306	8
23 All Others	1034	0	1	1	99	80	779	958	32	32	64	11
TOTAL	7124	7	5	12	1047	924	4192	6162	643	242	885	66

Table 4.5.7 Road Commodity Flow Projections Summary, 1996, Khon Kaen

(UNIT : THOUSAND TONS)

COMMODITY TYPE	TOTAL	THROUGH TO/FROM BANGKOK			CHANGWAT : KHON KAEN				BANGKOK TO KK	KK TO BANGKOK	BANGKOK AND KK	OTHER CHANGWATS
		TO	FROM	SUBTOTAL	INTO	FROM	INTRA	SUBTOTAL				
1 Rice	1436	53	16	69	439	304	292	1036	2	177	179	152
2 Sand & Gravel	6	0	1	1	1	0	2	3	0	1	1	0
3 Cement & Products	65	0	6	6	7	3	23	33	13	1	14	11
4 Steel	117	0	6	6	3	51	29	83	26	2	28	1
5 Other Construction	330	11	40	40	5	35	214	254	9	6	15	21
6 Timber	161	1	4	15	65	21	36	122	5	17	22	2
7 Firewood	7	1	0	1	1	0	2	2	0	3	3	0
8 Petroleum Products	380	11	16	27	43	43	110	196	151	1	151	6
9 Minerals	1	0	0	0	0	0	0	0	1	1	1	0
10 Vegetable & Fruit	233	4	6	10	54	25	60	139	17	21	38	46
11 Tapioca	765	40	6	46	79	187	150	416	0	76	76	227
12 Maize	340	0	0	0	12	262	8	282	12	45	57	0
13 Sugar	187	17	1	18	11	11	7	28	1	135	136	5
14 Beans	12	2	0	2	1	0	0	1	0	10	10	0
15 Jute & Products	52	1	0	1	20	2	24	46	2	2	4	1
16 Beverages	406	0	17	17	36	185	108	329	52	5	57	3
17 Processed Foods	339	56	17	73	67	46	48	161	9	42	50	55
18 Animals	707	0	0	0	85	40	266	391	1	12	13	303
19 Fish	17	0	1	1	7	1	3	10	5	0	5	0
20 Fertilizer & Animal Feeds	7144	0	185	185	4677	154	1300	6131	107	18	125	704
21 Personal Effects	229	3	26	29	25	33	37	95	21	73	94	11
22 Other Manufactures	1107	16	46	62	309	110	275	694	286	20	306	45
23 All Others	227	5	8	14	26	36	90	152	27	21	48	14
TOTAL	14266	220	402	622	5971	1550	3084	10604	745	687	1432	1607

(UNIT : THOUSAND TONS)

Table 4.5.8 Road Commodity Flow Projections Summary, 1996, Nakhon Sawan

COMMODITY TYPE	TOTAL	THROUGH TO/FROM BANGKOK			CHANGWAT : NAKHON SAWAN				BANGKOK TO NS	NS TO BANGKOK	BANGKOK AND NS	OTHER CHANGWATS
		TO	FROM	SUBTOTAL	INTO	FROM	INTRA	SUBTOTAL				
1 Rice	3212	223	62	285	778	199	1255	2232	4	473	477	218
2 Sand & Gravel	400	19	89	108	54	42	79	195	1	2	2	95
3 Cement & Products	1255	10	222	233	34	147	72	253	16	4	20	749
4 Steel	269	74	54	128	8	18	64	90	23	8	31	20
5 Other Construction	248	7	67	75	21	9	21	51	10	10	20	102
6 Timber	666	78	26	104	20	5	23	48	8	6	14	499
7 Firewood	228	81	0	81	16	4	19	39	4	12	16	92
8 Petroleum Products	1551	101	637	739	118	380	17	514	268	3	271	27
9 Minerals	425	78	0	78	0	16	0	16	7	30	36	295
10 Vegetable & Fruit	180	20	3	23	36	19	59	114	11	4	17	26
11 Tapioca	1472	274	27	300	133	164	96	393	0	115	115	643
12 Maize	1667	507	280	787	195	213	33	441	2	262	263	178
13 Sugar	254	33	13	96	66	3	42	111	0	22	24	23
14 Beans	137	70	8	77	23	0	2	25	0	30	30	5
15 Jute & Products	46	0	17	17	15	0	8	23	4	0	4	3
16 Beverages	670	109	129	238	49	130	144	324	39	0	39	70
17 Processed Foods	300	4	39	43	49	90	48	187	15	7	22	47
18 Animals	332	22	25	47	11	25	25	60	1	4	5	219
19 Fish	19	0	3	3	0	4	1	5	4	0	4	6
20 Fertilizer & Animal Feeds	486	5	144	149	25	10	67	102	66	25	91	145
21 Personal Effects	217	24	50	73	20	17	32	69	23	8	31	43
22 Other Manufactures	4016	313	1078	1391	204	372	1398	1975	294	20	314	336
23 All Others	978	196	126	322	70	128	166	364	30	41	70	223
TOTAL	19029	2296	3099	5395	1945	1995	3691	7632	830	1088	1918	4084

Table 4.5.9 Road Commodity Flow Projections Summary, 1996, Nakhon Ratchsima

(UNIT : THOUSAND TONS)

COMMODITY TYPE	TOTAL	THROUGH TO/FROM BANGKOK			CHANGWAT : NAKHON RATCHASIMA				BANGKOK TO NR	NR TO BANGKOK	BANGKOK AND NR	OTHER CHANGWATS
		TO	FROM	SUBTOTAL	INTO	FROM	INTRA	SUBTOTAL				
1 Rice	2438	267	0	267	476	173	964	1613	2	213	215	344
2 Sand & Gravel	70	0	9	9	4	14	23	41	1	2	3	16
3 Cement & Products	472	0	139	139	19	57	36	113	27	4	31	189
4 Steel	210	14	56	70	7	4	67	79	38	5	42	19
5 Other Construction	7647	108	1215	1323	434	192	3033	3658	12	7	19	2647
6 Timber	228	27	3	30	6	2	103	111	5	13	18	70
7 Firewood	28	1	2	3	6	0	13	19	0	4	4	2
8 Petroleum Products	3282	111	1390	1501	142	345	626	1112	607	2	609	59
9 Minerals	4	0	0	0	0	0	0	0	0	4	4	0
10 Vegetable & Fruit	818	40	21	61	310	108	159	577	33	37	71	109
11 Tapioca	6131	186	30	215	2079	538	2292	4909	0	363	363	643
12 Maize	390	0	67	67	52	0	0	52	0	271	271	0
13 Sugar	203	80	0	30	49	0	12	62	0	4	5	57
14 Beans	8	0	0	0	0	0	0	0	1	5	6	2
15 Jute & Products	660	0	36	36	290	13	104	407	12	167	179	38
16 Beverages	667	15	54	69	145	38	321	504	78	4	82	12
17 Processed Foods	2207	293	153	446	328	374	382	1084	18	479	497	180
18 Animals	700	5	2	8	84	66	175	325	2	30	32	336
19 Fish	129	15	0	15	10	13	40	63	14	0	14	38
20 Fertilizer & Animal Feeds	2242	7	107	114	255	536	972	1763	188	38	226	139
21 Personal Effects	248	8	27	35	17	48	73	138	40	17	57	18
22 Other Manufactures	4680	262	459	721	1089	206	1827	3123	394	62	456	381
23 All Others	3780	537	334	871	239	483	1709	2431	39	64	102	376
TOTAL	37244	1978	4104	6081	6041	3211	12932	22183	1512	1794	3306	5674

Table 4.5.10 Road Commodity Flow Projections Summary, 1996, Songkhla

(UNIT : THOUSAND TONS)

COMMODITY TYPE	TOTAL	THROUGH TO/FROM BANGKOK			CHANGWAT : SONGKHLA				BANGKOK TO SK	SK TO BANGKOK	BANGKOK AND SK	OTHER CHANGWATS
		TO	FROM	SUBTOTAL	INTO	FROM	INTRA	SUBTOTAL				
1 Rice	133	0	0	0	42	0	65	108	0	0	0	25
2 Sand & Gravel	780	0	0	0	121	38	621	780	0	0	0	0
3 Cement & Products	158	14	0	14	81	3	49	130	0	0	0	14
4 Steel	75	10	10	20	0	9	48	51	0	0	0	4
5 Other Construction	34	0	11	11	1	3	13	23	0	0	0	0
6 Timber	521	124	0	124	68	3	319	390	0	0	0	7
7 Firewood	56	0	0	0	8	0	49	56	0	0	0	0
8 Petroleum Products	1105	10	0	10	197	546	319	1062	15	0	15	18
9 Minerals	0	0	0	0	0	0	0	0	0	0	0	0
10 Vegetable & Fruit	77	0	1	1	21	7	16	44	2	1	2	31
11 Tapioca	4	0	0	0	0	0	0	0	0	4	4	0
12 Maize	18	0	0	0	3	0	15	18	0	0	0	0
13 Sugar	22	0	12	12	0	0	10	10	0	0	0	0
14 Beans	0	0	0	0	0	0	0	0	0	0	0	0
15 Jute & Products	0	0	0	0	0	0	0	0	0	0	0	0
16 Beverages	229	0	22	22	12	21	164	197	10	0	10	0
17 Processed Foods	53	1	17	17	5	5	15	26	3	5	8	2
18 Animals	134	0	0	0	14	10	97	121	0	0	0	12
19 Fish	302	12	0	12	104	67	83	254	1	12	14	23
20 Fertilizer & Animal Feeds	229	32	5	28	27	38	104	170	11	7	18	3
21 Personal Effects	31	0	0	0	9	5	13	28	1	0	1	3
22 Other Manufactures	510	4	0	4	112	46	203	360	52	3	56	90
23 All Others	874	254	0	254	290	39	206	535	18	5	23	63
TOTAL	5345	460	78	538	1116	837	2408	4361	114	37	150	295

Table 4.5.11 Road Commodity Flow Projections Summary, 1996, Hat Yai

(UNIT : THOUSAND TONS)

COMMODITY TYPE	TOTAL	THROUGH TO/FROM BANGKOK			AMPHOE : HAD YAI				BANGKOK TO HY	HY TO BANGKOK	BANGKOK AND HY	OTHER CHANGWATS
		TO	FROM	SUBTOTAL	INTO	FROM	INTRA	SUBTOTAL				
1 Rice	475	0	0	0	100	39	97	236	7	0	7	232
2 Sand & Gravel	2189	0	0	0	210	74	1906	2189	0	0	0	0
3 Cement & Products	217	0	4	4	54	37	60	151	10	2	12	50
4 Steel	120	24	11	35	5	0	62	67	13	5	17	0
5 Other Construction	127	6	10	16	15	21	67	103	7	1	8	1
6 Timber	973	62	0	62	113	25	652	790	1	16	17	105
7 Firewood	80	0	0	0	17	1	42	60	2	7	9	11
8 Petroleum Products	715	24	0	24	118	127	426	672	19	1	20	0
9 Minerals	16	0	0	0	0	5	0	5	1	0	1	10
10 Vegetable & Fruit	111	7	4	11	30	13	34	77	3	2	4	19
11 Tapioca	43	0	12	12	8	9	0	17	0	14	14	1
12 Maize	3	0	0	0	1	0	2	3	1	0	1	0
13 Sugar	3	0	2	2	0	0	0	1	1	0	1	0
14 Beans	1	0	0	0	0	0	1	1	0	0	0	0
15 Jute & Products	16	0	0	0	5	4	5	14	0	1	1	1
16 Beverages	315	0	40	40	23	58	163	244	16	1	16	15
17 Processed Foods	152	2	7	9	9	22	70	100	11	26	38	5
18 Animals	2	0	0	0	0	0	1	1	0	0	0	0
19 Fish	641	20	0	20	155	47	346	548	6	50	55	19
20 Fertilizer & Animal Feeds	665	5	24	29	141	71	290	502	74	43	117	17
21 Personal Effects	119	5	21	25	21	11	33	65	18	9	28	2
22 Other Manufactures	1365	0	16	16	334	210	425	969	338	17	356	25
23 All Others	1712	141	1	142	382	125	886	1393	6	144	150	27
TOTAL	10061	295	153	448	1741	898	5567	8206	533	338	871	536

Table 4.5.12 Road Commodity Flow Projections Summary, 2006, Chiang Mai

(UNIT : THOUSAND TONS)

COMMODITY TYPE	TOTAL	THROUGH TO/FROM BANGKOK			CHANGWAT : CHIANGMAI				BANGKOK TO CM	CM TO BANGKOK	BANGKOK AND CM	OTHER CHANGWATS
		TO	FROM	SUBTOTAL	INTO	FROM	INTRA	SUBTOTAL				
1 Rice	832	0	0	0	51	141	611	803	1	23	24	5
2 Sand & Gravel	1291	0	0	0	107	96	1083	1286	2	3	5	0
3 Cement & Products	584	0	0	0	341	37	152	530	54	0	54	2
4 Steel	171	7	0	7	28	16	82	125	28	3	37	2
5 Other Construction	274	0	0	0	26	25	111	173	77	12	89	12
6 Timber	148	0	0	0	86	7	48	141	4	3	7	0
7 Firewood	105	0	0	0	7	13	82	102	0	3	3	0
8 Petroleum Products	785	0	0	0	42	137	358	537	212	36	248	0
9 Minerals	213	0	0	0	33	8	89	180	0	19	19	14
10 Vegetable & Fruit	401	0	0	0	71	84	202	357	15	28	43	1
11 Tapioca	10	0	0	0	0	0	4	4	0	6	6	0
12 Maize	105	0	0	0	36	5	40	82	0	22	22	1
13 Sugar	1	0	0	0	1	0	0	1	0	0	0	0
14 Beans	27	0	0	0	15	2	5	23	0	5	5	0
15 Jute & Products	19	0	0	0	1	3	15	19	0	0	0	0
16 Beverages	540	0	0	0	72	47	353	472	55	13	67	1
17 Processed Foods	1324	3	0	3	173	397	664	1235	8	62	71	16
18 Animals	376	0	0	0	41	33	298	371	1	3	4	0
19 Fish	44	0	0	0	8	12	11	31	14	0	14	0
20 Fertilizer & Animal Feeds	289	0	0	0	64	24	141	229	47	5	52	8
21 Personal Effects	335	0	8	8	61	74	119	254	45	21	66	9
22 Other Manufactures	1313	0	0	0	67	61	680	808	466	26	492	13
23 All Others	1374	0	1	1	131	106	1036	1273	43	43	86	14
TOTAL	10559	10	8	19	1523	1327	6183	9033	1071	341	1412	95

Table 4.5.13 Road Commodity Flow Projections Summary, 2006, Khon Kaen

(UNIT : THOUSAND TONS)

COMMODITY TYPE	TOTAL	THROUGH TO/FROM BANGKOK			CHANGWAT : KHON KAEN				BANGKOK TO KK	KK TO BANGKOK	BANGKOK AND KK	OTHER CHANGWATS
		TO	FROM	SUBTOTAL	INTO	FROM	INTRA	SUBTOTAL				
1 Rice	1820	67	21	88	557	386	371	1313	2	224	226	192
2 Sand & Gravel	10	0	1	1	2	0	4	6	0	2	2	0
3 Cement & Products	105	0	10	10	12	4	37	54	22	2	23	18
4 Steel	199	0	10	10	5	87	49	141	44	3	47	1
5 Other Construction	745	0	90	90	12	78	484	573	21	13	34	47
6 Timber	177	12	5	17	72	23	40	135	5	19	24	1
7 Firewood	7	1	0	1	1	0	2	3	0	3	3	0
8 Petroleum Products	671	19	28	47	77	76	193	346	266	1	267	11
9 Minerals	1	0	0	0	0	0	0	0	0	1	1	0
10 Vegetable & Fruit	426	7	11	18	98	47	111	255	30	38	69	84
11 Tapioca	765	40	6	46	79	187	150	416	0	76	76	227
12 Maize	394	0	0	0	14	305	9	328	14	53	67	0
13 Sugar	206	19	1	20	12	12	7	31	1	149	150	5
14 Beans	12	2	0	2	1	0	0	1	0	10	10	0
15 Jute & Products	70	1	0	1	27	3	32	62	2	3	5	2
16 Beverages	768	0	32	32	68	349	205	622	98	9	107	7
17 Processed Foods	602	100	29	129	119	83	85	286	15	74	89	97
18 Animals	1047	0	0	0	126	60	393	579	1	18	19	449
19 Fish	18	1	0	1	7	1	3	11	6	0	6	0
20 Fertilizer & Animal Feeds	12027	0	312	312	7873	259	2189	10321	180	30	210	1185
21 Personal Effects	427	6	48	54	46	62	68	175	39	136	175	21
22 Other Manufactures	1747	25	73	98	488	173	434	1095	452	32	484	71
23 All Others	371	9	13	22	42	59	147	248	44	34	78	23
TOTAL	22616	308	692	999	9735	2253	5014	17001	1243	929	2172	2443

Table 4.5.14 Road Commodity Flow Projections Summary, 2006, Nakhon Sawan

(UNIT : THOUSAND TONS)

COMMODITY TYPE	TOTAL	THROUGH TO/FROM BANGKOK			CHANGWAT : NAKHON SAWAN				BANGKOK TO NS	NS TO BANGKOK	BANGKOK AND NS	OTHER CHANGWATS
		TO	FROM	SUBTOTAL	INTO	FROM	INTRA	SUBTOTAL				
1 Rice	4071	283	78	361	987	252	1591	2829	5	600	605	276
2 Sand & Gravel	625	29	140	169	84	66	155	304	1	3	4	148
3 Cement & Products	2044	17	362	379	55	240	117	412	27	6	33	1221
4 Steel	421	116	84	200	13	28	100	141	37	12	49	32
5 Other Construction	459	14	124	138	40	17	38	95	18	19	37	189
6 Timber	736	86	29	115	22	6	26	54	9	6	16	552
7 Firewood	252	89	0	89	18	4	21	44	5	13	18	102
8 Petroleum Products	2638	172	1084	1257	200	646	29	875	455	5	460	46
9 Minerals	550	101	0	101	0	20	0	20	9	38	47	381
10 Vegetable & Fruit	281	31	5	36	56	30	92	178	18	10	27	40
11 Tapioca	1472	274	27	300	133	164	96	393	0	115	115	663
12 Maize	1936	588	325	913	226	247	38	512	0	304	305	206
13 Sugar	280	92	14	106	73	4	47	123	2	24	26	25
14 Beans	137	70	8	77	23	0	2	25	0	30	30	5
15 Jute & Products	62	0	22	22	20	0	11	31	5	0	5	4
16 Beverages	1163	189	224	413	85	224	250	562	67	0	67	121
17 Processed Foods	463	5	61	56	75	139	74	289	23	12	35	73
18 Animals	470	31	56	67	15	35	35	85	1	6	8	310
19 Fish	26	0	4	4	0	6	1	8	5	0	6	9
20 Fertilizer & Animal Feeds	746	7	221	228	38	15	103	156	102	38	140	222
21 Personal Effects	370	40	85	126	34	29	54	117	39	14	53	74
22 Other Manufactures	6242	486	1676	2162	319	579	2174	3070	457	31	488	522
23 All Others	1593	319	205	524	114	208	270	592	48	66	114	363
TOTAL	27038	3039	4814	7854	2630	2960	5324	10914	1333	1354	2687	5584

Table 4.5.15 Road Commodity Flow Projections Summary, 2006, Nakhon Ratchasima

(UNIT : THOUSAND TONS)

COMMODITY TYPE	TOTAL	THROUGH TO/FROM BANGKOK			CHANGWAT : NAKHON RATCHASIMA				BANGKOK TO NR	NR TO BANGKOK	BANGKOK AND NR	OTHER CHANGWATS
		TO	FROM	SUBTOTAL	INTO	FROM	INTRA	SUBTOTAL				
1 Rice	3090	338	0	338	603	219	1222	2044	2	270	272	436
2 Sand & Gravel	120	0	15	15	6	25	40	71	2	4	6	28
3 Cement & Products	770	0	227	227	32	93	59	194	44	6	50	309
4 Steel	361	24	96	120	12	7	116	136	65	8	73	32
5 Other Construction	17651	250	2804	3054	1002	443	6999	9444	27	16	43	6110
6 Timber	252	29	4	33	7	2	113	122	6	14	20	77
7 Firewood	31	1	3	4	7	0	14	21	0	4	4	2
8 Petroleum Products	5933	200	2513	2713	257	623	1131	2011	1097	4	1101	107
9 Minerals	4	0	0	0	0	0	0	0	0	4	4	0
10 Vegetable & Fruit	1587	78	40	118	601	210	309	1120	65	72	137	212
11 Tapioca	6131	186	30	216	2079	538	2292	4909	0	363	363	643
12 Maize	453	0	78	78	61	0	0	61	0	314	314	0
13 Sugar	224	88	0	98	54	0	14	68	0	5	5	63
14 Beans	3	0	0	0	0	0	0	0	1	5	6	2
15 Jute & Products	888	0	49	49	389	18	140	547	16	224	240	51
16 Beverages	1297	30	104	134	282	74	624	979	152	9	160	23
17 Processed Foods	4370	580	302	882	649	741	757	2147	36	948	984	357
18 Animals	1076	8	4	12	129	101	269	499	4	46	49	515
19 Fish	140	16	0	16	10	14	44	68	15	0	-15	41
20 Fertilizer & Animal Feeds	3968	13	189	202	452	948	1720	3119	333	67	400	246
21 Personal Effects	474	16	52	67	53	91	139	264	76	33	109	34
22 Other Manufactures	7552	422	738	1160	1752	332	2941	5025	635	99	734	613
23 All Others	6816	968	603	1570	431	871	3081	4383	70	115	185	678
TOTAL	63174	3250	7849	11099	8847	5350	22024	36221	2646	2630	5276	10578

Table 4.5.16 Road Commodity Flow Projections Summary, 2006, Songkhla

(UNIT : THOUSAND TONS)

COMMODITY TYPE	TOTAL	THROUGH TO/FROM BANGKOK			CHANGWAT : SONGKHLA				BANGKOK TO SK	SK TO BANGKOK	BANGKOK AND SK	OTHER CHANGWATS
		TO	FROM	SUBTOTAL	INTO	FROM	INTRA	SUBTOTAL				
1 Rice	168	0	0	0	54	0	83	137	0	0	0	31
2 Sand & Gravel	1300	0	0	0	202	63	1034	1300	0	0	0	0
3 Cement & Products	257	23	0	23	132	0	79	212	0	0	0	23
4 Steel	124	16	17	33	0	5	79	85	0	0	0	7
5 Other Construction	41	0	13	13	2	10	16	28	0	0	0	0
6 Timber	575	137	0	137	75	3	352	431	0	0	0	8
7 Firewood	62	0	0	0	8	0	54	62	0	0	0	0
8 Petroleum Products	2000	18	0	18	356	989	576	1921	27	0	27	32
9 Minerals	0	0	0	0	0	0	0	0	0	0	0	0
10 Vegetable & Fruit	102	0	1	1	28	9	21	57	2	1	3	40
11 Tapioca	4	0	0	0	0	0	0	0	0	4	4	0
12 Maize	21	0	0	0	3	0	18	21	0	0	0	0
13 Sugar	22	0	12	12	0	0	10	10	0	0	0	0
14 Beans	0	0	0	0	0	0	0	0	0	0	0	0
15 Jute & Products	0	0	0	0	0	0	0	0	0	0	0	0
16 Beverages	458	0	44	44	23	42	328	393	20	0	20	5
17 Processed Foods	102	1	32	33	10	10	29	49	6	9	15	5
18 Animals	226	0	0	0	23	17	165	206	0	0	0	21
19 Fish	403	16	0	16	139	89	111	338	2	17	18	30
20 Fertilizer & Animal Feeds	461	65	11	76	55	78	209	342	23	14	37	7
21 Personal Effects	62	0	0	0	17	10	26	54	2	0	3	5
22 Other Manufactures	951	8	0	8	208	86	377	672	98	6	104	168
23 All Others	1777	516	0	516	590	79	418	1097	36	10	46	128
TOTAL	9115	800	130	930	1927	1490	3987	7404	216	60	276	505

4 - 27

Table 4.5.17 Road Commodity Flow Projections Summary, 2006, Hat Yai

COMMODITY TYPE	TOTAL	THROUGH TO/FROM BANGKOK			AMPHOE : HAD YAI				BANGKOK TO HY	HY TO BANGKOK	BANGKOK AND HY	OTHER CHANGWATS
		TO	FROM	SUBTOTAL	INTO	FROM	INTRA	SUBTOTAL				
1 Rice	602	0	0	0	127	49	123	299	9	0	8	294
2 Sand & Gravel	3648	0	0	0	350	123	3175	3648	0	0	0	0
3 Cement & Products	354	0	7	7	88	60	97	246	16	4	20	82
4 Steel	200	41	19	59	8	0	104	112	21	8	29	0
5 Other Construction	155	7	12	20	18	25	81	125	8	2	10	0
6 Timber	1075	69	0	69	125	28	720	872	2	17	19	115
7 Firewood	88	0	0	0	19	1	47	66	2	7	10	12
8 Petroleum Products	1294	43	0	43	213	231	771	1215	34	2	36	0
9 Minerals	16	0	0	0	0	5	0	5	1	0	1	10
10 Vegetable & Fruit	146	9	6	15	39	17	45	101	4	2	5	24
11 Tapioca	43	0	12	12	8	9	0	17	0	14	14	0
12 Maize	4	0	0	0	1	0	2	3	1	0	2	0
13 Sugar	3	0	2	2	0	0	0	1	1	0	1	0
14 Beans	1	0	0	0	0	0	1	1	0	0	1	0
15 Jute & Products	16	0	0	0	5	4	5	14	0	1	1	1
16 Beverages	631	0	80	80	46	116	326	487	31	2	33	31
17 Processed Foods	292	3	14	17	17	42	134	193	22	50	72	10
18 Animals	3	0	0	0	1	0	2	2	0	0	0	0
19 Fish	855	26	0	26	206	62	462	730	8	66	74	25
20 Fertilizer & Animal Feeds	1338	10	49	59	283	143	584	1010	149	86	235	34
21 Personal Effects	234	9	40	49	41	22	64	127	36	18	54	4
22 Other Manufactures	2545	0	31	31	622	391	792	1805	631	32	663	46
23 All Others	3480	286	3	289	777	254	1801	2832	12	293	305	55
TOTAL	17021	503	273	776	2995	1582	9334	13912	987	604	1591	742

CHAPTER 5

CHARACTERISTICS OF COMMODITY FLOW IN THAILAND
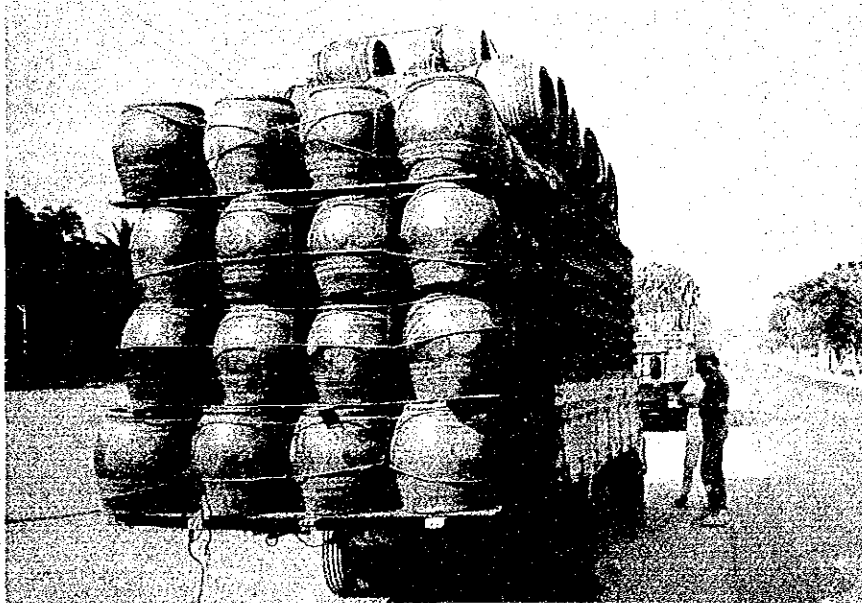
CHAPTER 5   CHARACTERISTICS OF COMMODITY FLOW IN THAILAND

5.1   General

Based on the analyses of commodity flow surveys and commodity flow forecast described in the preceding Chapters, the study results of further investigations and analyses regarding the characteristics of commodity flow are presented in this Chapter.

Demand characteristics, types and amounts for road freight transport are described in further detail in this Chapter than in the preceding Chapter with particular attention given to the road transport industry to accommodate them. Existing, as well as future conditions of commodity flows are analyzed in Section 5.2.

Section 5.3 examines the existing systems of road transport with their problems and discusses possible changes in the industry in the future from the organizational viewpoint. Shipper's distribution systems are also examined.

Existing laws and regulations are examined in Section 5.4 with regard to their effects on existing conditions of the road freight transport industry.

These study results reflect the analyses of the roles, functions and utilization of truck terminals and the terminal system described in the next Chapter.

5.2   Existing and Future Conditions of Commodity Flows

5.2.1 Existing National Systems and Conditions of Commodity Flows

1) Cargo Flows between Bangkok and the Rest of the Country

Cargo transport throughout the Kingdom is heavily dependent on trucks, while railways play a comparatively less significant role as seen in Fig. 5.2.1. The marine transport including river transport is the sector which has even less importance in terms of volume.

The dominant domestic truck transport in the Kingdom is spread along the radial routes emanating from Bangkok to the various regions. Fig. 5.2.2 shows this pattern. Direct exchange of cargoes among the rural regions is less significant. As shown in Fig. 5.2.3, about 77% of the total volume transported between Bangkok and the rest of the country are inbound cargoes to the Bangkok Metropolitan Area, while only 23% of the total is outbound cargoes transported from Bangkok to the respective regions. A large difference is observed between the volume transported to and from the Bangkok Metropolitan Area.

The cargoes transported from the various regions to Bangkok are generally grouped into two categories: one consists of rice, maize, cassava, sugar, other cereals, rubber and other agricultural and forest products, while the other is comprised of sand/gravel, cement and other construction materials. Both categories of commodities are generally handled as bulk cargo, either in bulk or in bags. Commodities transported from Bangkok to the regions

are mostly industrial products, which are sometimes carried as bulk cargo as in the case of oil and fertilizer, while machinery and consumer goods are transported as general cargo.
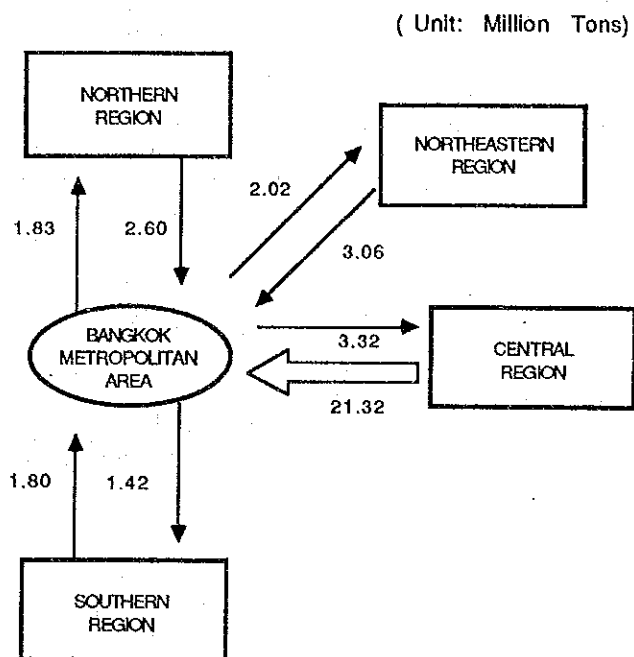
Agricultural products from the regions to Bangkok are lower in value per unit weight. Industrial products from Bangkok to the regions are relatively higher in value per unit weight.
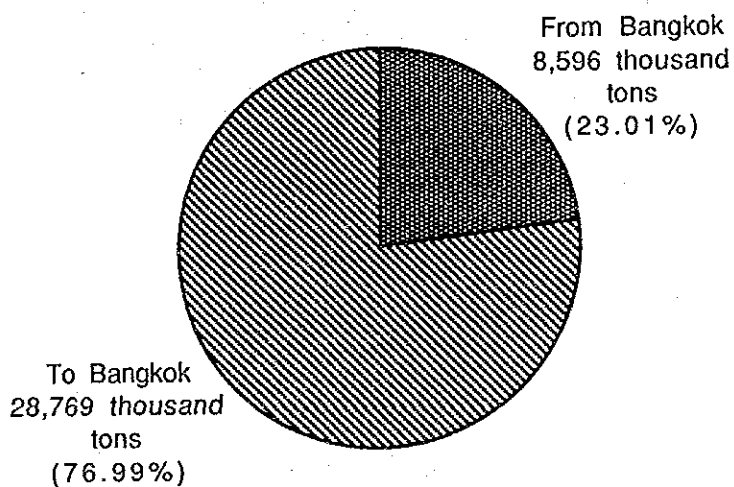
Fig. 5.2.1 Cargo Flows of Thailand (1984)

Domestic

54.2 Million Tons

Import

Truck 87.2%
Rail 10.5%
Water 0.0%
Coastal 2.2%

Export

20.2 million tons
Sea 99.3%
Land 0.6%
Air 0.1%

17.8 million tons
Sea 95.7%
Land 3.7%
Air 0.5%
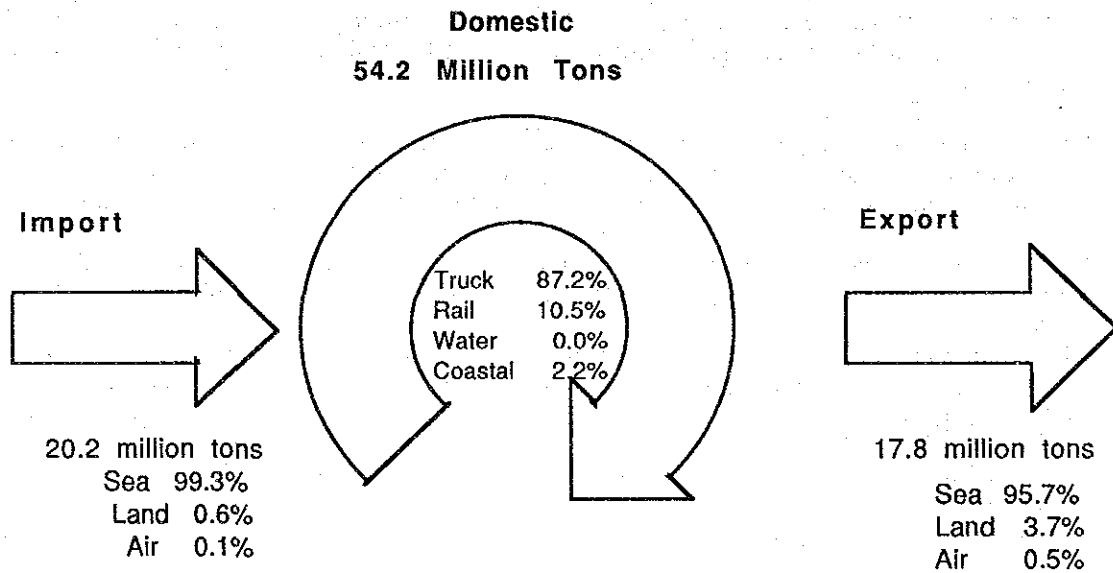
Source: "Annual Transport Statistics" by the Ministry of Communications, 1985

Fig. 5.2.2 Region's Cargo Volume to and from Bangkok, 1985

(Unit: Million Tons)

Fig. 5.2.3 Road Transport Volume to and from Bangkok, 1985

From Bangkok
8,596 thousand
tons
(23.01%)

To Bangkok
28,769 thousand
tons
(76.99%)

Major export commodities in terms of weight are agricultural, forest and marine products. They are carried to the Bangkok Metropolitan Area prior to being shipped abroad, except for tapioca. International truck transport is observed along the borders with Malaysia. At present, it is specialized mode in transport of perishables such as fresh fish, vegetables, and fruits. The volume involved is relatively small compared with that by marine transport.

According to the limited data which are provided by the Land Transport Department and compiled by the Study Team, between a Project City and the surrounding Changwat, there is a certain amount of radial pattern of cargo similar to that between Bangkok and the regions.

2) Pattern of Cargo Transport by Trucks

There are two methods of transport. One is the method by which a commodity of a larger lot is loaded on a single truck, while in the other method, commodities of smaller lots are combined to make a truck load. The latter is called the consolidated cargo. For the Bangkok bound cargo, the former method is chiefly employed, while for the province or upcountry bound, both methods are used.

a) Flow Patterns for Bangkok Bound Cargo

The following patterns are observed in the transport of agricultural and marine products from provinces to the Bangkok Metropolitan Area.

Fig. 5.2.4 shows the patterns of cargo flow of agricultural products from the provinces to the Bangkok Metropolitan Area.

Agricultural products are procured by middlemen who collect them by heavy or light trucks and carry them to processing plants within the respective provinces. Having been processed in the plants, they are stored temporarily in private warehouses. Responding to the demand of the market or controls by the Government, they are forwarded to warehouses in the Metropolitan Area and some coastal areas by heavy trucks.

A part of processed agricultural products forwarded to the Bangkok Metropolitan Area are redistributed for domestic consumption. They are sent to wholesalers and retailers in the regions where they are consumed, via large wholesalers in Bangkok.

As for exports, they are stored in warehouses in Ayutthaya, Chon Buri, and other areas around Bangkok. Then, they are mostly carried by barges for loading aboard ocean vessels for shipping abroad.

b) Flow Patterns for the Upcountry Bound Cargo

i) Transport of Industrial Products as Truck Loads

Some industrial products are transported as truck load bulk cargo such as oil and cement.

Fig. 5.2.5 shows the flow of bulk industrial products. In the depots of processing factories, bulk cargo are placed in specially designed facilities. These depots are connected by special heavy trucks built for

bulk cargo shipment, i.e., tank trucks. From the terminal depots, delivery is performed by heavy trucks and light trucks.

ii) Transport of General Cargo* in Truck Load Units

Fig. 5.2.6 shows truck load transport of general cargo. This pattern is often followed by large scale manufacturers and "national brand" products. Shipments from factories or factory warehouses are transported by heavy trucks to the provinces. In the provinces, these commodities are usually stored first at depots of the manufacturers, distributors, and local agents. Sometimes, they are delivered directly by heavy trucks to local retailers. In the case of direct delivery, line-haul transport and terminal delivery are not separated, leading to less effective truck operation and other undesirable effects such as aggravating congestion in urban centers by heavy trucks and long roadside parking which also causes traffic congestion.

iii) Transport of General Cargo as Consolidated Load

Typical commodities for consolidated transport are machinery, electrical appliances, light industry consumer goods and sundries in lots too small to make a full truck load by themselves. Patterns for consolidated transport are shown in Fig. 5.2.7. The products to be transported are either manufactured in the Bangkok Metropolitan Area or imported from abroad.

Cargoes are collected from the door of consignors to the cargo handling sites (It has the same function as a terminal, but has not been developed to have a platform with adequate parking spaces on both sides. For this reason, in this Section the term of cargo handling site is preferred rather than the term of existing private terminal).

Most of this collection is done by direct consignment of consignors but sometimes by forwarders. As most cargo handling sites of forwarders are situated in congested urban centers, the concentration of cargoes by light delivery trucks to these sites adds to traffic hazards. The handling facilities at these sites are very often limited in space and inadequate. Haphazard development of cargo handling sites results in the lack of well-planned layout of materials handling, causing less efficiency in cargo handling.

Consolidated load is carried not only by forwarders' trucks. The trucks that have carried agricultural products from the provinces are utilized on their return trip back home.

Note: * "General cargo" is a general term for packaged cargoes, as against "Bulk cargo" which refers to commodities handled in bulk, such as dry bulk coal, ironstone, grain, etc., and liquid bulk oil, etc.
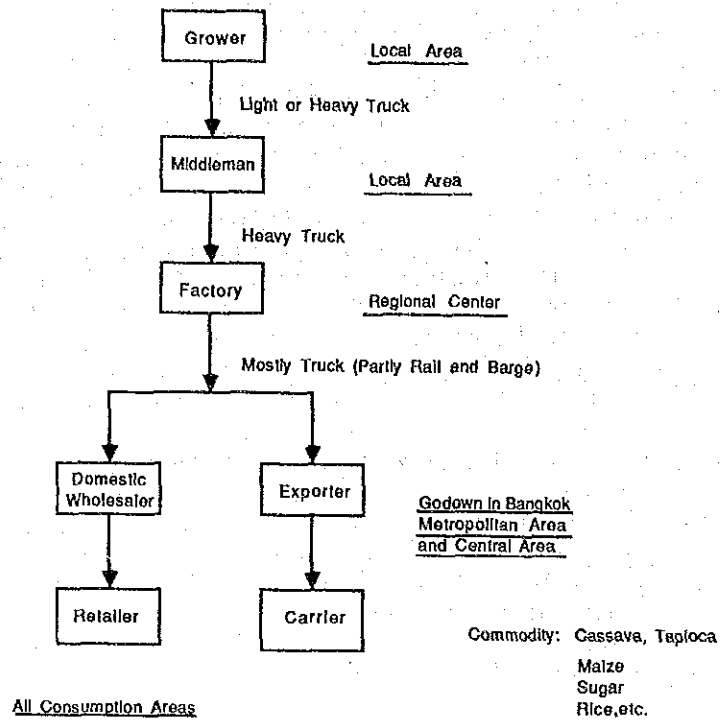
Fig. 5.2.4　Cargo Flows of Bulk Agricultural Products

```
        ┌─────────┐
        │ Grower  │          Local Area
        └─────────┘
             │
             │  Light or Heavy Truck
             ▼
        ┌──────────┐
        │ Middleman│          Local Area
        └──────────┘
             │
             │  Heavy Truck
             ▼
        ┌─────────┐
        │ Factory │          Regional Center
        └─────────┘
             │
             │  Mostly Truck (Partly Rail and Barge)
        ┌────┴───────────────┐
        ▼                    ▼
  ┌───────────┐        ┌──────────┐
  │ Domestic  │        │ Exporter │      Godown in Bangkok
  │ Wholesaler│        └──────────┘      Metropolitan Area
  └───────────┘              │           and Central Area
        │                    │
        ▼                    ▼
  ┌──────────┐        ┌──────────┐
  │ Retailer │        │ Carrier  │
  └──────────┘        └──────────┘

                            Commodity: Cassava, Tapioca
                                       Maize
                                       Sugar
  All Consumption Areas                Rice,etc.
```

Fig. 5.2.5　Cargo Flows of Bulk Industrial Products

```
              ┌─────────┐
              │ Factory │       Depot owned by Factory
              └─────────┘       in Bangkok Metropolitan Area
                   │
        ┌──────────┴──────────┐
        │                     │   Heavy Truck or Rail
        ▼                     ▼
  ┌───────────┐        ┌──────────┐
  │ Regional  │        │ Company  │      Depot in
  │ Wholesaler│        │ Regional │      Regional Center
  └───────────┘        │ Agent    │
        │              └──────────┘
        │                     │
        │                     │  Heavy Truck
        │                     ▼
        │              ┌────────────┐
        │              │ Provincial │     Depot in
        │              │ Wholesaler │     Changwat
        │              └────────────┘
        └──────────┬──────────┘
                   │  Small Truck      Commodity : Fuel Oil
                   ▼                              Cement
             ┌──────────┐                         etc.
             │ Retailer │   District
             └──────────┘
```
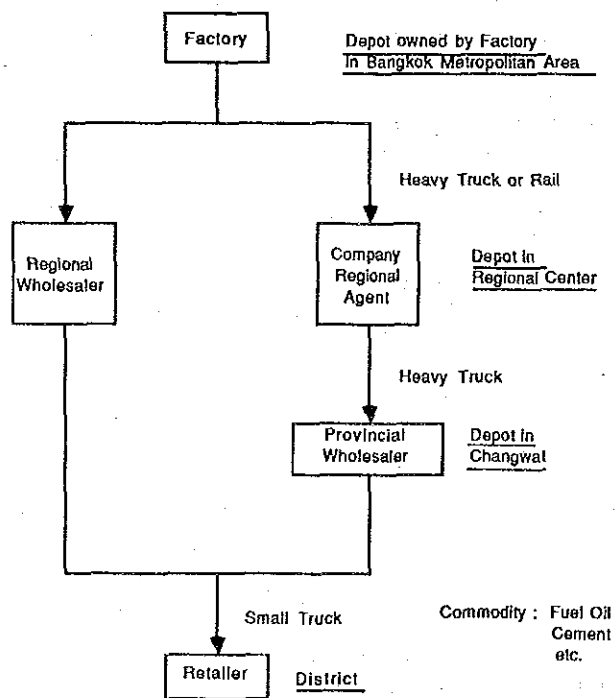
Fig. 5.2.6 Cargo Flow of Truck Load Consumer Goods

Factory
Subsidiary Wholesaler — Bangkok Metropolitan Area

Heavy Truck

Provincial Wholesaler

Subsidiary Wholesaler Prov. Agent — Depot at Changwat Center

Small Truck

Retailer — District — Commodity : Household Appliances
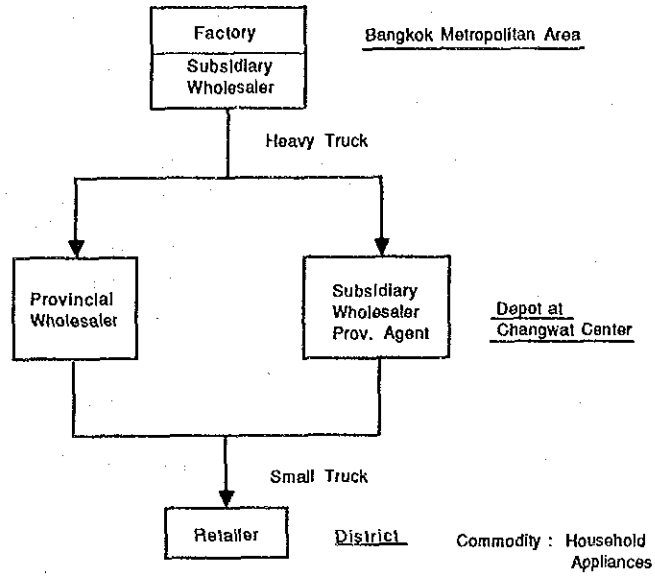
Fig. 5.2.7 Cargo Flow of Less Than Truck Load Consumer Goods

Factory   Importer — Bangkok Metropolitan Area

Contract Truck (Small)

Central Wholesaler — Depot in Bangkok Metropolitan Area

Consolidater's Truck (Heavy)

Central W.S Provincial Branch

Provintial Wholesaler — Depot at Changwat Center

Forwarder's Small Truck   Commodity : Daily Consumer Goods

Retailer — District
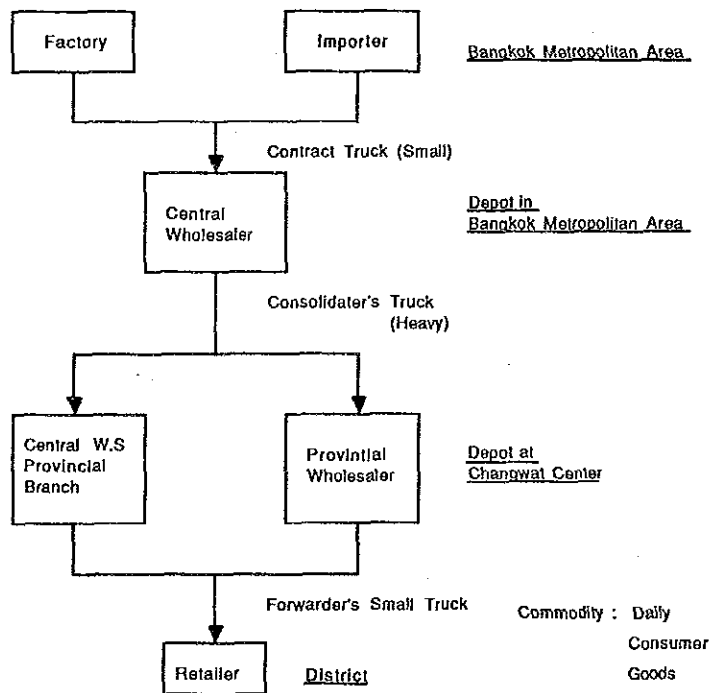
5.2.2 Existing Systems and Conditions in Project Cities

In this Section the cargo flow between the Project Cities and the Bangkok Metropolitan Area are analyzed.

1) Cargo Flows between the Five Project Cities and Bangkok

Fig. 5.2.8 shows cargo volumes between the five Project Cities and the Bangkok Metropolitan Area.

Flow patterns in the figure are shown as follows: The pattern is similar to that of the cargo flows throughout the Kingdom except for Chiang Mai; the Bangkok bound cargoes exceed that of the upcountry bound cargo.   The five provincial capitals concerned here have urbanized areas, and the differences between volumes in the two directions are less conspicuous when compared with figures for the Kingdom as a whole.

The volume of cargo flows to and from Bangkok was studied for each Project City.   Those cities which are at shorter distances from Bangkok, such as Nakhon Ratchasima, Nakhon Sawan indicate higher volumes of cargo transported, while cities at longer distances such as Chiang Mai, Khon Kaen, Hat Yai/Songkhla indicate lower figures.

Fig. 5.2.8 Cargo Flows between Project Cities and Bangkok
(thousand tons/year)
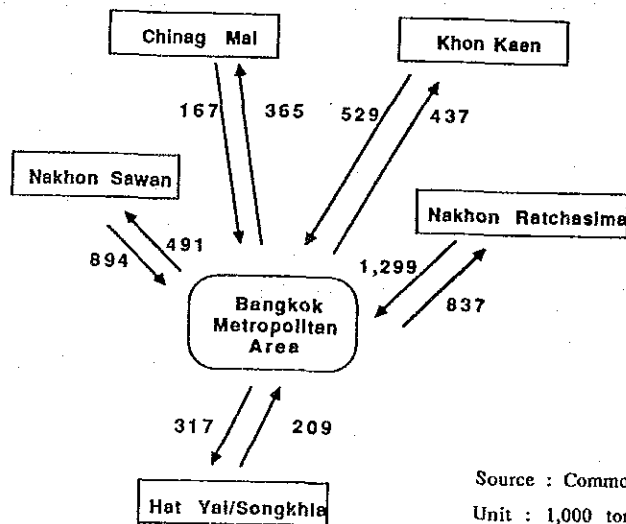
Source : Commodity Flow Survey,Feb. 1987

Unit : 1,000 tons/year

2) Cargo Flows between Each Project City and Other Regions

a) Movement Patterns of Loaded Trucks

Table 5.2.1 and Table 5.2.2 show the number of loaded trucks between each Project City and other regions (excluding their own region) surveyed by the Study Team.

As shown in Table 5.2.1, there are four distinctive features of outbound cargoes from the Project Cities. The first feature is: The figure of loaded trucks from Chiang Mai is very small, compared with trucks from other cities. The second: The number of outbound trucks from Nakhon Ratchasima, Nakhon Sawan and Hat Yai/Songkhla to Bangkok were the highest, and the next high number of trucks were to the Central Region which surround the Metropolis. The third: As for the destination of shipment from Khon Kaen and Nakhon Ratchasima in the Northeast region, the Central Region was the highest in volume, and the next high volumes were to Bangkok. The fourth: Between two cities of Chiang Mai, Nakhon Sawan in the North region, and two cities of Khon Kaen, Nakhon Ratchasima in the Northeast region, there is little connection regarding commodity exchange. On the contrary, the Southern region and Hat Yai/Songkhla which are far from other Project Cities have closer connections regarding commodity exchange.

As shown in Table 5.2.2, there are three distinctive features of inbound patterns to the Project Cities. The first feature is: The highest inbound number of trucks to the Project Cities were from Bangkok. Second: As for Nakhon Ratchasima and Nakhon Sawan which are closer with the Central region, the number of trucks from the Central region were second highest in number. Third: four cities in the North and the Northeast have closer connection with the Southern region than the connection between the North and the Northeast.

b) Features of Commodity Types from and to Project Cities

Table 5.2.3 shows the volume of each cargo item which flows between Bangkok and the Project Cities.
Concerning inbound commodity types from Bangkok, each Project City has little distinguishing features. The commodity type of the highest volume to the project cities was general cargo classified as "other manufactured products", and second highest volume of cargo was "petroleum products". The figures of petroleum products from Bangkok showed remarkable volume to Nakhon Sawan and Nakhon Ratchasima, which are located near Bangkok.

Concerning the outbound flow to Bangkok from each Project City, the characteristics of the composition of cargo items were identified. For example of the items from Nakhon Sawan, the weights of "rice", "tapioca" and "maize" were very large, and from Nakhon Ratchasima, "jute & products" and "processed foods" and above-mentioned cargo items were remarkably large. From Khon Kaen, "rice" and "sugar" were very large.

Table 5.2.1 Loaded Truck Volumes from Each Project City to Other Regions

From \ To	North	Northeast	Central	Bangkok Metro. Area	South	Total
Chiang Mai	-	26	103	331	73	533
Nakhon Sawan	-	23	2432	3216	438	6109
Khon Kaen	70	-	3206	2441	212	5929
Nakhon Ratchasima	22	-	5003	3241	602	8868
Hai Yai / Songkhla	75	30	202	2714	-	3021

Table 5.2.2 Loaded Truck Volumes from Other Regions to Each Project City

From \ To	Chiang Mai	Nakhon Sawan	Khon Kaen	Nakhon Ratchasima	Hat Yai Songkhla
North	-	-	97	56	121
Northeast	7	59	-	-	95
Central	337	2890	886	3482	108
Bangkok Metro. Area	673	3064	1841	4090	1544
South	42	491	156	325	-
Total	1059	6504	2980	7953	1868

Unit: Number of Loaded vehicles
(Interviewed Sample only)
Source: Commodity Flow Survey
by the Study Team, 1987

Note: Numbers of Interview Stations
and Periods are as follow

	No. of stat.	Period
Chiang Mai	6	12 ~ 20 hrs
Nakhon Sawan	3	12 ~ 18 hrs
Khon Kaen	4	12 ~ 18 hrs
Nakhon Ratchasima	4	12 ~ 18 hrs
Hat Yai / Songkhla	5	12 ~ 18 hrs

Table 5.2.3 Volume of Cargo Flow at Project Cities, to and from Bangkok, 1987

(Unit: 1000 tons / year)

	Chaing Mai		Nakohan Sawan		Khon Kaen		Nakhon Ratch.		Hat Yai / Songkhla		Total	
	From BKK	To BKK	From BKK	To BKK	From BKK	To BKK	From BKK	To BKK	From BKK	To BKK	From BKK	To BKK
Rice	1	15	3	382	2	143	1	172	5	0	12	712
Sand & Gravel	1	1	0	1	0	1	1	1	0	0	2	4
Cement & Products	21	0	11	2	9	1	17	2	6	2	64	7.
Steel	10	3	16	5	17	1	25	3	8	3	76	15
Other Construction Materials	14	2	5	5	4	2	5	3	6	1	34	13
Lumber	3	2	8	5	4	16	5	12	1	14	21	49
Firewood	0	2	4	11	9	2	0	4	2	6	15	25
Petroleum products	49	8	138	2	80	0	314	1	18	1	599	12
Minerals	0	9	4	16	0	1	0	4	1	0	5	30
Vegetable & Fruit	7	13	7	4	7	9	14	16	3	2	38	44
Tapioca	0	6	0	115	0	76	0	363	0	18	0	578
Maize	0	16	0	229	11	40	0	237	1	0	12	522
Sugar	0	0	2	20	1	123	0	4	1	0	4	147
Beans	0	5	0	30	0	10	1	5	0	0	1	50
Jute & Products	0	0	3	0	1	2	9	128	4	1	17	131
Beverages	15	3	19	0	23	2	34	2	7	0	98	7
Processed Foods	5	38	11	5	5	22	8	221	5	14	34	300
Animals	0	1	1	3	0	8	2	20	0	0	3	32
Fish	5	0	3	0	5	0	13	0	6	50	32	50
Fert. & Ani. Feeds	22	2	43	16	57	10	98	20	37	22	257	70
Personal Effects	12	6	11	4	10	35	18	8	8	4	59	57
Other Manufactures	175	10	185	13	184	13	249	39	187	10	980	85
All Others	23	23	18	24	17	13	22	36	9	62	89	158
Total	365	167	491	894	437	529	837	1299	317	209	2452	3098

Note: Underlines indicate "More than one hundred thousand tons".
Source: Commodity Flow Servey by the Study Team, 1987

c) <u>Physical Distribution Character of Each Project City</u>

It can be said that all Project Cities have strong ties with the Bangkok Metropolitan Area. The Project Cities, in closer proximity with the Central region surrounding Bangkok, such as Nakhon Sawan and Nakhon Ratchasima, have strong connections with the Central region.

Chiang Mai and Hat Yai/Songkhla are Project Cities that have a larger amount of inbound cargo than outbound one.

Hat Yai/Songkhla area has some connection with the North and Northeast with respect to cargo flow by the reason of different characters of primary industry in the peninsula as compared to other regions.

River or coastal located cities such as Nakhon Sawan and Hat Yai/Songkhla have the tendency of depending more on the waterway for bulk cargo transport.

3) <u>Cargo Flows between Project Cities and Surrounding Provinces</u>

The present distribution patterns of commodities in the surrounding provinces vary depending on the commodity, as shown by figures in Appendices 5.1 through 5.18. Other construction materials show a narrow distribution pattern. Processed foods and household appliances show wide distribution patterns.

For cargo items with a wider distribution pattern such as processed foods and household appliances, there are two patterns of distribution. One is the cargo flow which comes from a limited number of provinces into the Project City and spreads to many provinces. The other is the cargo flow which comes from many provinces to the Project City and spreads within a limited number of provinces.

In the case of a region where two Project Cities exist, the two cities divide the region geographically into two distinctive territories. Nakhon Sawan and Nakhon Ratchasima, in closer proximity with the Central region, extend their distribution areas to the Central region as well.

5.2.3 Future Conditions and Characteristics

1) <u>National Economy and Cargo Transport in Future</u>

Economic forecasts adopted in this study are explained in Chapter 4. According to this Chapter, changes in sectoral shares of GDP in future can be summarized as follows:

i) The service sector that accounts for half of GDP in 1986 will continue to expand.
ii) The agricultural sector will continue to decrease its share.
iii) The manufacturing sector will continue to grow rapidly.
iv) Expansion of construction sector share and decline in mining sector share would take place in the latter decade.

Since a relatively high rate of the GDP growth and changes of economic structure of Thailand will take place, the following changes will be expected to take place in future cargo transport in Thailand.

i) The slow growth of agricultural sector would stagnate the growth in cargo flow from provinces to Bangkok. The expansion of manufacturing sector would expand the upcountry bound cargo flow resulting in narrowing down for the difference between the Bangkok bound and upcountry bound flows.

ii) Expansion of the service sector and manufacturing sector will accompany the increase in transport of high value cargo. As a result, the demand for small lot transport increases with the increased level of service. Consequently, it would expand the demands for scheduled and consolidated line-haul transport.

2) Future Cargo Flows in the Project Cities

a) Regional Prospects for the Influence Areas

Influence area was defined for each of the Project Cities as described in Chapter 4. Some areas overlap each other.

Fig. 5.2.9 shows the changes in relative importance of respective influence areas in the national economy in terms of Gross Domestic and Regional Products. GDP of Thailand for 1986 and forecasted values for 2006 are taken as 100% in the figure, and GRPs of influence areas are taken as a percentage.

Fig. 5.2.10 shows the growth in Gross Regional Product by sector in respective influence areas. Agriculture will grow only marginally in all areas, especially in Chiang Mai area. Growth in service and construction industries will be high in all areas. A high growth will be marked in mining in Chiang Mai and Nakhon Sawan influence areas, while the mining industry may decrease in output in the Nakhon Ratchasima and Hat Yai/Songkhla areas.

Manufacturing development of these areas will be slower than for the whole of Thailand. When compared among the influence areas, Nakhon Sawan and Nakhon Ratchasima which are near Bangkok will show higher development, while influence areas such as Chiang Mai, Khon Kaen and Hat Yai/Songkhla may be left behind.

On the basis of the above, the following will be given as prospective cargo flow characteristics in the future.

i) There will be little fundamental changes in cargo flow patterns: industrial products and consumer goods from Bangkok to provinces and agricultural products from provinces to Bangkok.

ii) When the Bangkok bound cargo volume is compared with the upcountry bound cargo volume, the Bangkok bound flows would grow slower than the upcountry bound flows (See Fig. 5.2.11).

Fig. 5.2.9 GRP Weight of Each Project City's Influence Area
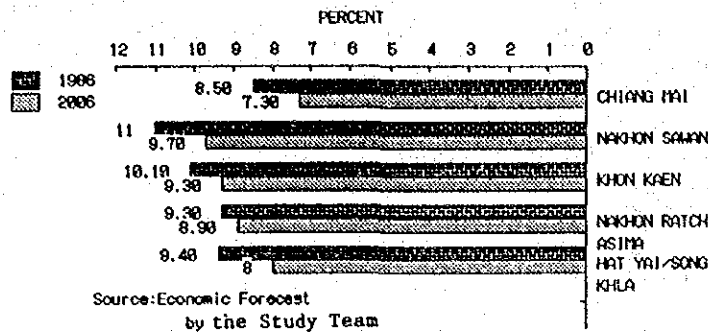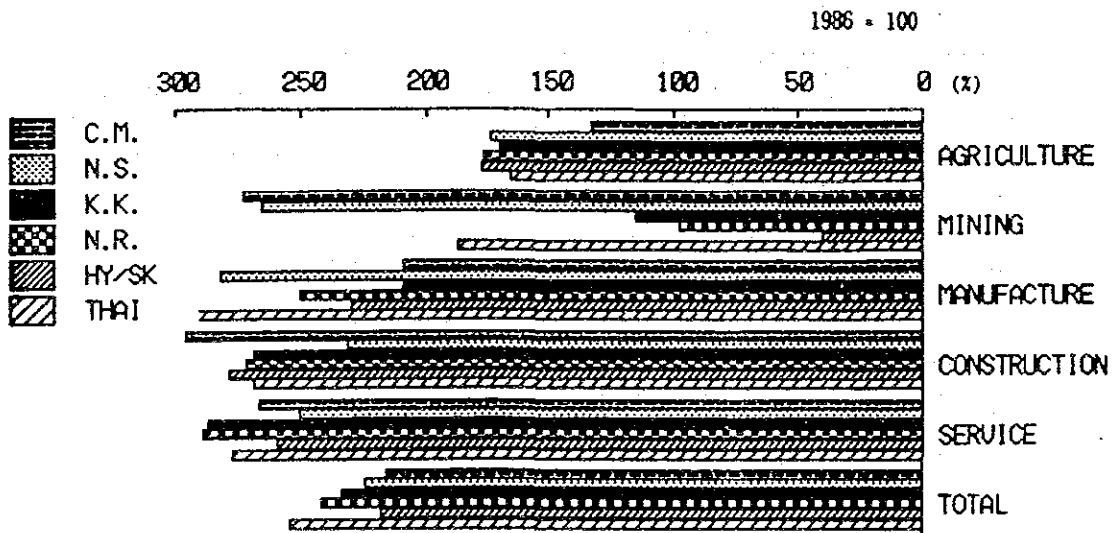in GDP of Thailand

PERCENT

Source:Economic Forecast
by the Study Team

Fig. 5.2.10 Growth Index of Each Industrial Sector's Regional
Product for Project City Influence Area (1986-2006)

1986 = 100

Source: Economic Forecast, by the Study Team

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3) Flows of General Cargo in Project Cities

a) General Cargo Volume to and from Bangkok

Fig. 5.2.12 shows the estimated volumes of general cargo to and from Bangkok in 1987, 1996 and 2006.

In Nakhon Ratchasima, the growth of Bangkok bound general cargo will be large, due to the high pace of industrialization in the area. The expansion of Bangkok bound general cargo will place new demands for the smaller lot consolidated system.

As valued commodities will increase their composition with the expansion of general cargo transport, there will be increased demand for speed, promptness, safe delivery and reliability in transport. General cargo transport between Bangkok and Project Cities will be increased accordingly.

Table 5.2.4 shows the present as well as future volume of general cargo to and from Bangkok by commodity. There will be no substantial change in both directions in terms of commodity compositions, but a total expansion of transport in volume.

The major commodity group in cargo flow from Bangkok at present, as well as in the future, is the other manufactured goods, among which dominant is the household containers. The second group is the fertilizer and animal feeds which are distributed to rural areas surrounding the Project Cities. The third is the beverages followed by the household appliances, which are supplied to people in the provinces.

Among the Bangkok bound cargo of today, as well as in the future, few commodities are common across the regions. Bangkok bound cargo sent from respective regions reflect characteristics of agriculture and manufacturing industries locally prevalent.
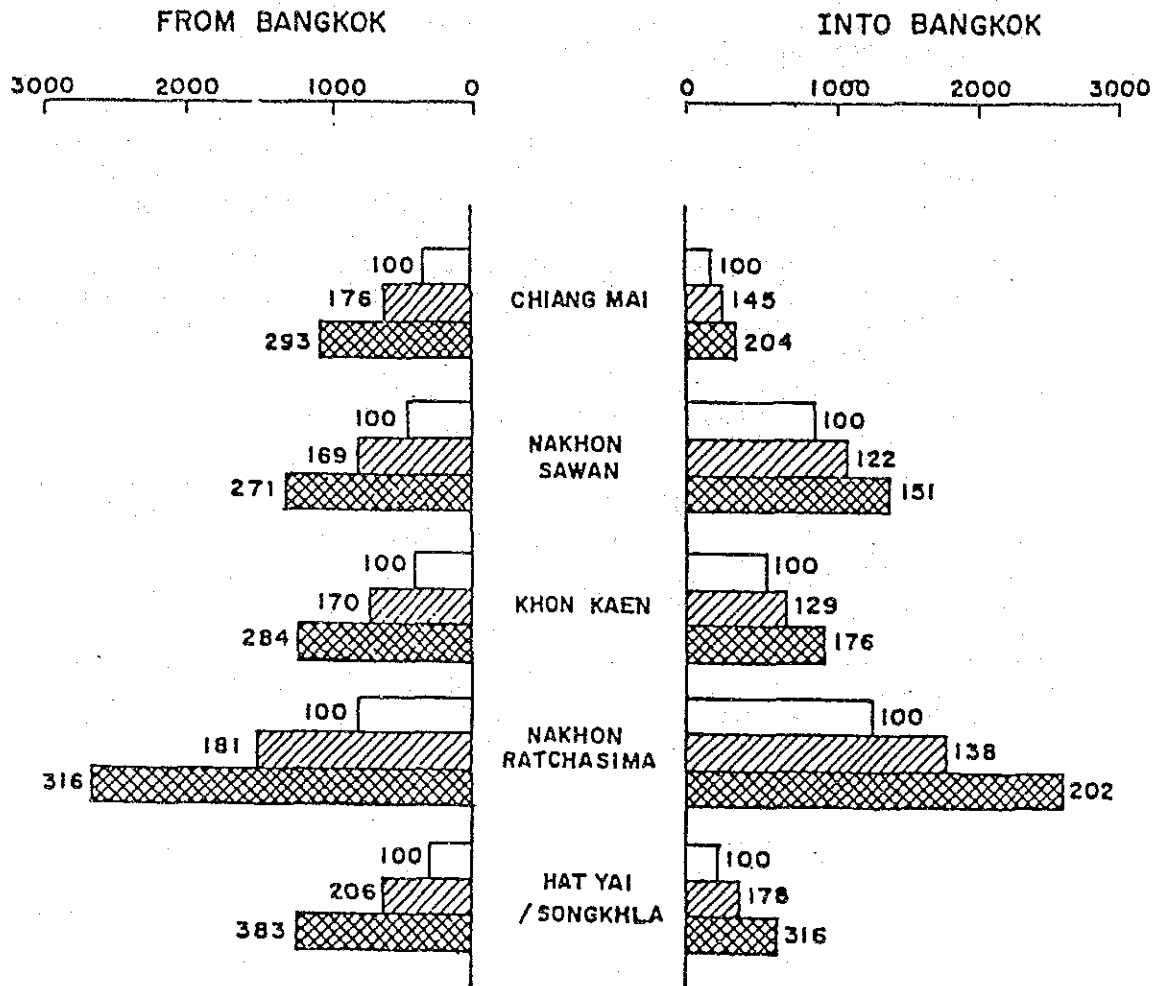
i) Chiang Mai

Among cargoes from Bangkok, the other construction materials account for a high portion of shipment due to expected expansion of the construction industry, followed by household appliances. On the contrary, fertilizer and animal feeds show a decline in weight. Among Bangkok bound cargoes, processed foods, vegetables and fruits account for a high volume as a result of highland crop expansion in Chiang Mai with beverages immediately following.

ii) Nakhon Sawan

Cargo from Bangkok is characterized by a relatively high ratio of processed foods in comparison with other cities. Among other manufactured products besides household containers, there are considerable volumes of mixed ready-made products indicating increasing demand for small lot consolidated transport.

Among the Bangkok bound cargo, other construction materials and fertilizer and animal feeds occupy a high portion.

Fig. 5.2.11 Gross Volume of Cargo Flow to and from Bangkok Present and Future

FROM BANGKOK   INTO BANGKOK

3000   2000   1000   0   0   1000   2000   3000

CHIANG MAI
- 100 / 100
- 176 / 145
- 293 / 204

NAKHON SAWAN
- 100 / 100
- 169 / 122
- 271 / 151

KHON KAEN
- 100 / 100
- 170 / 129
- 284 / 176

NAKHON RATCHASIMA
- 100 / 100
- 181 / 138
- 316 / 202

HAT YAI / SONGKHLA
- 100 / 100
- 206 / 178
- 383 / 316

Unit: Thousand tons per year, 1987=100

Source: Commodity Flow Forecast, by the Study Team
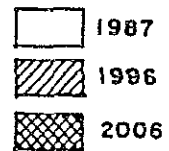
☐ 1987
▨ 1996
▧ 2006

Fig. 5.2.12 Volume of General Cargo Flow to and from Bangkok Present and Future
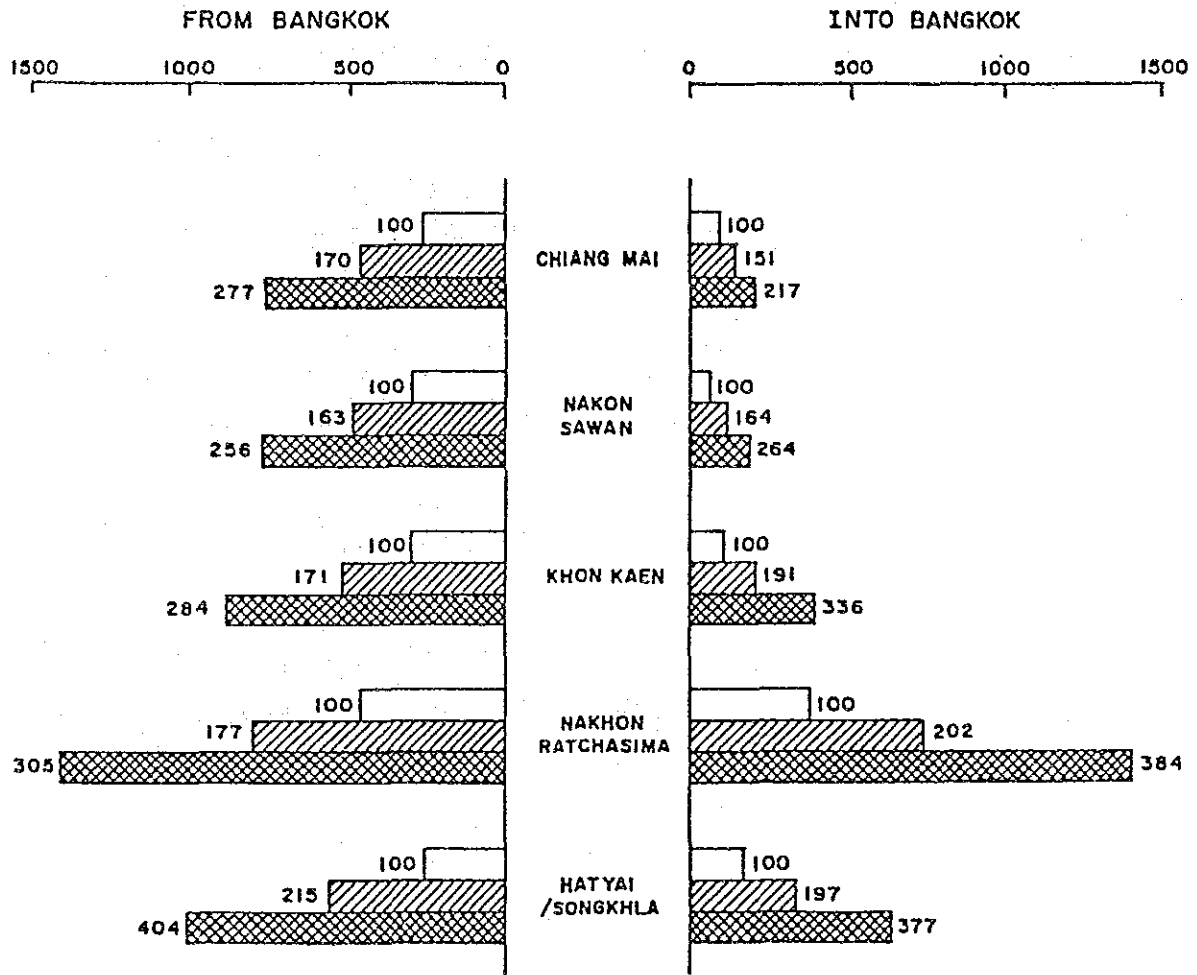
FROM BANGKOK   INTO BANGKOK

| 1500 | 1000 | 500 | 0 | | 0 | 500 | 1000 | 1500 |

CHIANG MAI
- 100
- 170
- 277
- 100
- 151
- 217

NAKON SAWAN
- 100
- 163
- 256
- 100
- 164
- 264

KHON KAEN
- 100
- 171
- 284
- 100
- 191
- 336

NAKHON RATCHASIMA
- 100
- 177
- 305
- 100
- 202
- 384

HATYAI /SONGKHLA
- 100
- 215
- 404
- 100
- 197
- 377

Unit: Thousand tons per year, 1987=100

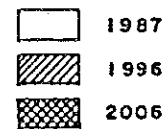Source: Commodity Flow Forecast, by the Study Team

- 1987
- 1996
- 2006

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Table 5.2.4 General Cargo Flow of Project Cities, from and to Bangkok, Present(1987) and Future(2006)

(Unit: 1,000 tons/year, 1987=1.00)

FROM BANGKOK

	Chiang Mai			Nakhon Sawan			Khon Kaen			Nakhon Ratchasima			Hat Yai / Songkhla		
	1987 (a)	2006 (b)	(b)/(a)	1987 (a)	2006 (b)	(b)/(a)	1987 (a)	2006 (b)	(b)/(a)	1987 (a)	2006 (b)	(b)/(a)	1987 (a)	2006 (b)	(b)/(a)
Other Construction Materials	14	77	5.50	5	18	3.60	4	21	5.25	5	27	5.40	6	8	1.33
Vegetables & Fruits	7	15	2.14	7	18	2.57	7	30	4.29	14	65	4.64	8	6	0.75
Beverages	15	55	3.67	19	67	3.53	23	98	4.26	34	152	4.47	10	51	5.10
Processed Foods	5	8	1.60	11	23	2.09	5	15	3.00	8	36	4.50	6	28	4.67
Animals	0	1	-	1	1	1.00	0	1	-	2	4	2.00	0	0	-
Fish	5	4	0.80	3	5	1.67	5	6	1.20	13	15	1.15	6	10	1.67
Fertilizer & Animal Feeds	22	47	2.14	43	102	2.37	57	180	3.16	98	333	3.40	37	172	4.65
Personal Effects	12	45	3.75	11	39	3.55	10	39	3.90	18	76	4.22	8	38	4.75
Other Manufactured Items	175	46	0.26	185	457	2.47	187	452	2.42	249	635	2.55	187	729	3.90
All Others	23	45	1.96	18	48	2.67	17	44	2.59	22	70	3.18	9	48	5.33

TO BANGKOK

	Chiang Mai			Nakhon Sawan			Khon Kaen			Nakhon Ratchasima			Hat Yai / Songkhla		
	1987 (a)	2006 (b)	(b)/(a)	1987 (a)	2006 (b)	(b)/(a)	1987 (a)	2006 (b)	(b)/(a)	1987 (a)	2006 (b)	(b)/(a)	1987 (a)	2006 (b)	(b)/(a)
Other Construction Materials	2	12	6.00	5	19	3.80	2	13	6.50	3	16	5.33	1	2	2.00
Vegetables & Fruits	13	28	2.15	4	10	2.50	9	38	4.22	16	72	4.50	1	3	3.00
Beverages	10	37	3.70	0	0	-	2	9	4.50	2	9	4.50	0	2	-
Processed Foods	38	62	1.63	5	12	2.40	22	74	3.36	221	948	4.29	14	59	4.21
Animals	1	3	3.00	3	6	2.00	8	18	2.25	20	46	2.30	0	0	-
Fish	0	0	-	0	0	-	0	0	-	0	0	-	50	83	1.66
Fertilizer & Animal Feeds	2	5	2.50	16	38	2.38	10	30	3.00	20	67	3.35	22	100	4.55
Personal Effects	6	21	3.50	4	14	3.50	35	136	3.89	8	33	4.13	4	18	4.50
Other Manufactured Items	10	26	2.60	13	31	2.38	13	32	2.46	39	99	2.54	10	38	3.80
All Others	23	43	1.87	24	66	2.75	13	34	2.62	36	115	3.19	62	303	4.89

Source: Commodity Flow Forecast for the Project Areas, by the Study Team

iii) **Khon Kaen**

Among cargo from Bangkok, fertilizer and animal feeds which are for the surrounding rural areas show a high weight when compared with other cities, followed by beverages.

Among the Bangkok bound cargo, household appliances, with furniture as its core, occupies a high portion, followed by vegetables and fruits, and animals.

iv) **Nakhon Ratchasima**

Among the cargo from Bangkok, fertilizer and animal feeds for surrounding rural area account for a high portion at present as well as in the future, followed by beverages, vegetables and fruits, and processed foods.

Among Bangkok bound cargo, processed foods which accounts for a high portion at present may increase even more in the future.

v) **Hat Yai/Songkhla**

Cargo from Bangkok is characterized by the dominance of other manufactured products at present as well as in the future, which can be broken down into sizable amounts of household containers, and equivalent amount of mixed ready-made products. Agricultural and marine products specific to the Southern region dominate the cargo from the region and the characteristics will be carried over into the future.

4) **Likely Changes in Truck Transport**

The task given here is to point out which may change the characteristics of truck transport in the future.

i) The imbalance between cargo into Bangkok and cargo from Bangkok will remain, but the difference will become narrower. In the Bangkok bound traffic, empty heavy trucks on their way back to regional cities will remain to some extent.

ii) In the Bangkok bound cargo flow, bulk cargo composed of rice, maize, sugar and other primary industrial products will increase in volume, though at a slower rate.

iii) In the upcountry bound cargo flow, general cargo transport by trucks, especially truck load transport within the distribution system of national brand manufactured products will expand rapidly. Intra-region direct delivery in respective regions will grow rapidly.

iv) In the upcountry bound cargo flow, general cargo transport by the small lot consolidation system will increase in hand with the Bangkok economic development.