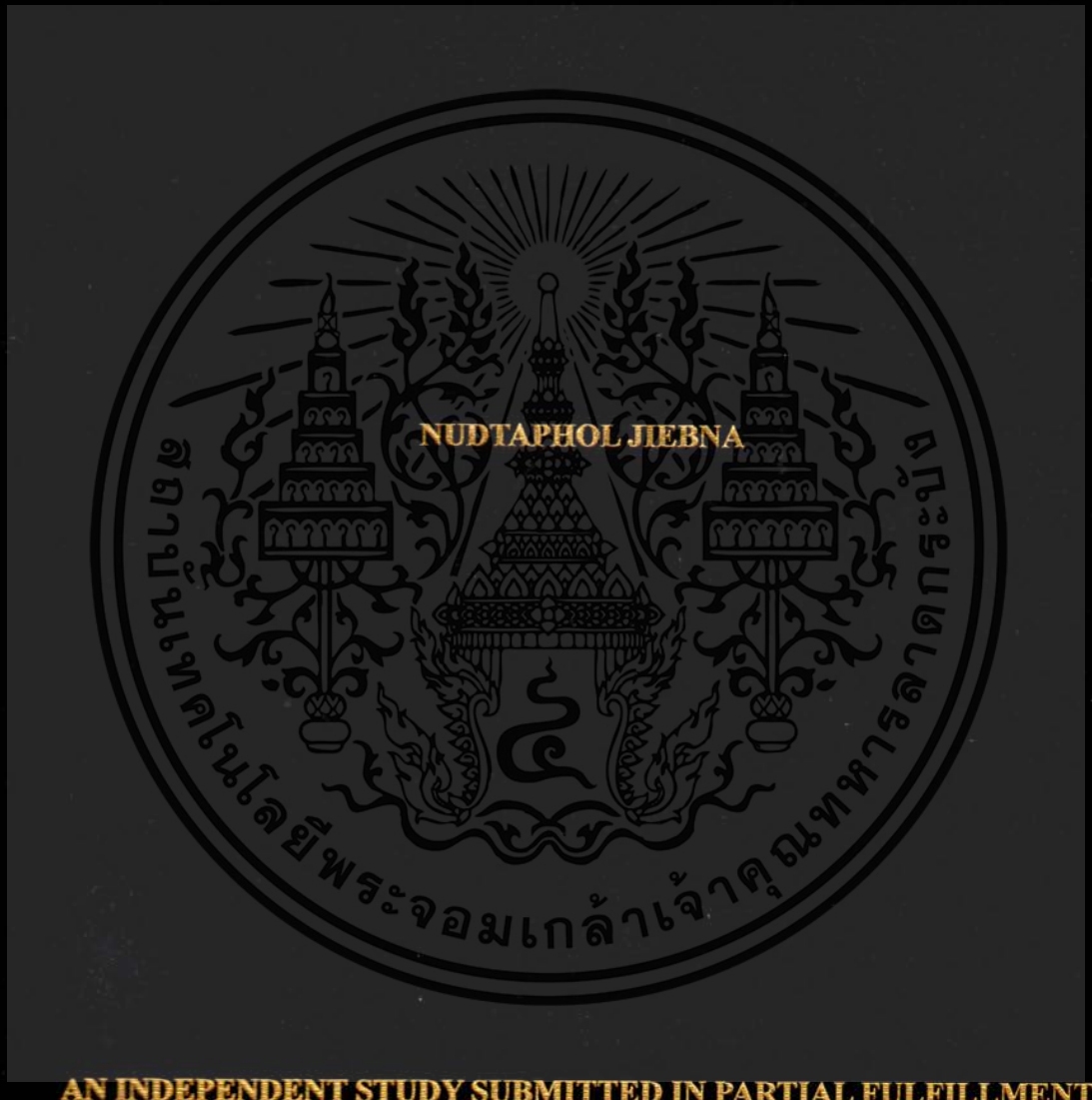
DOMESTIC ROAD FREIGHT DEMAND ESTIMATION FOR THAILAND



NUDTAPHOL JIEBNA

AN INDEPENDENT STUDY SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENT FOR THE DEGREE OF
MASTER OF SCIENCE IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT
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THESIS TITLE	Domestic Road Freight Demand Estimation for Thailand
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ABSTRACT

From last decades, the Department of Land Transport (DLT), Thailand, has been operating 3 freight terminals. All of them are located surrounding the Bangkok Metropolitan Area. In 2015, the DLT conducted a study on feasibility of the establishment 17 new freight terminals in 17 regional cities all over the country. These proposed terminals are expected to be connecting points to transportation network. In order to design the freight terminals in a proper size, it is very important to know a ballpark figure of freight demand and potential volume for each terminal. In the part, the freight demand and potential volumes are very difficult to precisely estimate. Since modern technology, such as GPS, and complex estimation technique, such as transport modelling, are available. Now freight demand can be estimated in more manner and several techniques and data sources can make the job more easily. However, the question is that how much different if analyses from a variety of techniques and datasets are compared. That leads to the objectives of this study which are: to analyze truck freight demand pattern and volume in Thailand using advanced tools and datasets, to compare results among various techniques and datasets, and to provide suggestions on truck freight demand pattern and volume in Thailand. As the result of the study, it is found that

different techniques could lead to differences in results. One technique might be good for develop a country-wide analysis, which another technique might be suitable for specific area analysis. Besides, one might be accounting zone-internal trips while the other two are not taken into account of those zone-internal trips.

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I would like to express my deepest gratitude toward these people who have contributed to my success in completing this research paper.

First of all, I am grateful to my supervisor Asst. Prof. Dr. Jaruwit Prabnasak for introducing me to the topic as well for the support on the rich information, the useful comment, remark and engagement through the learning process of this independent study and think all staffs at KMTL for their assistance and motivation.

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CHAPTER 1
INTRODUCTION

1.1 Background

Department of Land Transport have a 3 freight terminal both in Bangkok and Metropolitan Region (Phutthamonthon Distinct, Klong Luand Distinct, Rom Klao Distinct) but had not “Freight terminal” to serve a connection point for transportation transformation, Distribution in the region

In 2015 Department of Land Transport has a study possibility of the establishment increase 17 freight terminals all over the country (City and the Border)

1) Northern Chiang Rai, Chiang Mai, Tak, Phitsanulok, Nakhon Sawan
2) Northeastern Nong Khai, Mukdahan, Ubon Ratchathani, Khon Kaen, Nakhon Ratchasima
3) Eastern Prachin Buri, Sa Kaeo, Trat
4) Western Kanchanaburi
5) Southern Surat Thani, Songkha, Narathiwat

Freight terminals are connecting point to transportation network, Domestic Consolidation Centre Systematically, Facilities to support transportation activities such as a Distribution Center, a Container Yard, a Services from government agencies, etc. and an enhance Thailand’s potential for leadership and logistic center for ASEAN will help reduce logistic cost go side by side an efficiency increasement of transportation and a support the development of intercity routes to connected to other transportation systems will makes transportation network has a Seamless

Connectivity to increased competitiveness in a country go side by side ability development of transport operator.

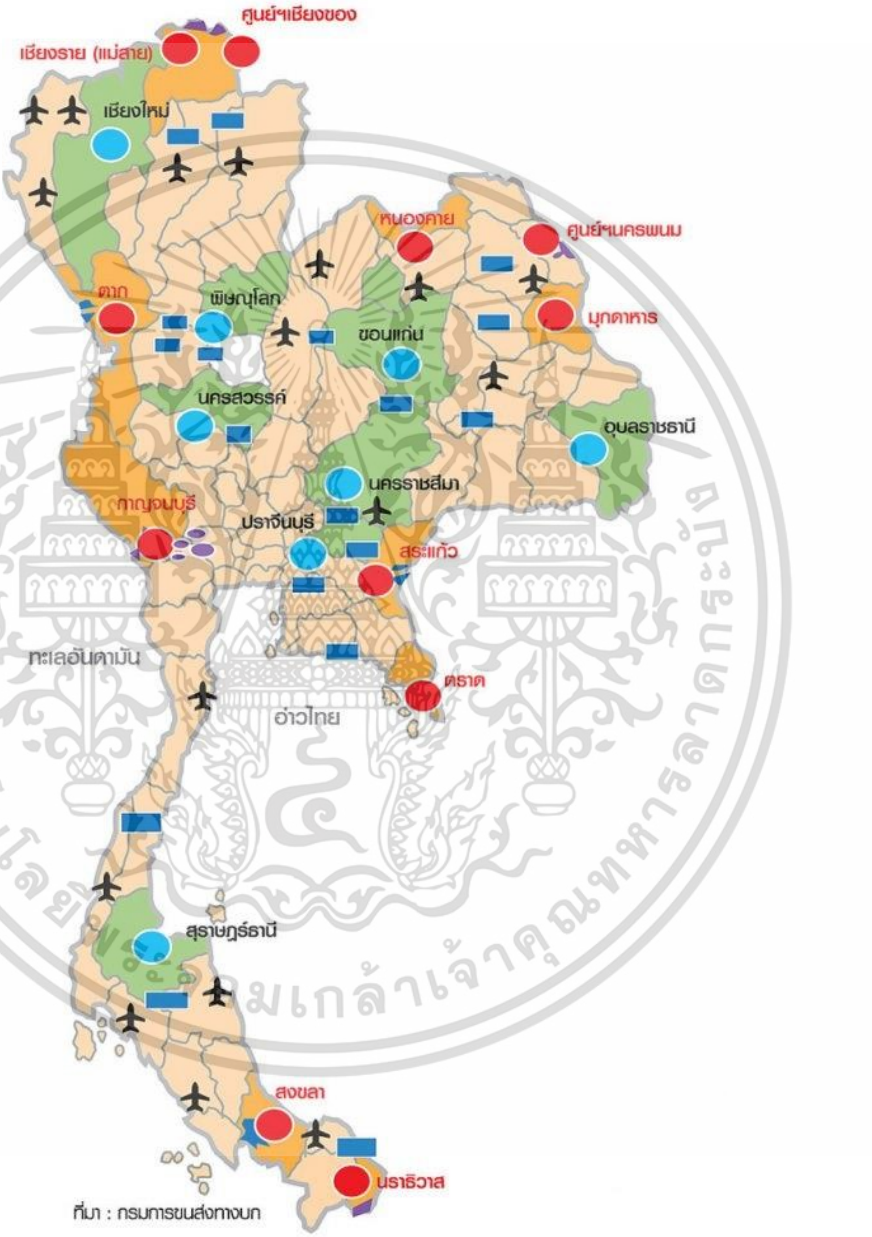


Figure 1.1-1 Proposed Locations of Truck Terminal Developments in Thailand

1.2 Statement of problem

A development of freight terminal has a started form Department of Land Transport will construct 17 freight terminal all country to get a study freight volume in Thailand. A volume freight terminal is an appropriate. Nowadays, use NAM MODEL of Transport and Traffic Policy Plan Office to analysis but it has found a problem. It is an inaccurate.

1.3 Study objective

1) To analyze truck freight demand pattern and volume in Thailand using advanced tools and datasets

2) To compare results among various techniques and datasets

3) To provide suggestions on truck freight demand pattern and volume in Thailand

1.4 Scope of study

1) Use a secondary data form 3 different data (GPS data and truck Ownership data from the Department of Land Transport and NAM model from the Transport and Traffic Policy Plan Office) to analysis to find a volume freight terminal appropriately.

2) Comparing the results obtained from the three analysis techniques

1.5 Limitation of study

The major limitation of this study is that all data used is referred to secondary data available in a specific period of time.

CHAPTER 2

LITERATURE REVIEW

2.1 Domestic Freight Transport in Thailand

Thailand is the most important Hub Logistic of transport and logistic. Because Thailand is located at the center of the region suitable for production to distribute goods or use as a route to neighboring countries.

Table 2.1-1 Domestic freight volume in 2015 – 2016 (Thousand Tons)

Transportation system	2015	2016
Road	482,358	486,743
Growth rate (%)	3.7	0.9
Rail	11,356	11,970
Growth rate (%)	4.9	5.4
Domestic water	50,907	50,327
Growth rate (%)	1.6	-1.1
Coast	51,872	50,894
Growth rate (%)	11.1	-1.9
Air	117	122
Growth rate (%)	1.7	4.2
Total Domestic Freight Volume	596,610	600,056
Growth rate (%)	4.2	0.6

Source: Ministry of Transport (2017)

According to **Table 2.1-1**, Domestic freight volume 2016 is increasing from 2015 to 0.6% come from the expansion of almost all Transportation system except the domestic water and the coast transportation 2016 are decreasing from 2015 to 1.1% and 1.9% respectively.

- At the domestic water transportation volume 2016 is decreasing from 2015 to 1.1% come from the construction materials (Soil, Stone, Sand), the Fertilizer, the rice.
- At the coast transportation volume 2016 is decreasing from 2015 to 1.9% come from the petroleum products.
- At the road transportation volume 2016 is increasing from 2015 to 0.9% come from the domestic demand recovery and high demand for Door to Door services from the continuous expansion of E-commerce business value.
- At the rail transportation volume 2016 is increasing from 2015 to 5.4% come from the Railway Improvement Project and the Additional Locomotive supply.
- At the Air transportation volume 2016 is increasing from 2015 to 4.3% come from the expansion of freight through Low cost Carrier.

Table 2.1-2 Proportion of domestic freight

Transportation System	2015	2016
Road	80.86%	81.12%
Rail	1.90%	1.99%
Domestic water	8.53%	8.39%
Coast	8.70%	8.48%
Air	0.01%	0.02%

Source: Ministry of Transport (2017)

According to **Table 2.1-2**, The road transportation is the main form of the country accounted for 81.12% in 2016 come from the accelerating the development of main roads into 4 traffic lanes, such as Tak -Mae Sot and Chiang Mai – Chiang Rai to link with neighboring countries. The rail transportation 2016 is proportionate 1.99% come from the rail infrastructure investment is connected to the original rail transport. The domestic water and coast transportation are proportionate 8.39% and 8.48% respectively come from the Coastal Harbor Development Project and the Train to Laem Chabang Port Project to support the growth of water transportations in the future. The Air transportation is proportionate 0.02% come from the Suvarnabhumi Airport Development Project by adding a runway and the U-Tapao Airport Development Project by adding a parking airplane and a warehouse.

Thailand's Transport Development Direction (Land, Water, Ship, Air) have 3 things. Number One, Multimodal Transport combines seamless transport in many ways by take freight vehicle more than one in freight transportation for make the most efficient way of transportation, the lowest system cost from the beginning to the end. Number two, Logistic 4.0 is the most efficient of logistic and supply chain management from the

procurement, import material, manufacturing, storage to transport by integrating production technology and logistics together. Number three, Reduce reliance on road transport to use rail and water transport because lower cost and Packing a lot.

2.2 NAM Model

NAM Model is a Strategic Model by Office of Transport and Traffic Policy and Planning (OTP) developed into the Base Model. It is a tool to predict the transportation of people and goods between provinces and analyze that takes place in different ways: road, rail, air and water. By NAM Model results can be used to planning, analyzing and evaluating projects related to traffic and transportation at the national level.

NAM Model uses the following data: Economy and society, national transport network, travel, goods movement and goods groups to analysis, forecast the freight volume.

Figure 2.2-1. Development of NAM Model

Source:: www.tdsotp.com (2017)

Volume analysis and freight behavior by NAM Model has divided the forecasts of freight transport into 2 parts: Domestic Freight and International Freight.

For the domestic freight, has divided into 2 parts: Present transportation estimation and Expectations of freight expansion on the Thai road network in the future.

The domestic trucking demand model has been improved by the Department of Highways for nationwide roadside interview in 2016. It has the variables and coefficients are as follows.

PROD Truck Freight = (78.228 x GPP) + (7.157 x GPP_InfProv) + (0.437 x POWER)

$R^2 = 0.826$

ATT Truck Freight = (81.426 x GPP) + (7.103 x GPP_InfProv) + (0.412 x POWER)

$R^2 = 0.813$

By PROD Truck Freight = The volume of freight transported by truck (Ton/Day)

ATT Truck Freight = The volume of trucking attractiveness (Ton/Day)

GPP = Gross Provincial Product of volume chain (Billion Baht)

GPP_InfProv = Gross Provincial Product including neighborhoods of volume chain (Billion Baht)

POWER = Capacity of the factory in the province (Thousand horsepower)

According to NAM Model, by entering the value of the variable, which is the provincial baseline, the model can estimate the volume of goods entering and leaving from each province.

Table 2.2-1 Estimates of volume goods in present and anticipated future expansion.

NO.	Province	Freight volume of study area from the model in 2014 (TON/Days)	Growth rate of freight volume (% / Years)		
			2015 - 2019	2020 - 2024	2025 - 2029
1	Kanchanaburi	8,185	3.97%	3.81%	3.52%
2	Khon Kaen	14,991	4.79%	4.53%	4.10%
3	Trat	2,582	4.62%	4.32%	3.85%
4	Tak	4,827	4.67%	4.35%	3.86%
5	Nakhon Ratchasima	45,598	2.19%	2.17%	2.12%
6	Nakhon Sawan	6,635	4.85%	4.55%	4.09%
7	Narathiwat	2,906	5.49%	5.08%	4.47%
8	Prachin Buri	23,233	2.64%	2.61%	2.54%
9	Phitsanulok	4,389	4.57%	5.30%	3.87%
10	Mukdahan	1,765	5.32%	4.98%	4.45%
11	Songkhla	13,831	4.72%	4.45%	4.02%
12	Sa Kaeo	3,317	5.26%	4.92%	4.39%
13	Surat Thani	11,194	5.23%	4.86%	4.29%
14	Nong Khai	2,278	4.43%	4.13%	3.67%
15	Ubon Ratchathani	14,123	1.64%	1.61%	1.54%
16	Chiang Rai	4,087	4.60%	4.28%	3.78%
17	Chiang Mai	9,716	4.20%	3.93%	3.51%

2.3 Truck GPS Policy

In currently, the use of truck for freight in Thailand is always higher as a result price competition so operators must reduce operating costs effect to the lower service standards and lower transport safety. They are the cause of higher road accidents also using the truck was not registered correctly and are not standardized so Department of Land Transport follow by government policies “Confident with the car using GPS in Thailand Project” to install GPS Tracking and install of driver’s indicator in the truck since 25 Jan. 2016 and complete in 2019. The Department of Land Transport asked the operators and car owners to accelerate the old car to install GPS and then check the link to complete this year.

The objectives of installing GPS tracking devices on trucks are

- Effective travel planning by reducing the number of empty trucks and reduce freight cost.
- A medium for matching between transport operators and transport users.
- Reduce accidents by the trucks.
- Increase service channels and reassure transport user in choosing transport operators.
- Calculate shipping distances for reference in planning and freight charges.

According the statistics report on GPS system installation in 2 Oct. 2017

Table 2.3-1 The numbers of trucks connected to GPS

For Hire Truck (Registration Category 70)	Private Use Truck (Registration Category 80)
76,216	50,343

Source: http://gps.dlt.go.th/index.php (2017)

Table 2.3-2 The numbers of trucks to install GPS and GPS installed.

Types of Truck	Volume of trucks to install GPS	Volume of trucks to GPS installed	Volume of trucks to GPS installed (%)
For Hire Truck (Registration Category 70)	181,879	76,216	41.90
Private Use Truck ((Registration Category 80)	278,421	50,343	18.08
Total	460,300	126,559	27.49

Source: http://gps.dlt.go.th/index.php (2017)

2.4 Truck Ownership and Freight Service Provider Database

The data shows the volume of transport permits and volume of operators (**Table 2.4-1**) and the volume, type of domestic freight trucks (**Table 2.4-2** – **Table 2.4-4**) since 2015 – 2017. According to the data, it can be seen that the number of trucks registered in the country has been stable for the period of time. For Hire Truck Category (License Plate 70x) are growing slowly from approximately 20,000 to 25,000 trucks in 3 years. In contrast, Trucks registered for private use (License Plate 80x) are steady throughout the years. Besides, in the statistics it can be seen that most of the trucks registered in

Thailand are pickup trucks, which take about 50 percent of total registers. Apart of pickup trucks, trailers and semi-trailers are both most popular trucks types for heavy duty purpose, approximately 200,000 trucks.

Table 2.4-1 Statistics numbers of transport permits and numbers of operators in Thailand.

Types of Truck	2015		2016		2017	
	Number of transport permits	**Numbers of operators**	**Numbers of transport permits**	**Numbers of operators**	**Numbers of transport permits**	**Numbers of operators**
For Hire Truck (70)	18,705	18,705	20,499	20,499	23,404	23,404
Private Use Truck (80)	365,687	365,687	360,486	360,486	356,585	356,585
Total	384,392	384,392	380,985	380,985	388,989	388,989

Source: Transport Statistic Sub – Division, Planning Division (2017)

Table 2.4-2 Numbers of total trucks registered in Thailand 2015

Types of Truck	Types of Truck Total	Pick up Trucks	Trucks	Liquid Trucks	Hazardous Material Trucks	Special Trucks	Trailer	Semi-Trailer	Semi-trailer Truck long material.	Towing Trucks	Unknow Trucks
For Hire Truck (70)	259,084	62,208	28,681	2,641	5,431	18,692	24,190	73,487	248	58,573	0
Private Use Truck (80)	771,662	534,988	43,951	17,230	4,851	59,501	68,570	28,313	938	23,224	0
Total	1,030,746	597,196	72,632	19,871	10,282	78,193	92,760	101,800	1,186	81,797	0

Source: Transport Statistic Sub – Division, Planning Division (2018)

Table 2.4-3 Numbers of trucks registered in Thailand 2016

Types of Truck	Types of Truck Total	Pick up Trucks	Trucks	Liquid Trucks	Hazardous Material Trucks	Special Trucks	Trailer	Semi-Trailer	Semi-trailer Truck long material.	Towing Trucks	Unknow Trucks
For Hire Truck (70)	274,151	62,208	26,681	2,641	5,431	18,692	24,190	73,487	248	58,573	0
Private Use Truck (80)	781,566	534,988	43,951	17,230	4,851	59,501	68,570	28,313	938	23,224	0
Total	1,055,717	597,196	72,632	19,871	10,282	78,193	92,760	101,800	1,186	81,797	0

Source: Transport Statistic Sub – Division, Planning Division (2018)

Table 2.4-4 Numbers of trucks registered in Thailand 2017

Types of Truck	Types of Truck Total	Pick up Trucks	Trucks	Liquid Trucks	Hazardous Material Trucks	Special Trucks	Trailer	Semi-Trailer	Semi-trailer Truck long material.	Towing Trucks	Unknow Trucks
For Hire Truck (70)	293,167	67,027	30,913	2,713	5,895	20,075	25,620	78,023	278	61,588	1,035
Private Use Truck (80)	796,454	535,113	44,745	17,898	4,690	61,935	71,200	29,183	955	23,415	7,320
Total	1,089,621	602,140	75,658	20,611	10,585	82,010	96,820	107,206	1,233	85,003	8,355

Source: Transport Statistic Sub – Division, Planning Division (2018)

CHAPTER 3
STUDY METHODOLOGY

3.1 Study Problems

As it is known that freight demand is crucial for transport planner, it is however very difficult to precisely estimate. Since modern technology, such as GPS, and complex estimation technique, such as transport modelling, are available. The question is that how much different if analyses from a variety of techniques and datasets are compared. That leads to the objectives of this study which are: to analyze truck freight demand pattern and volume in Thailand using advanced tools and datasets, to compare results among various techniques and datasets, and to provide suggestions on truck freight demand pattern and volume in Thailand.

3.2 Methodology Framework

This study analyses and estimates the cargo volumes in an area that the Department of Land Transport plans to develop truck terminals. Three sources of data are used for the analyses. Methodology Framework can be drawn as in Figure 3.2-1

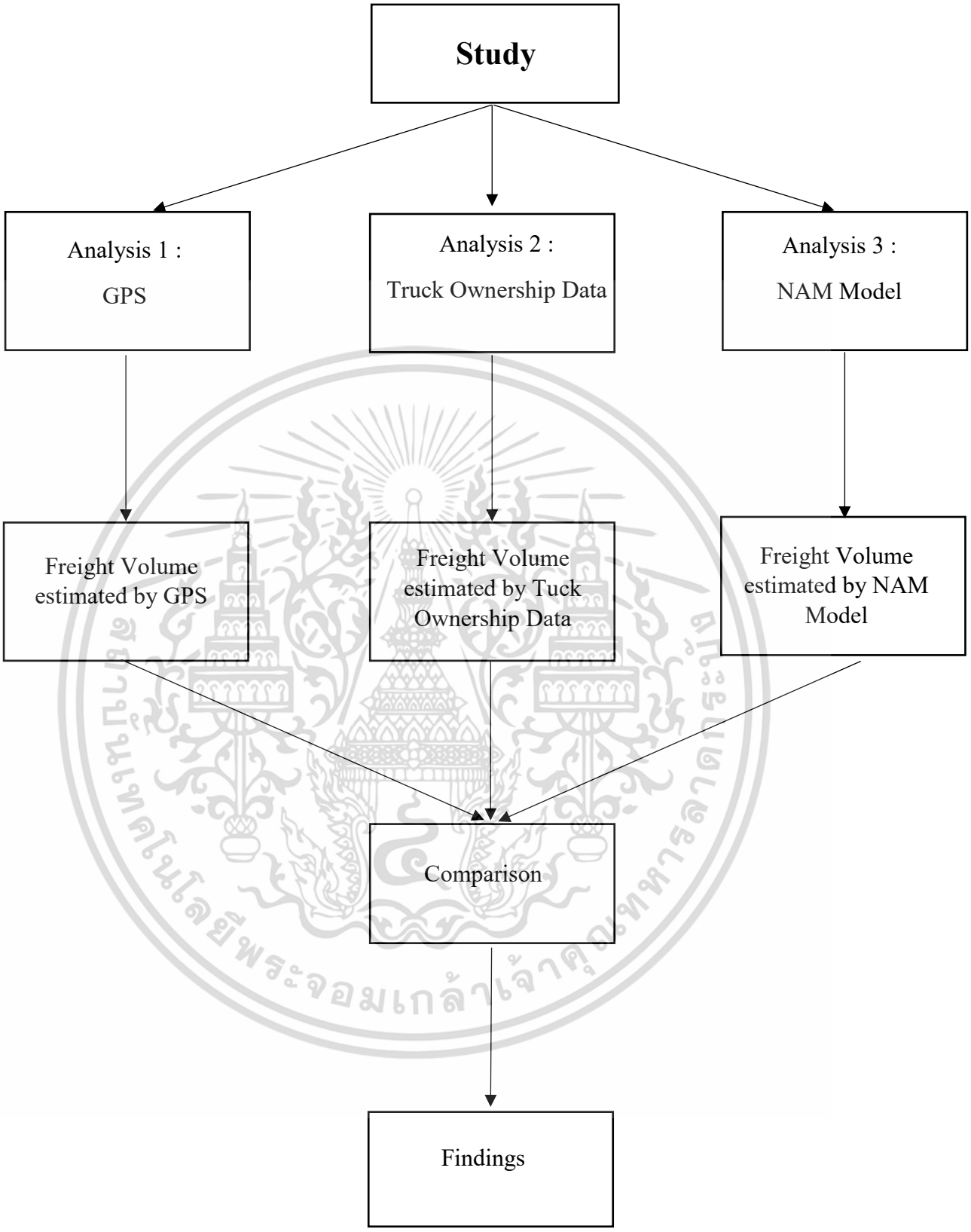


Figure 3.2-1 Methodology Framework

3.3 Analysis Technique

3.3.1 Analysis of GPS Data

As mentioned earlier, this study obtained Truck GPS data from a GPS federal agency, the Department of Land Transport. The data is presented in figure of origin-destination pairs of all trucks with GPS devices attached. The number of trucks with GPS devices attached is approximately 10 percent of all operating trucks in Thailand.

To analyze the freight demand based on this dataset, proportion of truck types registered in the country is used to average the potential cargo volume carrying on all trucks in an area. Additionally, truck utilization rate is obtained from a road-side survey conducted by Department of Highway in 2018.

Because the study focuses on potential freight demand for truck terminals, only estimated demand for the specific origin and destination zones are summed up.

3.3.2 Analysis of Truck Ownerships

The truck ownership dataset obtained from the Department of Land Transport is used for this analysis. Type of trucks, type of business, purposes, and some other attributes of the dataset are used to estimate the cargo volume in a particular area. A basic but very crucial assumptions used in this analysis is that: “in a working day, it is assumed that all of the trucks registered in the particular area must be used to carry one full load for one time, except some specific purpose trucks that might be less frequently used and left out from the analysis – these specific purpose trucks are in a small proportion. Eventually, all trucks are converted to cargo volume based on the given assumption.

3.3.3 Analysis of NAM

According to DLT (2015), NAM is used to estimate freight volume in each district of Thailand. This study refers to the NAM estimation results given in the DLT study. The model result is used to compare with the results for the two earlier estimation techniques.

CHAPTER 4
ANALYSIS AND RESULTS

4.1 Truck Freight Volume in Thailand Estimated by GPS

For GPS data on freight volumes of the Land Transport Department, the current number of about 120,000 trucks, dangerous goods trucks and public buses are equipped with GPS and linked to the Land Transport Department's system or about 10 percent of the total presently available in the country.

This GPS under development can create Origin-Destination Matrix of trucks equipped with GPS and the freight trucks through the study provinces as shown in **Figure 4.1-1**

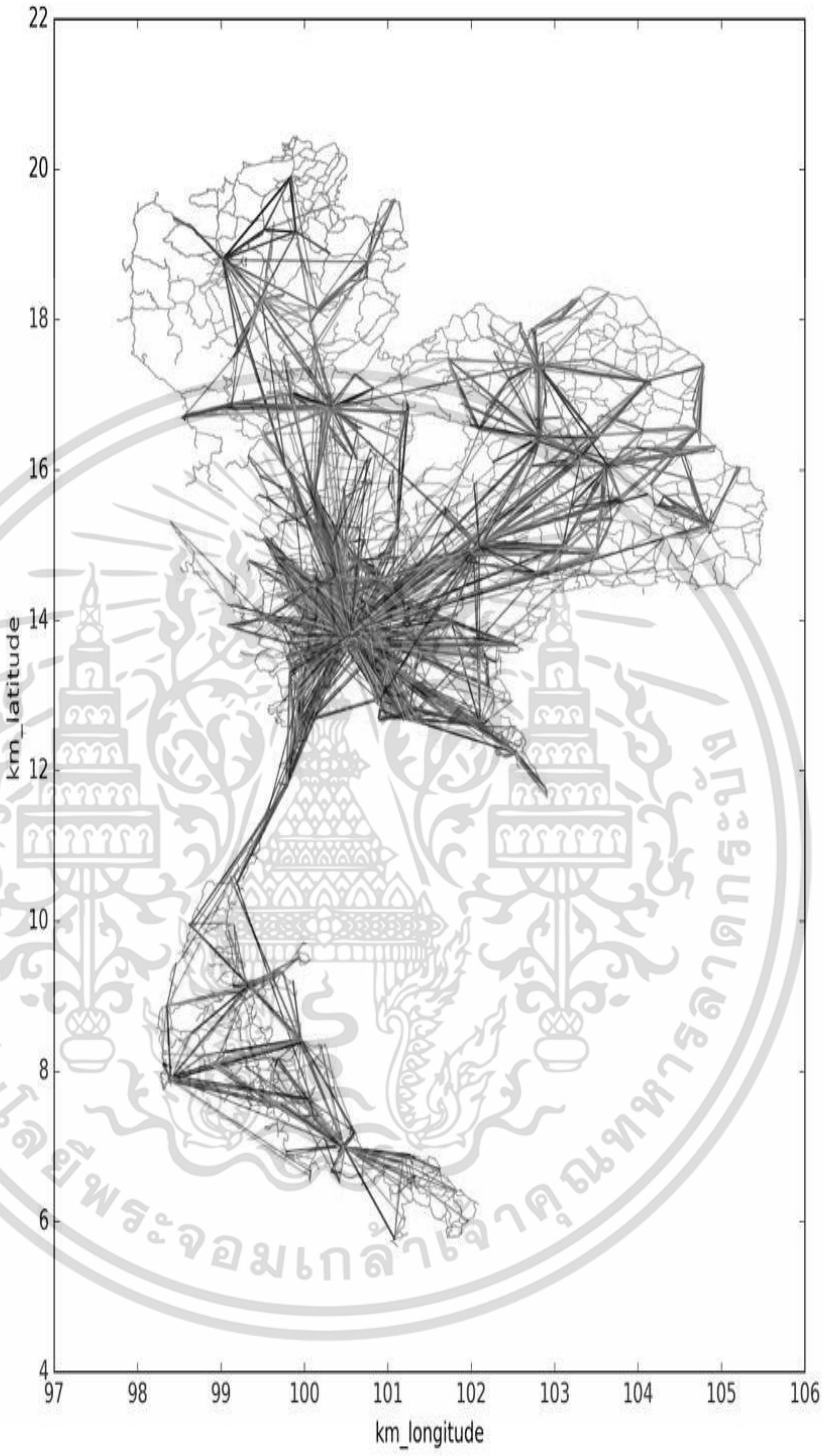


Figure 4.1-1 Origin-Destination Map of Domestic Freight Activities Collected by Trucks with GPS tracking devices equipped in February 2017
(Department of Land Transport, 2017)

First, that most of Thailand's freight transport is characterized by traveling in the lower Central Region and the East considered as the country's main economic and industrial areas. Second, all major provinces with the freight terminal development plan in major regional cities, including Khon Kaen, Nakhon Ratchasima, Chiang Mai, Phitsanulok, Ubon Ratchathani, Surat Thani and Songkhla are characteristic of the collection point and Hub. Third, the most border city has transportation network to support idea choose the location of freight station in the province.

According to **Table 4.1-1** the provinces of Nakhon Ratchasima, Prachin Buri, Nakhon Sawan and Kanchanaburi had the top 4 highest numbers of trips by freight trucks equipped with GPS. These four provinces are within a radius of 250 kilometers from Bangkok. The provinces of Nakhon Ratchasima and Nakhon Sawan have a reason for high freight volumes due to being like the frontiers of the Northeast and the North. But it is interesting that Kanchanaburi and Prachin Buri are small provinces and not the passage of goods. Because the provinces of Prachin Buri and Kanchanaburi have a lot of industrial factories. These factories must produce goods to feed into the economic areas. And the transport of raw materials is necessary for feeding into the factories. Another observation from this data is that Nakhon Ratchasima and Nakhon Sawan are the two provinces that link goods to more than other 20 provinces according to the locations as frontiers of the Northeast and the North.

Table 4.1-1 Numbers of GPS-equipped freight trucks with origin or destination in the study provinces

No.	Province	Trip with origin in the province		Trip with destination in the province	
		Quantity (trip/day)	Number of destinations	Quantity (trip/day)	Number of origins
1	Kanchanaburi	307	14	246	13
2	Khon Kaen	263	17	320	17
3	Trat	27	5	23	4
4	Tak	50	9	43	8
5	Nakhon Ratchasima	587	22	585	23
6	Nakhon Sawan	371	20	354	25
7	Narathiwat	21	3	31	3
8	Prachin Buri	485	21	427	13
9	Phitsanulok	173	13	175	10
10	Mukdahan	47	8	28	6
11	Songkhla	214	13	172	10
12	Sa Kaeo	140	12	169	12
13	Surat Thani	190	11	212	12
14	Nong Khai	123	8	92	7
15	Ubon Ratchathani	98	10	76	10
16	Chiang Rai	60	8	36	5
17	Chiang Mai	213	11	165	12

Source: GPS-based travel information of the Land Transport Department as of February 2017

Data in **Table 4.1-1** can be used to calculate intercity freight volumes with origin or destination in the study provinces on the basis of the following key assumptions:

- Estimated proportion of the truck equipped with GPS accounting for 10 percent of all truck and representing the behavior of freight transport of all trucks in Thailand.
- Traffic Composition and Utilization Rate of the trucks across Thailand are based on survey data of the Planning Bureau, Department of Highway in 2015

The results of estimated intercity freight volumes with origin or destination in the study provinces are shown in **Table 4.1-2**

Table 4.1-2 Estimated intercity freight volumes with origin or destination in the study provinces

No.	Province	Freight volume (Ton / day)			NAM Model (2015)	
		Origin in the province	Destination in the province	Total origin-destination	Total origin-destination	Difference
1	Kanchanaburi	18,420	14,760	33,180	16,370	-51%
2	Khon Kaen	15,780	19,200	34,980	29,982	-14%
3	Trat	1,620	1,380	3,000	1,164	72%
4	Tak	3,000	2,580	5,580	9,654	73%
5	Nakhon Ratchasima	35,220	35,100	70,320	91,196	30%
6	Nakhon Sawan	22,260	21,240	43,500	13,270	-69%
7	Narathiwat	1,260	1,860	3,120	4,012	29%
8	Prachin Buri	29,100	25,620	54,720	46,466	-15%
9	Phitsanulok	10,380	10,500	20,880	8,778	-58%
10	Mukdahan	2,820	1,680	4,500	3,560	-22%
11	Songkhla	12,840	10,320	23,160	27,662	19%
12	Sa Kaeo	8,400	10,140	18,540	6,634	-64%
13	Surat Thani	11,400	12,720	24,120	22,388	-7%
14	Nong Khai	7,380	5,520	12,900	4,556	-65%
15	Ubon Ratchathani	5,880	4,560	10,440	28,246	171%
16	Chiang Rai	3,600	2,160	5,760	8,174	42%
17	Chiang Mai	12,780	9,900	22,680	19,432	-14%
	Total	202,140	189,240	391,380	345,514	-12%

4.2 Truck Freight Volume in Thailand Estimated by Truck Ownership

GPS data reflects freight volumes in the study provinces well. However, GPS data cannot classify transport characteristics and product types whereas information on product type and transport. In this topic use analysis of transport operators in the study areas based on data from transport operator and Q-Mark database of the Land Transport Department. This is summarized in **Table 4.2-1** to **Table 4.2-2**

Table 4.2-1 is as expected. Major regional provinces have the numbers of transport operators higher than border provinces and small provinces clearly. Moreover, these provinces are transport Hub of the region or provincial group in consistency with GPS data. Besides, for all 17 provinces as a whole, more than 80 percent of transport operators in the study areas owned less than 10 small or large trucks and only 5 percent owned more than 50 trucks. This reflects the importance of supporting small and medium-sized transport operators.

In addition, **Table 4.2-2** show the numbers of trucks owned by transport operators in the study provinces which have been registered only. It was found that there were more than a total of 40,000 trucks in the study provinces. Out of this number, 58% were large trucks, e.g. ten -wheeled truck, trailer and semi-trailer truck while 30 percent are pickup trucks (1- ton truck), reflecting intercity transport (Line-haul) and freight transport to the destination (Delivery) clearly.

Table 4.2-1 The Number of operators by number of holdings trucks.

No.	Province		The Number of operators by number of holdings trucks.				Total
			1 - 10	11 - 50	51 - 100	>100	
1	Chiang Rai	Amount	28	36	9	7	80
		%	35	45	11.3	8.8	100
2	Chiang Mai	Amount	413	79	16	4	512
		%	80.7	15.4	3.1	0.8	100
3	Tak	Amount	273	29	3	3	308
		%	92.4	6.4	0.6	0.6	100
4	Phitsanulok	Amount	290	20	2	2	314
		%	92.4	6.4	0.6	0.6	100
5	Nakhon Sawan	Amount	124	29	8	13	174
		%	71.3	16.7	4.6	7.5	100
6	Nong Khai	Amount	121	14	3	3	141
		%	85.8	9.9	2.1	2.1	100
7	Mukdahan	Amount	89	17	1	2	109
		%	81.7	15.6	0.9	1.8	100
8	Ubon Ratchathani	Amount	573	27	2	3	605
		%	94.7	4.5	0.3	0.5	100
9	Khon Kaen	Amount	415	38	8	6	467
		%	88.9	8.1	1.7	1.3	100
10	Nakhon Ratchasima	Amount	478	61	12	13	564
		%	84.8	10.8	2.1	2.3	100

11	Prachin Buri	Amount	253	19	0	1	273
		%	92.7	7	0	0.4	100
12	Sa Kaeo	Amount	123	15	0	3	141
		%	87.2	10.6	0.0	2.1	100
13	Trat	Amount	4	7	0	1	12
		%	33.3	58.3	0	8.3	100
14	Kanchanaburi	Amount	50	20	4	7	81
		%	61.7	24.7	4.9	8.6	100
15	Surat Thani	Amount	172	48	12	4	236
		%	72.9	20.3	5.1	1.7	100
16	Songkhla	Amount	140	113	22	24	299
		%	46.8	37.8	7.4	8	100
17	Narathiwat	Amount	18	12	0	1	31
		%	58.1	38.7	0	3.2	100
	All 17 Provinces	Amount	3,564	584	102	97	4,347
		%	82	13.4	2.3	2.2	100

Table 4.2-2 The Number of trucks owned by transport operators in the study area.

No.	Province		Truck	Sami Trailer	Pole Trailer	Van	Liquid Truck	Special Truck	Dangerous Truck	Trailer	Drag Trailer	Total
1	Chiang Rai	Amount	1,700	614	0	76	1	155	17	881	552	3,996
		%	43	15	0	2	0	4	0	22	14	100
2	Chiang Mai	Amount	1,746	867	5	393	43	498	201	453	837	5,043
		%	35	17	0	8	1	10	4	9	17	100
3	Tak	Amount	767	248	0	26	2	27	6	492	225	1,793
		%	43	14	0	1	0	2	0	27	13	100
4	Phitsanulok	Amount	422	307	0	48	7	138	23	101	343	1,389
		%	30	22	0	3	1	10	2	7	25	100
5	Nakhon Sawan	Amount	1,190	1,175	2	71	4	179	30	1,148	1,039	4,838
		%	25	24	0	1	0	4	1	24	21	100
6	Nong Khai	Amount	467	440	0	37	3	17	38	137	413	1,552
		%	30	28	0	2	0	1	2	9	27	99
7	Mukdahan	Amount	338	239	4	5	1	14	7	106	228	942
		%	36	25	0	1	0	1	1	11	24	100

No.	Province		Truck	Sami Trailer	Pole Trailer	Van	Liquid Truck	Special Truck	Dangerous Truck	Trailer	Drag Trailer	Total
8	Ubon Ratchathani	Amount	1,243	335	0	103	26	25	33	436	304	2,505
		%	50	13	4	1	1	1	1	17	12	100
9	Khon Kaen	Amount	814	563	0	388	1	599	22	352	532	3,271
		%	25	17	0	12	0	18	1	11	16	100
10	Nakhon Ratchasima	Amount	1,388	1,447	0	385	140	301	298	687	1,281	5,927
		%	23	24	0	6	2	5	5	12	22	100
11	Prachin Buri	Amount	383	277	0	264	3	63	8	121	251	1,370
		%	28	20	0	19	0	5	1	9	18	100
12	Sa Kaeo	Amount	423	104	0	48	11	32	3	288	102	1,011
		%	42	10	0	5	1	3	0	28	10	100
13	Trat	Amount	116	80	0	0	0	2	0	74	82	354
		%	33	23	0	0	0	1	0	21	23	100
14	Kanchanaburi	Amount	1,471	404	2	39	19	109	22	259	365	2,690
		%	55	15	0	1	1	4	1	10	14	100

No.	Province		Truck	Sami Trailer	Pole Trailer	Van	Liquid Truck	Special Truck	Dangerous Truck	Trailer	Drag Trailer	Total
15	Surat Thani	Amount	847	843	0	115	77	96	157	427	815	3,377
		%	25	25	0	3	2	3	5	13	24	100
16	Songkhla	Amount	1,581	3,765	8	293	9	459	120	330	2,876	9,441
		%	17	40	0	3	0	5	1	3	30	100
17	Narathiwat	Amount	261	50	0	1	0	2	2	55	50	421
		%	62	12	0	0	0	0	0	13	12	100
	All 17 Provinces	Amount	15,157	11,758	21	2,292	347	2,716	987	6,347	10,295	49,920
		%	30	24	0	5	1	5	2	13	21	100

4.3 Truck Freight Volume in Thailand Estimated by NAM

Estimate an amount of freight originating or terminal point in all 17 provinces from NAM Model to performance of goods volume in each regions by a result of domestic freight volume as shown in **Table 4.3-1**

According to **Table 4.3-1**, currently all 17 study provinces have different freight volumes with origin or destination in the study provinces and intercity transport, ranging from 2,000 to over 40,000 tons per day. Only two provinces, i.e. Nakhon Ratchasima and Prachinburi have freight volumes over 20,000 tons per day (equivalent to 40-foot semi-trailer truck, about 800 vehicles per day) because these 2 provinces have many industrial estates and industrial zones. The provinces with goods of 10,000 – 20,000 tons per day include provinces in each region.

Khon Kaean, Surai Thani, Ubon Ratchathani and Songkhla. Considering the expansion of freight volume in the study provinces in the future, the current provinces in the regions with large industrial investments include Nakhon Ratchasima and Prachin Buri that still have increasing goods until the volumes will double the current products in the period of 20-30 years in the future as a result of industrial and agricultural sectors in the areas mostly. The result from the forecasts by national model with a certain degree of accuracy and classification of goods is unclear. As a result, these figures are considered to be information for studying freight volumes of each area.

Table 4.3-1 Estimate the amount of freight originating or terminal point in all 17 provinces

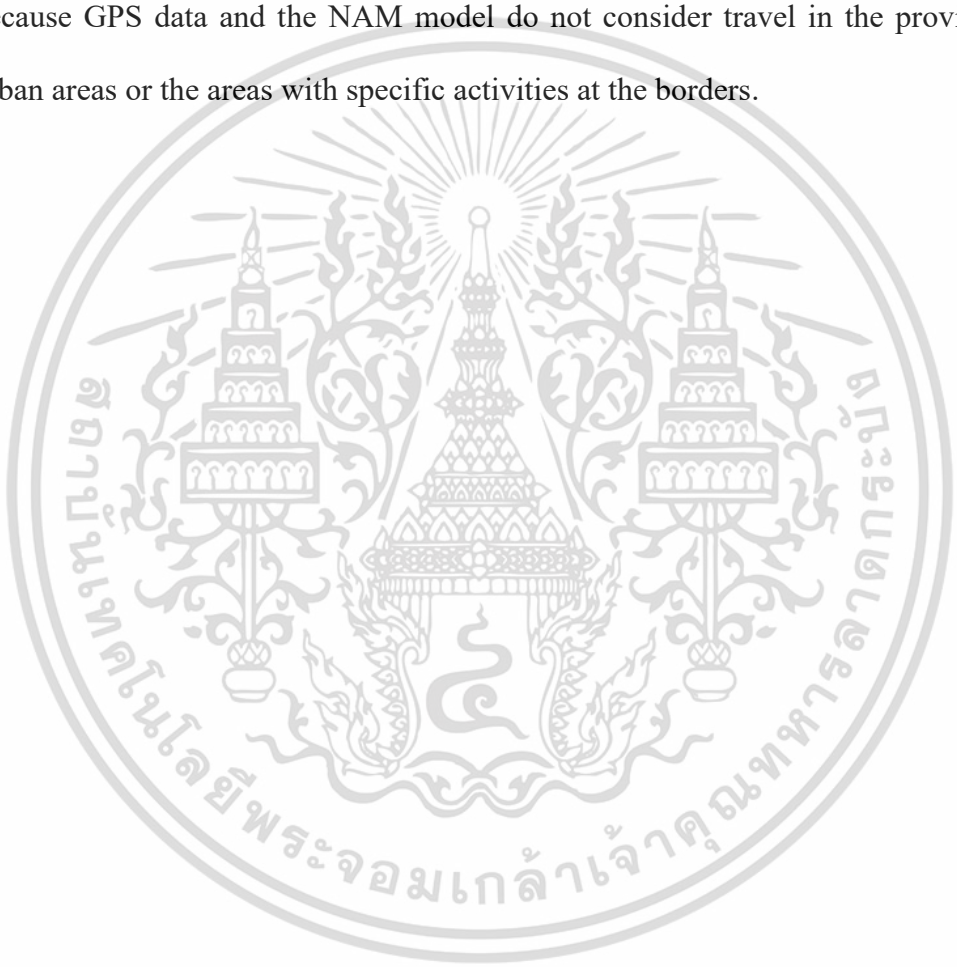
No.	Provinces	Goods volume in 2014 (Ton/Day)	Estimate average daily freight volume (Ton/Day)			
			Y. 2019	Y. 2029	Y. 2039	Y. 2049
1	Kanchanaburi	8,185	9,944	14,453	21,006	28,230
2	Khon Kaen	14,991	18,942	29,501	45,946	61,748
3	Chiang Rai	4,087	5,118	7,782	11,833	15,902
4	Chiang Mai	9,716	11,935	17,548	25,801	34,675
5	Trat	2,582	3,236	4,940	7,540	10,113
6	Tak	4,827	6,064	9,284	14,211	19,099
7	Nakhon Ratchasima	45,598	50,815	62,983	78,065	104,913
8	Nakhon Sawan	6,635	8,408	13,120	20,472	27,513
9	Narathiwat	2,006	2,620	4,301	7,060	9,487
10	Prachin Buri	23,233	26,466	34,244	44,308	59,546
11	Phitsanulok	4,389	5,488	8,361	12,738	17,118
12	Mukdahan	1,765	2,287	3,718	6,045	8,125
13	Songkhla	13,831	17,418	26,921	41,607	55,917
14	Sa Kaeo	3,317	4,286	6,929	11,200	15,052
15	Surat Thani	11,194	14,444	23,216	37,315	50,148
16	Nong Khai	2,278	2,829	4,241	6,356	8,542
17	Ubon Ratchathani	14,123	15,320	17,973	21,085	28,337

4.4 Estimation Results Comparison

Table 4.4-1 Forecasts for freight volumes in the study provinces from the numbers of owned trucks compared with the results of analysis by GPS data and NAM

No.	Province	Freight volume (Ton/day)		
		Calculation from truck ownership	**Calculation from GPS data**	**Calculation from NAM model**
1	Kanchanaburi	19,093	33,180	16,370
2	Khon Kaen	35,540	34,980	29,982
3	Trat	3,813	3,000	5,164
4	Tak	16,794	5,580	9,654
5	Nakhon Ratchasima	67,272	70,320	91,196
6	Nakhon Sawan	57,130	43,500	13,270
7	Narathiwat	2,656	3,120	4,012
8	Prachin Buri	14,389	54,720	46,466
9	Phitsanulok	14,519	20,880	8,778
10	Mukdahan	9,389	4,500	3,530
11	Songkhla	115,071	23,160	27,662
12	Sa Kaeo	9,512	18,540	6,634
13	Surat Thani	38,259	24,120	22,388
14	Nong Khai	16,546	12,900	4,556
15	Ubon Ratchathani	20,097	10,440	28,246
16	Chiang Rai	36,715	5,760	8,174
17	Chiang Mai	48,536	22,680	19,432
	Total	525,326	391,380	345,514

According to **Table 4.4-1**, when calculating freight volumes from the amount of truck ownership in the total of 17 provinces, the average freight volume is more than 520,000 tons per day, which is higher than the amount calculated by GPS data and the NAM model up to 34% and 52%, respectively. It is also interesting to note that the analysis process from truck ownership data causes border provinces to have increased volumes from calculation by GPS data and the NAM model clearly. This is because GPS data and the NAM model do not consider travel in the provinces, the urban areas or the areas with specific activities at the borders.



Chapter 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This study aims at analyzing truck freight demand pattern and volume in Thailand using advanced tools and datasets, comparing results among various techniques and datasets, and providing suggestions on truck freight demand pattern and volume in Thailand. The secondary data given by the Department of Land Transport is used as the study's principal datasets.

According to the results, it is found that, when calculating freight volumes from the amount of truck ownership in the total of 17 provinces, the average freight volume is more than 520,000 tons per day, which is higher than the amount calculated by GPS data and the NAM model up to 34% and 52% respectively.

It is also interesting to note that the analysis process from truck ownership data cause border provinces to have increased volumes from calculation by GPS data and the NAM model clearly. This is because GPS data and the NAM model do not consider travel in the provinces, the urban areas or the areas with specific activities at the borders.

Therefore, analysis based on truck ownership data can reflect the transport activities in the area better than the first two methods. Or, it can be explained that freight volumes in the specific areas or in the provinces account for 35% to 50% of intercity freight volumes of the provinces.

Although the volume of the goods from the data analysis, holding the vehicle will be able to reflect activates within the study area. However, some of the large trucks calculated together are specialized trucks such as water truck, chemical truck and sewage truck, etc.

5.2 RECOMMENDATION

With this study relies on secondary data over time. And each set of databases that store the applied at different times. Ongoing studies are thus possible to include additional storage trials, particularly on the part of the GPS data.

In the addition, this study is based on an analysis of country-level, which is the approximate level of analysis or roughness of high analysis results. Another approach to study so interesting in the future include: an analytical study by the process, as well as in this study, but the only study area selection, or a single space, and the survey collects data in greater detail.

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