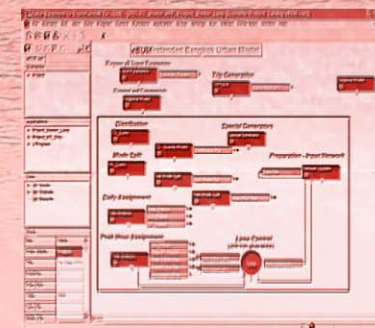




MINISTRY OF TRANSPORT
OFFICE OF TRANSPORT AND TRAFFIC POLICY AND PLANNING (OTP)

EXECUTIVE SUMMARY REPORT

TRANSPORT DATA AND MODEL INTEGRATED WITH MULTIMODEL TRANSPORT AND LOGISTICS (TDML II)



SUBMITTED BY



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CHAPTER 1: Introduction

- 1.1 Background
 - 1.2 Project Objectives
 - 1.3 Scope of Work
 - 1.4 Project Duration
 - 1.5 Structure of the Report
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1.1 Background

Office of Transportation and Traffic Policy and Planning (OTP) is a center in stipulating national traffic and transportation policies, including land, water, and air transportations. OTP is also coordinating with other institutes or organizations to manage policies, plans, projects, and measures in the most effective way.

The development of information system shows the collection of transportation statistics and infrastructural data of every sector in Ministry of Transport (MOT) and related sector isn't consistency in format because of different usage. This problem makes OTP can't integrate data from every government sector for planning. The update of database system, information system and intermodal transportation geographic information system should be continuously updated in responding to government policies and OTP assignments.

1.2 Project Objectives

OTP had hired the consultant for the Transport Data and Model Center II (TDML II) project. The project has the following objectives:

- 1.2.1 To improve and maintain the transportation & traffic database and information system by adding the freight data as well as infrastructure data in order to standardize the logistics system. This is necessary for supporting the stipulation of freight and logistics planning strategies and policies as well as support planning and implementing the transportation projects in any provinces and travel modes (land, water, and air transportation). However the goal of this objective is aimed at making the database available at any times and ready to support decision makings in transportation and traffic planning processes.

- 1.2.2 To revise the cycle of the freight transportation that significant to the economic system including the database of intermodal transport with standard Global Information System.
- 1.2.3 To improve and maintain the database, information system and GIS of intermodal shift that necessary to planning and operating project to be a standard especially structure of data arrangement, “Open Geospatial Web Service (OWS)”, Applied program and presentation via the networking for the officers about the business part and people.
- 1.2.4 To identify the essential factor to introduce to the development of transportation and logistics system that sustainable development including framework presented and preliminary conceptual short-term strategic mid-term strategic and long term strategic. For guide line and assign the clearly policy in the future.
- 1.2.5 To improve and maintain the OTP’s transportation & traffic models for National model, Bangkok Metropolitan Region model, Local Area Model and Regional City model to be used as a tool for planning, managing transportation & traffic projects and to support the development of Transport Logistics for the Nation. Especially in the part of develop model of freight transportation and model of transportation in the city and make the manual of development and application of urban transportation to meet international standards and comply with Thailand’s overall condition to be the standards and way to advocate the development and application of transportation model in each scenario.
- 1.2.6 To apply the database system and traffic transport model. That is the tool for decision that suitable and efficiency for assign tendency of policy and traffic transport development. This objective also includes OTP human resource capacity strengthening for using these information systems and models.

1.3 Scope of Work

In order to implement the project correctly according to the objectives, the scope of work is very important, i.e.

1.3.1 Data Collection, review and analysis

- (1) Study and review the management and implementation policies of each agencies that related to traffic and transport sector as well as the freight transportation in Thailand
- (2) Survey, collect, and improve the transport and traffic database, freight transportation and commodity flow in the part of primary and secondary database from users and service providers, including government agencies and related private sectors.

1.3.2 Improvement and maintenance of transportation & traffic database and information system

- (1) Study and revise the steps of the development of transportation & traffic database and information system in every data group that was designed by OTP, including the recommendation and management of the database system that is suitable for integrating TDMC VI and TDML. This would be able to share the database in the form of XML.
- (2) Improve and maintain the geographical information system (GIS) and management information system (MIS) emphasizing the new report system from CUBE and survey data addition.
- (3) Develop the information system for people by applying traffic and transport database, mode choice/ freight transport and intermodal transport report.
- (4) Develop and integrate the transportation & traffic database, transportation network, and related data by applying GPS, GIS and MIS in order to support the strategic plan and decision
- (5) Improve the computer equipment and network in order to support the future developing system.

1.3.3 Improvement and maintenance of transportation & traffic model

- (1) Study and revise the transportation & traffic model in each level of OTP's model
- (2) Improve the National Model (NAM) for the base year 2008 and future year 2012, 2017, 2022, 2027, and 2032 by applying Cube Cargo and surveying the additional data as well as improving the road network.
- (3) Improve the Extended Bangkok Urban Model (eBUM) for AM Peak and PM Peak as well as daily trip in the base year 2008 and future year 2012, 2017, 2022, 2027, and 2032 by surveying the additional data in order to adjust the model according to the Module Voyager structure reliably. Moreover, transportation network should be improved by utilizing satellite image to make the model more realistic and include the connection to the real time system of OTP.
- (4) Develop the Provincial Transport Model by importing the database from NAM model in order to support the creating of provincial transport model at least one province for the base year 2008 and future year 2012, 2017, 2022, 2027, and 2032 as well as applying OTP's Freight Analysis program in the part of Service Model to simulate the freight transport inside the city and develop the traffic simulation model. The province should have at least 15 major intersections.

1.3.4 Application of transportation & traffic information system and Human resource development

- (1) Consultant should apply the transportation & traffic information system to analyze and appraise the plans, projects, transportation & traffic measures, and related impacts at least 5 issues.
- (2) Consultant should arrange the seminar for understanding of the transportation & traffic information system and transport model to OTP and related agencies at least 2 times.
- (3) Consultant should arrange the GIS and MIS technical training for 15 OTP officers in the standard and approved institute.

- (4) Consultant should provide the technology transfer of traffic and transport as well as logistics system for at least 15 OTP officers in the successful country.

1.4 Project Duration

2008 annual budget, time duration is 10 months.

1.5 Structure of the Report

The Executive Summary report is composed of 6 chapters as follows:

Chapter 1 : Introduction

Chapter 2 : Data Collection, Review and Analysis

Chapter 3 : Traffic and Transportation Database Information System Development and Maintenance

Chapter 4 : GIS System Development and Integration with MIS System

Chapter 5 : Transportation and Traffic Model Improvements and Maintenances

Chapter 6 : Database System and Transport Model Applications and Human Resource Capacity Development

CHAPTER 2 : DATA COLLECTION, REVIEW AND ANALYSIS

2.1 Freight Data Collection and Commodity Flow Survey

This project is aimed at collecting data, analyses, and recommendations on the guidelines for developing transportation modes and logistics, including related basic transportation data, as stated in various studies, for use in the review.

Thus the review conducted on these studies will provide detailed information on the original status of transport system in terms of road, rail, water and air, including the guidelines for development, problems and restrictions, so as to improve the database and develop a model integrated with multimodal transport and logistics, to ensure they are up-to-date and can be used for future analysis.

Upon studying the data and plans in various projects, the following 9 projects are found to be relevant and require review.

- (1) The Development of Multimodal Transport and Logistics Supply Chain Management for Implementation of Action Plan.
- (2) Pilot Project for Freight Transport Management System and Railway Service.
- (3) The Development of Economic Corridor Network Project.
- (4) Railway Capacity Management Route ICD-Chachengsao-Leamchabang.
- (5) The Master Plan for Railway System and High Speed Train Development.
- (6) Feasibility Study and Design of Nation-Wide Double-Tracking System.
- (7) The Master Plan for Transportation and Traffic System Development.
- (8) Feasibility Study of Second Inland Container Depot.
- (9) Project on Logistic Development through Pakbara port.

2.1 Freight Data Collection and Commodity Flow Survey

For this section, the consultant has reviewed, surveyed, studied, and analyzed the latest data available, which include transport and logistics of commodity flow, as follows.

2.1.1 Collecting and updating data of commodity flow

The consultant has gathered statistics for updating data on commodity flow deemed as important to the traffic and transport plan and policy, by collecting the latest secondary data from public and private agencies involved to update statistics in the following fields.

- (1) Demand
- (2) Commodity Flow
- (3) OD Report
- (4) Logistics Nodes

2.1.2 Data survey and collection of commodity flow

In studying the transport and logistics of commodity flow, the consultant will use both secondary data and primary data obtained from the survey conducted previously. The consultant has surveyed the commodity flow, which covers 40 types following commodities shown

1. Synthetic filament yarn	21. Knives and cutting blades, for machines or for mechanical appliances
2. Woven fabrics of synthetic filament yarn	22. Telephone and Telegraph
3. Men or boys overcoats, car-coats, capes, cloaks, anoraks (including ski-jackets), wind-cheaters, wind-jackets and similar articles, knitted or crocheted	23. Computer Parts and devices
4. Men or boys overcoats, car-coats, capes, cloaks, anoraks (including ski-jackets), wind-cheaters, wind-jackets and similar article	24. Computer
5. Woven fabrics of cotton, containing 85% or more by weight of cotton, weighing not more than 200 g/m ² .	25. Televisions
6. Fish, frozen, excluding fish fillets	26. Cathode Ray Tube
7. Fresh Durian	27. Transformer
8. Soybean	28. Medical equipment
9. Oil-cake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soybean oil	29. Printed circuit board.
10. New pneumatic tires, of rubber.	30. Jewelry
11. Articles for the conveyance or packing of goods, of plastics; stoppers, lids, caps and other closures, of plastics.	31. Orchids
12. Poly-acetyl, polyether and epoxy resin	32. Coffee, Tea and Spices
13. Acyclic alcohol and derivatives	33. Wood and Wood product
14. Wood furniture	34. Footwear and parts
15. Paper and Rolled Paper	35. Vegetables, fruit, nuts and other edible parts of plants prepared or preserved by vinegar or acetic acid.
16. Unwrought aluminum	36. Malt Drinks, Liquor, Vinegar and Beer
17. Cold rolled steel sheet	37. Tractors
18. Air or vacuum pumps, air or other gas compressors and fans, ventilating or recycling hoods incorporating a fan, whether or not fitted with filters.	38. Product ion of milling industry: malt, starches, inulin and wheat gluten
19. Interchangeable tools for hand tools, whether or not power-operated	39. Cereal
20. Casting mold	40. Electronic machinery, Electronic devices and parts

Table 2.1-1 Population and Samples in Commodity survey

Type	HS Code	Population				Number of Samples				Number of Samples (Extra)			
		L	M	S	Total	L	M	S	Total	L	M	S	Total
1. Synthetic filament yarn	5402	47	6	48	101	10	1	10	22	3	2	2	7
2. Woven fabrics of synthetic filament yarn	5407	13	2	4	19	3	0	1	4	1	0	0	1
3. Men or boys overcoats, car-coats, capes, cloaks, anoraks (including ski-jackets), wind-cheaters, wind-jackets and similar articles, knitted or crocheted	6101	5	2	9	16	1	0	2	3	0	1	0	1
4. Men or boys overcoats, car-coats, capes, cloaks, anoraks (including ski-jackets), wind-cheaters, wind-jackets and similar article	6201	3	2	10	15	1	0	2	3	0	1	0	1
5. Woven fabrics of cotton, containing 85% or more by weight of cotton, weighing not more than 200 g/m ² .	5208	7	0	10	17	2	0	2	4	0	0	0	1
6. Fish, frozen, excluding fish fillets	0303	57	28	171	256	12	6	37	55	4	6	8	18
7. Fresh Durian	0810	0	1	21	22	0	0	5	5	0	0	1	2
8. Soybean	1201	23	4	11	38	5	1	2	8	2	1	0	3
9. Oil-cake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soybean oil	2304	23	2	15	40	5	0	3	9	2	1	0	3
10. New pneumatic tires, of rubber.	4011	15	1	2	18	3	0	0	4	1	0	0	1
11. Articles for the conveyance or packing of goods, of plastics; stoppers, lids, caps and other closures, of plastics.	3923	74	20	85	179	16	4	18	39	5	5	2	12
12. Poly-acetyl, polyether and epoxy resin	3907	92	15	61	168	20	3	13	36	6	3	2	12
13. Acyclic alcohol and derivatives	2905	12	2	12	26	3	0	3	6	1	0	1	2

Type	HS Code	Population				Number of Samples				Number of Samples (Extra)			
		L	M	S	Total	L	M	S	Total	L	M	S	Total
14. Wood furniture	9403	33	28	125	186	7	6	27	40	2	6	5	13
15. Paper and Rolled Paper	4811	46	11	60	117	10	2	13	25	3	3	2	8
16. Unwrought aluminum	7601	12	1	4	17	3	0	1	4	1	0	0	1
17. Cold rolled steel sheet	7209	14	0	10	24	3	0	2	5	1	0	0	2
18. Air or vacuum pumps, air or other gas compressors and fans; ventilating or recycling hoods incorporating a fan, whether or not fitted with filters.	8414	80	10	93	183	17	2	20	40	5	3	4	5
19. Interchangeable tools for hand tools, whether or not power-operated	8207	92	21	56	169	20	5	12	37	6	4	2	6
20. Casting mold	8480	105	31	60	196	23	7	13	42	7	5	2	7
21. Knives and cutting blades, for machines or for mechanical appliances	8208	42	8	76	126	9	2	16	27	3	3	3	3
22. Telephone and Telegraph	8517	66	11	100	177	14	2	22	38	5	4	4	5
23. Computer Parts and devices	8473	97	24	103	224	21	5	22	48	7	5	4	7
24. Computer	8471	59	13	98	170	13	3	21	37	4	3	5	4
25. Televisions	8528	10	2	3	15	2	0	1	3	1	0	0	1
26. Cathode Ray Tube	8540	16	4	12	32	3	1	3	7	1	0	1	1
27. Transformer	8504	87	12	74	173	19	3	16	37	6	4	2	6
28. Medical equipment	9018	29	6	100	135	6	1	22	29	2	3	4	2
29. Printed circuit board	8542	103	13	58	174	22	3	13	38	7	4	1	7

Type	HS Code	Population				Number of Samples				Number of Samples (Extra)			
		L	M	S	Total	L	M	S	Total	L	M	S	Total
30. Jewelry	7113	19	27	115	161	4	6	25	35	1	7	3	1
31. Orchids	0603	1	2	160	163	0	0	35	35	0	1	10	0
32. Coffe, Tea and Spices	0901	2	1	33	36	0	0	7	8	0	0	0	0
33. Wood and Wood product	4401	6	2	12	20	1	0	3	4	0	1	2	0
34. Footwear and parts	6401	5	2	38	45	1	0	8	10	0	0	1	0
35. Vegetables, fruit, nuts and other edible parts of plants prepared or preserved by vinegar or acetic acid.	2001	12	5	50	67	3	1	11	15	0	0	2	2
36. Drinks, Liquor, Vinegar	2201	2	0	32	34	0	0	7	7	1	1	3	5
Malt Beer	2203	6	0	33	39	1	0	7	8	0	0	2	2
37. Tractors	8701	14	7	52	73	3	2	11	16	0	0	2	2
38. Product ion of milling industry: malt, starches, inulin and wheat gluten	0011	52	15	91	158	11	3	20	34	1	1	3	5
39. Cereal	0010	32	13	122	167	7	3	26	36	4	3	5	12
40. Electronic machinery, Electronic devices and parts	0085	139	13	13	165	30	3	3	36	2	5	5	12
รวม		1,552	367	2242	4,161	336	79	485	900	76	58	69	286

Remark: Number of samples 1,301 samples from target 900 samples, 144.56 percentage

2.1.3 Data collection method

In collecting data on commodity flow, the consultant has carried out a survey by means of questionnaires sent to the sample group by post, direct interview, and telephone interview, which will be additionally made only in case the returned questionnaires are not complete. The detailed procedures and method used for data collection can be summarized as follows.

- (1) Make phone calls to ensure the availability of the sample group and ask for preliminary cooperation in responding the questionnaires (by verbal).
- (2) Send questionnaires by post, using the following steps
 - Coordinate with the Office of Transport and Traffic Policy and Planning (OTP) under the Ministry of Transport, to prepare a covering letter asking for cooperation from the sample group and indicating the deadline for returning the questionnaire
 - Send the questionnaires by (registered) post
 - Check the validity of the questionnaire
 - Follow up and make telephone interviews for more information in case the returned questionnaires are not complete
 - Gather the completely filled questionnaires for further processing
- (3) Conduct direct interview with the sample group, using the following steps
 - Make an appointment for telephone interview
 - Send the questionnaires to the sample group before making interviews by fax so that the interviewee can prepare information
 - Make an interview in the date and time as appointed
 - Check the validity of the questionnaire
 - Gather the completely filled questionnaires for further processing

2.1.4 Database updating for analysis and report preparation

The data obtained from the survey will be processed and input into the database for analyzing the logistics of commodities (in case of commodities) and giving recommendations on improved logistics in order to increase transport efficiency. The result of analysis will be prepared and presented in the form of report with diagrams for easy understanding.

The process details can be summarized as follows:

The study is set to survey, collect, and select 40 commodities with a view to study the production and consumption sources, as well as transport features. The case study of the 40 commodities include

- (1) First 20 commodities with maximum import values
- (2) First 10 commodities with maximum export values
- (3) 10 categories of commodities with maximum net export values for 10 items in addition to those given in (2)
- (4) First 10 commodities with maximum cross-border volumes

The import and export values are set as selection criteria, which are used as a convenient tool for the selection of commodities for the case study. In addition, the high-valued commodities have an important role in the country's economy so the development of transport system and logistics management that contribute to lower cost will be beneficial to the national economy. However, heavy weighted commodities often require greater demand on transport. The weight will then be used as a criterion (optional) for this selection.

To ensure the study result will be useful to draw up a strategy for multimodal transport development, additional criteria will be set to select the commodities for in-depth study. They include

- (1) Commodities with high potential and growth in the future
- (2) Commodities with obvious transport routes that make the study possible
- (3) Diversity of commodities that enables the study on multimodal transport
- (4) Commodities of diversified types such as container type, conventional type, liquid type, etc.

Summary on the survey conducted on the flow of 40 commodities classified by items under the Harmonized System

The result of survey conducted on the flow of 40 commodities classified by items under the Harmonized System consists of the questionnaires sent by post to 2,081 companies and direct interviews with 80 companies, totaling 2,161 companies. There were responses from 1,211 companies, of which 1,000 companies hired transport agencies, so additional interviews were conducted by phone to validate the questionnaires and collect more information. In conclusion, the questionnaires were responded by 1,301 companies or 144.56% of the required target at 900 questionnaires.

The result of survey is presented by items classified under the Harmonized System with regard to transport method, distance and time, weight, freight charge, and overall transport cost, as well as vehicles mainly used in transport, volume per annum, average distance and time, average weight per trip, average freight charge, and average transport cost per trip, based on origin to destination, as shown in the following example.

(1) Sample survey on the flow of frozen fish (HS 0303)

The survey on frozen fish was successfully conducted on 42 companies. Most manufacturers of frozen fish products hired transport agencies, or equivalent to 69.0%, whereas the other 31.0% handled the transport themselves. The overall result shows the average distance of 243.88 kilometers, average time of transport 4.15 hours, average weight per trip 20.88 tons, and the transport cost 7,523.53 Baht/trip. When comparing the distance and weight, the transport cost per trip will be equivalent to 2.76 Baht/ton/km.

Table 2.1-2 Survey data of Fish frozen

Origin	Destination	Vehicle Type	Volume (tonnes)	Distance (km)	Duration (hr)	Total load (ton/veh)	Transportation Cost	
							Baht/veh/trip	Baht/ton/km.
Bangkok	Laem Chabang Port	18 Wheeled Truck (Trailer)	240	140.00	3.00	19.00	5,000	1.46
Chonburi	Laem Chabang Port	18 Wheeled Truck (Trailer)	2,400	50.00	1.50	19.00	2,100	2.21

Origin	Destination	Vehicle Type	Volume (tonnes)	Distance (km)	Duration (hr)	Total load (ton/veh)	Transportation Cost	
							Baht/veh/trip	Baht/ton/km.
Chumphon	Laem Chabang Port	18 Wheeled Truck (Trailer)	2,400	650.00	11.00	24.00	25,000	1.60
Trang	Songkha Port	18 Wheeled Truck (Trailer)	3,000	170.00	3.50	42.00	13,500	1.89
Samut Sakhon	Bangkok	10 Wheeled Truck	400	50.00	1.00	12.00	3,000	5.00
Laem Chabang Port	Samut Sakhon	18 Wheeled Truck (Trailer)	4,000	138.00	3.00	19.00	8,000.	3.05
Nakhon Pathom	Bangkok Port	18 Wheeled Truck (Trailer)	8,880	120.00	1.50	20.00	6,000	2.50
Songkha	Sa-Dao Customs House	18 Wheeled Truck (Trailer)	432	50.00	1.00	12.00	3,000	5.00
Songkha	Bangkok Port	18 Wheeled Truck (Trailer)	9,000	950.00	12.00	25.00	7,000	0.29
Songkha	Laem Chabang Port	18 Wheeled Truck (Trailer)	9,000	1,040.00	13.50	24.00	8,000	0.32
Samut Sakhon	Bangkok Port	18 Wheeled Truck (Trailer)	525	55.00	2.00	19.50	5,850	5.45
Samut Sakhon	Laem Chabang Port	18 Wheeled Truck (Trailer)	70	157.00	3.50	20.25	8,375	2.53
BKK	BKK port	6,10,18 Wheeled truck	454.00	46.67	1.83	14.00	3,000.00	5.73
	LCP	6 wheeled truck	10,000.00	60.00	3.00	5.00	1,500.00	5.00
Khon Kaen	BKK port	6 wheeled truck	300.00	400.00	6.00	3.00	6,500.00	5.42
BKK Port	Chonburi	6,18 wheeled truck	2,636.00	80.00	1.00	13.50	10,590.00	8.55
Nakhon Pathom	LCP	18 wheeled truck	400.00	300.00	5.00	15.00	5,000.00	1.11
Samut Sakhon	BKK port	18 wheeled truck	2,000.00	70.00	2.00	12.00	4,000.00	4.76

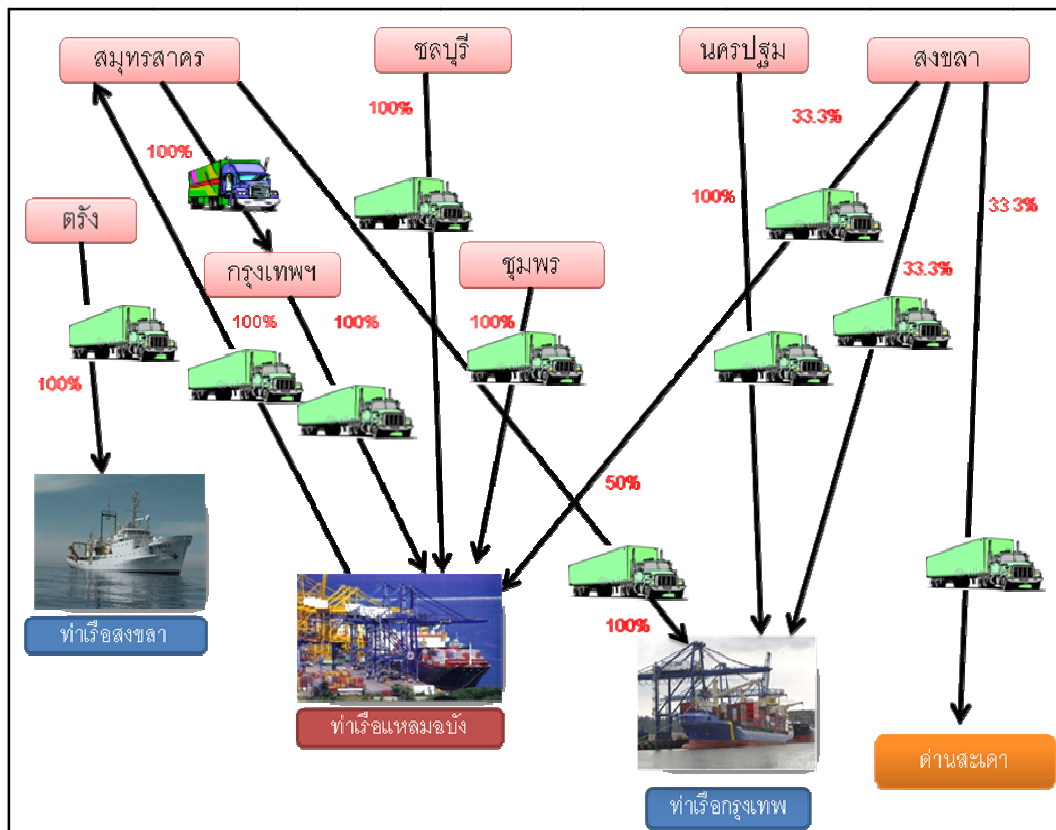


Figure 2.1-1 Percentage of transport-modal (HS 0303)

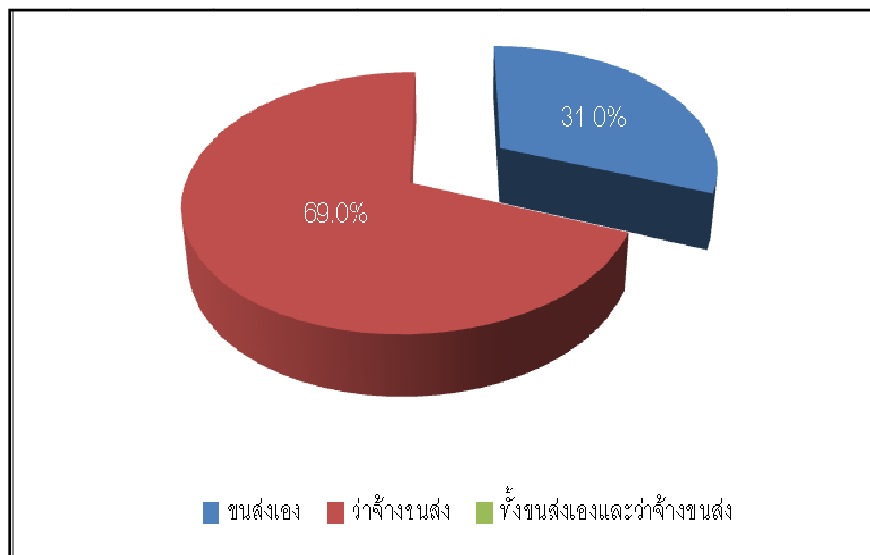


Figure 2.1-2 Percentage of company divided by hiring type

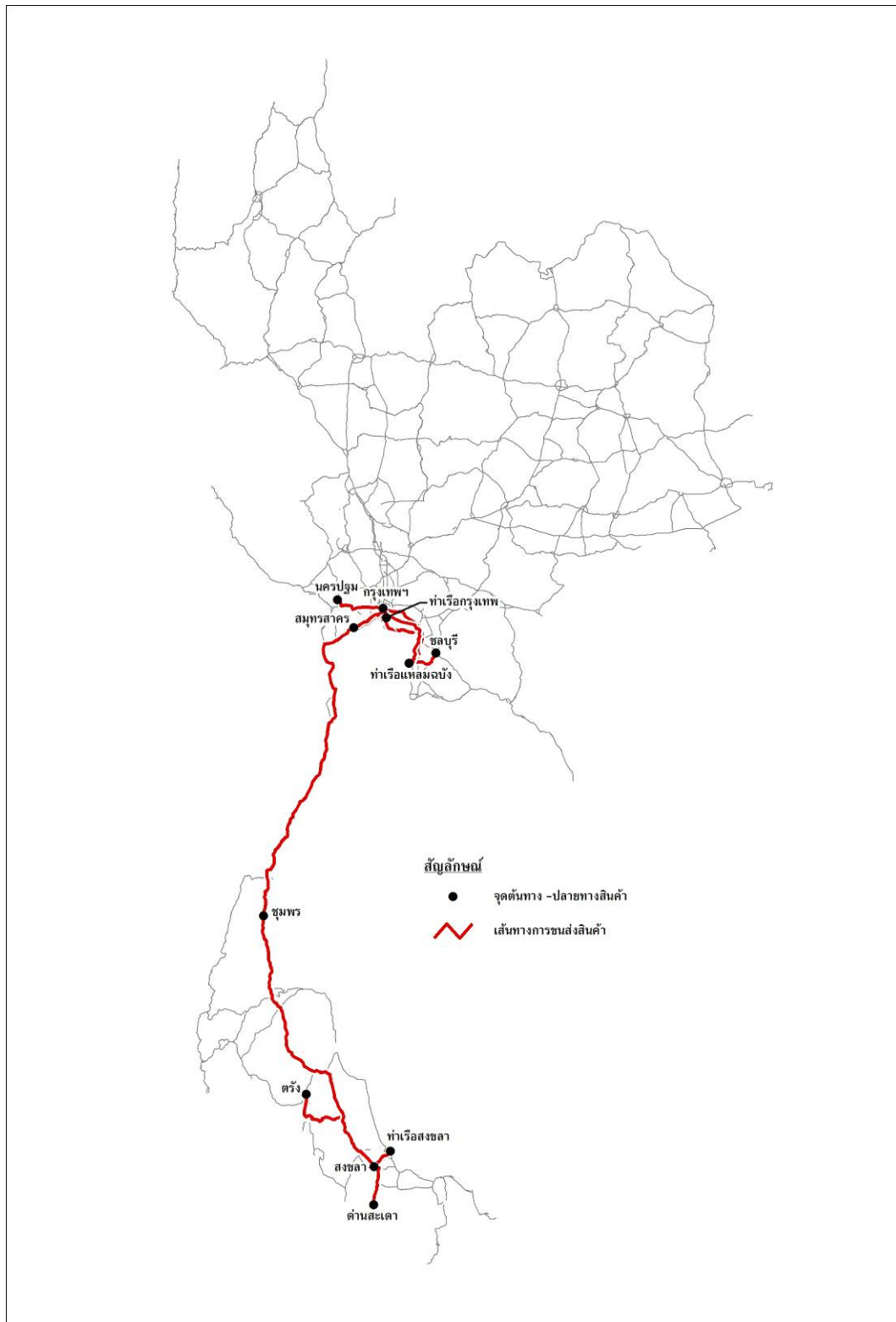


Figure 2.1-3 Route of Commodity Flow (HS 0303)

CHAPTER 3: TRAFFIC AND TRANSPORTATION DATABASE INFORMATION SYSTEM DEVELOPMENT AND MAINTENANCE

- 3.1 Study and Analysis of the Development Process
- 3.2 Data Cleaning and Update
- 3.3 Existing Database and Systems Improvement
- 3.4 MIS Reporting System Development
- 3.5 Electronic Book Development
- 3.6 OTP Website Redesign and Development
- 3.7 Computer Equipments and Networking System Improvement

In the TDML II Project, the Consultant has divided the task into 7 major parts, including the study and review on the development of information database, the updating of data, the maintenance and improvement of the database and the existing system, the development of information report system, the preparation of electronic book, the development of OTP's main website, and the improvement of computer system and network. All parts of the task can be illustrated in chart as shown in figure 3-1.

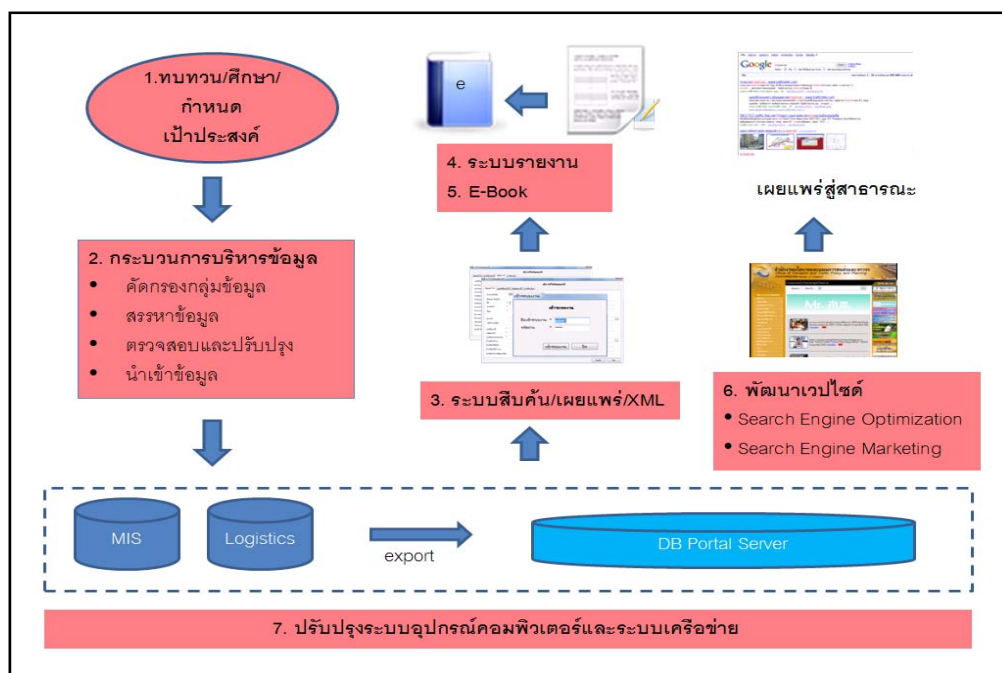


Figure 3-1 Transport Database Development and Maintenance

3.1 Study and Analysis of the Development Process

To ensure optimal efficiency in all parts of the development and maintenance of transport and traffic database system, the Consultant has studied and reviewed the operations previously performed in the TDML II related projects, to be a guideline for the development of a new system or improvement of the existing system to ensure higher efficiency. The operation can also be analyzed to meet the current situation and to support adjustments or changes that may arise in the future, and above all, to respond to OTP's objectives. The result is summarized as follows:

The study and analysis include all the 8 related previous projects as follows:

- (1) Urban Transport Database and Model Development Project (UTDM)
- (2) Transport Data and Model Center (TDMC I)
- (3) Transport Data and Model Center (TDMC II)
- (4) Transport Data and Model Center – (TDMC III)
- (5) Transport Data and Model Center – (TDMC IV)
- (6) Transport Data and Model Center – (TDMC V)
- (7) Transport Data and Model Center – (TDMC VI)
- (8) Transport Data and Model Integrated with Multimodal Transport and Logistics (TDML)

From the works previously performed in TDMC IV, V, VI and TDML, the Consultant has developed various database systems to support and handle OTP's abundant data. The Consultant found the advantages and disadvantages of the system and processed the data to draw the most efficient plan for information system development and improvement. The result is summarized as follows:

Table 3.1-1 Summary on the study of the related projects

No.	Items requiring improvements	Actions taken for improvement
1	Report format should be presented in a more interesting way to the executives and general users.	Apply the report presentation mainly in GIS format with supporting information in the forms of tables and graphs from MIS system
2	Search system should be improved to access the report according the given rights.	Improve the search system to set the rights for report access
3	Search system should be improved to determine which reports can be published to the public.	Improve the search system to determine which reports can be published and linked to the transport and traffic information publishing system
4	Search system should be improved to have a more efficient section for data upload.	Improve the search system by developing data upload system on Windows Application with increased performance speed and better data upload correction
5	Transport and traffic information publishing system should be improved to ensure easy data search.	Improve query conditions in data search and result display
6	Transport and traffic information publishing system should be improve to have a section for rapid file upload.	Improve transport and traffic information publishing system by developing data upload system on Windows Application with increased performance speed and larger file support
7	The display of data group in transport and traffic information publishing system should be improved.	Improve data group by dividing into 3 main groups as follows: - Annual Report and Journal - Report on the study project and related reports - Laws and general knowledge on transport and traffic
8	Information should be published in the form of electronic books that could be opened without other software installation.	Provide an application for document file conversion into electronic books that can be instantly opened (*.EXE)

The result of study on relational database and developed system is shown in the figure 3-2 .

3.2 Data Cleaning and Update

To determine the scope and clarity of data updating operation, the Consultant has updated the checklist and estimated completion schedule. The Consultant has also added details on the data sources to enable the data operators to search and retrieve data easily. The updated data groups are shown in Table below.

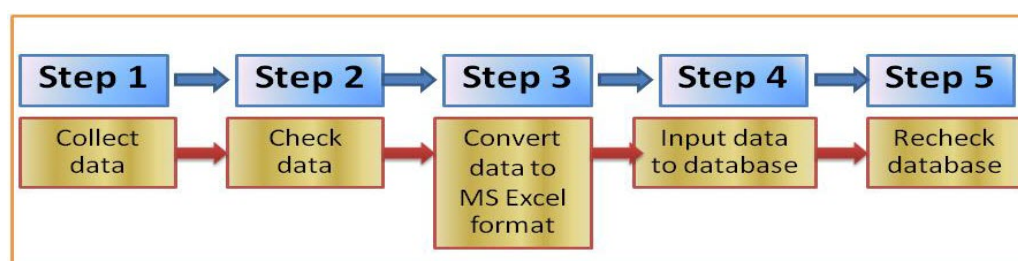
Table 3.2-1 Summary on updated data groups

Main data group	Sample data type
Group01_FixInfraInventory	Data on road physical format General data on expressway General data on rail route operation
Group02_ShOfService	Data on public transport Data on air traffic volume Data on inter-airport transportation
Group03_Travel	General data on tourism places General data on accommodations Data on the number of tourists entering the country
Group04_Accident	Data on land traffic accident statistic summary Data on the number of persons/vehicles in accidents Data on land traffic accident causes
Group05_SocioEco	Data on population census Data on population work conditions Data on household income
Group06_TransEco	Gross national product at fixed price in 1988 Gross provincial product at fixed price in 1988 Gross regional product at fixed price in 1988
Group07_Environment	Data on air pollution Data on noise pollution Data on pollutants
Group08_VehInventory	Data on vehicle registration Data on annual vehicle registration Data on airplane registration

Main data group	Sample data type
Group09_FreighVol	Data on goods import Data on goods export Data on domestic transportation
Group10_CoAmong	Data on police order issuance statistic (master) Data on land use (master) Data on project work plan
Group13_ProgAndProj	Data on the Cabinet's traffic related resolutions Data on the resolutions on the subjects proposed for consideration and acknowledgement from the Commission for the Management of Land Traffic (CMLT)
Group18_VehicleCount	Data on vehicle count classified by type at intersections Data on the standard for automobile equivalent unit

The Consultant has gathered raw data from the Checklist and converted it into MS Excel Template for uploading to the system. Test has then been conducted on data upload in the test machine and data validated. After validation, the Consultant has uploaded data to the system's main server.

In the operation procedure, upon collecting data from various sources, the Consultant has preliminarily inspected its validity prior to converting it with a developed application (for certain data groups only) or entering it in MS Excel file format and converting it for uploading to the database system through the existing search system. The data upload to the database system can be illustrated as shown.



Picture 3.2-1 Data Import Process.

3.3 Existing Database and Systems Improvement

3.3.1 Improvement of the data display in transport and traffic information publishing system (MIS) via the Internet and Intranet

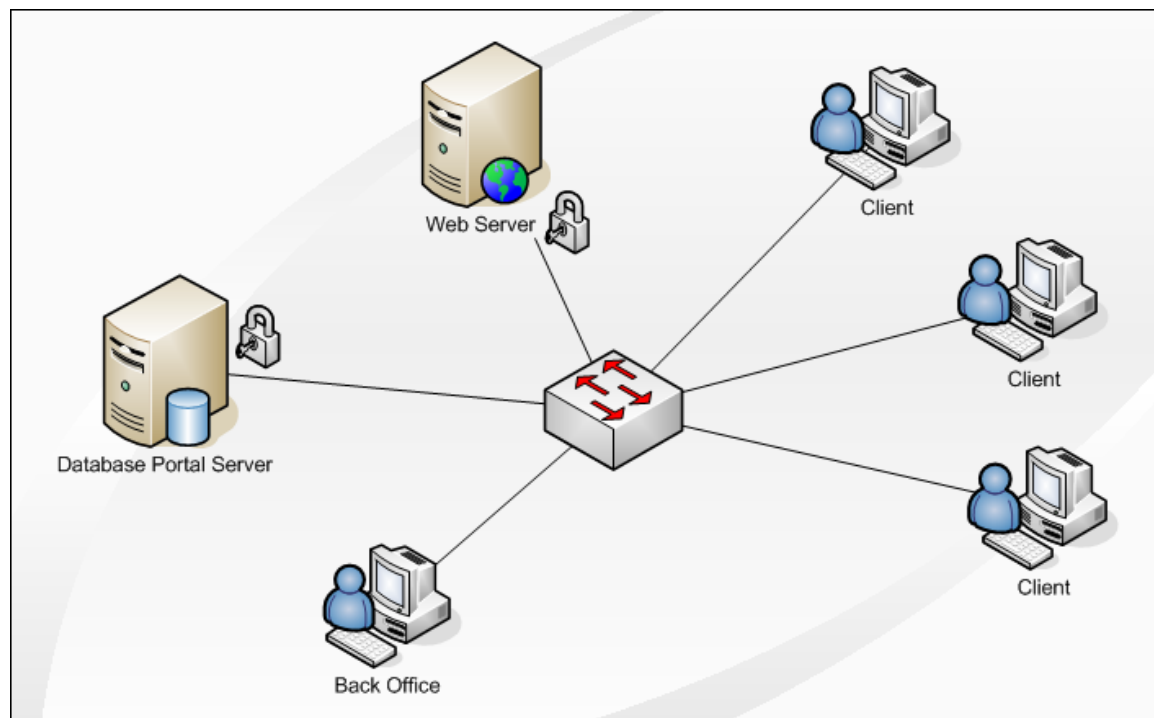
The Consultant has improved 2 operation systems, including transport and traffic information system and transport and traffic information publishing system as follows:

Transport and traffic information system means data search system or report issuance system through the Intranet for OTP officers only. Such systems will not be available for the public.

If OTP finds that any report formats are beneficial to the public, OTP can select them for publishing. The selected report formats will be automatically linked to the transport and traffic information publishing system.

Back Office System of the Transport and Traffic information System means transport and traffic information management system with focus on the upload of raw data converted or entered in MS Excel format to the database system, including report formatting for publishing or cancellation of publishing in the transport and traffic information publishing system and the management of user data in the transport and traffic information system.

The system linkage structure of the transport and traffic information system is illustrated in the following diagram.



Picture 3.3-1 System Diagram of Transport Information System.

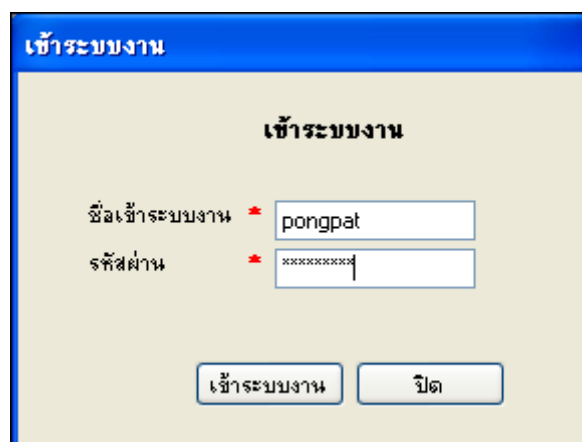
The Consultant has designed and developed the transport and traffic information system which is implemented as follows:

Design of Back Office Screen for Transport and Traffic Information System

Screen for system access

Screen for system access requires username and password entered by user. If the username and password are valid, the user can access to the system.

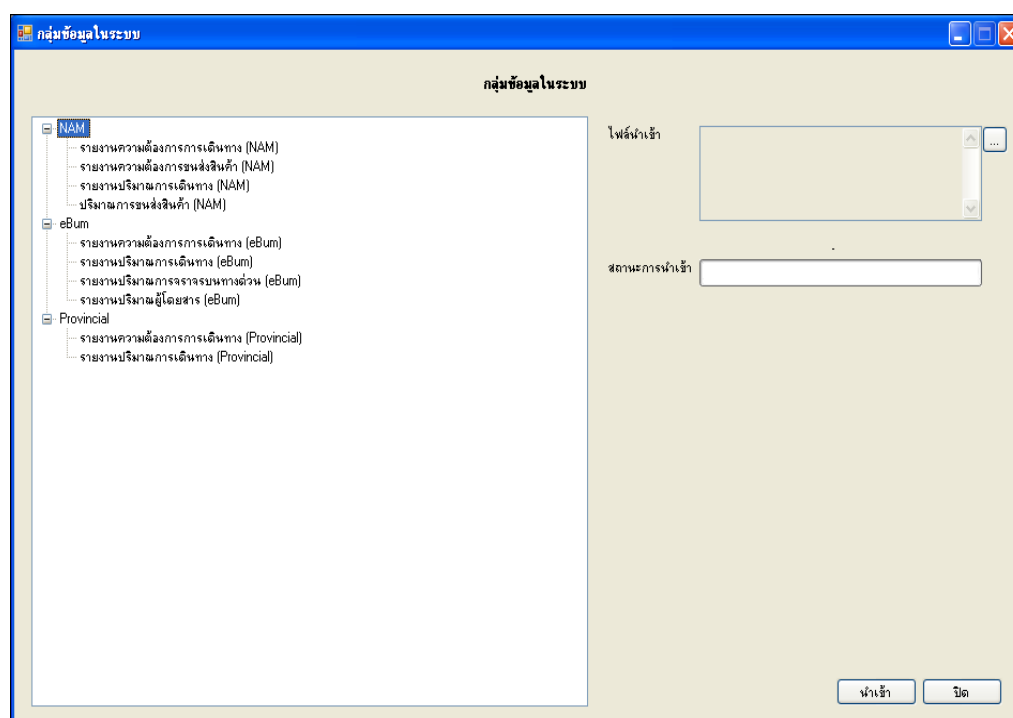
Main screen of the system



Picture 3.3-2 Login Screen for Back Office System

The main screen of the Back Office System consists of the following menus.

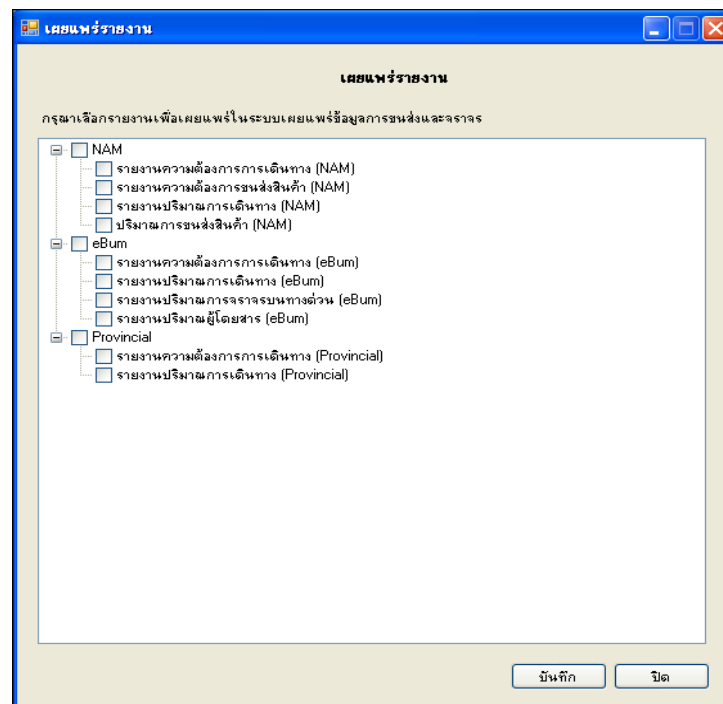
Screen for data groups in the system



Picture 3.3-9 Data Group Display Screen.

The screen is used for updating data in each group with a section for selecting MS Excel files for system upload. The operation status tab is shown in the figure.

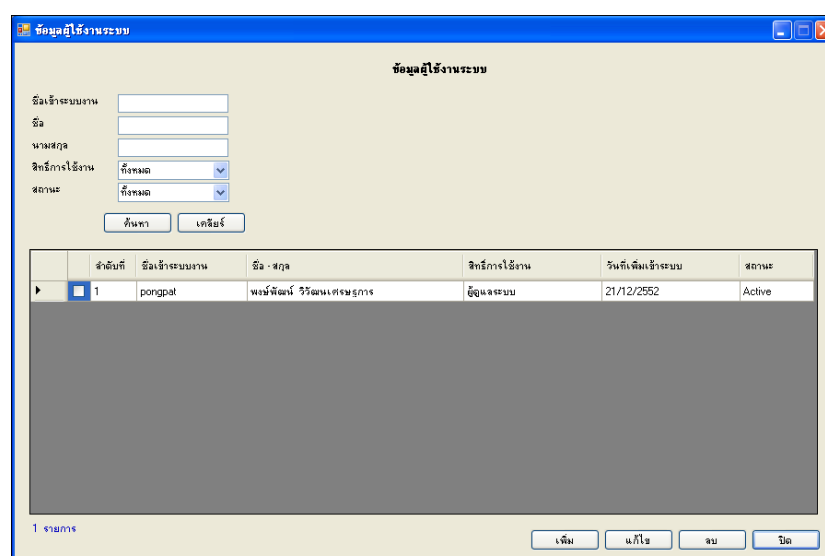
Screen for report publishing



Picture 3.3-11 Report Publishing Screen.

This screen is used to select the items for publishing in the transport and traffic information publishing system. Upon selecting the items and pressing <Save> button, such reports will be linked to the transport and traffic information publishing system.

User Management Screen



Picture 3.3-12 User Management Screen.

This screen displays lists of user in the system. There are search, search result and command button to facilitate users. User can also type name or surname to search the information. The screen allows administrator to access only.

Design of the screen for data search

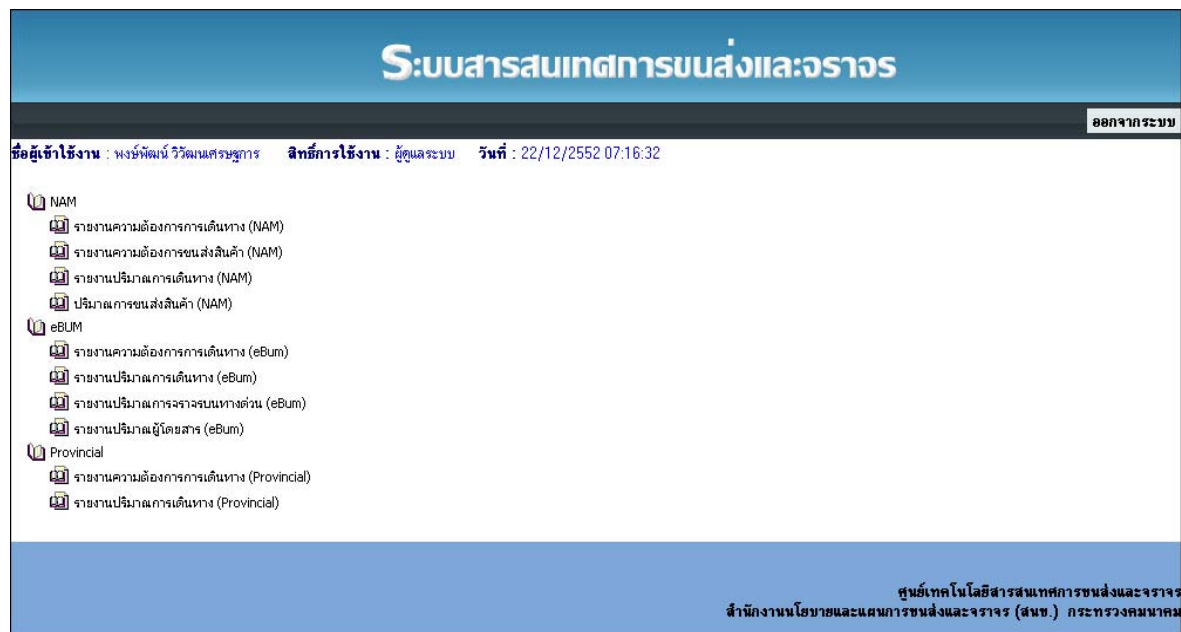
The Consultant has designed the following screens for data search through the Internet.

Login Screen

Picture 3.3-13 Login Screen

The user has to enter username and password to access further.

Main Screen

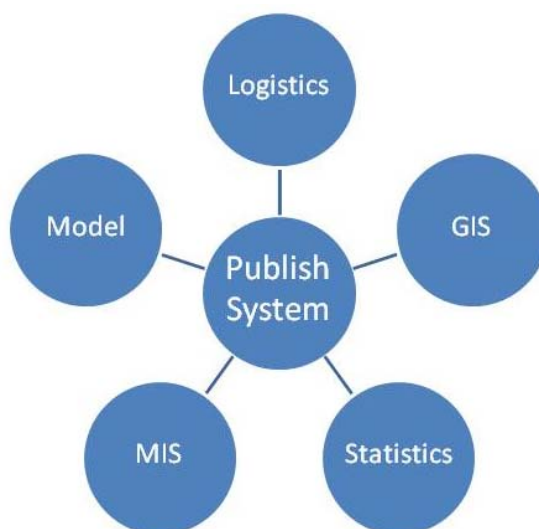


Picture 3.3-14 Main Screen

When the user can access the system, the user will come to the main screen showing a list of report. The lists of report will be shown differently depending on user access level. For example, Administrator can access every report while general user can access just some reports.

Transport and traffic information publishing system means the transport and traffic information publishing system via the Internet. The public and any interested persons can download data files in different formats such as MS Excel, PDF (Portable Document Format), XML (Extensible Markup Language), as well as video clips. The data for publishing is a direct result of this project or other related projects. If any project has already published the data from the existing system, it may be linked to the transport and traffic information publishing system or certain groups of data may be selected for publishing in the transport and traffic information publishing system.

To ensure convenient and rapid access to the required data groups under the transport and traffic information publishing system, the Consultant has categorized data for publishing into 5 groups, including transport and traffic model, logistics, MIS from the transport and traffic information publishing system, GIS, and interesting statistics data, which can be illustrated as follows:



Picture 3.3-15 Groups of data in Transport Information Publishing System.

The Back Office System of the transport and traffic information publishing system means data management system with a focus on data file upload in different formats for storage in the Server of the transport and traffic information publishing system, as well as data grouping.

The system linking structure of the transport and traffic information publishing system is shown in the diagram.

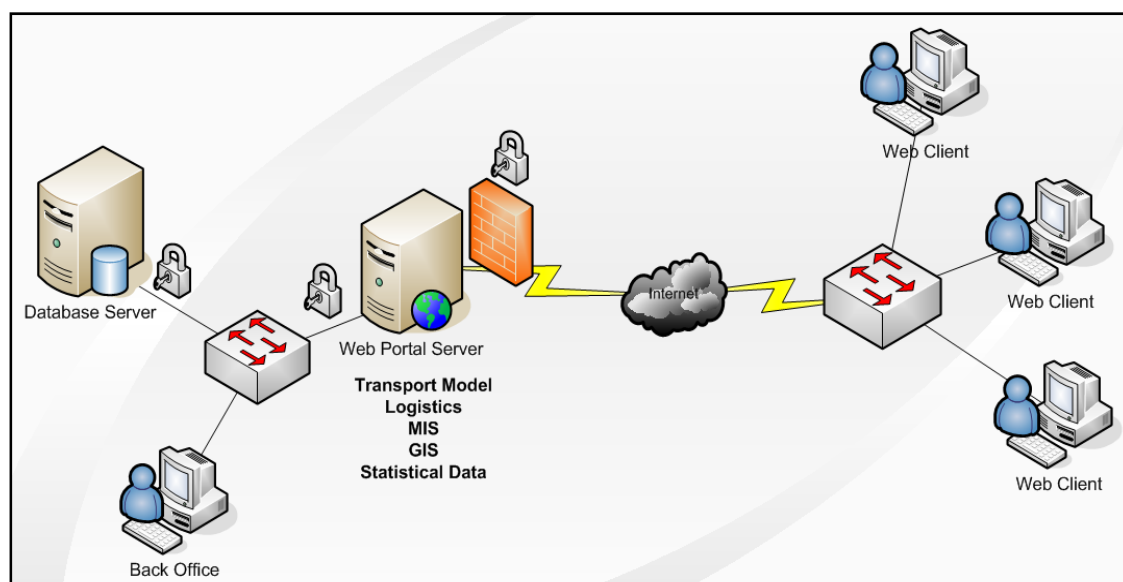
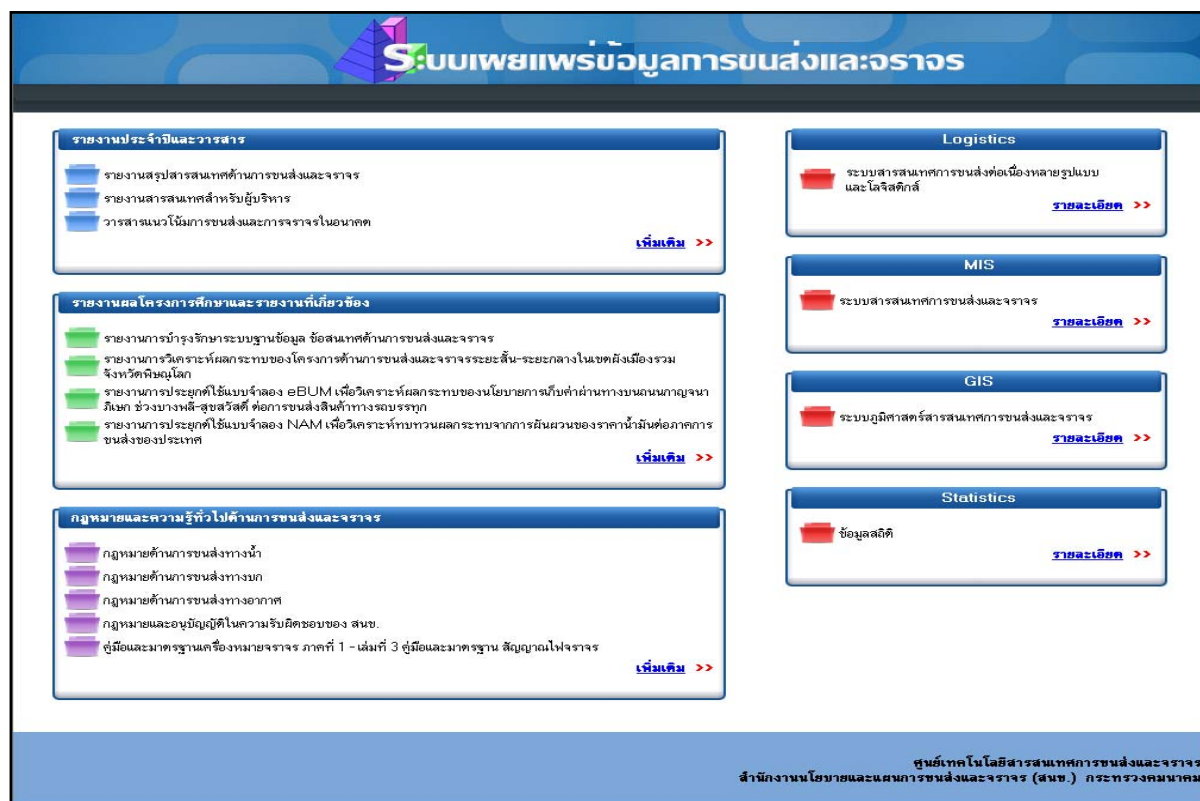


Figure 3.3-16 System Diagram of Transport Information Publishing System.

Design of information publishing screen

The Consultant has designed the screen for disseminating data via the Intranet/ Internet as shown in the figure.



The Consultant has categorized the published data into 3 groups as follows:

- ❖ Annual Report and Journal
- ❖ Report on the study project and other related reports
- ❖ Laws and general knowledge on transport and traffic

Besides, there are links to the related systems including

- ❖ Multimodal Transport and Logistics Information System
- ❖ Traffic and Traffic Information System
- ❖ Transport and Traffic Geographic Information System
- ❖ Statistic Data

3.3.2 Development of Information System to ensure data exchange among agencies with standard file format in XML

From the TDML project, the Consultant has developed an engine for data conversion from the database into XML file format for publishing. In this project, the Consultant has developed the existing engine to have more features by applying 2 standards, including statXML and the national data exchange standard framework of the National Statistics Office. Both help set standards to XML data for publishing and compatible use with other agencies across the country.

statXML data

To enable systematic and efficient exchange of statistic data among public agencies, the agencies involved are required to follow the guidelines and standards for data preparation. The National Statistics Office in its capacity as the central unit in charge of the country's statistic data management, has developed statXML standard for describing statistic data of other agencies, based on the Statistical Data and Metadata eXchange (SDMX), intended for statistic data exchange. The statXML standard has 3 highlights different from other data standards as follows:

- (1) It is capable of describing all types of public statistic data.
- (2) The user can name the data in Thai.
- (3) There is definite schema structure with no need to name the data as element name like other data standards. So it is not required to develop a specific program for a new set of data. On the contrary, the existing program can be easily realigned.

The public agencies can apply the statXML guideline to their statistic data.

Thailand e-Government Interoperability Framework : TH e-GIF

Overview of TH e-GIF

The overview of Thailand e-Government Interoperability Framework or TH e-GIF can be divided into 3 topics including

- (1) Data Standard
- (2) Data Exchange Standard
- (3) Standard for public data exchange facilitation

The details of each topic can be explained as follows:

Data Standard

TH e-GIF describes the guideline and procedures that should be observed so that the agencies can develop data storage systems in an interoperability framework, which can be linked efficiently. TH e-GIF sets the data storage guideline in the following 2 steps.

- (1) Data is stored under the international standards, such as XML and XML Schema.
- (2) TH e-GIF describes the priority of data structure by setting data model or data structure framework.

In conclusion, TH e-GIF points out that the first step of public data interoperability is the data standard preparation based on XML technology. The standard preparation consists of data description and data structure description that lead to the naming of data and the design of data structure, which can be explained by XML Schema. Although TH e-GIF describes data in steps, the description of data and data structure must actually be made in parallel. The agencies are required to prepare data in XML format as specified by TH e-GIF.

Data Exchange Standard

TH e-GIF has explained the guidelines and procedures that should be observed in system data transfer, which can be divided into 2 steps as follows:

- (1) The agencies involved are required to adopt the same data exchange standard. TH e-GIF specifies the data exchange standard consisting of Web Service Description Language (WSDL), Simple Object Access Protocol (SOAP), UDDI, and Hypertext Transfer Protocol over Secure Socket Layer (HTTPS).

- (2) When the data exchange standard is on the same basis, TH e-GIF specifies a guideline to ensure higher safety in data transfer. The Security Specification consists of 22 items of technology and standard, such as HTTPS.

Standard for Public Data Exchange Facilitation

TH e-GIF sets the framework requiring the central unit to adopt for convenient and efficient data exchange by establishing the data management center that allows data owners to register whereas the data searcher linked to the system can do the thing. The data management center is required to have the UDDI Registry, which is currently set up and maintained by ICT Ministry. TH e-GIF sets a framework for operation to consider whether the National Standard Data Set Committee should be set up. This implies that if this organization is established,) โดยนัยสำคัญของการมีหน่วยงานกำกับมาตรฐานข้อมูลคือ ในที่สุดแล้ว TH e-GIF will set a standard for the national data set, adopted by the agencies involved to describe the linked data.

After developing a report under the information report system development, the Consultant has converted important data into XML format for publishing purpose.

3.4 MIS Reporting System Development

In TDML II Project, the Consultant has proposed to develop additional 5 formats of report with a focus on the application of data from MIS, GIS, and model systems. The data imported into the Database Portal Server are integrated by analyzing and finding linkage of data, in preliminary principle, and the linked data are used to develop different formats of report.

The Consultant has initiated an idea to mainly present data in GIS format and provide supporting data in a table of detailed data. Such report covers provincial model, NAM, and eBUM. The Consultant takes into account the simplicity of format to enable user's understanding, the period of data updating, the further development for future application, and the benefits received from the developed report.

The Consultant has set the content and 10 formats of the MIS report to support the main GIS report and developed a report to link data and the operation of GIS and MIS with the following details.

1. Passenger demand (NAM)

รายงานความต้องการการบริการทางของแบบจำลองระดับประเทศ (NAM)													
รหัส กลุ่มพื้นที่	ชื่อกลุ่มพื้นที่	ปี พ.ศ. 2552		ปี พ.ศ. 2555		ปี พ.ศ. 2560		ปี พ.ศ. 2565		ปี พ.ศ. 2570		ปี พ.ศ. 2575	
		เข้า	ออก	เข้า	ออก	เข้า	ออก	เข้า	ออก	เข้า	ออก	เข้า	ออก
1	กรุงเทพ	727,000	727,000	768,000	768,000	834,000	834,000	896,000	896,000	960,000	960,000	1,024,000	1,024,000
2	ภาคกลางตอนบน กลุ่มที่ 1	131,000	131,000	142,000	142,000	161,000	161,000	183,000	183,000	208,000	208,000	235,000	235,000
3	ภาคกลางตอนบน กลุ่มที่ 2	81,000	81,000	85,000	85,000	90,000	90,000	95,000	95,000	101,000	101,000	107,000	107,000
4	ภาคกลางตอนล่าง กลุ่มที่ 1	167,000	167,000	180,000	180,000	205,000	205,000	235,000	235,000	271,000	271,000	316,000	316,000
5	ภาคกลางตอนล่าง กลุ่มที่ 2	71,000	71,000	77,000	77,000	88,000	88,000	100,000	100,000	114,000	114,000	131,000	131,000
6	ภาคกลางตอนล่าง กลุ่มที่ 3	174,000	174,000	180,000	180,000	191,000	191,000	203,000	203,000	216,000	216,000	230,000	230,000
7	ภาคตะวันออก	235,000	235,000	246,000	246,000	266,000	266,000	288,000	288,000	313,000	313,000	341,000	341,000
8	ภาคตะวันออกเฉียงเหนือตอนบนกลุ่ม1	79,000	79,000	86,000	86,000	98,000	98,000	112,000	112,000	128,000	128,000	146,000	146,000
9	ภาคตะวันออกเฉียงเหนือตอนบนกลุ่ม2	35,000	35,000	37,000	37,000	38,000	38,000	40,000	40,000	42,000	42,000	44,000	44,000
10	ภาคตะวันออกเฉียงเหนือตอนบนกลุ่ม3	65,000	65,000	70,000	70,000	80,000	80,000	95,000	95,000	113,000	113,000	137,000	137,000
11	ภาคตะวันออกเฉียงเหนือตอนล่างกลุ่ม1	103,000	103,000	105,000	105,000	109,000	109,000	114,000	114,000	118,000	118,000	124,000	124,000
12	ภาคตะวันออกเฉียงเหนือตอนล่างกลุ่ม2	42,000	42,000	42,000	42,000	43,000	43,000	45,000	45,000	47,000	47,000	49,000	49,000
13	ภาคเหนือตอนบน กลุ่มด้านนา	79,000	79,000	83,000	83,000	89,000	89,000	95,000	95,000	101,000	101,000	107,000	107,000
14	ภาคเหนือตอนล่าง กลุ่มที่ 1	58,000	58,000	60,000	60,000	63,000	63,000	66,000	66,000	69,000	69,000	72,000	72,000
15	ภาคเหนือตอนล่าง กลุ่มที่ 2	69,000	69,000	72,000	72,000	78,000	78,000	84,000	84,000	91,000	91,000	97,000	97,000
16	ภาคใต้ 1	56,000	56,000	57,000	57,000	58,000	58,000	59,000	59,000	60,000	60,000	62,000	62,000
17	ภาคใต้ 2	56,000	56,000	57,000	57,000	58,000	58,000	59,000	59,000	60,000	60,000	60,000	60,000
18	ภาคใต้ 3	69,000	69,000	82,000	82,000	110,000	110,000	149,000	149,000	203,000	203,000	278,000	278,000
19	ภาคใต้ชายแดน 1	46,000	46,000	47,000	47,000	48,000	48,000	49,000	49,000	50,000	50,000	51,000	51,000
20	ภาคใต้ชายแดน 2	58,000	58,000	60,000	60,000	64,000	64,000	71,000	71,000	81,000	81,000	95,000	95,000
รวม		2,401,000	2,401,000	2,536,000	2,536,000	2,771,000	2,771,000	3,038,000	3,038,000	3,346,000	3,346,000	3,706,000	3,706,000

หน่วย : คน-เที่ยววัน
แหล่งข้อมูล : สำนักงานนโยบายและแผนการขนส่งและจราจร

2. Freight demand (NAM)

รายงานความต้องการการขนส่งสินค้าของแบบจำลองระดับประเทศ (NAM)													
รหัส กลุ่มพื้นที่	ชื่อกลุ่มพื้นที่	ปี พ.ศ. 2552		ปี พ.ศ. 2555		ปี พ.ศ. 2560		ปี พ.ศ. 2565		ปี พ.ศ. 2570		ปี พ.ศ. 2575	
		เข้า	ออก	เข้า	ออก	เข้า	ออก	เข้า	ออก	เข้า	ออก	เข้า	ออก
1	กรุงเทพ	64,826,000	88,595,000	69,226,000	96,920,000	74,797,000	109,465,000	77,715,000	121,812,000	78,660,000	134,313,000	78,236,000	148,766,000
2	ภาคกลางตอนบน กลุ่มที่ 1	60,532,000	46,664,000	63,045,000	53,122,000	84,332,000	66,232,000	100,766,000	83,095,000	117,003,000	104,525,000	133,799,000	131,669,000
3	ภาคกลางตอนบน กลุ่มที่ 2	11,428,000	6,823,000	11,333,000	7,440,000	12,731,000	8,737,000	13,712,000	10,521,000	14,646,000	12,396,000	15,828,000	16,297,000
4	ภาคกลางตอนล่าง กลุ่มที่ 1	77,202,000	46,156,000	98,598,000	56,268,000	194,370,000	83,039,000	250,538,000	132,007,000	414,148,000	223,578,000	691,071,000	396,004,000
5	ภาคกลางตอนล่าง กลุ่มที่ 2	11,418,000	12,789,000	12,398,000	13,873,000	14,159,000	16,038,000	16,026,000	18,798,000	17,950,000	22,333,000	20,042,000	26,862,000
6	ภาคกลางตอนล่าง กลุ่มที่ 3	21,685,000	51,172,000	22,431,000	53,844,000	23,305,000	58,431,000	23,847,000	63,499,000	24,175,000	69,003,000	24,136,000	74,996,000
7	ภาคตะวันออก	82,422,000	54,763,000	86,386,000	58,408,000	92,218,000	65,002,000	97,083,000	72,617,000	101,621,000	81,337,000	104,537,000	91,365,000
8	ภาคตะวันออกเฉียงเหนือตอนบนกลุ่ม1	10,207,000	12,743,000	11,908,000	15,288,000	15,341,000	20,920,000	19,552,000	28,866,000	24,669,000	40,081,000	30,821,000	55,891,000
9	ภาคตะวันออกเฉียงเหนือตอนบนกลุ่ม2	11,102,000	16,946,000	11,459,000	17,889,000	11,887,000	19,823,000	12,071,000	21,274,000	12,033,000	23,192,000	11,800,000	26,151,000
10	ภาคตะวันออกเฉียงเหนือตอนบนกลุ่ม3	8,367,000	13,977,000	9,712,000	17,605,000	12,977,000	26,774,000	17,825,000	41,238,000	24,649,000	64,101,000	33,976,000	99,659,000
11	ภาคตะวันออกเฉียงเหนือตอนล่างกลุ่ม1	27,604,000	17,754,000	26,778,000	17,516,000	25,388,000	17,357,000	23,798,000	17,405,000	22,111,000	17,671,000	20,442,000	12,192,000
12	ภาคตะวันออกเฉียงเหนือตอนล่างกลุ่ม2	2,077,000	9,219,000	2,069,000	9,373,000	2,124,000	9,832,000	2,301,000	9,945,000	2,664,000	10,389,000	3,205,000	10,940,000
13	ภาคเหนือตอนบน กลุ่มด้านนา	40,574,000	46,222,000	41,419,000	48,632,000	41,970,000	52,439,000	41,428,000	56,320,000	39,982,000	60,483,000	38,037,000	64,881,000
14	ภาคเหนือตอนล่าง กลุ่มที่ 1	26,218,000	25,027,000	25,294,000	24,983,000	23,468,000	24,919,000	21,435,000	25,061,000	19,374,000	25,595,000	17,491,000	26,461,000
15	ภาคเหนือตอนล่าง กลุ่มที่ 2	29,100,000	28,555,000	30,500,000	30,476,000	32,459,000	33,956,000	33,620,000	37,720,000	34,168,000	41,869,000	34,168,000	46,399,000
16	ภาคใต้ 1	11,417,000	11,875,000	10,267,000	11,619,000	9,944,000	11,301,000	8,935,000	11,045,000	7,903,000	10,862,000	6,929,000	10,749,000
17	ภาคใต้ 2	8,585,000	8,122,000	8,228,000	7,946,000	7,583,000	7,695,000	6,837,000	7,437,000	6,023,000	7,175,000	5,221,000	6,904,000
18	ภาคใต้ 3	934,000	1,440,000	1,208,000	1,843,000	1,923,000	2,960,000	3,185,000	5,006,000	5,268,000	9,190,000	8,879,000	17,149,000
19	ภาคใต้ชายแดน 1	2,172,000	4,261,000	2,153,000	4,301,000	2,082,000	4,348,000	1,965,000	4,385,000	1,816,000	4,418,000	1,694,000	4,445,000
20	ภาคใต้ชายแดน 2	8,115,000	12,932,000	7,747,000	12,334,000	7,489,000	11,842,000	7,936,000	12,392,000	9,544,000	14,806,000	13,012,000	20,602,000
รวม		516,035,000	516,031,000	559,265,000	559,367,000	650,612,000	650,610,000	780,605,000	780,609,000	978,406,000	978,407,000	1,293,390,000	1,293,388,000

หน่วย : คน-เที่ยววัน
แหล่งข้อมูล : สำนักงานนโยบายและแผนการขนส่งและจราจร

3. Passenger volume (NAM)

รายงานปริมาณการเดินทาง						
รูปแบบการเดินทาง	ความต้องการเดินทาง (พันคน-เที่ยว/วัน)					
	พ.ศ.2552	พ.ศ.2555	พ.ศ.2560	พ.ศ.2565	พ.ศ.2570	พ.ศ.2575
รถยนต์ส่วนบุคคล	1,392,000	1,468,000	1,607,000	1,766,000	1,951,000	2,170,000
รถโดยสารประจำทาง	816,000	861,000	940,000	1,027,000	1,127,000	1,241,000
รถไฟฟ้า	167,000	175,000	191,000	209,000	229,000	252,000
อากาศ	28,000	29,000	32,000	36,000	39,000	44,000
รวม	2,403,000	2,533,000	2,770,000	3,038,000	3,346,000	3,707,000

แหล่งข้อมูล : สำนักงานนโยบายและแผนการขนส่งและจราจร

4. Freight volume (NAM)

รายงานปริมาณการขนส่งสินค้า						
รูปแบบการขนส่ง	ปริมาณการขนส่ง (ตัน/วัน)					
	พ.ศ.2552	พ.ศ.2555	พ.ศ.2560	พ.ศ.2565	พ.ศ.2570	พ.ศ.2575
ทางถนน	1,233,800	1,337,400	1,555,500	1,866,300	2,339,200	3,092,300
ทางรถไฟ	36,500	39,500	46,000	55,200	69,200	91,400
ทางน้ำ	143,400	155,400	180,800	216,900	271,800	359,300
ทางอากาศ	180	190	230	280	370	500
รวม	1,413,880	1,532,490	1,782,530	2,138,680	2,680,570	3,543,500

แหล่งข้อมูล : สำนักงานนโยบายและแผนการขนส่งและจราจร

5. Passenger demand (eBUM)

รายงานความต้องการการเดินทางของแบบจำลองระดับกรุงเทพมหานครและปริมณฑล												
จังหวัด	ความต้องการเดินทาง (พันคน-เที่ยว/วัน)											
	พ.ศ.2552		พ.ศ.2555		พ.ศ.2560		พ.ศ.2565		พ.ศ.2570		พ.ศ.2575	
	เข้า	ออก	เข้า	ออก	เข้า	ออก	เข้า	ออก	เข้า	ออก	เข้า	ออก
กรุงเทพมหานคร	12,037,000	12,037,000	12,859,000	12,859,000	14,279,000	14,279,000	15,804,000	15,804,000	17,483,000	17,483,000	19,493,000	19,493,000
สมุทรปราการ	1,632,000	1,632,000	1,734,000	1,734,000	2,010,000	2,010,000	2,368,000	2,368,000	2,844,000	2,844,000	3,455,000	3,455,000
นนทบุรี	1,212,000	1,212,000	1,272,000	1,272,000	1,385,000	1,385,000	1,528,000	1,528,000	1,685,000	1,685,000	1,894,000	1,894,000
ปทุมธานี	1,046,000	1,046,000	1,083,000	1,083,000	1,162,000	1,162,000	1,252,000	1,252,000	1,323,000	1,323,000	1,427,000	1,427,000
นครปฐม	1,262,000	1,262,000	1,301,000	1,301,000	1,371,000	1,371,000	1,455,000	1,455,000	1,520,000	1,520,000	1,615,000	1,615,000
สมุทรสาคร	651,000	651,000	679,000	679,000	721,000	721,000	771,000	771,000	811,000	811,000	866,000	866,000
รวม	17,840,000	17,840,000	18,928,000	18,928,000	20,928,000	20,928,000	23,178,000	23,178,000	25,666,000	25,666,000	28,750,000	28,750,000

แหล่งข้อมูล : สำนักงานนโยบายและแผนการขนส่งและจราจร

6. Passenger volume (eBUM)

รายงานปริมาณการเดินทาง												
จังหวัด	ปริมาณการเดินทาง (คนเที่ยว/วัน)											
	พ.ศ.2552		พ.ศ.2555		พ.ศ.2560		พ.ศ.2565		พ.ศ.2570		พ.ศ.2575	
	ส่วนบุคคล	สาธารณะ	ส่วนบุคคล	สาธารณะ	ส่วนบุคคล	สาธารณะ	ส่วนบุคคล	สาธารณะ	ส่วนบุคคล	สาธารณะ	ส่วนบุคคล	สาธารณะ
กรุงเทพมหานคร	6,086,000	5,951,000	6,288,000	6,571,000	7,104,000	7,175,000	8,122,000	7,682,000	8,999,000	8,484,000	10,233,000	9,260,000
สมุทรปราการ	1,023,000	609,000	1,069,000	665,000	1,271,000	739,000	1,550,000	818,000	1,893,000	951,000	2,354,000	1,101,000
นนทบุรี	731,000	481,000	745,000	527,000	824,000	561,000	931,000	597,000	1,026,000	659,000	1,172,000	722,000
ปทุมธานี	702,000	344,000	705,000	378,000	756,000	406,000	823,000	429,000	870,000	453,000	960,000	477,000
นครปฐม	869,000	393,000	868,000	443,000	910,000	461,000	977,000	478,000	1,017,000	503,000	1,090,000	525,000
สมุทรสาคร	430,000	221,000	427,000	252,000	459,000	262,000	500,000	271,000	526,000	285,000	567,000	299,000
รวม	9,841,000	7,999,000	10,092,000	8,836,000	11,324,000	9,604,000	12,903,000	10,275,000	14,331,000	11,335,000	16,366,000	12,384,000

แหล่งข้อมูล : สำนักงานนโยบายและแผนการขนส่งและจราจร

7. Highway traffic volume (eBUM)

รายงานปริมาณการจราจรบนทางด่วน						
ชื่อทางด่วน	ปริมาณการจราจร (PCU/ชม.)					
	พ.ศ.2552	พ.ศ.2555	พ.ศ.2560	พ.ศ.2565	พ.ศ.2570	พ.ศ.2575
ทางพิเศษเฉลิมมหานคร (ทางด่วนขั้นที่ 1)	343,044	385,877	469,479	571,193	694,943	845,505
ทางพิเศษศรีรัช (ทางด่วนขั้นที่ 2 - ส่วน AB)	284,877	320,448	389,874	474,341	577,109	702,141
ทางพิเศษศรีรัช (ทางด่วนขั้นที่ 2 - ส่วน C)	145,295	163,438	198,847	241,928	294,342	368,112
ทางพิเศษศรีรัช (ทางด่วนขั้นที่ 2 - ส่วน D)	131,607	148,040	180,113	219,135	266,611	324,373
ทางพิเศษฉลองรัช (รามอินทรา-อาจณรงค์)	102,900	115,749	140,826	171,337	208,457	253,620
ทางพิเศษบูรพาวิถี (บางนา-ชลบุรี)	74,005	83,245	101,281	123,224	149,920	182,401
ทางพิเศษอุดรรัถยา (บางปะอิน-ปากเกร็ด)	52,734	59,319	72,171	87,806	106,830	129,975
ทางพิเศษสายบางพลี-สุขสวัสดิ์	106,482	119,777	145,728	177,300	215,712	262,447
ทางพิเศษสายรามอินทรา-วงแหวนรอบนอกกรุงเทพมหานคร	13,203	14,851	18,069	21,984	26,746	32,541
รวม	1,254,147	1,410,744	1,716,388	2,088,248	2,540,670	3,091,115

แหล่งข้อมูล : สำนักงานนโยบายและแผนการขนส่งและจราจร

8. Passenger volume (eBUM)

รายงานปริมาณผู้โดยสาร						
ระบบขนส่งสาธารณะ	ปริมาณผู้โดยสารบนระบบขนส่งสาธารณะ					
	พ.ศ.2552	พ.ศ.2555	พ.ศ.2560	พ.ศ.2565	พ.ศ.2570	พ.ศ.2575
รถไฟฟ้าสายสีเขียว	427,000	566,000	1,255,000	1,539,000	1,937,000	2,219,000
รถไฟฟ้าสายสีน้ำเงิน	188,000	256,000	1,003,000	1,170,000	1,670,000	1,911,000
รถไฟฟ้าสายสีแดง	0	139,000	798,000	1,271,000	1,520,000	1,753,000
รถไฟฟ้าสายสีม่วง	0	0	190,000	802,000	928,000	1,038,000
รถไฟฟ้าสายสีส้ม	0	0	0	440,000	573,000	654,000
รถไฟฟ้าสายสีชมพู	0	0	0	145,000	180,000	215,000
รถไฟฟ้าสายสีเหลือง	0	0	0	0	0	254,000
รถไฟฟ้าสายสีเทา	0	0	0	0	0	160,000
รถไฟฟ้าสายสีฟ้า	0	0	0	0	0	120,000
เรือโดยสาร	239,000	245,000	249,000	251,000	259,000	300,000
รถโดยสารประจำทาง	10,651,000	9,868,000	9,124,000	8,719,000	8,870,000	8,236,000
รถไฟ	63,000	73,000	71,000	75,000	80,000	86,000
รถตุ้	175,000	202,000	255,000	324,000	410,000	464,000
อื่นๆ	147,000	171,000	218,000	280,000	358,000	399,000
รวม	11,890,000	11,520,000	13,163,000	15,016,000	16,785,000	17,809,000

9. Passenger demand (PTM): Nong Khai Province

รายงานความต้องการการเดินทาง (PTM) : จังหวัดหนองคาย												
กลุ่มพื้นที่	ความต้องการเดินทาง (คน-เที่ยว/วัน)											
	พ.ศ.2552		พ.ศ.2555		พ.ศ.2560		พ.ศ.2565		พ.ศ.2570		พ.ศ.2575	
	เข้า	ออก	เข้า	ออก	เข้า	ออก	เข้า	ออก	เข้า	ออก	เข้า	ออก
ภาคกลาง 1	5,300	5,303	4,343	4,345	4,922	4,918	5,432	5,431	5,854	5,857	6,429	6,428
ภาคกลาง 2	10,174	10,178	12,859	12,856	14,530	14,533	16,361	16,356	17,532	17,528	18,823	18,825
ภาคตะวันออก	8,318	8,314	10,198	10,199	11,516	11,513	12,916	12,917	13,940	13,935	15,048	15,046
ภาคใต้ 1	15,251	15,249	17,700	17,698	19,995	20,001	22,196	22,199	23,898	23,899	25,644	25,642
ภาคใต้ 2	4,408	4,408	5,939	5,941	6,826	6,824	7,610	7,611	8,217	8,220	8,847	8,846
ภาคใต้ 3	1,692	1,693	1,805	1,804	2,088	2,089	2,367	2,367	2,536	2,537	2,741	2,742
ภาคตะวันตก	4,165	4,163	4,648	4,649	5,261	5,260	5,901	5,902	6,359	6,360	6,921	6,924
รวม	49,308	49,308	57,492	57,492	65,138	65,138	72,783	72,783	78,336	78,336	84,453	84,453

แหล่งข้อมูล : สำนักงานนโยบายและแผนการขนส่งและจราจร

10. Passenger volume (PTM): Nong Khai Province

รายงานปริมาณการเดินทาง (PTM) : จังหวัดหนองคาย						
ประเภทการเดินทาง	ปริมาณการเดินทาง (คน-เที่ยว/วัน)					
	พ.ศ.2552	พ.ศ.2555	พ.ศ.2560	พ.ศ.2565	พ.ศ.2570	พ.ศ.2575
ส่วนบุคคล	27,119	27,119	31,621	31,621	35,826	35,826
ขนส่งสาธารณะ	22,189	22,189	25,871	25,871	29,312	29,312
รวม	49,308	49,308	57,492	57,492	65,138	65,138

แหล่งข้อมูล : สำนักงานนโยบายและแผนการขนส่งและจราจร

3.5 Electronic Book Development

The Consultant has prepared report documents for publishing in the form of electronic books; for example, executive summary and transport and traffic information summary, etc. Such reports have been converted into electronic books by Desktop Author, which is an application for document conversion for instant reading without additional program installation (*.EXE).

Procedures of electronic book preparation are as follows:

- Design of electronic book format
- Preparation of proper file converting engine for electronic books
- Preparation of electronic book creating engine
- Preparation of electronic books with the provided engines

Sample electronic books are as follows:

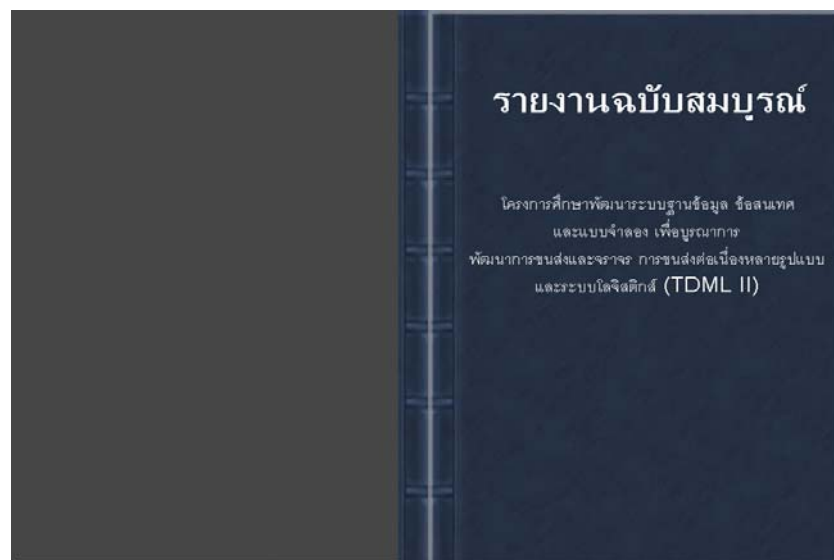


Figure 3.5-1 E-book of TDML II's Project

3.6 OTP Website Redesign and Development

3.6.1 Study and Review on OTP's Main Website Structure

Main Screen of OTP's Website (previous version)



Figure3.6-1 Main Screen of OTP's Website (previous version).

The Consultant has analyzed all the components available on OTP's mainscreen website shown in **Figure 3.6-1**, for use as a guideline for improvement. The criteria and result of analysis are shown in **Table 3.6-1**.

Table 3.6-1 Result of the analysis on OTP's (existing) main website components

No.	Criteria for Consideration	Result of Analysis
1.	Good Appearance	- Website designed in yellow / dark brown causes uncomfortable viewing and stresses to visitors - Website structure is in traditional format.
3.	Menu	- Font color on menu is unclear as it is in white color on yellow /dark brown background. - Menu with color fading effect makes user waiting for effect before clicking. - There are a lot of menus overlapping in layers.
3.	Website Structure	- Minor pages in the main website have different theme.
4.	Banner	Some banners do not provide clear message and have small font size
5.	Data Validity	Certain pages on the website have incomplete data, such as http://otp.go.th/otpdatacenter/rule.asp
6.	Make the website known by Search Engines such as Google, Yahoo, etc.	Certain keywords concerning OTP that are expected to be found by Search Engine do not appear in the search result or do not list in the upper order; for example, "Joint Ticket Project," which is under OTP's responsibility. The Search Engine (Google) does not find result in OTP website (in the upper or first order) but finds it in other websites.

3.6.2 Analyze, Design, and Present Development Guideline for OTP's Main Website

The Consultant has collected data on system requirements for design and development of OTP's main website. Upon analyzing the advantages and disadvantages of the current website, the Consultant has presented both local and foreign website formats relating to transport and traffic, to be a guideline for discussion on OTP's new website. The system requirements have then been analyzed and concluded in overview and in details jointly with OTP for use as a framework for website development.

3.6.3 Development of OTP's Main Website and System Setup

Upon concluding the requirements of the new website, the Consultant has designed a website for presentation to OTP and the structure has been adjusted to meet OTP's demand.

The development of OTP's main website consists of the following components.

- (1) Design of website banner and structure with adjustments made to meet the resolutions of the meetings
- (2) Linkage of traffic condition report and the new website structure
- (3) Improvement of website contents according to the information received from OTP and adjustment of texts for legibility
- (4) Structural improvement of data access to projects and clean office to have similar format and to be easy for data updating in the future
- (5) Improvement of OTP's English website structure to meet OTP's demand

Sample website screens are as follows:



Figure 3.6-2 Main Screen of OTP Website (new Thai version).



Figure 3.6-3 Main Screen of OTP Website (new English version)

Upon uploading all contents to the website, the Consultant has installed the website in the test machine for OTP's inspection and improvement. The Consultant has adjusted the website as notified and installed it in the Web Server.

On 9 October 2009, the new website was available for operation and public viewing. The Consultant has arranged training courses on new website implementation to OTP's officers and later to the persons involved.

3.6.4 Public relations and promotions for OTP's main website

Upon installing OTP's main website and publishing it to the public, the Consultant has launched PR campaigns and promotions by means of search engine optimization. The PR campaigns and promotions of the website consist of

- (1) Public relations campaigns via the Internet
- (2) Addition of OTP's new website in local and international web indexing
- (3) Addition of OTP's new website in Search Engines
- (4) Website improvement by means of Search Engine Optimization

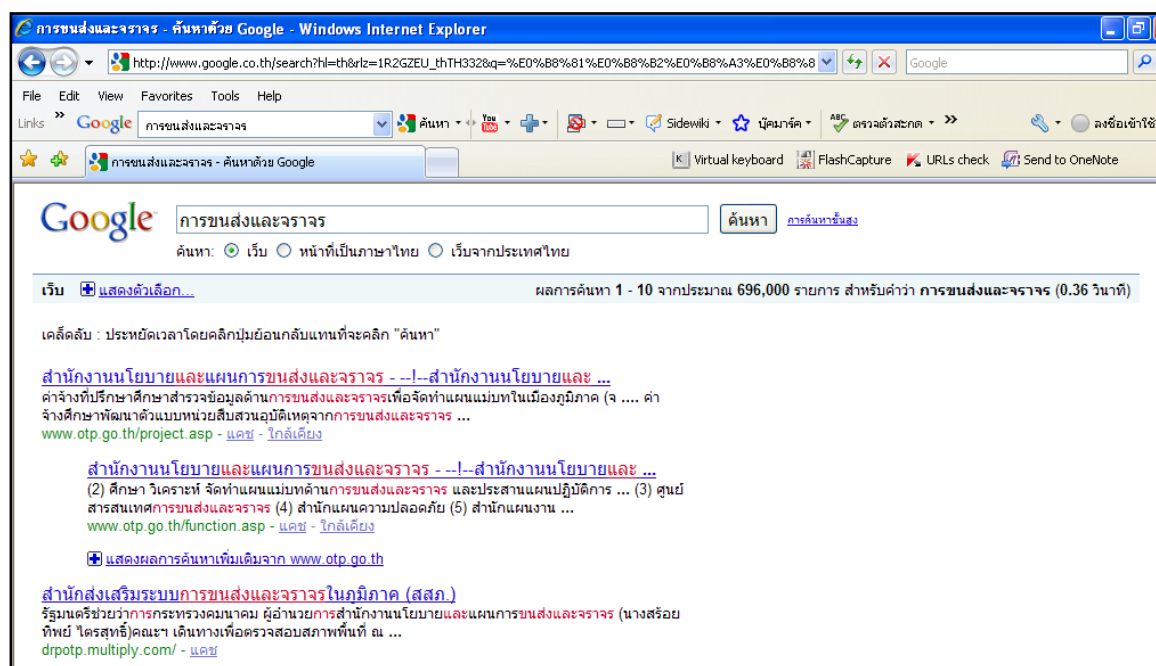
The improvement of website by means of search engine optimization has been jointly implemented by the Consultant and OTP to set keyword control and improve the website to ensure the first 10 search results in www.google.co.th within the implementation period. This will help increase visitors to OTP's main website. The keyword control may be changed by the Consultant to be in line with search engine optimization. There are 14 keywords as follows:

- (1) Transport and Traffic Related Laws
- (2) Traffic Condition Report
- (3) Traffic Report
- (4) Transport and Traffic
- (5) Transport and Traffic Policy and Planning
- (6) Transport and Traffic Data
- (7) Transport and Traffic Projects
- (8) Transport and Traffic Model
- (9) Transport and Traffic Geographic Information

- (10) Electric Rail Project
- (11) Transport and Traffic Technology
- (12) Multimodal Transport
- (13) Mass Transit System
- (14) Logistics

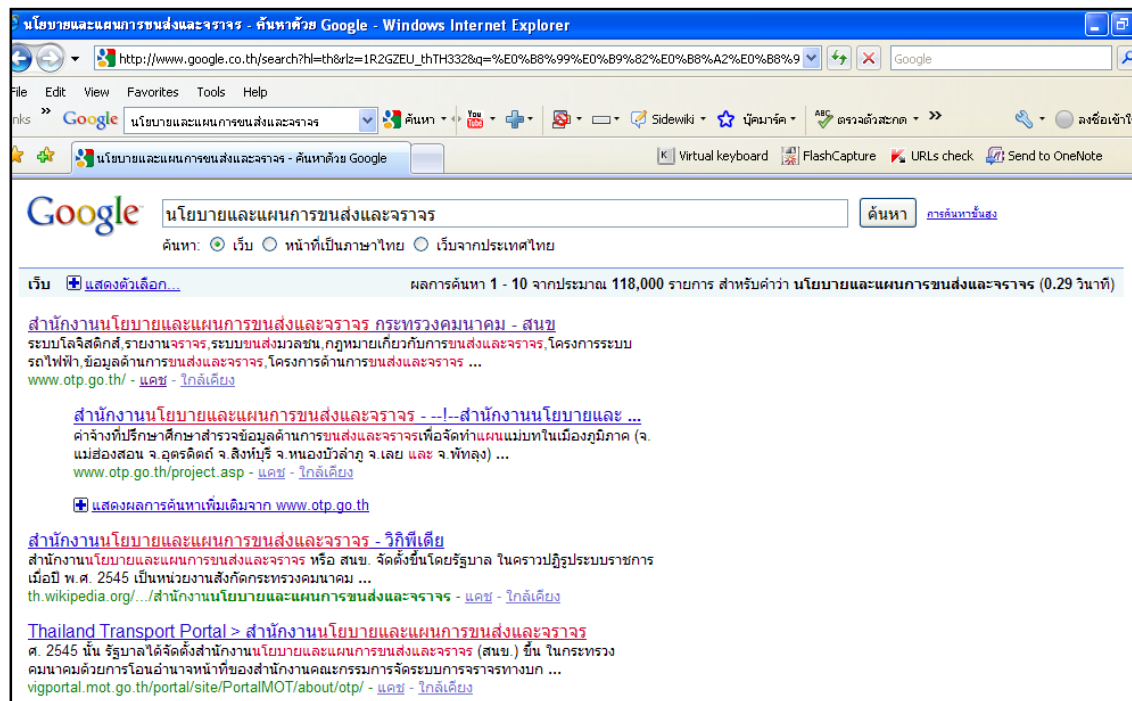
The results of website promotions are as follows:

Search result of “การขนส่งและจราจร” No. 1 in Google.co.th



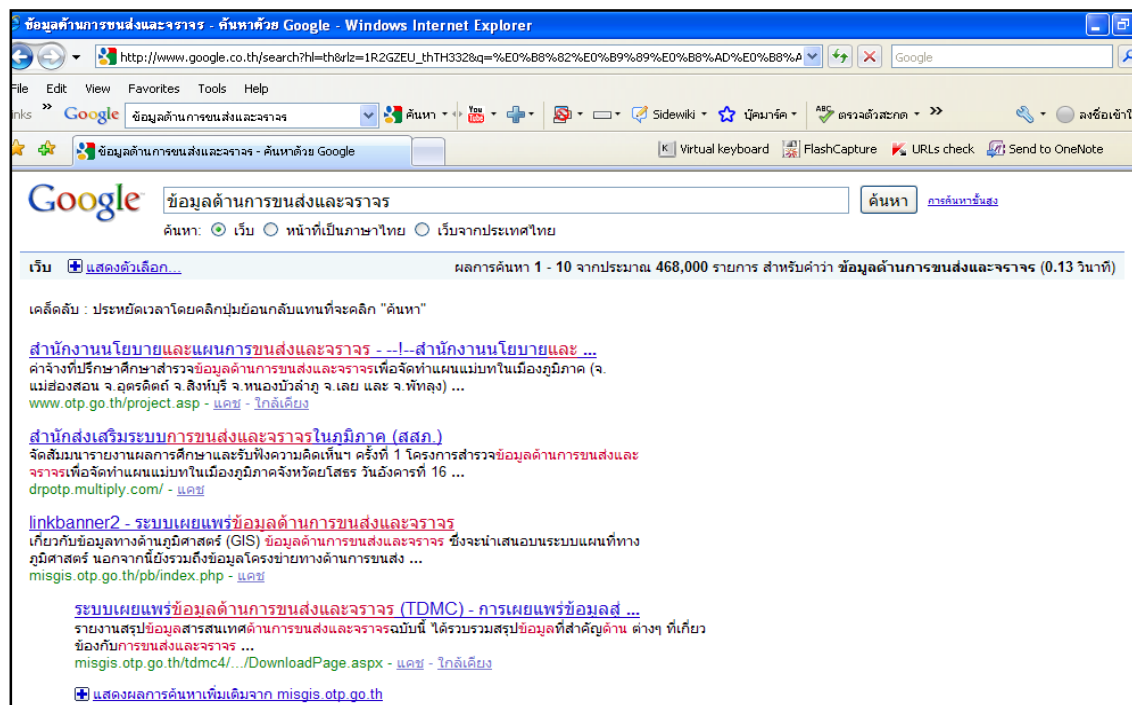
Picture 3.6-4 Result of Website Promotion (1)

Search result of “นโยบายและแผนการขนส่งและจราจร” No. 1 in Google.co.th



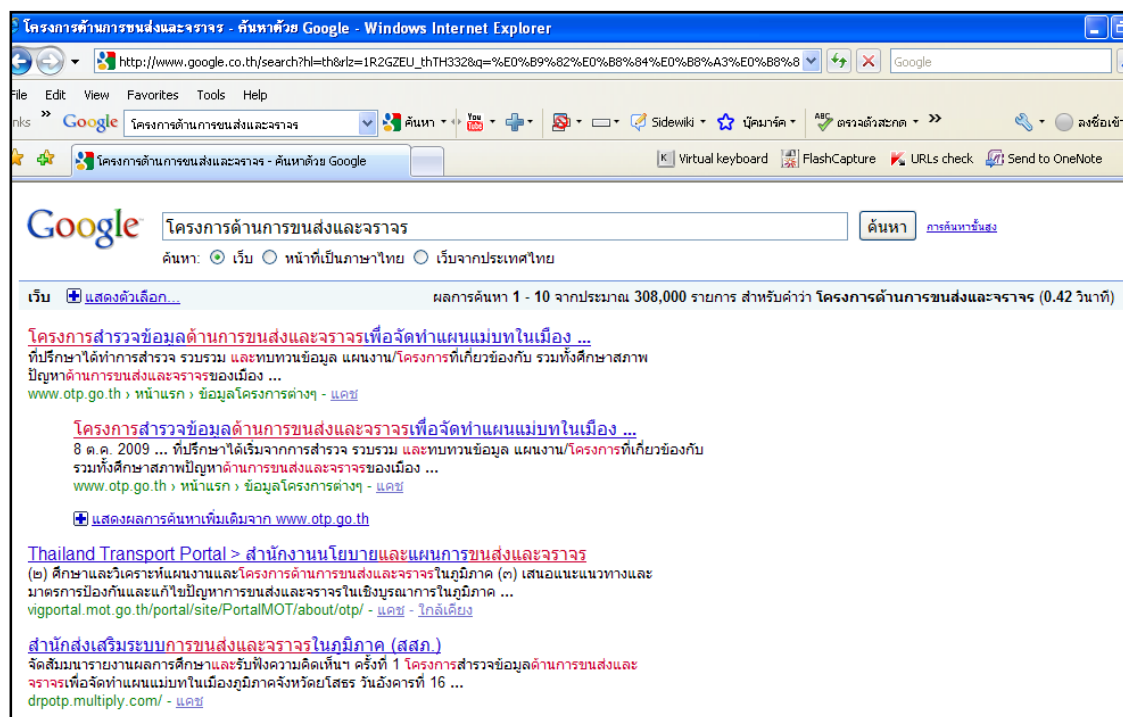
Picture 3.6-5 Result of Website Promotion (2)

Search result of “ข้อมูลด้านการขนส่งและจราจร” No. 1 in Google.co.th



Picture 3.6-6 Result of Website Promotion (3)

Search result of “โครงการด้านการขนส่งและจราจร” No. 1 in Google.co.th



Picture 3.6-7 Result of Website Promotion (4)

3.6.5 OTP's Intranet Development

The Consultant has discussed with the officers in charge of OTP's website database maintenance to set Intranet system installation plan. After discussion, the Consultant has redesigned OTP's Intranet system using the Content Management System. The theme of the main website applied to OTP's Intranet system has been installed in the new database system with the links connecting certain parts of the old system to the new Intranet system for prompt operation. The installation has been made on 30 November 2009.

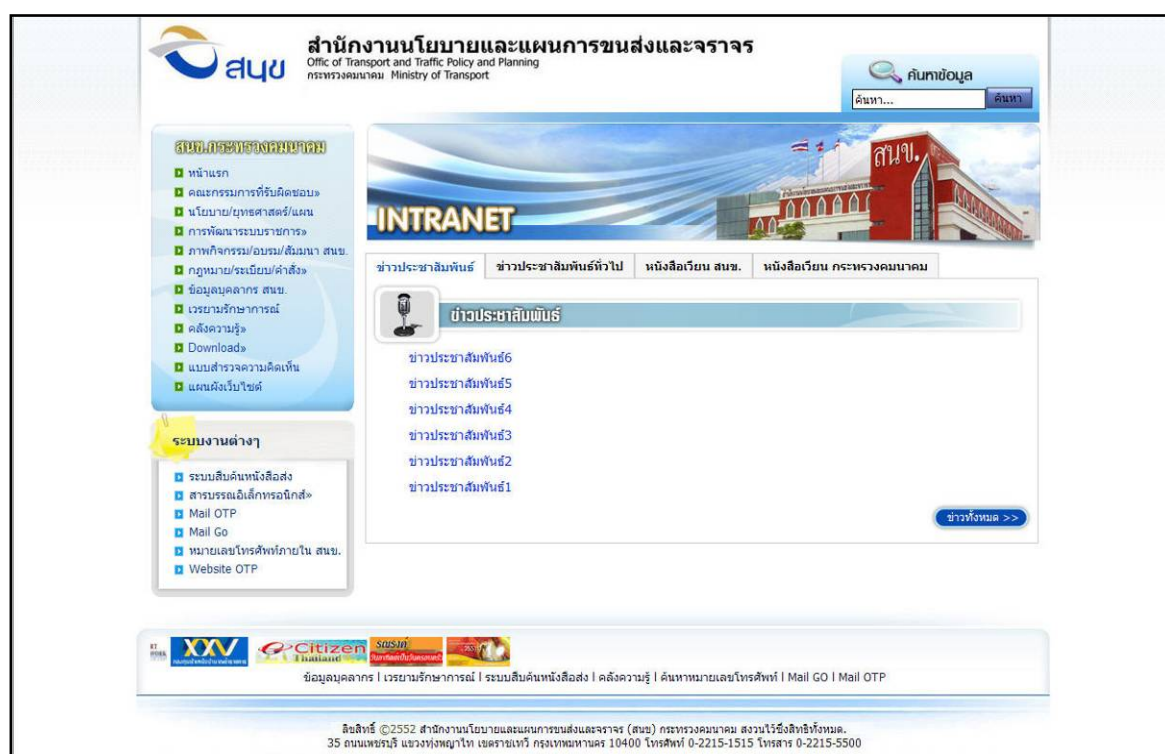
After installing the Intranet web, OTP officers will be able to change the main subjects, news tab, and presentation format as required.

OTP's Intranet web structure consists of

- ❖ Banner at the top
- ❖ Main menu

- ❖ Sub menu
- ❖ Tabs displaying PR news, OTP and MoT circular notices
- ❖ Data search system within the Intranet

Main screen of the Intranet system



Picture 3.6-8 Main Screen of Transport Information System

3.7 Computer Equipments and Networking System Improvement

The Consultant has coordinated with computer system providers for both hardware and software to control server operation, as well as accessories required for efficient operation of server, to get hardware details and make preparation for new server purchase to replace the existing database server. Since the Consultant has found that the existing database server has long service years and less space for data storage due to annual data upload. The server and supporting accessories considered by the Consultant as proper to seek OTP's approval are as follows:

Table 3.7-1 Procurement Lists of Hardware and Software

No.	Description	Quantity
1	Server HP Proliant DL380 G6 Server 2U Rack	1
2	Microsoft Windows Server 2008 Std OEM+5CAL	1
3	KVM Extender, USB Keyboard / Mouse (150M). STP/FTP RJ45 Video up to 1280x1024	1
4	USB Line with Audio 5m Line (monitor, keyboard, mouse)	3
5	USB Flash Drive 16 GB 'Kingston'	6
6	Harddisk External ST310005FDM201-RK 'Seagate' EXT HDD 3.5"	5
7	Harddisk External 'Western Digital' EXT HDD 2.5"	2
8	Netbook SAMSUNG N310	1

Chapter 4 GIS SYSTEM DEVELOPMENT AND INTEGRATION WITH MIS SYSTEM

- 4.1 Review of GIS Related Projects
 - 4.2 GIS/MIS Database Management System Improvement
 - 4.3 Commodity Flow Data Layer Development
 - 4.4 Additional Reports for ArcGIS Desktop System Development
 - 4.5 Web-based GIS applications Development
 - 4.6 Data System Integration
-

4.1 Review of GIS Related Projects

The consultants had studied and reviewed the OTP's previous GIS related projects for the benefit of the work of the project TDML II as follows:

4.1.1 TDMC V Project

This project has integrated the GIS with the extended Bangkok Urban Model (eBUM) and acquired the satellite image of Bangkok Metropolitan Region. As a result, the network of eBUM has been adjusted to fit with the satellite image by adjusting the network on GIS base map of the scale of 1:4,000 to match with the satellite image as well as adding other networks necessary for a more effective analysis. Additionally, 20 categories of MIS database has been evaluated, 12 important categories were selected to be linked with GIS, which had been developed for intranet and internet in PDF format.

4.1.2 TDMC VI Project

This project has integrated the GIS with the National Model (NAM) together with the development of a linkage with MIS database necessary for models and GIS integration using GIS map (scale of 1:20,000 from Information Center, Ministry of Transport). In addition, eBUM and NAM networks have been adjusted to be more realistic. TDMC VI also improved and maintained the information system and transportation models, which were developed in TDMC IV and TDMC V for

13 information groups. Also, this project connected the information from Real Time traffic to use in many works of OTP. And it improved better display of GIS on Intranet/Internet by adapting the information in PMF form to be more friendly usage with ArcReader application, which can be used with the basic command on GIS.

4.1.3 The Development of Multimodal Transport and Logistic Supply Chain Management for Implementation of Action Plan (Logistic)

The objectives of this project were the ability to reduce logistics cost and energy consumption from overall transportation system of the country. It used GIS map to present the transportation route for many transportation categories. Moreover, it showed the connection points and route database and the quantity of the cargo types for both domestic and international area.

TDML Project

TDML Project is for integrating the geographic information system (GIS) to work with the National Model (NAM) and for developing and linking the database of MIS, which is very essential to the model and GIS by using GIS map with the scale of 1:20,000 from Information Center, Ministry of Transport. This project started to adjust the simulate network to be more realistic and adjusted and maintained the information and transportation and traffic models for TDMC IV, TDMC V, TDMC VI, and Logistics projects with 13 information groups. In addition, TDML project linked the information of Real Time traffic report to use in OTP's works. And it improved better display of GIS on Intranet/Internet by adapting the information in PMF form to be more friendly usage with ArcReader application, which can be used with the basic command on GIS.

Improving the network of Local Area Model (LAM) was for supporting the analyze and display from the models in one city plan area (Phitsanulok), which use mainly the map data from the Information Center, Ministry of Transport, by selecting the road network to analyze the model in the city plan. This project also linked the database in order to make more reality to the information network according to the information from Ministry of Transport in the selected area. The central road information line (roadcl) was used to improve the stimulated network. This project reviewed and corrected the satellite image in the coverage area.

TDML project updated and maintained the information on the GIS system of the TDMC V, and TDMC VI projects. TDML project also linked with a Real Time traffic conditions in TDMC VI project according to the model and MIS database and it can work on the new version of GIS of OTP. TDML project updated and maintained the information on GSI system according to 13 information groups on MIS in TDMC VI to be more current.

The project linked and updated the GIS information layer to be compatible with the former GIS table and to be applicable with ArcGIS and updated the most recent information. Currently, TDML project has been linking and updating MIS on GIS database.

TDML project updated the information on GIS system in TDMC VI to be coherent with Logistics database and to be able to work with table's data class information of Logistics. Additionally, it revised any information layers, which related to the important position on the transportation routes, such as the positions of warehouses, ports, manufacturing factories, tank farms, companies, etc.

The development of the analyzing system for GIS is to support the analysis of the policy and plan. This project developed the tool on GIS system of TDMC project to work with OTP's new version of GIS, which is more sophisticated, for more effective and faster. Therefore, GIS can analyze and display more effective result than the former version of TDMC project. There are many functions analyzing and displaying on the map of GIS. These can represent the analysis and display abilities of GIS.

TDML project had developed new tools for working with former ArcView. The project developed new version of ArcGIS with more modern and convenient.

This project can display the result via Internet and Intranet by studying the model in Open GIS of "The Development of Multimodal Transport and Logistic Supply Chain Management for Implementation of Action Plan" to practice and to be a guideline of displaying the result via Internet and Intranet and of developing the suitable result display with the new design database of TDML. This project can use XML to display the result of Logistics on OTP's website, which can be displayed on the screen and taken the map information for any usage, however, the user can not change or add or manage the map. Because the consultant wants to protect the database of OTP

(Security Purpose) from disturbing or hacking through website. The consultant has considered this protection as the important point.

4.2 GIS/MIS Database Management System Improvement

The consultant will update and maintain the information and arrange additional information from additional survey for the project. The tasks can be divided as the followings:

- Updated the Information of GIS

The former information of MIS will be updated. The consultant will link the additional MIS information with the information related with GIS. The information was from extended Bangkok Urban Model (eBum) and National Model (NAM).

4.3 Commodity Flow Data Layer Development

Besides, updating the former GIS database, TDML II project will survey and arrange additional 41 data layers of freight transportation route.

There were 41 freight transportation route layers additionally and they were divided into 2 parts as the followings:

- Inputting the transportation route data from the survey information. Data will be in Text File consist of coordinate data to show each path for each categories. The coordinates may be in the UTM WGS84. When we input this data in GIS, we can check and adjust the coordinate system to be the same as OTP to be able to work with other former information layers.
- Linking the descriptive information from MIS system to GIS. Because the prior information can be the freight transportation route with the codes of the routes. These codes will be used for linking with the descriptive information, which were developed in MIS. Therefore, it can display with GIS as shown in Figure 4.1.

Consequently, it is required to link the information about each route from MIS to GIS through the codes of the route.

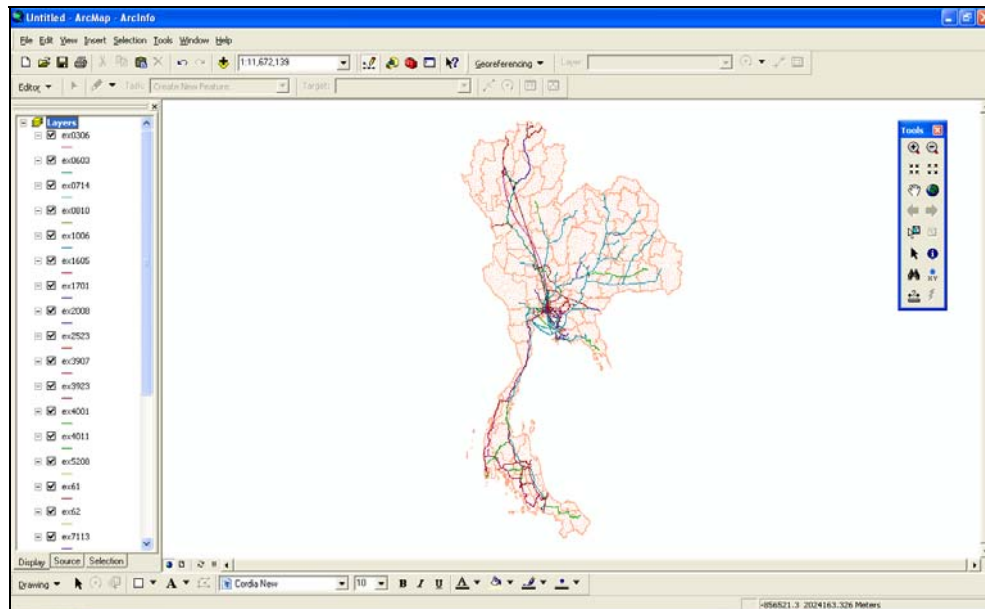


Figure 4.1 The Information of the Freight Transportation Route in GIS

4.4 Additional Reports for ArcGIS Desktop System Development

TDML Project had developed and linked the information GIS and MIS to be more corresponding with the simulated models and the display development and reports in order to present 13 groups of GIS information on ArcGIS.

The consultant in TDML II Project will design the additional report display from CUBE program by using the result from CUBE and design the display in ArcGIS by adding more menus. Therefore, the user can work with GIS. The consultant will coordinate with OTP to select the information for analyzing with CUBE to create new group of information as shown in **Figure 4.2**.

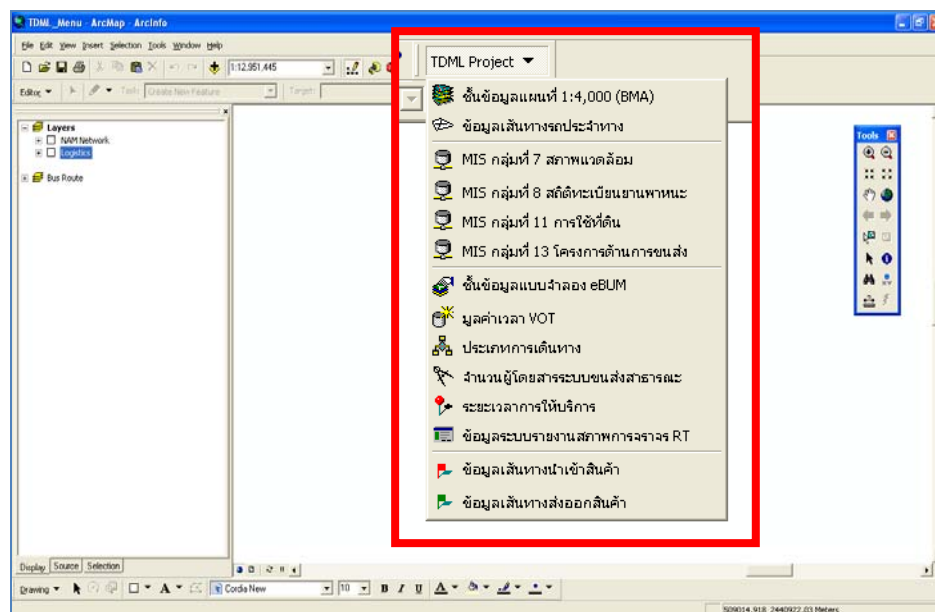
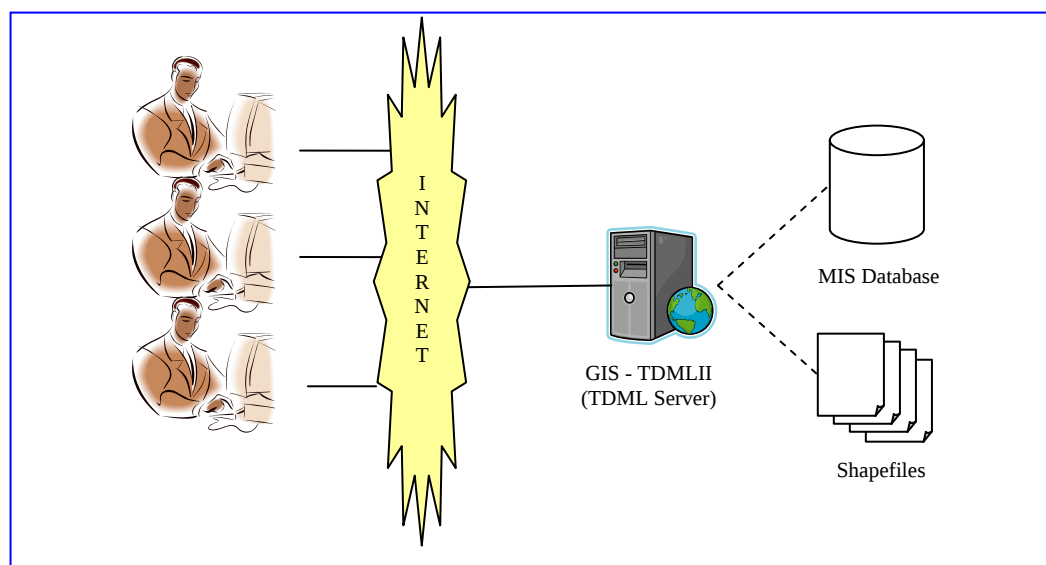


Figure 4.2 The Menu for Displaying the Reports and Map Information

4.5 Web-based GIS applications Development

The consultant had developed Web-based GIS to disseminate the map information. This new system will be installed in the server of TDML system, which is in MIS database in the former TDML project. The consultant installed the additional software (GeoServer is the map provider software via Internet) for developing Web-based GIS. The GIS information will be kept in Shapefile and then linked to MySQL database for storing MIS and pull the information to display with the map information. The network system was shown in Figure 4.3.



Picture 4.3 Web-based GIS system's Infrastructure

Ajax was used to develop the interactive response for users and API, consisted with OpenLayers, EXT and Mapfish. The connection with information service provider was via OGC WMS.

Map data sets for disseminating in the application consist of the data sets in the former GIS and additional data sets from TDML project. There were 13 data sets in the former GIS and the consultant had studied the exist layers and selected and then adjusted the data sets to be suitable with the disseminated system, which was designed from the former data sets.

The consultant researched the layers in each data set to consider the ability to combine the layers for each year, which have duplicated data. Or the consultant updated the new data set for gaining the information for publicizing on the Internet to enhance the effectiveness of map data management and the dissemination via the Internet.

For the result, the consultant designed the fundamental layers for displaying on the Web-based GIS application for 3 data sets, according to display and area of publicized information, which consisted as the followings:

(1) Data Sets of Bangkok and Metropolitan Area

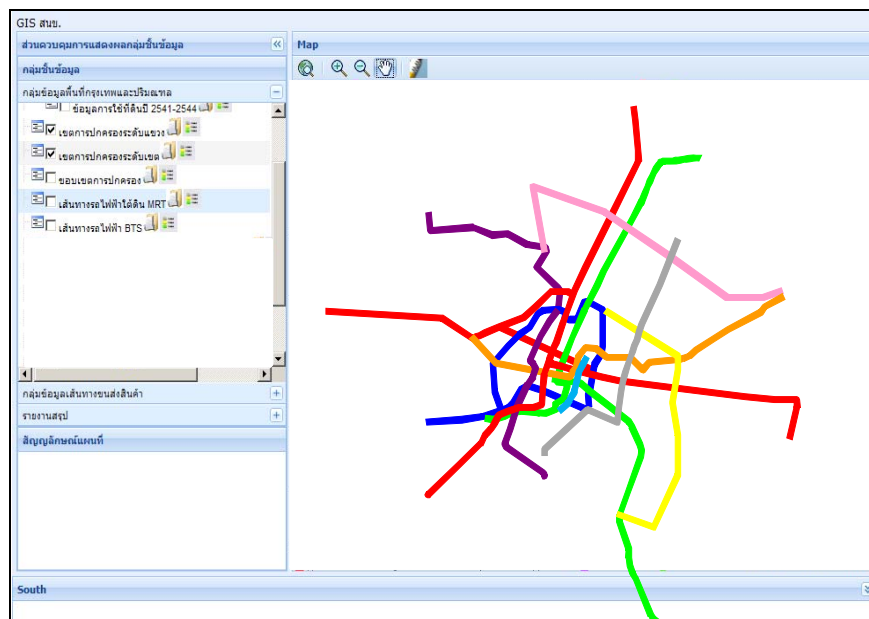


Figure 4.4 Traffic and Transportation Plan for 12 routes

(2) Data Sets of Former Freight Transportation Routes

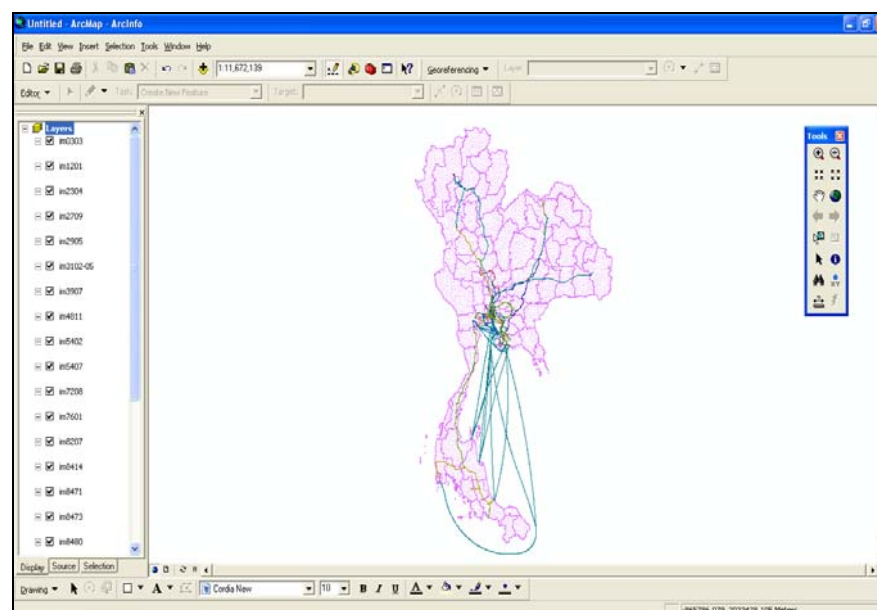
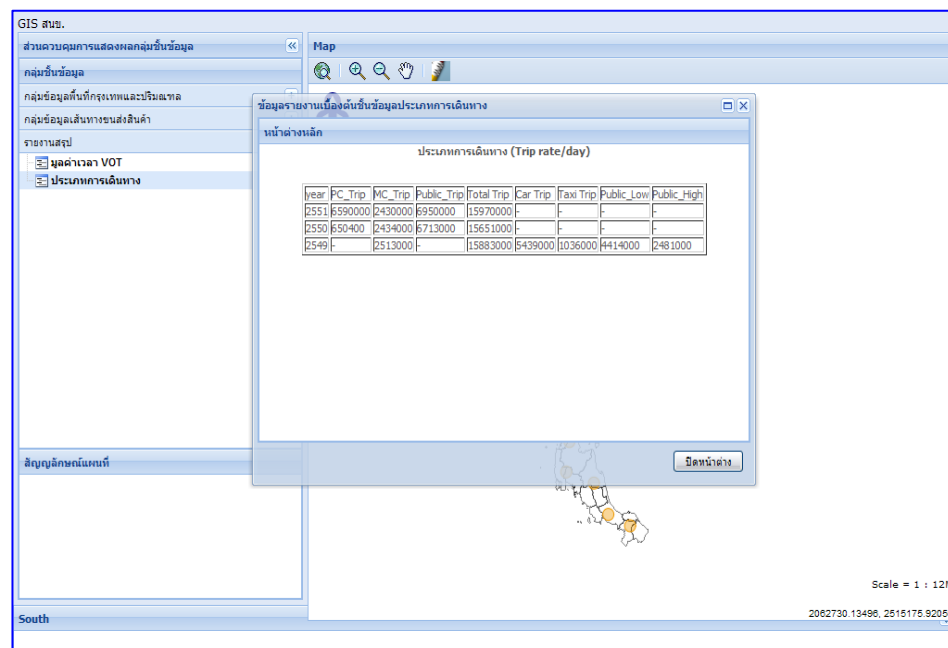


Figure 4.5 Import Route

(3) Summary Report



Picture 4.6 Summary Report of Trip

4.6 Data System Integration

The consultant will consider the integrating pattern of multi information for analyzing/researching the Methodology for integrated GIS System of Transport Data and Model Integrated with Multimodal Transport and Logistics of related state agencies, state enterprises and private sectors. This is due to GIS has limited form of stored data unlike MIS. Therefore, the consultant has researched and tested the information characters of Multimodal Transport and Logistics to propose the filing solution for GIS and to use as the standard guideline for gathering the information of Multimodal Transport and Logistics. In addition, the consultant linked the freight transportation data of many categories and the freight transportation routes of each category from MIS database to be able to analyze each area for every aspect effectively. It will be useful for surveying and storing the continuous information in the future. The related parties from state agencies, and private sectors will be able to use this information to analyze and make a related decision.

However, there was the effective development of traffic and transportation information system of Office of Transport and Traffic Policy and Planning (OTP) according to the policy and cooperation of national traffic and transportation management by land, by water, and by air. It is necessary to produce the system and distribute the information in the map form. Or there should be the analysis in spatial and network patterns in order to increase the ability to analyze the traffic and transportation data including displaying the Spatial Data in digital form, which can be useful and effective for additional analysis. Consequently, the decision process for planning will be easier and clearer and the information in the database can be used at its maximum ability.

Spatial Data/Information means the information describing the position of the object or the geographical phenomenon. It is necessary and useful for understanding the relationship for related factors with national traffic and transportation planning. Geographic Information System/GIS was designed for using and managing Spatial Data/Information and it was developed from some parts of OTP's works in order to link the traffic and transportation information system with GIS. This is one of the important tasks in this project.

This project updated and developed the Geographic Information System (GIS) for national traffic and transportation planning to correspond with multimodal transport and logistics of state agencies, state enterprises and private sectors. Because nowadays GIS becomes more famous and use in many works especially mapping and networks. Therefore, it is more convenient and friendly usage especially updating the information in GIS both maps and tables, which link with each other. GIS can search the information and can display in many forms. GIS system has 2 parts: Spatial Data and Attribute Data. Both data will be linked together. Consequently, they can be displayed in the digital map immediately and can be seen the overall picture for planning and arranging the policy. However, the ability to store the complicated information is not as good as MIS's.

As stated above, the consultant can identify the framework of the overall integrated information of traffic and transportation of OTP for planning the multimodal transport and logistics system of state agencies, state enterprises and private sectors as the followings:

- The system will consist of MIS database, GIS database and CUBE simulation model.

- MIS system will consist of 13 data sets of spatial data/information database, which links tables in each set as the Relational Database. MIS user can import, update, save, open, and maintain the information. The user can display the information in the report and graph forms and export the information in many kinds of forms. This system can be used by many users at the same time.
- GIS will have map database, which can show the analysis on the map. GIS will allow the map user ask and pull the information as the user's conditions. It can analyze multimodal transportation and Logistics system by link the information from MIS and CUBE to display the spatial data/information to support the better decision.
- There are many displays, such as reports, graphs, Thematic Map, etc. The result can be showed on the computer screen directly or printed for the executive to make a decision on the policy and planning. Moreover, the information can analyze and display via the Internet and Intranet. The Internet will be shown through OTP's website, so the civilians will know the information and OTP's work. The Intranet will analyze and display only inside the office and it can send the information to the executive's computer screen. This system will be very useful, fast and convenient.
- TDMLII Project had updated more tools on ArcGIS to be more efficient and convenient by addition more information from the survey.

Chapter 5 : Transportation and Traffic Model Improvements and Maintenances

- 5.1 Review of the transport model developments
 - 5.2 National Model (NAM)
 - 5.3 extended Bangkok Urban Model (eBUM)
 - 5.4 Provincial Transport Model (PTM)
 - 5.5 The Development of Mesoscopic Model for Traffic Crisis Management Guideline
 - 5.6 The Development of Pedestrian Model in MRT Station for Pedestrian Crisis Management Guideline
-

In improving and maintaining OTP transport and traffic models, a review on the procedures of model development of all modeling levels is required. The capabilities of such models will also be assessed in order to develop an action plan and criteria for the model development and maintenance to enable more efficient transport and traffic analysis. The recommendations will therefore be made to improve the main structure of the transport and traffic models. The procedures are shown in **Figure 5.1**, of which the details are as follows:

5.1 Review of the transport model developments

The Consultant has reviewed OTP's existing transport and traffic model, including the National Model (NAM), the extended Bangkok Urban Model (eBUM), and the Provincial Transport Model (PTM), as well as the Local Area Model (LAM), developed by OTP. The models have been reviewed in 3 areas as follows:

- (1) The operating mechanism and process of the models
- (2) Data used in the models
- (3) The arithmetic parameters and relations used in the models

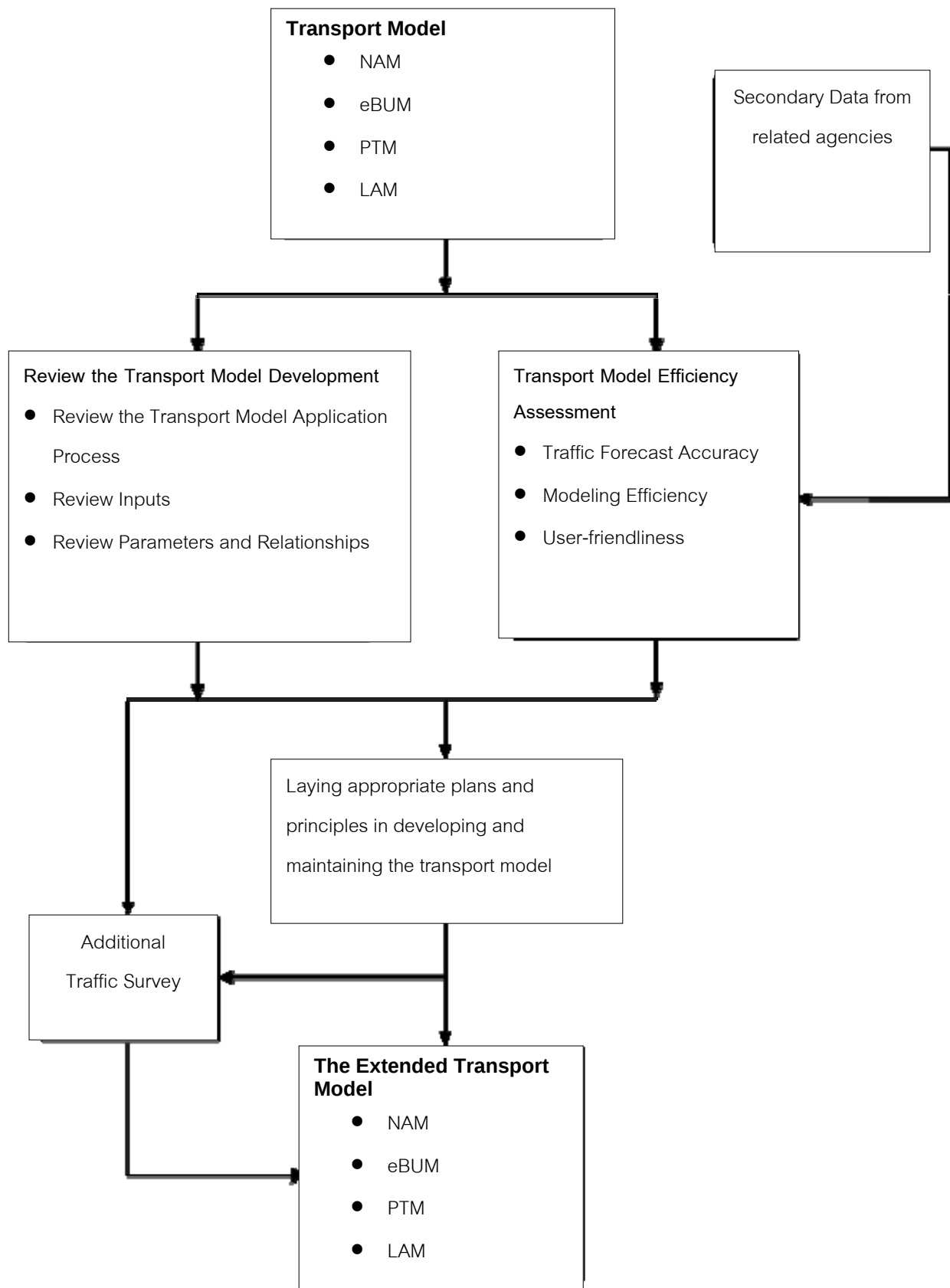


Figure 5.1 Transport Model Development and Maintenance Process

5.2 National Model (NAM)

National Model (NAM) has been initially developed in the Urban Transport Database and Model Development Project (UTDM), which was aimed at forecasting passenger trip and freight transportation among provinces and analyzing the volume of trips made in different modes (by car, train, air, and water). The results can be used by the concerning agencies to conduct planning, analysis and assessment of the traffic and transport related projects at the national level.

The Consultant has collected, reviewed, and checked the planning data through the study of the previous projects, especially TDMC II, TDMC III, TDMC IV, TDMC V, TDMC VI and TDML, which is the latest study, and then gathered more data to ensure up-to-date status and make National Model more accurate. The following steps have been used for model improvement.

5.2.1 Improvement of transport network

The Consultant has improved the transport network of all transport modes to be up-to-date. The existing database has been inspected and updated by using the gathered data from all concerning agencies.

5.2.2 Improvement of socio-economic data

TDML II has improved the planning data, including the population by utilizing the data from the Office of the Civil Registration, Department of Local Administration, Ministry of Interior. The estimated population and gross provincial product were based on the growth rate from the Office of the National Economic and Social Development Board.

5.2.3 Improvement of model structure

NAM is 4-steps sequential model, including Trip Generation model, Trip Distribution model, Modal Split model, and Traffic Assignment model, the result of the model are presented in Table 5.1-5.3.

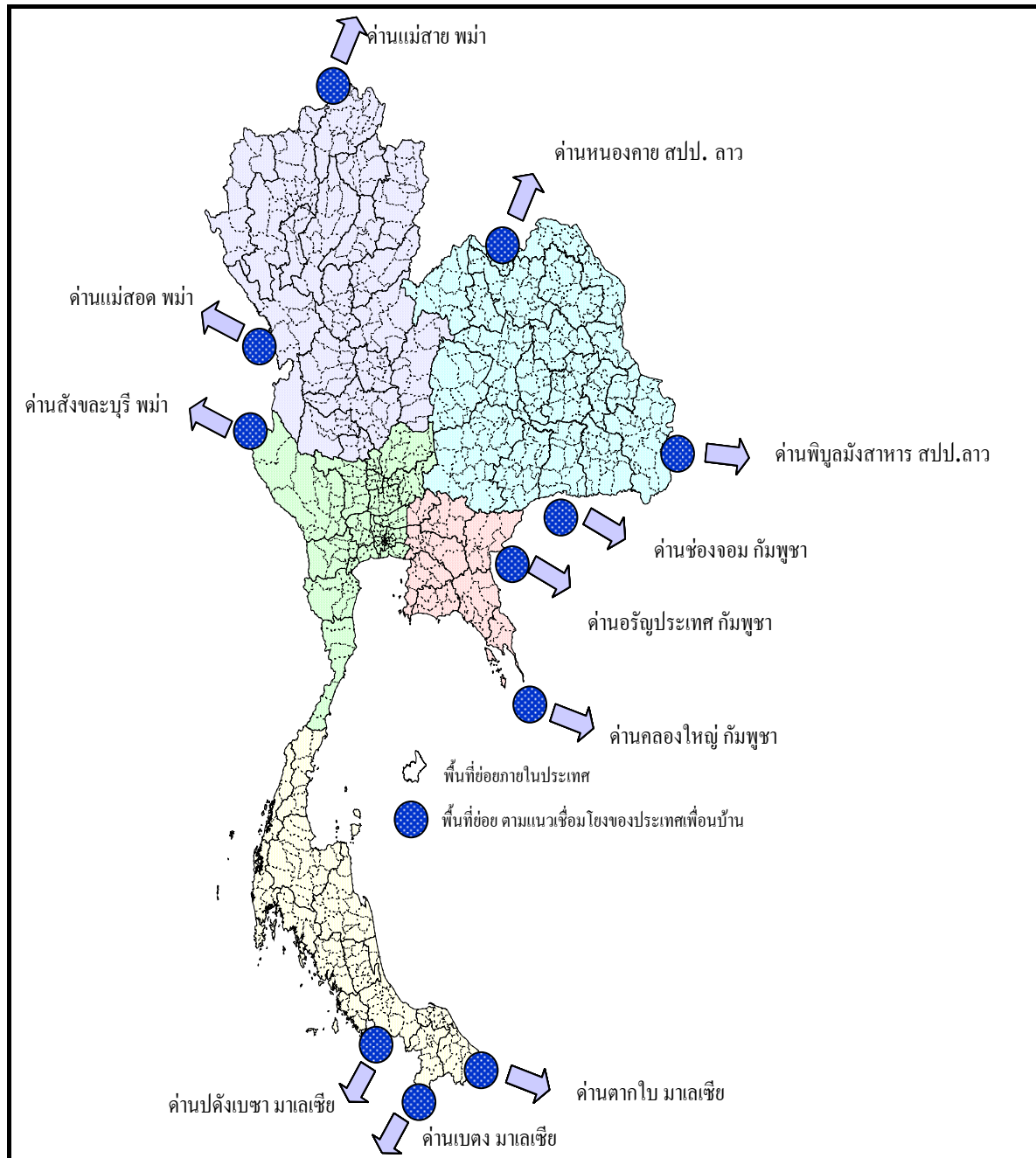


Figure 5.2-1 Zone in NAM Model

The result of forecasting demand from Model has shown in figure 5.2.3-4 – 5.2.3-7.

Table 5.2.3-4 Freight transport in year 2009, 2012, 2017, 2022, 2027 and 2032 (Unit: thousand-Ton/year)

Group No.	Commodity	2009	2012	2017	2022	2027	2032
1	Synthetic filament yarn	324	351	408	490	614	812
2	Seafood	1,052	1,140	1,326	1,591	1,995	2,637
3	Fruit	824	893	1,039	1,246	1,562	2,065
4	Agricultural products	16,284	17,651	20,531	24,633	30,875	40,814
5	Minera, fertilizer and cement products.	17,274	18,725	21,779	26,131	32,752	43,296
6	Chemical raw materials, plastics and outside rubber	2,953	3,201	3,723	4,467	5,599	7,401
7	Paper and Wood furniture	14,786	16,028	18,642	22,367	28,035	37,060
8	Steel and Aluminium	3,578	3,878	4,511	5,412	6,784	8,968
9	Automotive machine, mold and parts	743	805	937	1,124	1,409	1,862
10	Computer Parts and Transformer	939	1,018	1,184	1,420	1,780	2,354
11	Medical equipment, microchip and Jewelry	39	42	49	59	74	98
12	Crude oil and petroleum fuel	33	36	42	50	63	83
13	Orchids	18	20	23	27	34	45
14	Import-export commodities other than 13 groups	119,491	129,525	150,654	180,756	226,558	299,495
Inland Commodity flow		337,694	366,051	425,763	510,833	640,275	846,399
Total		516,032	559,364	650,611	780,606	978,409	1,293,389

Remark: Group No. 1-14 are import and export commodities.

Table 5.1 Results of Person Trips from NAM (1,000 trips/day)

Mode	2009	2012	2017	2022	2027	2032
Passenger Car	1,392	1,468	1,607	1,766	1,951	2,170
Bus	816	861	940	1,027	1,127	1,241
Train	167	175	191	209	229	252
Air Transportation	28	29	32	36	39	44
Total	2,402	2,534	2,771	3,037	3,346	3,706

Table 5.2 NAM Freight Transportation Results (tons/day)

Mode	2009	2012	2017	2022	2027	2032
Road	1,233,766	1,337,368	1,555,522	1,866,317	2,339,219	3,092,275
Train	36,481	39,544	45,995	55,185	69,168	91,434
Water	143,364	155,402	180,751	216,866	271,817	359,322
Air	176	193	229	282	365	499
Total	1,413,787	1,532,507	1,782,497	2,138,650	2,680,569	3,543,530

Table 5.3 Result of National Model

Year	Mil. Veh-Kms	Mil. Veh-Hrs	Speed (Kph)
2009	317.79	3.97	79.98
2012	328.63	4.12	79.77
2017	361.50	4.43	81.57
2022	485.01	6.20	78.23
2027	558.70	7.42	75.33
2032	573.18	7.04	81.46

Remark: Veh-Kms:VehicleDistance Veh-Hrs:VehicleTravel Time

5.3 extended Bangkok Urban Model (eBUM)

extended Bangkok Urban Model (eBUM) has been continuously developed as NAM and is widely used for assessing project planning by various agencies currently involved in the traffic and transport areas. This model has been developed from the study on the Urban Transport Database and Model Development Project (UTDM) in a continuous manner. For the zoning system used for the traffic and transport study in Bangkok and the vicinities, the Consultant has improved the zones in suh areas from 761 zones to 1,642 zones as shown in **Figure 5.3-1**.

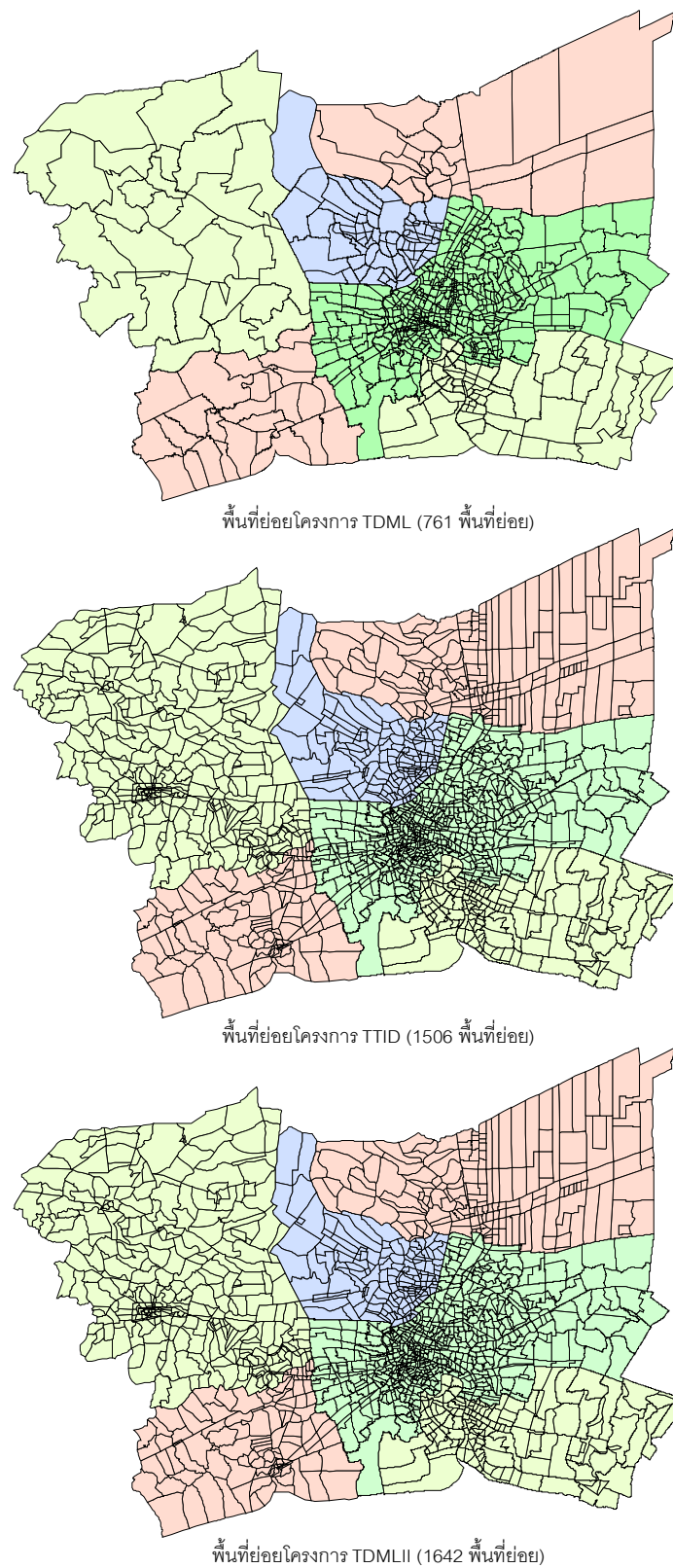


Figure 5.2 BMR Zoning System in eBUM

5.3.1 Guideline for improvement and maintenance of Extended Bangkok Urban Model (eBUM)

The Consultant has inspected and improved the model from TDML study by using the following guideline for model improvement and maintenance.

(1) Improvement of transport and service network

The Consultant has improved highway network and public transportation network by adding Metrobus route in the public transportation network.

(2) Improvement of eBUM model structure

eBUM has been improved in 4 main steps as follows:

- Trip Generation
- Trip Distribution
- Modal Split
- Trip Assignment

5.3.2 Survey for improvement and maintenance of extended Bangkok Urban Model (eBUM)

For the improvement and maintenance of eBUM, the Consultant has surveyed the following data.

- Home Interview Survey
- Modal Split Interview Survey
- Mid-Block Count
- Roadside Interview Survey

5.3.3 Improvement of Modal Split model in eBUM

The consultant has improved the Modal Split in eBUM, which consist of the following:

- Modal Split of private car.
- Modal Split of private motorcycle.
- Modal Split of high performance modes.

- Modal Split of low performance modes.
- Modal Split of train transit.
- Modal Split of paratransit

5.3.4 Guideline for the application of activity-based model in eBUM

eBUM was developed using principles known as Trip-Based Approach, a model that consists of 4 subprocess. The limit of this kind of model is the consideration of Trips as a subunit of analysis. As a result, the model has to divide into subsets of Home-Based trips and the Non-Home-Based trips without considering correlation among travel in different subsets. It is also not consider the schedule of travel and trip changing characteristic.

To solve the above problems, the consultant has developed a guideline to restructure the model to an activity-based model. The consultant has prepared an operational manual, which consists of guidelines for collating data from various sources. The guidelines for collecting additional required data. The guidelines for calibrating variables and parameters of the model as well as ways to check the accuracy of the results from the model. The consultant has also added a structure of the activity-based model into eBUM using Cube Voyager as in Provincial Transport Model (PTM).

Activity-based Model differ drastically from Trip-based Model to the foundation of its underlining principles. The Model considers travel that occurs as a *side effect* of any activities (derive demand) distributed all over a city. The framework of the Model considers the complex interactions between activities and travel behaviors. As a result, it enables the possibility of analyzing the effect of policies related to traffic management on an individual activity.

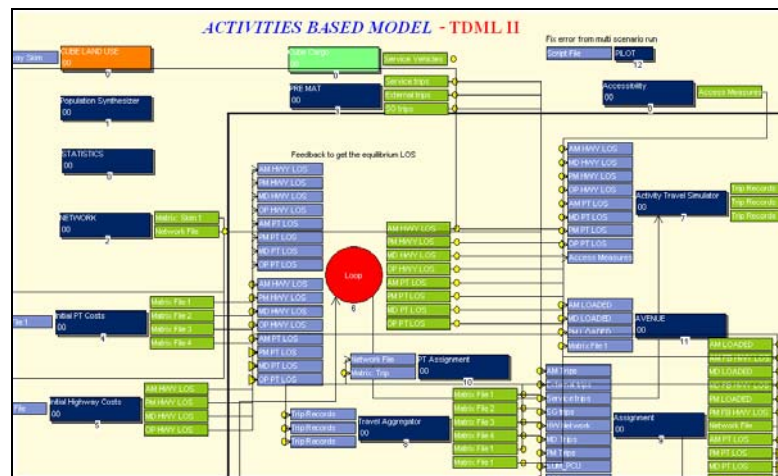


Figure 5.4 Structure of Activity-Based Model

5.3.5 Socioeconomic data for eBUM

The Consultant has improved eBUM by utilizing population and employment data of 5-year period starting from base year in 2009, and 2012, 2017, 2022, 2027, and 2032.

The forecasted population and employment, from IMAC project, which is considered the most recent one, is used. The socioeconomic data has been adapted to suit the eBUM zoning system of 1,642 zones, which was continuously developed from TDML project.

Table 5.3.5-1 Population and Employment Data in Bangkok and Surrounding

Data	Year					
	2009	2012	2017	2022	2027	2032
Population (Million-Person)	11.35	11.68	12.29	12.99	13.86	14.94
Household (Million)	3.78	3.92	4.18	4.48	4.83	5.21
Avg. size of household (No. of household)	3.00	2.98	2.94	2.89	2.86	2.86
Avg. income per month per household (Baht) (2009)	26,340	29,261	33,927	38,378	42,616	47,044
Employment (Million-Person)	6.16	6.34	6.71	7.20	7.81	8.36

Remark: Estimated by consultant

5.3.6 Base Year 2009 Validation of eBUM

In validating the model, the Consultant has checked the accuracy of eBUM forecasting results with base year 2009 data so from now on, the base year in eBUM will be set to 2009. The Consultant has used the 2009 planning data from IMAC project together with the survey data in the project, as well as the data surveyed from CDM II and other related projects under OTP supervision, as the input for validation process.

The comparison of results show the model can simulate current situation and has a stable result. In conclusion, the model has been validated for the base year 2009.

The eBUM results for base year 2009, after improving and validating, can be summarize as follows:

- There are 16.26 million persons-trip per day in BMR. In case of including External Trips and special generators, the trips will be approximately 17.69 million persons-trip perday.
- The majority of trips are for work purpose, which are 6.52 million trips per day.
- The ratio of private trips in 2009 covers 56%, most of which are made by the household having 1 or more vehicles.
- The average speeds of vehicles during AM and PM peaks in BMR are 21.82 km/hr and 23.22 km/hr respectively.
- The passengers using public transit systems such as BTS and MRT are 427,000 and 188,100 respectively.

5.3.7 Forecasting Future travel Demand

The Consultant has analyzed the future network including transport projects by various concerning agencies and mass rapid transit projects in **Figure 5.3-4**.

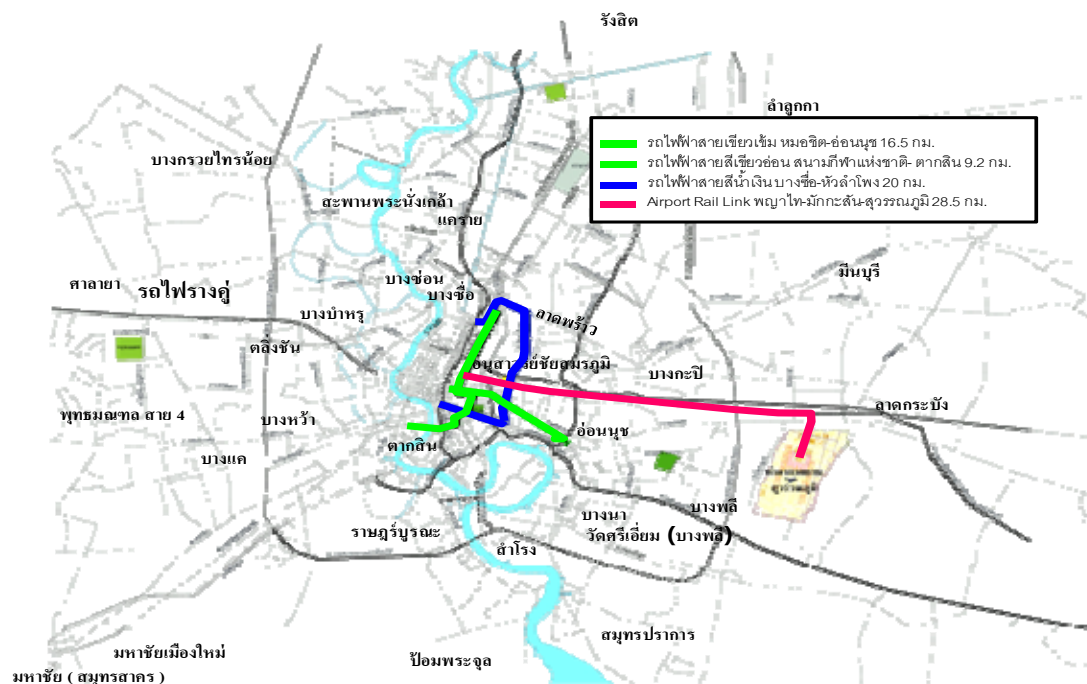


Figure5.3.7-3 Mass Rapid Transit Network in 2012

Table 5.4 eBUM AM Peak Results

AM Peak			
Year	Veh-Kms	Veh-Hrs	Speed (Km./Hr.)
2009	9,932,600	455,200	21.82
2012	11,625,100	555,100	20.94
2017	12,768,500	589,100	21.67
2022	14,415,700	746,900	19.30
2027	16,101,500	931,300	17.29
2032	19,034,600	1,295,900	14.69

Remark: Veh-Kms:Vehicle x Distance, Veh-Hrs:Vehicle xTravel Time

Table 5.5 eBUM PM Peak Results

PM Peak			
Year	Veh-Kms	Veh-Hrs	Speed (Km./Hr.)
2009	10,767,500	463,800	23.22
2012	11,633,200	511,300	22.75
2017	13,142,600	591,000	22.24
2022	14,528,300	673,700	21.56
2027	16,148,500	800,400	20.18
2032	19,252,900	1,059,300	18.18

Remark: Veh-Kms:Vehicle x Distance, Veh-Hrs:Vehicle x Travel Time

Table 5.6 eBUM Daily Results

Daily			
Year	Veh-Kms	Veh-Hrs	Speed (Km./Hr.)
2009	178,266,300	6,296,100	28.31
2012	201,617,300	7,617,600	26.47
2017	227,062,800	8,365,200	27.14
2022	253,910,100	10,086,400	25.17
2027	280,026,000	12,043,400	23.25
2032	338,325,200	16,626,300	20.35

Remark: Veh-Kms:Vehicle x Distance, Veh-Hrs:Vehicle x Travel Time

Table 5.3.7-6 Main Modal Proportion by Vehicle Type (1,000 person-trips/day)

Year	Total	Private Car	Private Car (%)	Public Transport	Public Transport (%)
2009	17,840	9,841	55.2	7,999	44.8
2012	18,927	10,092	53.3	8,835	46.7
2017	20,927	11,323	54.1	9,604	45.9
2022	23,177	12,902	55.7	10,275	44.3
2027	25,665	14,330	55.8	11,335	44.2
2032	28,748	16,365	56.9	12,384	43.1

Remark: from origin to destination considers as 1 trip (not include transferred trip)

Table 5.3.7-7 Main Public Transport Passenger (Person Trips)

รูปแบบ	Passenger (1,000 person-trips/day)					
	2009	2012	2017	2022	2027	2032
BTS	2012	737	2,368	3,672	4,597	5,788
Bus	2017	7,568	6,657	5,966	5,990	5,727
Boat	2022	188	182	172	175	209
Others	2027	342	397	465	573	660
Total	2032	8,835	9,604	10,275	11,335	12,384

Table 5.3.7-8 Public Transport Passenger (Include transferred trip)

Line	Passenger Boarding (1,000 person-trips/day)					
	2009	2012	2017	2022	2027	2032
Green	427	566	1,255	1,539	1,937	2,219
Blue	188	256	1,003	1,170	1,670	1,911
Red	-	139	798	1,271	1,520	1,753
Purple	-	-	190	802	928	1,038
Orange	-	-	-	440	573	654
Pink	-	-	-	145	180	215
Yellow	-	-	-	-	-	254
Gray	-	-	-	-	-	160
Sky-Blue	-	-	-	-	-	120
Boat	239	245	249	251	259	300
Bus	10,651	9,868	9,124	8,719	8,870	8,236
Train	63	73	71	75	80	86
Van	175	202	255	324	410	464
Others	147	171	218	280	358	399
Total	11,890	11,519	13,164	15,015	16,785	17,809

Remark: Number of trips includes transferred trip

5.4 Development of Provincial Transport Model

The transport and traffic model was previously developed by using *trip-based* approach, of which the basic restriction lies in the use of trips as unit of analysis. Besides, the model cannot simulate the impact arising from the transport system and land used. No consideration is made for the impact of transport network on any form of land used.

In order to solve the above problems, the Consultant has improved newly implemented model and added service model in the transport model structure that used Cube Cargo as in OTP previous projects. The Consultant has also developed traffic simulation model for at least 15 intersections and made use of the other features in Cube Program to enhance the efficiency of Provincial Transport Model. These features include Geo-Database and Dynamic Assignment Model using Cube Avenue.

5.4.1 Development procedures

In developing the Provincial Transport Model, the Consultant has selected a province to be a study area by considering the related factors and proposed Nong Khai that is facing traffic problems so as to set plan for future city expansion. Nong Khai has many favorable factors that are suitable for the development transport and traffic model.

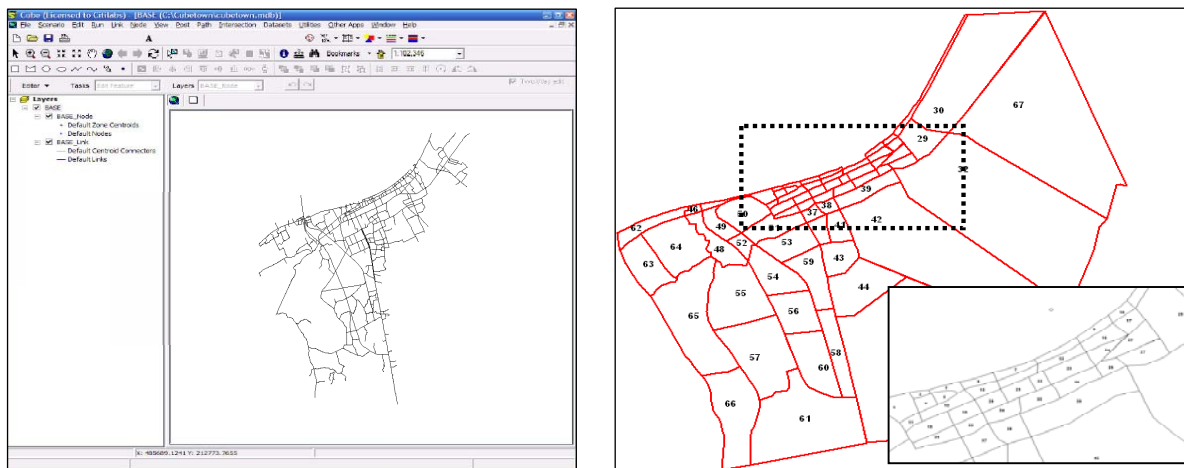


Figure 5.4.1-3 Road Network Geo-Database and Nong Khai PTM Zoning System

Intersection Traffic Survey Results

Among 15 intersections, the maximum traffic volume found at TMC 9, the intersection of Mitrapap Road and Highway No. 212, is 27,881 PCU (total 12 hours).

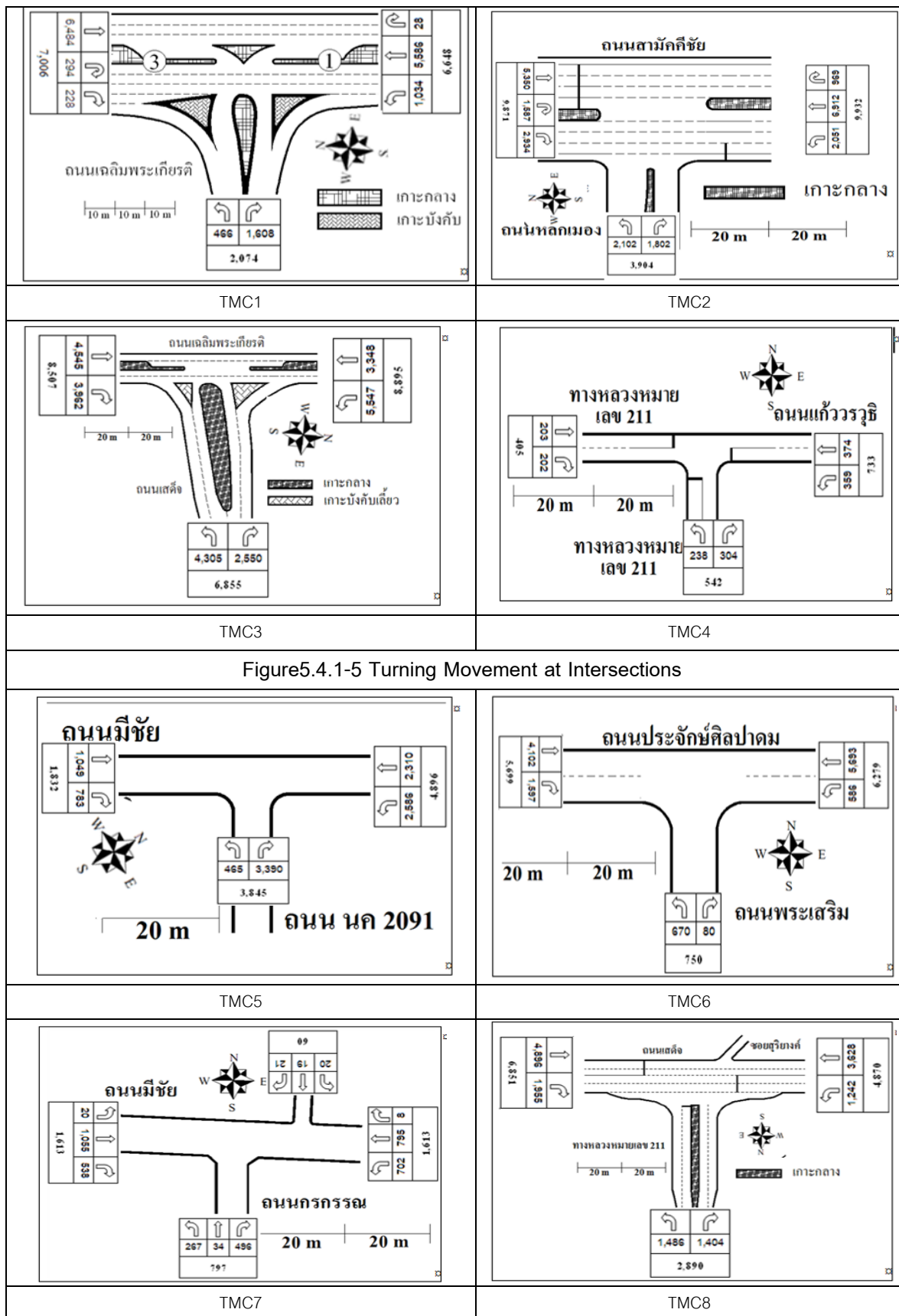


Figure 5.4.1-5 Turning Movement at Intersections

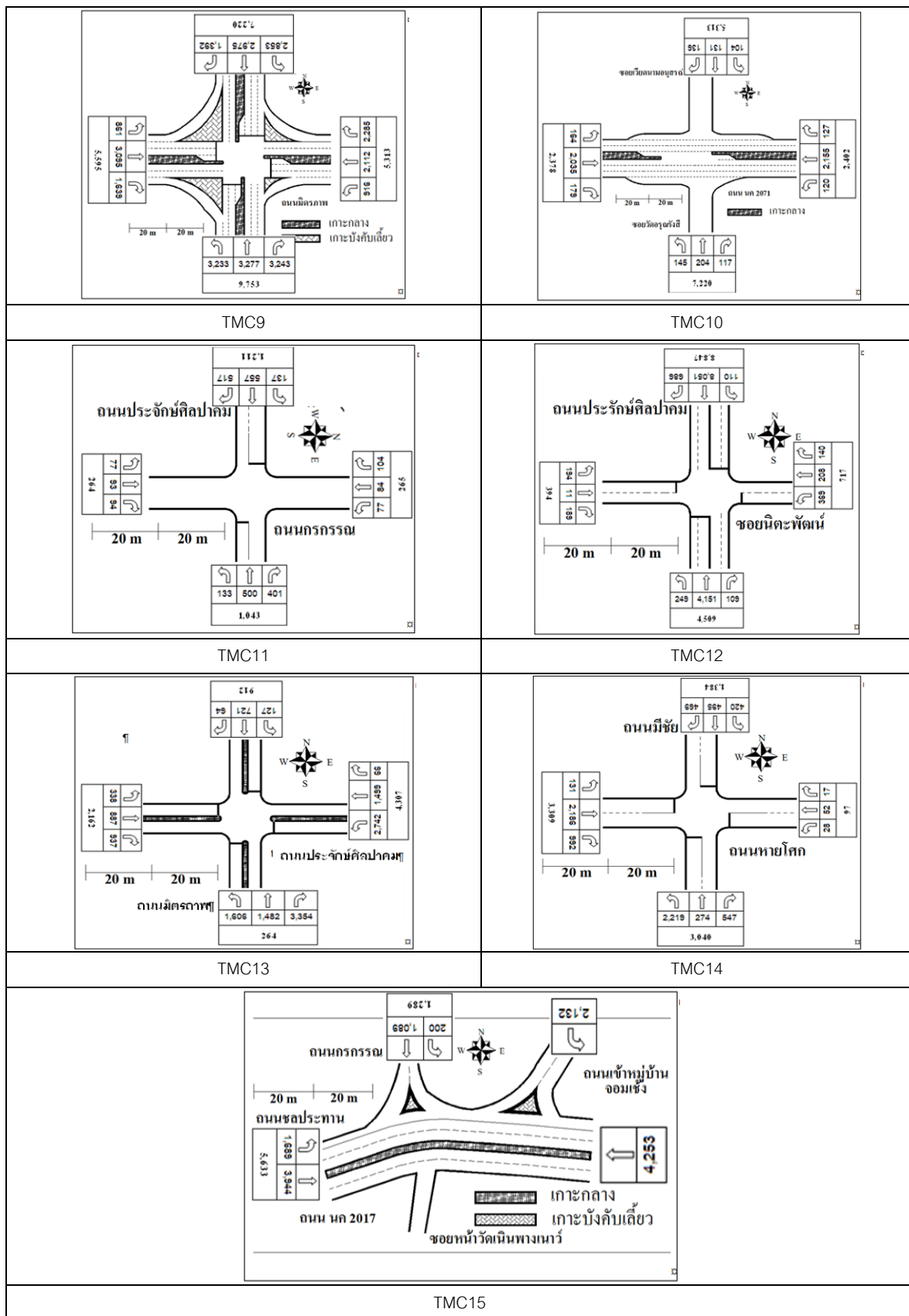


Figure 5.4.1-5 Turning Movement at Intersections

Mid-Block Traffic Survey Results

Among 15 locations on the road, the maximum traffic volume found at MB1 on Highway No. 212 is 16,762 PCU (total 12 hours).

Table 5.4.1-1 Mid-Block Traffic Volume (PCU)

Survey Location	Direction	Traffic Volume (PCU)
1. Highway No. 212	1	8,454
	2	8,308
2. DPT. NK. 2017	1	4,438
	2	4,896
3. Highway No. 211	1	621
	2	708
4. ARD. NK. 2024	1	1,159
	2	566
5. Mittraphap Road (Go to Mittraphap Bridge)	1	2,613
	2	3,070
6. Mittraphap Road (Go to Nong Khai)	1	7,336
	2	7,696
7. Mittraphap Road (Nong Khai-Udonthani)	1	6,648
	2	8,120
8. Koaw Woravut Road	1	1,063
	2	1,440
9. Mi chai Road	1	3,949
	2	2,662
10. Prajak Sillapakhom Road	1	4,307
	2	4,368
11. Highway No.212	1	8,353
	2	5,651
12. Rim Khong Road	1	450
	2	313
13. Mi chai Road	1	1,596
	2	1,337

Survey Location	Direction	Traffic Volume (PCU)
14. Prajak Sillapakhom Road	1	5,699
	2	6,279
15. Highway No.212	1	5,638
	2	4,537

Reference: The consultant

Table 5.4.1-2 Mid-Block Traffic Volume at Mittraphap Border Control (PCU)

Survey Point	Direction	Traffic Volume(PCU)
1. Mittraphap Immigration Office (Saturday, 15 Hours)	In-bound	4,525
	Out-bound	5,246
2. Mittraphap Immigration Office (Friday, 12 Hours.)	In-bound	3,791
	Out-bound	4,480

Land use model principle of Cube Land simulates the relationship between demand, under which a group of people or organization in the study area wants to buy land for residential or business purpose, to maximize satisfaction (utility function), and supply, on the contrary, under which a group of people or organization wants to sell or rent land for residential or business purpose, to maximize profit. With all these reasons, Cube Land model has adjusted balance between demand and supply by using equilibrium model. The overview of Cube Land model is as follows:

- Demand model
- Supply model
- Equilibrium model

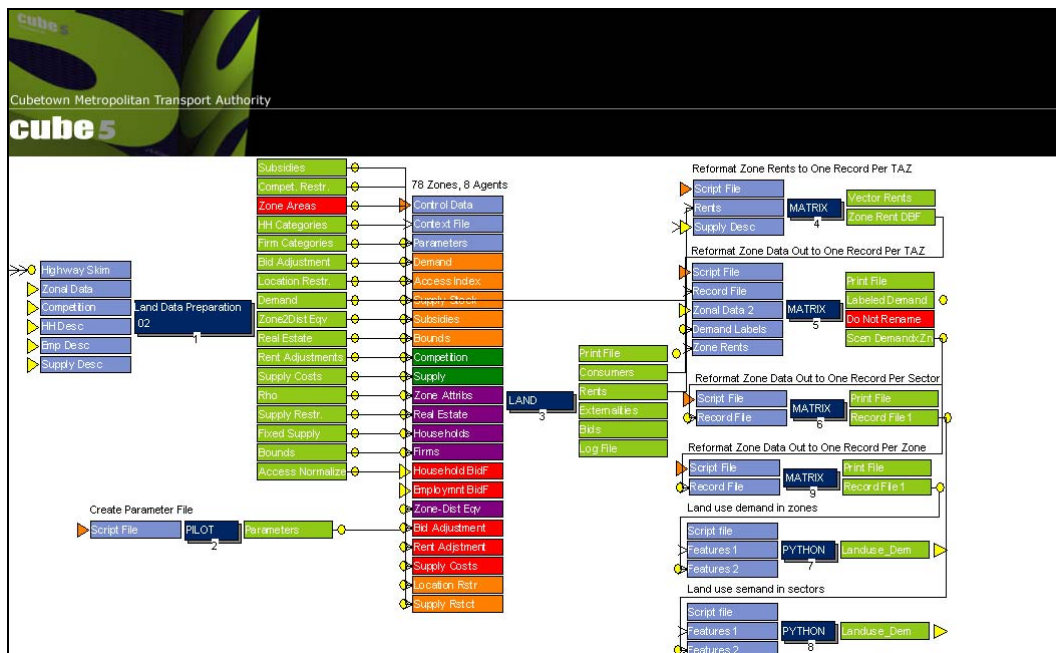


Figure 5.6 Relationship between Module in Land Use Model

5.4.2 Activity-Based Model

Activity-based Model differ drastically from Trip-based Model to the foundation of its underlining principles. The Model considers travel that occurs as a *side effect* of any activities (derive demand) distributed all over a city. Activity-based model consists of the following components.

- Pattern type model
- Location choice model
- Mode choice model
- Assignment model

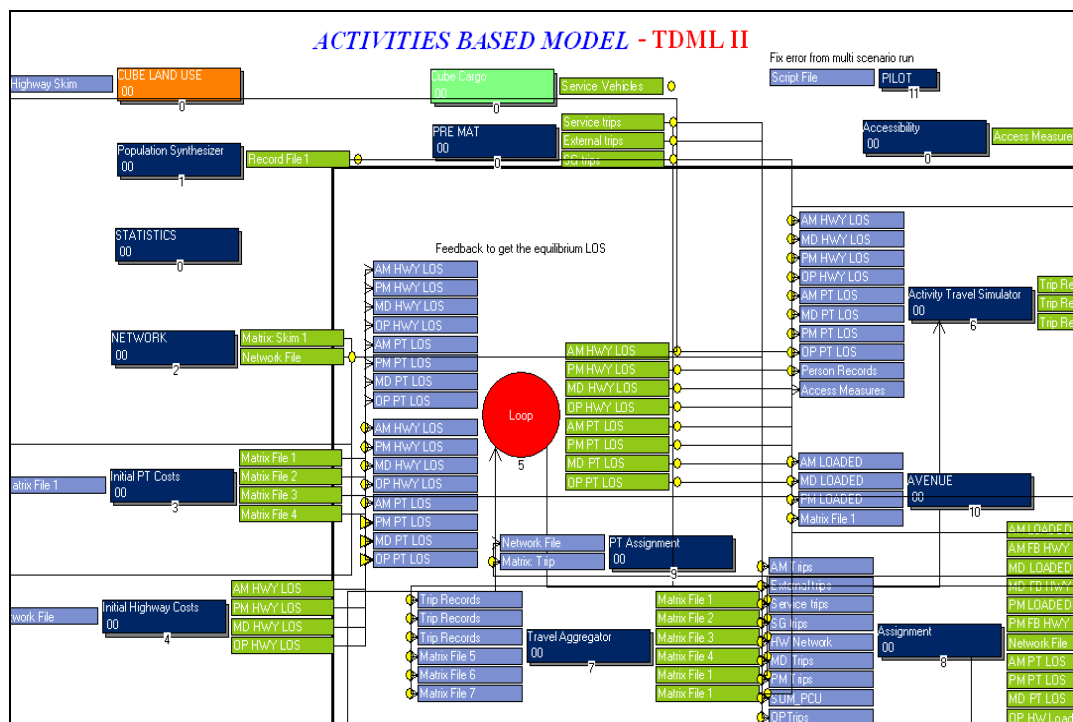


Figure 5.4.2-1 Model Structure

Figure 5.7 Nong Khai PTM Data Input Screen

Model Results

The Consultant has forecasted traffic volume in 2012, 2017, 2022, 2027, and 2032 with 2009 as the base year, including Vehicle Kilometers Travelled (VKT), Vehicle Hours Travelled (VHT), travel speed (SPEED), and vehicle trips, details shown in **Table 5.9**. The results have been displayed by 7 internal sectors and 7 external sectors at all entrances and exits to the study area, totaling 14 sectors.

For daily trips forecast, it is found that most trips are entering or exiting Zone 1 and 2, which are in the city center. Such a high trips result in low travel speed and traffic congestion. Travel speed in Zone 1 and 2 in 2009 during AM and PM peaks is 40.6 – 43.9 and 40.0 – 42.5 km/hour respectively. Due to low rate of population increase, travel speed in Zone 1 and 2 in 2032 during AM and PM peaks will fall a little to 38.3 -41.8 and 39.1 – 41.5 km/hour respectively.

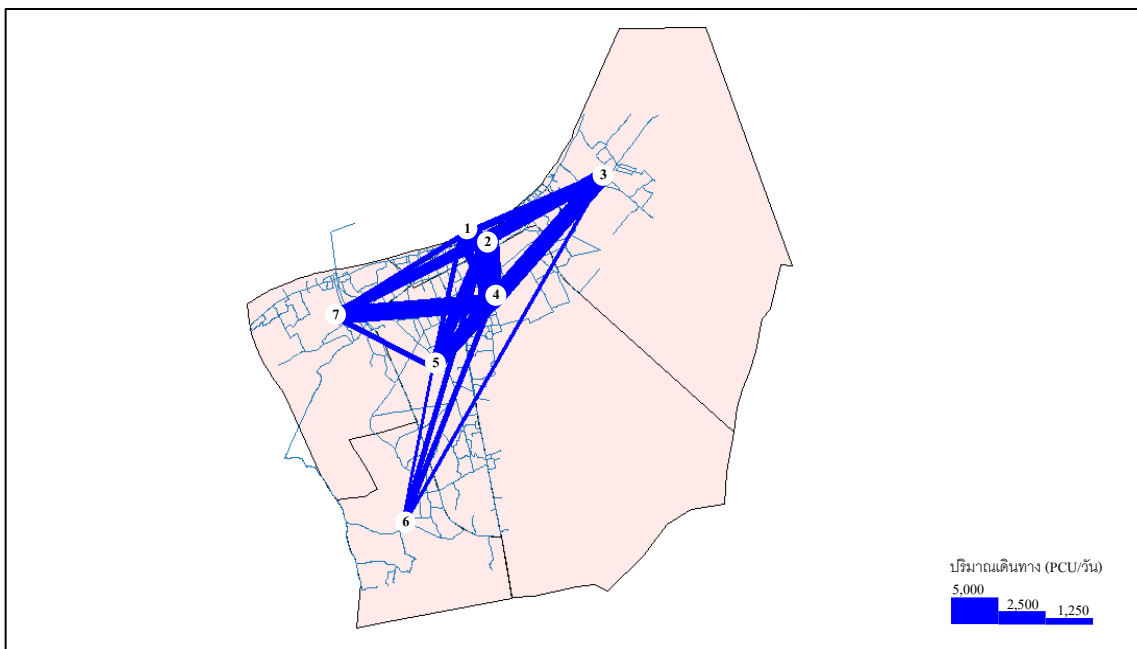


Figure 5.4.2-17 Demand in 2012

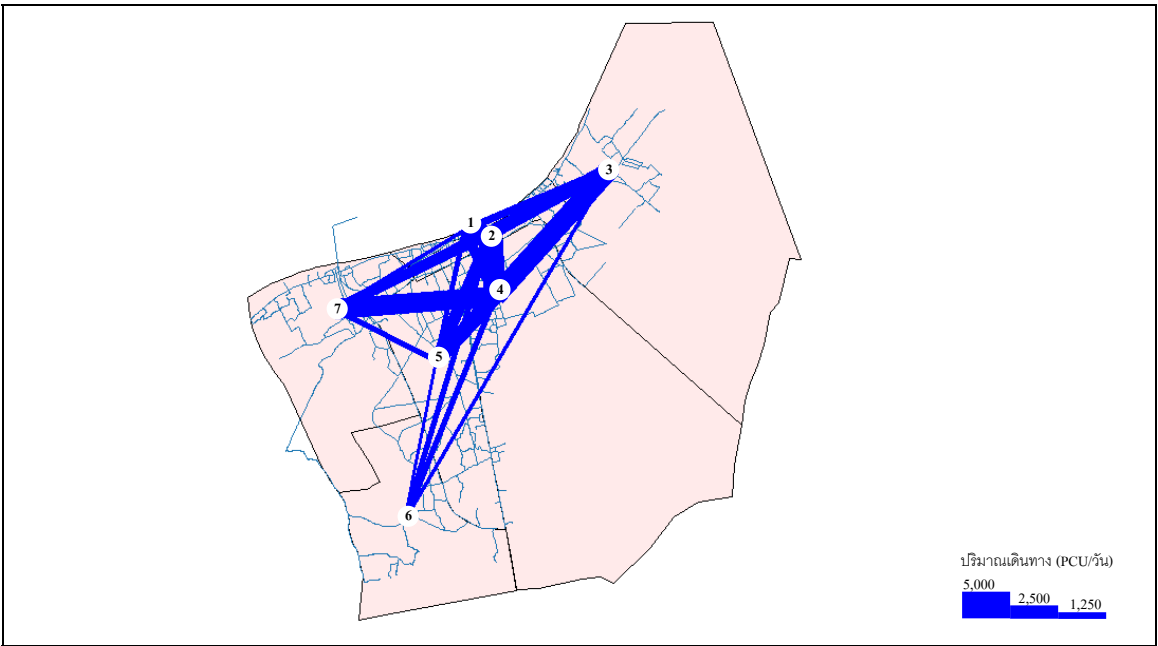


Figure 5.4.2-18 Demand in 2022

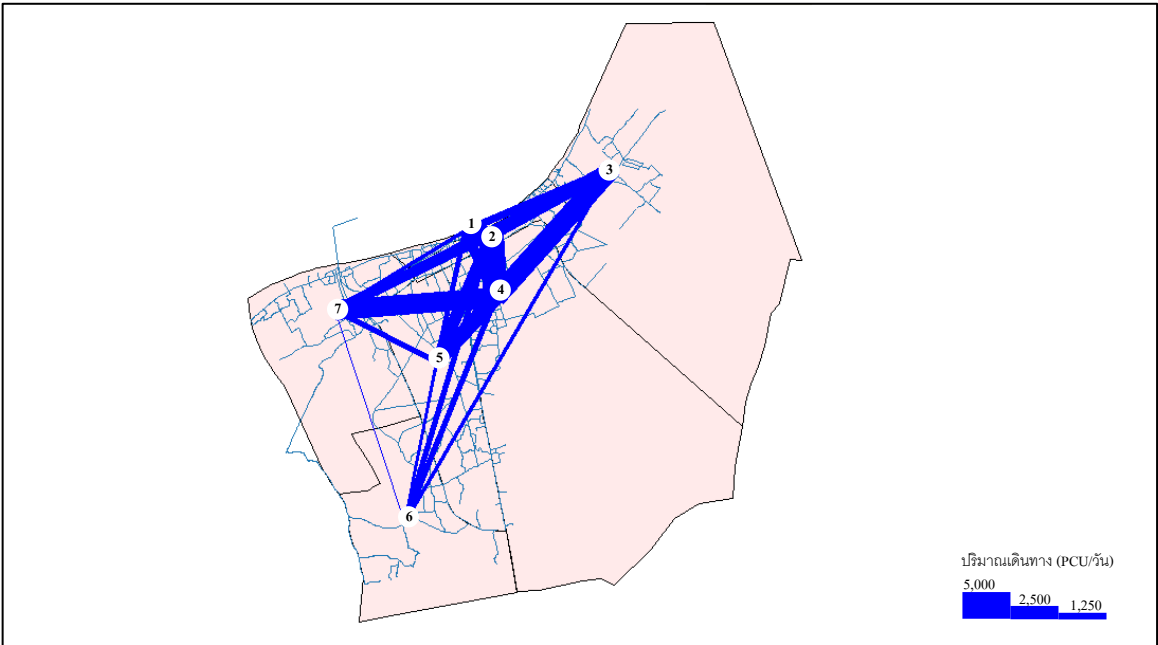


Figure 5.4.2-19 Demand in 2032

Table 5.4.2-1 Results from Nong Khai PTM

GROUP AREA	Base year 2009											
	AM			MD			PM			OP		
	VKT	VHT	SPEED	VKT	VHT	SPEED	VKT	VHT	SPEED	VKT	VHT	SPEED
1	3,302	74	44.9	1,089	23	48.0	3,696	84	44.1	307	6	50.4
2	3,178	80	39.9	1,183	28	42.8	4,378	110	39.8	223	5	44.3
3	6,218	162	38.4	3,727	98	37.9	7,614	230	33.0	504	9	57.2
4	10,798	243	44.4	4,946	99	50.0	11,752	279	42.1	745	11	65.8
5	10,601	212	50.1	4,029	69	58.7	11,235	222	50.6	865	13	65.3
6	3,417	65	52.7	1,208	21	57.6	3,552	72	49.3	414	6	68.9
7	9,270	201	46.2	3,727	79	47.4	9,056	205	44.2	985	20	48.1
Total	46,784	1,035	45.2	19,908	416	47.9	51,283	1,202	42.6	4,043	71	57.0
GROUP AREA	2012											
	AM			MD			PM			OP		
	VKT	VHT	SPEED	VKT	VHT	SPEED	VKT	VHT	SPEED	VKT	VHT	SPEED
1	3,732	84	44.7	1,451	30	47.8	4,137	95	43.6	319	6	50.4
2	3,425	88	39.1	1,350	32	42.0	5,228	133	39.3	230	5	44.3
3	6,920	187	37.0	4,080	111	36.8	10,099	325	31.0	532	9	56.9
4	12,263	286	42.8	5,728	115	49.8	13,358	326	41.0	767	12	64.3
5	11,132	229	48.6	4,614	80	57.8	11,821	239	49.4	860	13	64.1
6	3,393	65	52.6	1,368	24	56.5	3,799	78	48.8	416	6	65.7
7	9,516	211	45.0	4,283	91	47.1	10,367	239	43.4	1,013	21	48.0
รวม	50,380	1,150	43.8	22,876	483	47.3	58,810	1,434	41.0	4,138	74	56.2
GROUP AREA	2017											
	AM			MD			PM			OP		
	VKT	VHT	SPEED	VKT	VHT	SPEED	VKT	VHT	SPEED	VKT	VHT	SPEED
1	4,225	96	43.9	1,645	35	47.6	4,741	111	42.6	359	7	50.3
2	3,964	101	39.1	1,491	36	41.7	6,084	158	38.4	255	6	44.2
3	7,728	214	36.1	4,587	127	36.2	11,450	381	30.0	594	10	56.7
4	13,617	327	41.7	6,363	130	48.9	14,893	376	39.6	847	13	64.1
5	12,623	268	47.2	5,246	92	56.9	13,449	280	48.0	958	15	63.9
6	3,922	75	52.1	1,569	28	56.1	4,264	89	48.1	462	7	65.7
7	10,823	245	44.1	4,799	103	46.6	11,572	272	42.5	1,127	24	47.9
รวม	56,901	1,327	42.9	25,700	550	46.7	66,454	1,668	39.8	4,602	82	56.0

Remark: 1. Period used in the analysis consists of 6.00 AM–9.00 AM, MD 9.00 AM – 04.00 PM, 04.00 PM – 07.00 PM and OP 07.00 PM 06.00 AM

2. VKT: Vehicle-Kilometer/Hour., VHT: Vehicle-Hour/Hour. and SPEED: Kilometer/Hour.

Table 5.4.2-1 Results from Nong Khai PTM (cont.)

GROUP AREA	2022											
	AM			MD			PM			OP		
	VKT	VHT	SPEED	VKT	VHT	SPEED	VKT	VHT	SPEED	VKT	VHT	SPEED
1	4,940	115	42.8	1,873	40	47.2	5,325	128	41.5	392	8	50.3
2	5,165	132	39.0	1,612	39	41.5	7,128	192	37.0	277	6	44.2
3	8,737	248	35.3	5,108	143	35.8	12,817	449	28.5	652	12	56.6
4	14,176	348	40.7	6,980	145	48.1	16,346	438	37.3	928	14	64.0
5	14,048	302	46.5	5,819	103	56.6	14,823	315	47.1	1,051	16	63.9
6	4,431	87	50.7	1,731	31	55.8	4,705	101	46.7	507	8	65.6
7	11,973	274	43.7	5,310	115	46.2	12,771	307	41.7	1,234	26	47.9
รวม	63,470	1,507	42.1	28,433	615	46.2	73,915	1,930	38.3	5,040	90	56.0
GROUP AREA	2027											
	AM			MD			PM			OP		
	VKT	VHT	SPEED	VKT	VHT	SPEED	VKT	VHT	SPEED	VKT	VHT	SPEED
1	4,367	102	42.8	2,040	43	47.0	6,100	152	40.2	420	8	50.2
2	5,870	151	39.0	1,728	42	41.2	7,772	214	36.3	296	7	44.2
3	8,801	276	31.9	5,480	155	35.3	13,770	485	28.4	703	12	56.4
4	15,554	405	38.4	7,519	158	47.6	17,364	476	36.5	999	16	64.0
5	15,253	343	44.4	6,262	111	56.3	15,807	342	46.2	1,133	18	63.8
6	4,518	94	47.9	1,868	34	55.7	5,105	109	46.7	546	8	65.5
7	12,250	296	41.3	5,727	124	46.0	13,839	335	41.3	1,328	28	47.8
รวม	66,614	1,667	40.0	30,624	668	45.9	79,757	2,114	37.7	5,426	97	55.9
GROUP AREA	2032											
	AM			MD			PM			OP		
	VKT	VHT	SPEED	VKT	VHT	SPEED	VKT	VHT	SPEED	VKT	VHT	SPEED
1	4,574	108	42.4	2,286	49	46.6	6,629	169	39.3	450	9	50.2
2	6,294	166	37.9	1,865	45	41.2	8,390	235	35.8	316	7	44.2
3	9,540	307	31.1	5,891	168	35.0	15,037	538	27.9	755	13	56.3
4	16,761	450	37.2	8,049	172	46.9	18,511	519	35.7	1,072	17	63.9
5	16,270	373	43.6	6,702	120	56.1	16,780	368	45.6	1,216	19	63.8
6	4,944	105	47.2	2,014	36	55.7	5,502	118	46.6	587	9	65.5
7	13,369	327	40.9	6,144	135	45.7	14,927	365	40.9	1,428	30	47.7
รวม	71,752	1,836	39.1	32,950	725	45.5	85,775	2,312	37.1	5,825	104	55.9

Remark: 1. Period used in the analysis consists of 6.00 AM–9.00 AM, MD 9.00 AM – 04.00 PM, 04.00 PM – 07.00 PM and OP 07.00 PM – 06.00 AM

2. VKT: Vehicle-Kilometer/Hour., VHT: Vehicle-Hour/Hour. and SPEED: Kilometer/Hour.

5.4.3 Freight Model

Freight Model has used Cube Cargo to calculate trip schedule from origin to destination (OD Matrix) in the form of annual weight (ton per annum) of different types of commodities, classified by transportation modes, including trip table of different types of trucks. Cube Cargo can also calculate trip table for cargo delivery in urban area, which enables a complete good transportation by truck forecast.

5.4.4 Traffic Simulation Model

Traffic Simulation Model simulates traffic flow at microscopic level for detailed analysis to find the impact on travel demand due to traffic network improvement. It can demonstrate the results in details in both 2-D and 3-D.



Reference : <http://www.citilabs.com/dynasim/>

Figure 5.4.4-2 Example of 3D Simulation Results

Cube Dynasim

In this study, the Consultant has developed Traffic Simulation Model in the provinces as approved by OTP, using Cube Dynasim to simulate traffic flow at microscopic level for 15 intersections.

Cube Dynasim simulates traffic situation in 2-D and 3-D of cars, trucks, buses, rails, bicycles, pedestrians, utilizing mathematic modeling to analyze the impact caused by the modification of geometric design and traffic management scheme, as well as the change in land use and mode of travel.

The analysis of passenger and freight transport on the network can be divided into 3 levels, including macroscopic, mesoscopic, and microscopic levels.

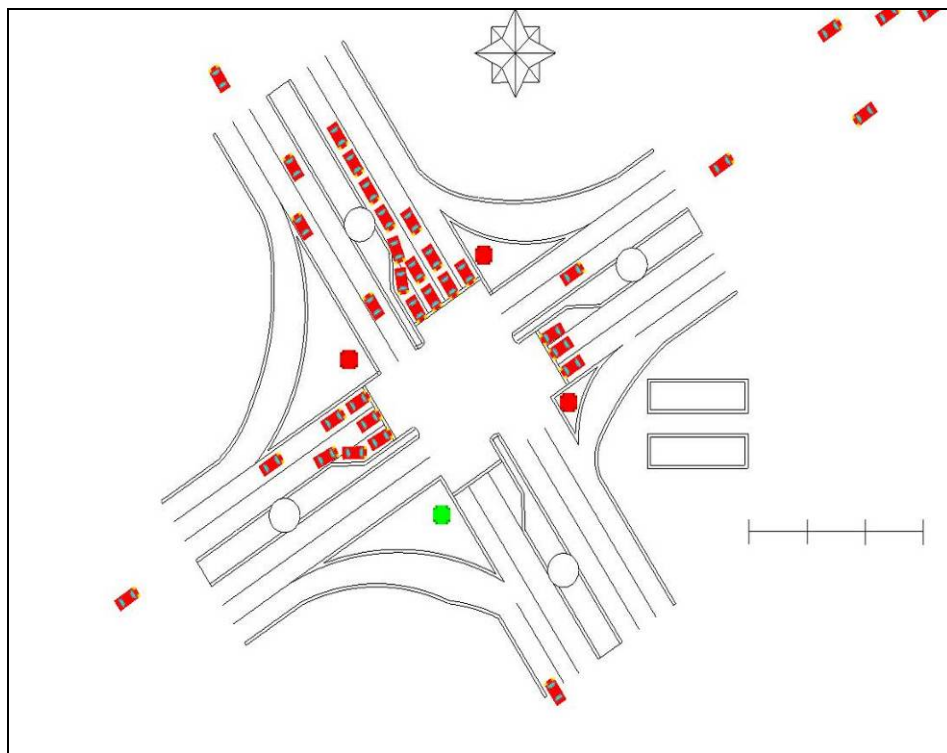


Figure 5.9 2D Simulation Model at TMC 9

5.5 The Development of Mesoscopic Model for Traffic Crisis Management Guideline

In the past, traffic crisis management in BMR cannot be analyzed by eBUM in efficient manner. The Consultant has therefore prepared a guideline for the development of mesoscopic model for traffic crisis management, which consists of various implementation steps starting from adding Cube Avenue in eBUM. The Consultant has selected an area on Rajdamneon Nok Road for Cube Avenue application by subtracting the area from the eBUM network and then adding control details at the intersections in the network as shown in Figure 5.5.

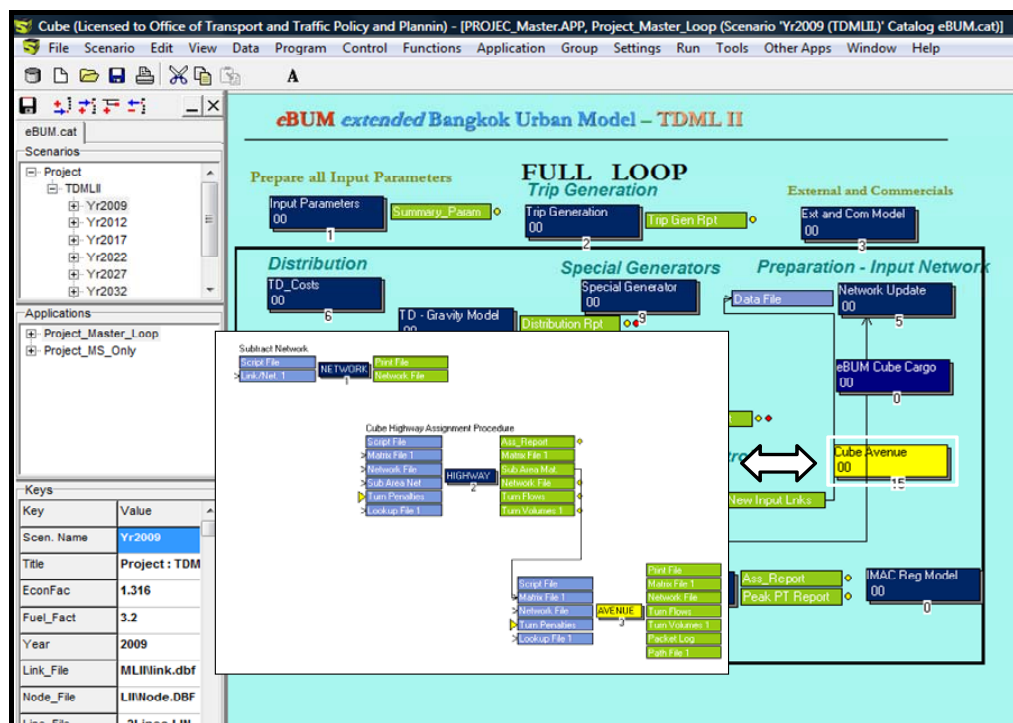


Figure 5.10 Details of Intersection in Cube Base

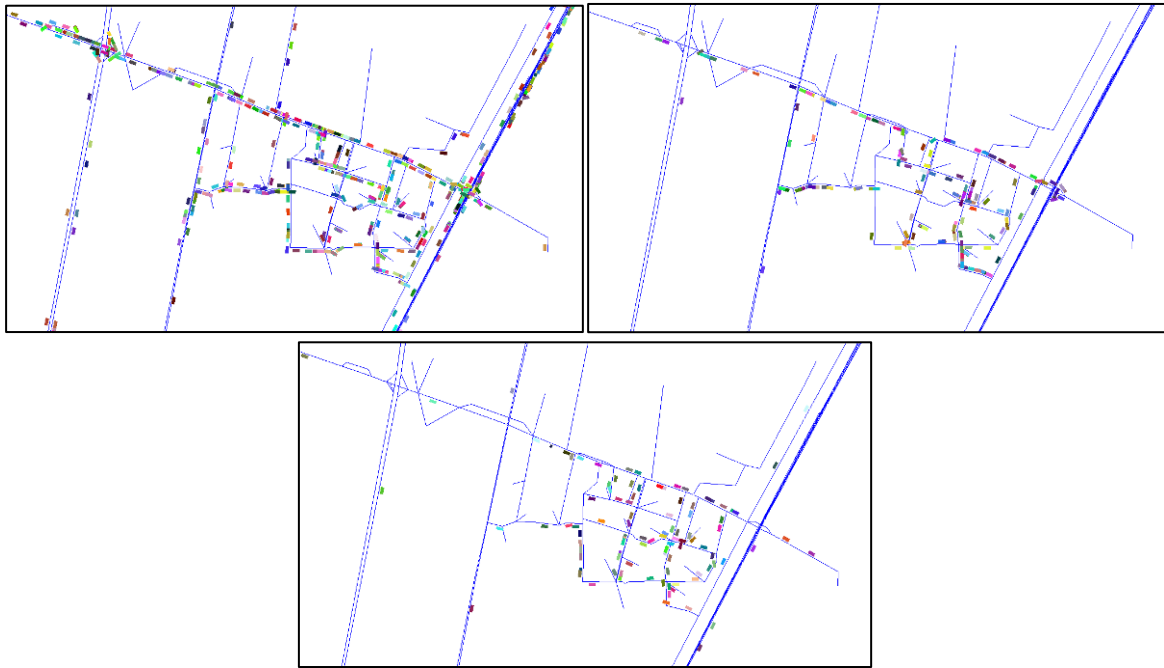


Figure 5.5-4 Dynamic Assignment in Crisis Condition at the new government center

5.6 The Development of Pedestrian Model in MRT Station for Pedestrian Crisis Management Guideline

In the past, pedestrian crisis management in BMR cannot be analyzed by eBUM in efficient manner. The Consultant has therefore prepared a guideline for the development of pedestrian model in MRT stations for pedestrian crisis management. There is no evacuation plan during crisis in the stations; for example, riot, fire, emergency system failure, etc., using the pedestrian model for planning purpose.

The Consultant has implemented OTP's Vissim Program, which is capable of simulating pedestrians efficiently as shown in Figure 5.6-1. Vissim Program adopts Social Force Model approach developed by Dirk Helbing and team.

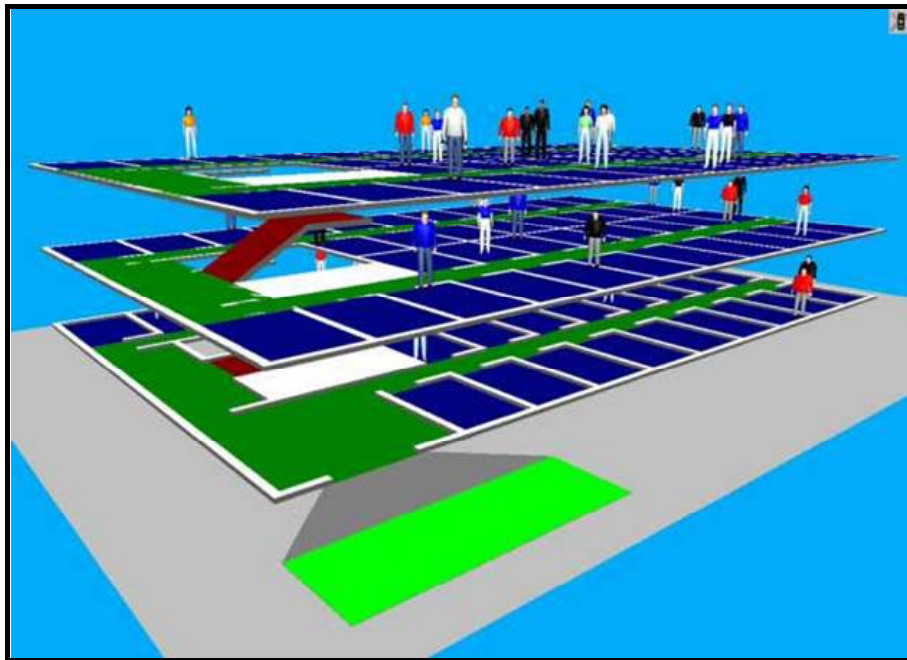


Figure 5.11 Example of Pedestrian development model

The result derived from the pedestrian model can evaluate the area efficiency in terms of quality and quantity. By quantity, the model can display the number of pedestrians passing points or routes. By quality, the model can state the level of service in such area as shown in Figure 5.6-1



Figure 5.12 Example of Pedestrian Model Result

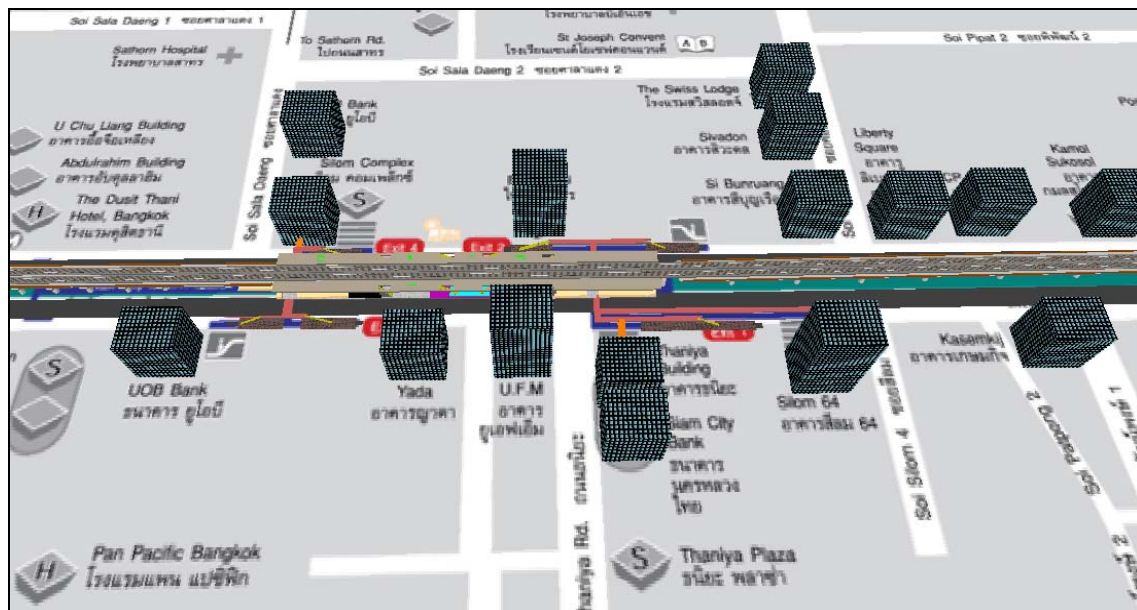


Figure 5.13 3D-Simulation Model of Sara Daeng BTS Station (Top view)

The Consultant has prepared a guideline of pedestrian model for traffic crisis management, including implementation steps starting from developing the model based on the station layout drawing to calibrating the pedestrian model and providing case studies for application in a step-by-step tutorial with sample files.

CHAPTER 6 : DATABASE SYSTEM AND TRANSPORT MODEL APPLICATIONS AND HUMAN RESOURCE CAPACITY DEVELOPMENT

- 1.1 Analysis and Appraisal of Transportation Project
 - 1.2 Technical Consultation
 - 1.3 Seminars
 - 1.4 GIS and MIS Training
 - 1.5 Technical Tour
-

6.1 Analysis and Appraisal of Transportation Project

The consultant has applied the transport database and model to the work plans or projects assigned by the Office of Transport and Traffic Policy and Planning (OTP). The model has 3 levels of application.

- National Model (NAM)
- extended Bangkok Urban Model (eBUM) and/or Provincial Transportation Model (PTM)
- Local Area Model (LAM)

In applying the transport models, the consultant has carried out analysis and assessment of 7 transportation related plans or projects, as defined in the Term of Reference. In case of applying Local Area Model, the consultant's work covers urgent and specific traffic problems if the model is applied to smaller areas; for example, the construction of flyover across an intersection, the management of one-way traffic system, and the construction of connecting road to solve super block problem. This is the traffic problem analysis on in Bangkok and major rural cities. In case of the models for the Greater Bangkok (eBUM) and/or provincial transport model in the city plan, the analysis and assessment will be carried out on the projects focused on the metropolitan areas that

affect the overall traffic situation; for example, the use of model for assessing the construction of a bridge across Chao Phraya River to accommodate the traffic between the East and the West banks of Bangkok, the analysis and assessment of mass transit rail extension project, etc. As regards the model application at the national level, the project used for this purpose will be, for example, the construction of inter-city motorway.

In applying the transport models, the consultant has carried out the analysis and assessment of 7 work plans or projects, out of which 3 projects have been completed as follows:

- (1) Report on 5 Mass Rapid Transit Riderships Forecast
- (2) Report on Traffic Mitigations for the new Government Center at Chaengwattana
- (3) Report on The Impact of Traffic Management Measures in the Municipality of Nong Khai
- (4) Report on The Application of ArcGIS program to Find the Optimal Routes for Freight Transport
- (5) Report on The Application of Mesoscopic Model for Traffic Crisis Management in Bangkok
- (6) Report on The Application of Pedestrian Model for Pedestrian Crisis Management at BTS Chong Nonsi Station
- (7) Report on The Application of NAM for the analysis of Transportation Mode Shift of Commodity Case Study

6.2 Technical Consultation

During the course of consultation provided on the improvement and maintenance of transport database and models for OTP, the consultant is pleased to cooperate with OTP with regard to the transport in order to

- Provide in-house consultation to the Office of Transport and Traffic Policy and Planning (OTP)
- Participate in the project meetings under OTP's responsibility as delegated

- Give academic opinion and justification on transport and traffic as delegated by OTP
- Jointly give recommendations on transport and traffic issues and solutions deemed as beneficial to the public and in line with the state's traffic solution policy

6.3 Seminars

The consultant has organized 3 Seminars attended by staff from OTP and the agencies involved.

- 1st Seminar on 28 September 2009 at Meeting Room 401, 4th Floor of OTP Building for 1 day
- 2nd Seminar on 27 November 2009 at Meeting Room 401, 4th Floor of OTP Building for 1 day
- 3rd Seminar to be arranged for 1 day after submitting the complete report

The consultant will make all the arrangements including the preparation of documents, which will be submitted to OTP 7 days before the Seminar.

The training of staff from OTP and the agencies involved, in these workshops will provide the participants with theoretical knowledge on transport and traffic, as well as information system. The participants will have a chance to learn from experiences and conduct an analysis on actual examples. The consultant will demonstrate the case study for the application of actual project.

In addition, the participants will also learn and try the transport and traffic model, as well as database application in the exercises prepared by the consultant.

6.4 GIS and MIS Training

The consultant has made an arrangement for 15 OTP staffs to attend the MIS and GIS application training course organized by ESRI in Shanghai from 5-9 December 2009.

6.5 Technical Tour

The consultant has arranged the technological transfer on transport and logistics by arranging a study trip for 15 staffs from OTP and the concerning agencies to the Scandinavian countries widely known for their successes in transport and logistics technology from 11-18 September 2009.