



# PLANNING AND EVALUATION OF PUBLIC VAN TRANSPORTATION IN BANGKOK

by

Ms. Kanitta Eaimsupawat

A Final Report of the Three-Credits Course  
CE 6998 Project

Submitted in Partial Fulfillment  
of the Requirements for the Degree of  
Master of Science  
in Computer and Engineering Management  
Assumption University

March 2002




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IN BANGKOK

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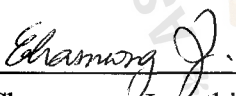
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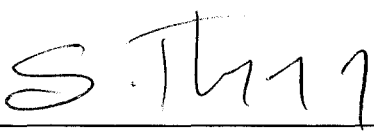
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The Graduate School of Assumption University has approved this final report of the three-credit course, CE 6998 PROJECT, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.

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## ABSTRACT

Public van is another choice for today's transportation. Some of the public vans are under control of the Ministry of Transport and Communications. Some are operated by private sector. In order to provide efficient service, a lot of processes are required. This project is to develop the effective information system to provide the security and discipline for the public van services.

There is no existing system to support the public van control. When passengers face any problem, it is quite difficult to identify that specific public van. Furthermore, the computer technology is not expensive if compared with using the manual system. Thus, this project would like to recommend the new proposed Information System to support the efficiency of public van control. All data are kept in the database server.

System development will improve the quality and the security of public van control. There will be the Public Van Control Center to control all the public vans.

## ACKNOWLEDGEMENTS

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## I. INTRODUCTION

### 1.1 Problem

There are many problems in Bangkok such as the increasing of the population, the expansion of the crowded city, the insufficient transportation and the unstructured urban growth. The major problem is the traffic congestion which affected the imbalance of the public utilities and the growth of the city. From the study of the Office of the traffic management system council about the number of the passengers. in Bangkok and urban area in 1998 was equal to 17.12 million trips per day, which has increased from 1991 around 2.51% per year. The number of passengers who used the public transport was 45% and the rest used the private vehicle. Nowadays, only 10% of the whole area in Bangkok has the roads that mean it is not enough to support using private vehicles. Thus, the Government attempts to improve and facilitate using the public mass transportations. Even this factor could not response to the passengers' needs but it pushed the new competition in the transportation business such as Minibus (Song-Taew), Hired Motorcycle, public van, etc.

Public vans emphasized on time and convenience for passengers. The routes are between the urban areas and center of Bangkok. The number of the public vans increases very rapidly. In 1997, there were 44 routes with 1,150 vans that carried 50,000 passengers per day (Bangkok Metropolitan 1997). In 1998, the numbers of public vans increased to 2,980 vans with 116 routes and the numbers of the passengers were 250,000 passengers per day (Bangkok Mass Transportation Organization 1998). That means only within one year the numbers of routes, vans and passengers increased around two times.



## **1.2 Objectives of the Project**

Nowadays, there are many types of public transportation services that are provided for passengers to get high satisfaction. For this project, the public van will be emphasized and the major objectives are as follows:

- (1) Consider the factors and conditions of van transportation.
- (2) Consider the types of van transportation services.
- (3) Consider characteristics and behaviors of van passengers in Bangkok.
- (4) Present the system for developing the efficient van transportation.

## **1.3 Scope of Study**

Bangkok area covers Dusit, Phayathai, Jactuchak, Bangsue, Huay Kwang, Bangkok Noi, Bangplad, Bangkok, Pasicharoen, Bung Kum, Ladpraw, Bangkok, Don Muang, Meanburi, Nong Jok, Talingchan, Laksi and Kong Sam Wa including Pratumnadee and Nontaburee. The total area is 3,086.157 KM<sup>2</sup>.

## **1.4 Process and Analysis**

The process and analysis of this project are provided by many methods which are collected from many sources.

- (1) Searching the theories and ideas from books, documents and research by emphasis on type of trip and the characteristic and factors of Para transit Behaviors of passengers travel by Para transit including the way to make the decision by Para transit with the others countries in order to analyze conditions and factors for van transportation in Bangkok.
- (2) Study, the information of the Bangkok area, the physical information of city, habitat, population and economic, transportation network and other types of transportation.
- (3) Study the factors of van transportation in Bangkok.

- (4) Study from the data of the government research concerned with the characteristic of vans and develop the route, distant and scope of the service, fee, van stop and relationship between the beginning point and the ending point and compared with others types of transportation. The main point of this phase is to find the advantages, disadvantages including sorting out the inefficiency of each type of transportation.
- (5) Survey the demands of van passenger by using the questionnaires. The questionnaires will be evaluated by the potential and comparison for each area for analyzing behavior and attitude of passengers.
- (6) Conclusion of the study phase of factors and conditions which is caused the van transportation. Then recommend the regulations and the service improvement.

### **1.5 Benefits from Studying This Project**

The reader or researcher ought to gain benefits after studying this report as follows:

- (1) Recognize the factors and conditions of the public van transportation.
- (2) Recognize the characteristic of van transportation services.
- (3) Understand the behavior and the characteristics of passengers especially in specific areas.
- (4) Suggest the disciplines to improve the van service for schedule planning.

## II. LITERATURE REVIEW

### 2.1 Review of Concept and Theories

Theories and concepts that involve the factors of van transportation consisted of urban growth concept, concepts of traveling, selection of traveling and efficiency of transportation and Para transit. All these concepts will support the analysis and research of this project, which will be described in details later.

#### Urban Growth

The theories of Burgess, Hoyt and McKenzie about city expansion, divided the city expansion into concentric Zone Theory, Sector Theory and Multiple Nuclei Concept. To understand the expansion of Bangkok, we should understand the general concept of city expansion.

#### Concept of city expansion

The city of expansion can be described in many ways such as:

- (1) Concentric Zone Theory: the city will be developed from the center, which is the area of industry and business. When the city grows, it will expand to the nearby areas which are the residence and agriculture area.
- (2) Sector Theory: Road will be the indicator of the developing area. The reason is that road will be the connection between the center of business with the urban area.
- (3) Multiple Nuclei Concept: emphasize on connection of one business area of city to another business area. This will bring to the development in that area or to response to the people's needs.

## The Importance of Transportation

Transportation is very important, especially to the city. Transportation is the way of moving from one place to another place and to commodity trading. The good transportation can support the development of the city.

### 2.2 Concept of Traveling

There are 2 types of traveling as follows:

(1) Short journey or the daily journey such as traveling to work, shopping and relax. This type of journey can be divided into 3 types as follows:

- (a) Downtown journey to work: started from the urban to town center by traveling on public transportation.
- (b) Reverse commuting: This concept is opposite to the Downtown journey to work. The traveling is not so convenient due to the route and the timetable of public transport.
- (c) Lateral commuting: traveling within the city or urban area. The destination is spread out and varied. The public transportation is not so convenient.

(2) The long journey or permanent journey such as changing the residence or changing jobs, etc.

The transportation in the city is the way of moving commodities, people from the started point to the destination within the city. There are million of trips within the city depending on the needs of people. There are also varying types of transportation. Most people will start their journeys from their homes or around 80-90% of all journeys. It can be divided into two groups, Home based and Non-home based.



The objectives of home based are

- (1) for working
- (2) for shopping
- (3) for relax
- (4) for business
- (5) for education

The purpose of the journey is one process of transportation planning which is concerned with the estimated number of journeys from one place to another place. At the same time, study the relationship between the journey and environment by factors and assumptions of Bruton, (1975:84-90)

- (1) Economic and social

Economic and social are involved with age, sex, education, income, car ownership, etc. These factors effect traveling such as the people who earn more income will have the opportunity to become the car owner. Thus, it will increase the number of journeys.

- (2) Land consumption and development

The characteristic of land will be related with the commence of traveling such as densely using land which will show the number of accommodations per area. The research found that the trend of traveling from family that has more than one car is higher than the family that has one car.

- (3) Characteristic, scope and the capacity of transportation

The characteristic, size and the capacity of transportation are the factors that influence the decision-making.

## 2.3 The Factors of Transportation

The capacity, speed and the selection of route are the factors of transportation.

The evaluation of transportation can measure from the following factors:

- (1) Time: which is the intangible cost or expenses.
- (2) Punctuality: is the most important factor.
- (3) Out-of-vehicle: means the time that passenger does not use any vehicle such as during traveling by foot, during changing vehicles, etc.
- (4) Out of pocket costs: including parking fee, express way commission, maintenance and insurance.
- (5) Comfort such as fixed seat and air conditioning.
- (6) Safety from accident and crime.
- (7) Income: the higher income people would like to save time and need comfort during their trip more than the lower income people.

The research found that the demand of comfort and capacities of traveling increase rapidly so the government should provide public transportation, the efficient transportation considered by the demand and supply of provider.

Table 2.1. Specification of Transportation.

Passenger	Provider	Community
Availability	Area coverage	Increasing the ability of access
Punctuality	Frequency	
Speed/Travel time	Speed	Reducing the pollution
User cost	Reliability	Land used
Comfortable	Cost	Environment and energy
Safety and security	Capacity	aspects
	Safety	Economic efficiency
	Side effect	Social objectives
	Passenger attractive	

**2.4 Passenger Requirement**

The requirements of passengers can be classified as follows:

(1) Availability

This requirement, without this the population cannot use a transit system, has two major factors which are the location and the frequency of service. The good availability, the station should be closed to the passengers and provide adequate frequency of service. Due to the cost of the constraints, trade-offs between the two must often be made. The locations of the station and the frequency have to be balanced so that it will meet the passengers' requirement.

(2) Punctual

Punctuality is defined as schedule adherence. The variance from scheduled travel times may result from traffic delays, vehicle breakdowns and adverse weather conditions. Since traffic delays and interference dominate as causes, by far the most significant factor for securing punctuality is control over the system.

(3) Speed/Travel time

The total door-to-door travel time can be composed of five parts: access, waiting, transfer and departure times. Relative weights of these time intervals vary, since passengers perceive them differently. Therefore, based on various studies reported in literature, a factor of 2.0 to 2.5 can be used for waiting and transfer times to obtain perceived travel times. The relative weight of walking time depends heavily on the attractiveness of the area.

(4) User cost

The price of transportation is another important factor for travelers. Transit fare is the most significant portion of it, but other out-of pocket costs are also included particularly by commuters. In a broader sense, cost of access by automobile and even its fixed costs should also be considered.

(5) Comfort

Comfort is a difficult concept to define because it encompasses many qualitative factors. Paramount is the availability of a seat and the quality of ride (affecting users' ability to read and write). The physical comfort of the seat itself naturally enters in, as does the geometry of the vehicle entrances/exits, width of aisles, presence of air conditioning, jerk and noise



levels, image of passengers relative to one's self image, and the degree of privacy offered, to name a few.

(6) Convenience

While comfort is related to the vehicle, convenience refers to the overall system. Lack of the necessity to transfer is a convenience. Good off-peak service, clear system information, well-designed and protected waiting facilities, and sufficient, close parking (if required) are all user conveniences. By nature, evaluation of conveniences is predominantly qualitative.

(7) Safety and security

Passenger safety is a term of accident prevention and it is very important, but this aspect is something less important for passengers than protection from crime. The securities are measured by statistics of crime records incidents of the system.

## 2.5 Operation Requirement

The operation requirement can be classified by:

(1) Area coverage

Area "covered" or served by transit is defined as the area within five or ten minutes walking distance from transit stations. Area coverage by a transit system can be expressed as percent of the urban area, which is the transit service area.

(2) Frequency

Frequency means the number of vehicles departure per unit time. It is often incorrectly believed that frequency is not important for computers. While its significance is greater for off-peak hours, it also seriously affects

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regular riders. For example, there are no residential areas in which only two or three departures during the whole 2- hours peak period would be convenience for all potential users. Short, regular headways are an essential element of attracting all categories of passenger trips.

### (3) Speed

While passengers are more sensitive to transfer and waiting than travel times, they also prefer high running speed on the line: the operator is particularly concerned with high commercial speeds on the lines, since they affect his fleet size, labor costs, fuel, maintenance and above all, attraction of passengers. Several speed are used in transit systems analysis:

- (a) Travel speed- one way average speed of vehicle, including stops
- (b) Commercial speed- average speed, including terminal times
- (c) Platform speed- overall average speed including travel to and from garages
- (d) Playtime speed- average speed based on driver's paid time.

### (4) Cost

Although cost is often given an unjustifiably high relative weight (even used as a single evaluation criterion for different systems), it does represent the most important single factor to the operator. In most cases, three aspects of costs are analyzed: investment cost, operating cost and revenue. All three vary greatly with local conditions and system characteristics, as well as with time. In evaluation, unit cost rather than total costs of individual modes should be compared.

(5) Capacity

Two different capacities can be defined for a system: way capacity and station capacity. The latter capacity of station along the line, governs line capacity since it is smaller in all cases except when vehicle from line-haul section branch out into several terminals.

(6) Safety

The operator must pay great attention not only to passenger security, but also to operational safety of the system.

(7) Side effects

System effects on the nonusers and the environment for which the operator is responsible include such physical impacts as aesthetics, noise and the air pollution.

(8) Passenger attraction

The number of passengers a transit line carries is usually the most important indicator of its success and its role in urban transportation. The attraction is obviously a function of the type and level of service, but there is also an additional factor, probably best described as system image, which can be very important. This image is difficult to define, but it is composed of such aspects as the simplicity of system, reliability of service, frequency and regularity, as well as physical characteristics of facilities, primary fixed line facilities.

## 2.6 Community Requirement

Items included in this category, listed in Table, are self-explanatory. In each specific case they must be carefully defined and analyzed, since they vary more due to local conditions than so such quantitative items as speed or frequency.

## 2.7 Land Transportation

The most influence of transportation is land transportation because it leads to the movement of products and people from one place to the destination. The transportation can be divided by the purpose of transportation and type of vehicle as follows:

- (1) Private transport: - Normally that person will own that vehicle as well. The samples of vehicle are car, motorcycle, bicycle, etc.
- (2) Public transport: - All types of public transport which have the specific the route, set the timetable and set up the appropriate fee such as bus, Rapid transit — transportation that have the medium capacity like electric tram, rail bus, Light Rail Transit — transportation between town and urban by using medium size of electronic tram which could carry passengers around 6,000 — 20,000 per hour per route.
- (3) Para transit: - This type the passengers can select the route and set their convenience time.

## 2.8 Para Transit

The meaning of Para transit by:

Kirby (1975), Para transit means the general transportation, which will carry the passengers, who have the same destination.

Vuchic (1981), Para transit means the transportation which travel within the town by using the main road. The Government or Private offers this service. The route and the schedule may be changeable upon the passenger such as taxi, Dial-a-Ride or Jitney.

#### 2.8.1 The Types of Para Transit in Other Countries

There are many types of Para Transit in each country. The different type of Para Transit can be described as follows:

- (1) Taxi: - Car that is hired by passenger. The service is upon the passenger requested. Traveling by taxi can reduce the parking problem and reduce the cost of private car maintenance. The weak point is the passenger waste his time than using private car. At the same time if compare with using other type of Para transit, cost of taxi fare is the highest.
- (2) Dial-a-Ride or Dial-a-Bus: - This type of transportation is the demand responsive transit, which means the flexible transportation such as flexible route and timetable. This transportation is the point-to-point service. Type of vehicle may be the small bus or van. When the passenger would like to use just call to the Dial-a-Ride Center and tell the start point, the destination and time. Then the operator will set the timetable and plan the route including grab the passengers who have the same destination in order to save cost on each ride. The concept of Dial-a-Ride is to reduce the gap between taxi (many to many) and bus (one to many).
- (3) Jitney: - In Developing countries especially the countries in Africa, Far East countries, the ratio of using Jitney is much more than using other types of transportation. The Jitney may be called differently in different countries such as Manila calls Jitney as Jeepney. Istanbul calls Jitney as Dolmus, etc. The vehicle may be van or minibus. The service depends on the passenger



requested. Jitney is more comfortable, has more frequency and more speedy than bus and the fare price also higher as well.

- (4) Carpool means the transportation that the owner uses his private car and pick up other passengers who have the same destination. The passenger may share some expense cost.
- (5) Subscription Bus means the transportation for the passenger who travel to the regularly destination such as for the passenger who travel to work, to study, etc. by using the same route at the same time. The subscription fee may be paid in the period of time like weekly or monthly payment. It is the Door-to-Door service and the starting point and the destination are based on the Many-to-Few concept.

Silcock (1985) said Para transit is the flexible process. No fixed timetable, the driver can decide where to go and when much more than the Public transportation. Like the destination of using Jitney and taxi is depended on the agreement between the passenger and the driver. For the Pubic transportation like bus the route is based on the permission from the Government.

### 2.8.2 Types of Para Transit

Kullman (1976) and Vuchic (1981) had studied the difference between Para transit and other types of transportation. They found that the characteristic of the service of Para transit is for the private or small group of passengers such as the neighborhood, groups of students, factory workers who have the same destination. It is the Door-to-Door service, which serves the small group of passengers by using the vehicle that could carry the number of passenger not exceeding 12 seats by fixing the timetable. The driver or the entrepreneur is the vehicle owner or any person who is not involved with Transportation Organization. They will set up their own rule.

## Para Transit in Developing Countries

There are many reasons of setting up the Para transit in the Developing countries. The most important problem is the traffic congestion due to the increasing in number of private cars. At the same time the construction of public utility could not support the needs of people. The increasing rapidity of crowded areas also increasing the traffic problem. Furthermore, the major problem of developing countries is lack of fund investment. From the studies of United Nations in 1987 about the capacity of Para transit of the metropolitan city such as Manila in Philippines, Jakarta in Indonesia and Kuala Lumpur in Malaysia, they found that the Para transit could contain the passengers around 70, 50 and 40 percent of the overall public transportation. In Bangkok Para transit can contain around 15 percent of the public transportation. From the study of JICA in 1990, they found that the percentage of Para transit in Bangkok would be increased to 21 percent of overall public transportation.

Coombe and Mellor (1986) said there are 2 factors that effect the growth of Para transit. First factor is the rapidly increase of the number of population which could be from the nature or from immigration. The study of United Nations in 1987 found that during 1960 — 1980, the number of population is increasing two times and may increase four times in 2001. The rapid increase of the number of the population. The towns expansion to the agriculture area together with expand of commercial and the industrial activities. All these factors bring the needs of rapid transportation.

Second factor is the increasing number of private car consumption due to the needs of speedy traveling. Furthermore, there are also some other factors such as unplanning the town structure, insufficiency and inefficiency of public utility. The report of United Nations (1987) said the major problems of public transport that could not response to the needs of passenger were the flexibility of the transport, the

frequency of the services, door-to-door service, fare of the transport. All these factors lead to the popular using Para transit especially for the area that the public transport could not reach and for the passenger who did not have his own car.

#### The Origin of Para Transit in Each Country

Each country will have its own characteristic Para Transit and may differ from each country. The samples of Para Transit for the countries in South East Asia are described as follows:

##### (1) In Philippines

From the study of characteristic and the function of Jeepney, which is the symbol of the Para transit in Cebu Metropolitan — the second largest city of Philippines. The number of population increase very fast including the number of immigrant people due to Cebu Metropolitan is a center of industry and commerce. Bus is the only transportation which serve within and outbound the town. The numbers of buses are not enough. There are some other types of transportation service such as Jeepney which services along the main road, motorcycle which service the minor road and rickshaw which service within the alley.

From the questionnaires about the management service, problem and the probability of Jeepney by interviewing the traders, drivers and passengers.

The Jeepney is the major transportation in Cebu Metropolitan. There is no competition between bus and Jeepney. The distances of the service are around 4-20 Kilometers, with 12-20 seats or around 17 seats for the long distance journey. There are 12 rounds per day and use around 26 minutes

per trip. Normally there is the specific route. The reason for using Jeepney is cheapness.

From the study of BLORECIA (1996) about the Para transit in Butuan city in Philippines. The Para transit occurred because of the lack of public transportation service such as bus. Thus, the private sector set up the Para transit to response to the needs of passengers especially for the person who does not own his car which is the majority in Medium to small size cities like Butuan.

Apart from the Jeepney, there is also the tricycle, which serves the passenger who would like to travel, as they want.

(2) In Thailand

The Para transit begins to affect Bangkok and other big cities like Chiang Mai, Hat Yai and Khongkang. It started because of the traffic congestion and the increasing use of cars. The type of Para transit of each city will vary upon the economic and culture of each society. The types of Para transit that is accepted by law are minibus, taxi, tricycle and mini four-wheel car. The unaccepted by law transport is hire-motorcycle. The services of these Para transits are quite similar which offer convenience, speed and more flexibility if compared with bus.

(3) The Para transit in Bangkok

There are many types of transportation service in Bangkok, which is controlled by the Government. The public transportation could not respond to the needs of the passengers, the Para transit becomes more powerful. There are many researchers doing the research about the various types of Para transits such as The Study of the Para transit: Taxi and Tricycle in

Bangkok of AGAD in 1990, he found that both these services are very flexible. In 1990, there were around 13,493 taxis and 7,405 tricycles in Bangkok. These types of transportation offer the convenience and speed which could respond to the needs of Bangkokians but the fares are quite high if compared with other types of public transport.

(4) The Para transit in Chiang Mai

Tungkavachiranon (1994) studied the Para transit in Chiang Mai which is called Mini bus or "Song Taew". The service of Mini bus is quite similar to taxi, the differential is, it acts as shared taxis. Most of these mini buses are not specific in route. The major reason of this service is convenience and speed.

(5) The Para transit in Khonkean

Pornrattanawanarom (1995) studied the Para transit in Khonkean by doing the research about mini bus, tricycle (Tuk Tuk) and riding tricycle. He found that most passengers prefer to use the mini bus, the main reason is the cheap fare price. The reasons for using tricycle (Tuk Tuk) and riding tricycle are convenience, speed and offers door-to-door service.

Now the Para transit in Bangkok and other provinces increased rapidly which could respond to the needs of the passengers. There are many factors that support the growth of the Para transit such as the increase of the number of population, second is the increase of the income per head, third is the insufficient public utility and the last reason is the unstructured town plan.

## 2.9 Conclusion of Concepts and Theories

From the revision of the concept and the theory we can conclude that:

The transportation is the tool which responses to the demand of passengers by moving from one place to another place for doing some activities. The spreads of the activities bring the several types of transportation. The transportation within the town is the way of traveling for doing the routine activities for the different purposes such as for working, studying, relaxing, shopping and returning home.

There are 3 factors that involve making the selection of transportation as follows:

- (1) The characteristic of journey: - distance, purpose of journey, etc.
- (2) The characteristic of passenger: - economics and social status, income, family size, vehicle owner, etc.
- (3) The characteristic of transportation, which can be divided by time, fare, convenience, point of service.

There are 3 types of transportation as follows:

- (1) Public transport: - bus, railway, ship, airplane, etc.
- (2) Private transport: - private car, private motorcycle, etc.
- (3) Para transit: - hired motorcycle, minibus, taxi, tricycle, etc.

The reasons of Para transit service are the increasing number of population, the town expansion and the insufficiency, which will be mentioned later on.

## 2.10 Urban Transportation

An urban transportation system is a basic component of an urban area's social, economic and physical structure. Not only does the design and performance of a transportation system provide opportunities for mobility but also over the long term, it influences the growth and level of economic activity through the accessibility it provides to land. In recent years, changes to the urban transportation have also been



treated by many public officials as a means of meeting an assortment of national and community objectives. For example, such changes have been motivated in some cities by the desire to improve air quality, enhance the economic viability of downtown area, provide government services to the elderly and handicapped and reduce the dependence on petroleum-based energy. Planning for the development or maintenance of the urban transportation system is thus an important activity, both promoting the efficient movement of people and goods in an urban area and for maintaining the strong supportive role that transportation can play in attaining other community objectives.

By the late 1980s many urban areas began to experience citizen unrest over the disruption caused by the construction and operation of the large-scale facilities that resulted from these comprehensive plans. This dissatisfaction with the results of planning raised serious questions about the underlying attitudes of the professionals responsible for planning and generated debate over the implicit assumptions used in the analysis approach.

The image of comprehensive transportation planning that emerged in this decade was still one dominated by region wide transportation plans. Further, these comprehensive planning efforts were based on many implicit assumptions about the future availability of gasoline, transportation technology, economic stability and urban demographics that by the end of 1986 begun to change in significant ways. The important political, economic and social trends that have evolved over the past ten years, have in turn affected transportation planning.

There is not one, but many transportation planning processes under way in an urban area at any given time, each defined at a different level of complexity and purpose. For example, while transit planners examine alternative service configurations, traffic engineers might be identifying problems on the highway network,

regional planners might be looking at urban development patterns and the provision of the public services, individual employers might be considering alternative employee transportation programs and social service agencies might be examining transportation options to improve delivery of their services to the general public.

With different groups and organizations concurrently conducting transportation planning activities in an urban area. The requirement of this planning effort will vary from one group to the next. However a primary purpose of each planning effort is the same in each case: to generate information useful to decision makers on the consequences of alternative transportation action. The definition of urban transportation planning used in this project will focus on this basic purpose and on the following proposition suggest:

- (1) The world moves into the future as a result of decision, not as a result of plans. Planning can only be effective if it provides useful information to those who must make decisions. It must not only provide information to those who must make decisions. It must not only provide information that is desired by decision makers, but also provide information that needed to understand fully the short and long-term consequences of alternative decision choices as well.
- (2) All decisions involve the evaluation of alternation image of the future and the selection of the most highly valued feasible alternative. Decision making thus involves two major elements: an agenda consisting of alternative images of the future with some conception of the relationship between present action and future society directions and valuation scheme which outlines preferences for the characteristics of likely decision outcomes. In this case urban transportation, this valuation scheme is often

intricately tied to societal values and goals as expressed in the political decision making process.

- (3) Evaluation and decision strategies and the quality of decision in general, depend on the degree of uncertainty associated with the items. Decisions regarding actions that will occur in the future are based on implicit and explicit assumption about the likely consequences of alternative decision options and the future state of the urban area. This is the most important due to commodity, people transferring.

### **2.11 The Urban Transportation Problem**

The urban transportation problem is actually a complex bundle of interrelated problems. They can be grouped in three major categories:

#### **(1) Congestion**

Congestion causes increased cost for travelers and freight movement, loss of time, accidents and psychosocial strain. This is simply congestion on streets and high ways, although this is the most common and simple. There is also congestion of transit vehicles during peak periods.

Congestion is what most people find objectionable about traveling in cities. It is the most common complaint. If there were no congestion, most people would be happy with their cars, and transportation would not be a widely discussed problem.

Congestion has several generic causes. The first is urbanization-the concentration of people and economic activities in urban areas. If everyone lived and worked on farms or small towns scattered over the landscape, congestion would be rare, but most people want to live in cities or suburbs, and it is efficient for most productive activities to cluster in cities.

Ironically, the main reason to locate in cities is to reduce travel. Indeed, travel distance is reduced, but the trade-off is that travel becomes slower.

The second cause is specialization within cities. People want to travel between different activities (or land uses), which are dispersed around the city. Workplaces are concentrated in some areas, living place in other areas, and recreation activities in still others. But these activities are interdependent, and people must travel between them.

The most important part of this is the separation of workplaces and homes, creating the journey to work. This became widespread with industrialization; it was uncommon earlier. In the middle ages, the usual pattern in European cities was for a building to have a shop and workroom on the first floor, kitchen and dining room on the second floor, and sleeping quarters on the upper floors. Going to work simply means going downstairs.

The third cause is the problem of matching supply and demand temporally. The supply of transportation facilities in U.S. cities is very large, but relatively fixed. Demand, however, varies greatly over the day; this is the peaking problem. It stems largely from the journey to work and the practice of having most people start and ends their workdays at about the same time.

The fourth cause of congestion is that supply often stimulates demand. Increases in transportation capacity can be self-defeating. A new highway that seems spacious when it opens may fill up with traffic in a few years. People seize opportunities to travel more; this comes with a rising standard of living. Furthermore, development is attracted to sites with superior

accessibility because of better movement facilities. In time, this advantage may decline because of congestion.

Consequently, increasing transportation supply is not sufficient to end congestion. It is also not economic. One form of transportation supply with potentially great capacity is transit service. This people-moving capacity continues to be important in large cities. This probably applies to all metropolitan areas of at least one million populations, but is most true of the older.

## (2) Mobility

The second aspect of the transportation problem is usually labeled mobility, or accessibility. Our society requires a great deal of travel, but people do not have equal abilities to travel or equal access to the transportation system.

Some form of public transportation will always be necessary. It may not be one of the forms common today. Perhaps in the future some form of Para transit will be the means used by most people who do not have a personal car.

Transportation for the disabled has been a political issue for two decades. Several million people have physical or mental problems that interfere with their travel, and how to provide transit service for such people has been a vexing question. One approach is to offer door-to-door service with taxis and vans. Another is to make all transit vehicles accessible to disabled, including those with wheelchairs.

Obviously congestion is more serious in large cities than in small ones. In smaller places, it would be physically feasible and perhaps

economically efficient, to handle all travel by automobiles (including rental vehicles and taxis). There would be some congestion, but it would be tolerable by any objective standards. No city has an ideal street system, but incremental improvements are continually made. A street system could be developed in a city of a few hundred thousand people that would handle all travel adequately.

In small cities, the primary role of transit is to provide mobility to the transportation disadvantages. This is a matter of equity more than efficiency. It reflects the view that travel is essential to human beings and that all citizens are entitled to some form of transportation service, regardless of their circumstances.

### (<sup>3</sup>) Ancillary Impacts

The ancillary impacts of the transportation system make up the third aspect of the transportation problem. A brief listing of major impacts follows:

- (a) Accident
- (b) Energy consumption and environmental Impacts
- (c) Land Consumption
- (d) Aesthetics

## **2.12 Public Transportation**

Bangkok Transportation System has been developed since 1997, which has the purpose for improvement and development for the transportation system. For the mentioned purpose, the roads increased to 1497 lines that can be devised into two types, main road and secondary road.



The main road is the road that connects the expressway or the other main road including ring road. In Bangkok, there are five major routes:

- (1) Phaholyothin Road and Viphavadi Road (Highway no. 1 and 32): - This road started from center to the north.
- (2) Ramintra Road and Rangsit Aongkaluk Road (Highway no. 304 and 305).
- (3) From center to the East we can use Sukumvit Road and Bangna Trad Road (Highway no. 3 and 34).
- (4) Rama II and Petchkasem Road (Highway Road no. 35 and 4):- This Road can be taken from center to the South.
- (5) Suphanburi-Bangbuathong Road (Highway Road no. 340) can be taken to the west.

The ring road is the road that connects urban and suburban also including the transportation from urban to suburban. This road can be classified into three lines, Khet Promprab and Khet Samphantawongse road that is the center, from the Rachadapisek through Thonburi road and the outside ring road.

For the expressway, there are many projects, which provide convenience for the passenger.

Project no. 1

This project started from Dingdaeng, Bangna Dawkanong to Taluer which the total length 27.1 kilometer.

Project no. 2

This project is linked with the project no. 1, total length 40.5 kilometers, which consisted of Bangkloe-Chaengwattana Road and Phayathai-Srinakarin Road.

#### Project no. 3

This expressway combined the east and the south part of Bangkok. The total length is 18.7 kilometers.

#### Project no. 4

The scope of this project covers Bangpain-Pakkred, which linked the Project no. 2. The first part starts from Chaengwattana road to Thammasat University (Rangsit) and the second part starts from Thammasat University (Rangsit) to Bangsai. This expressway can reduce the traffic problem on Viphavadi —Rangsit Road.

#### Project no. 5

This project started from the destination of Project no. 1 (around Bangna) to the East.

Even though the trend of transportation system at present and the trend of construction project in the future will be increased, the problems still remained as the increasing proportion of every area population is living there at least for some of time, the greatly increased proportion of economic value-added is being produced within them and the steadily increasing reliance of modern and modernizing societies on mobility and transport. The population of most sizeable towns and cities rely on a wide variety of transports public and private, motorized and non-motorized. The example that met this problem is: Lardpraw Road, Ramintra Road and New Road.

### 2.13 Sky Train Transportation System

The Sky train transportation capacity is limited to taking around 40,000-60,000 passengers per station. In Bangkok it is devised into three parts with the total length 269 kilometers.

Project 1 (Established during 1991-2002)

This project consists of three projects, Hopewell, Thanayong and Train Organization, with the total length 110 kilometers. Hopewell project cannot be finished due to economic crisis. For Thanayong Project, there are two parts, Sukhumvit (from Sukhumvit 77 to Mochit) and Silom (from National Stadium to Saphan Taksin) and the last one, Train Organization, this project is the underground train that is divided into two parts for the North and the South.

Project 2 (Established during 1995-2001)

Total length of this project is 116 kilometers. This project is the part that expands from the project 1 to new project of Sky train. It consists of four parts as follows:

- (1) The red line part, 24.9 kilometers.
- (2) The green line part which consist of four sides as follows:
  - (a) East: this part start form Sukhumvit 77 to Bangna Trad.
  - (b) North: this part start form Mo Chit to Ratchayothin. This part will be expanded from Saphan Taksin to Wong Vieng Yai
  - (c) South: This part starts from Bangna to Paknum.
- (<sup>3</sup>) The blue line part which consisted of two parts:
  - (a) The North West: This part starts from Bangsue Road To Nontaburi with the total length 11 kilometers.
  - (b) South West: This part started form Hualumpong to Rama W, Bangkok Yai, Petchkasem to the ring road.

(4) The orange line part: - This line started from Bangkapi to Saphan Rama IX.

Project 3 (Established in 2001-2011)

The project 3 has a total length 43 kilometers, which consists of the violet line and orange line.

- (1) The violet line: this line starts from Theawet to Tiwanon with a total length 21.2 kilometers.
- (2) The orange line: This part is separated into two parts.
- (3) The north part starts from Bangkapi to Meanburi
- (4) The south part starts from Suksawad.

The Sky train transportation is controlled by Bangkok Mass Transit System provided the comfort for passenger on tickets as follows:

- (1) Single-Journey Ticket: this is a pay-per-trip, which is available at any Ticket Issuing Machine, located in every station. The machines accept coins only and give change at any ticket office, located near the Ticket Issuing Machine.
- (2) Stored-Value Ticket: the value of the ticket will be deducted according to the distance of each journey, and is most suitable for regular commuters or for multiple journeys. Stored-Value tickets are available and can be refilled at any ticket office, located in every station. The ticket is valid for 2 years and has a thirty Baht deposit.

## **2.14 Land Transportation**

Nowadays the number of land transportation in Bangkok increases more than the past as the main roads such as Rama IV Road, Viphavadi Rangsit Road and Ratchadapisek Road which has the limitation area which cannot provide enough area for the car users who increased everyday.

The Traveling in Bangkok and Suburb Quality

From the amount of traveling in Bangkok and suburb areas, we can divide the travel classified by objectives as follows:

- (1) To Work: the number of this objective is 7.6 million times
- (2) To education: the amount is 3.7 million times
- (3) To other activities: the amount is 3.6 million times

The above classification showed that the main objective for traveling in Bangkok and suburb is working and education.

The amount of passengers in Bangkok and suburb in each day, classified by type and amount of vehicle.

Table 2.2. Amount of Passengers and Type of Vehicle.

The type of vehicle of family	Objective of traveling				Total amount
	HBW	HBE	HBO	NHB	
No vehicle	2,945,520	1,427,952	845,160	262,579	5,481,211
Own 1 motorcycle	1,596,194	662,352	868,408	501,760	3,628,714
Own 1 car	1,919,742	806,789	1,024,480	612,190	4,363,201
Own many cars	1,195,230	831,477	898,395	721,904	3,647,006
Total amount	7,656,686	3,728,570	3,636,443	2,098,433	17,120,132

Source: The Department of Land Transportation

The Department of Land Transportation estimates the transportation system in Bangkok and suburb is around 7.5 million times per day that is equivalent to 44 percent of total traveling. Due to the type of vehicle and objective, the group of education and no vehicle is highest.

Scatter of traveling

The Urban Transportation Database and Model Development Project of the Department of Land Transportation classifies the area of traveling as follows:

Table 2.3. Area of Traveling.

Zone	Area	District area
1.	Center of old city	Pranakorn, Pomprab and Samphantawongse
2.	West of interior city	Bangkok Noi, Bangplad, Klongsarn, Thonburi & Bangkok Yai
3.	East of interior city	Dusit, Bangkorlaem, Bangsue, Prathumwan, Phayathai, Yannawa, Rajthewe and Sathorn
4.	The joint of East	Klongtoey, Chatuchak, Don Muang, Bangkapi, Bangkhen, Bungkhum, Phakanong, Suanluang, Prawet, Huaykwang, Lard Praw and Din Daeng
5.	East of suburb	Meanburi, Lardkabung and Nongjok
6.	West of suburb	Jomthong, Talingchan, Bangkhuntien, Pasricharoen, Radburana, Tungkhu, Bangkae, Taweewattana
7.	East of Samutprakarn	Samutprakarn, Bangplee, Bangbua
8.	West of Samutprakarn	Prapradaeng, Prasamutjedee
9.	East of Nontaburi	Nontaburi, Parkkred
10.	West of Nontaburi	Nontaburi, Parkkred, Bangkrue, Bangyai, Bangbuathong & Sai Noi
11.	East of Prathumthane	Prathumthane, Samkok, Lumlukka, Thunyaburi, Klongluang & Nongsue
12.	West of Prathumthane	Prathumthane, Samkok, Lardlumkeaw
13.	Nakornprathom	Nakornprathom, Sampran, Nakornchaisri, Putthamonthon, Banglen and Khamphengsan
14.	Samutsakorn	Samutsakorn, Bangprew and Krathumban



The Urban Transportation Database and Model Development Project (UTDM) showed that the amount of traveling is related to the number of people in each area. UTDM education in 1995 explained that the total amount of People in Bangkok and suburb is 13,809,271 and employed amount is 11,451,731.

From the table, we can classify the type of business as follows:

- (1) From the first zone the fourth zone is the area that are the center of commerce and service.
- (2) In Samutprakarn, Prathumthanee and Samutsakorn, there are many industries and factories, so this area has the highest employment.
- (3) East of Nontaburi is the place that is located for commerce and service
- (4) West of Nontaburi through Nakornprathom is the agricultural area.

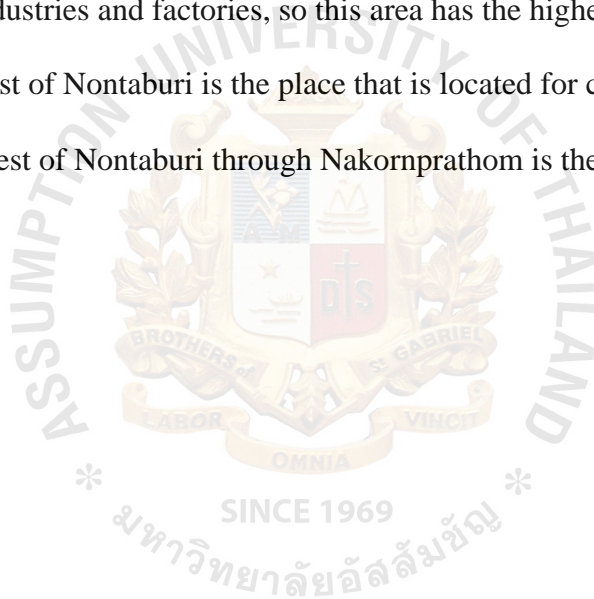


Table 2 The Amount of Scattering for Traveling in Bangkok Area and Suburb Classify by the Zone (1995).

OD Zone	Zone	Area	Population	Employment	Commercial	Industrial	Residential	Public	Private	Government	Non-Government	Total
		302,557	240,192		22,959	2,100	8,965	1,100	8,000	1,100	6,245	753,242
1	1	125,562									34,191	1,649,063
2	2	722,865									28,737	3,800,000
3	3	3,575,092										5,256,303
4	4	120,628									752	511,684
5	5	108,374										5,000,000
6	6	185,905									406	5,000,000
7	7	34,065										3,000,000
8	8	16,229										5,000,000
9	9	23,257										4,000,000
10	10	5,419										2,000,000
11	11	10,497										5,000,000
12	12	880										872,843
13	13	880										487,002
TOTAL		1,200,780	4,208,891	502,000	902,521	397,989	479,576	685,365	349,216	880,000	595,463	18,405,221

The Transportation Database and Model Development Project of Department of Land Transportation (estimated in December

The number of traveling in Bangkok and suburb in 1996 is 18,407,221 times per day that is equivalent to 60 percent of the traveling between zones. The most number of traveling is zone 4, which has 5,256,303 times per day. The distribution of traveling in each zone is as follows:

#### Zone 1 (The center of old city)

This zone is the smallest area, 8.4607 kilometers, which consisted of three districts, Phanakorn, Pomprab and Samphanthawongse. These areas have high number of traveling that is equivalent to 40.2 percent.

#### Zone 2 (The West of city)

The total area in this zone is 40.2409 kilometers and the population is 1,043,322. The number of outgoing traveling for this area is 1,651,063 and the incoming from other places is 1,200,780 trips.

#### Zone 3 (The East of city)

This zone consists of nine districts that have a total area of 78.8022 kilometers and the number of outgoing traveling is 3,807,182 times per day and the number of incoming traveling is 4,208,891 trips.

#### Zone 4 (The connection area of West)

Population in this area is crowded that brings to the outgoing traveling increased to 5,256,303 and 5,224,641 times per day. The incoming traveling amount is close to the outgoing. This reason shows the balance of employment area and accommodation area.

#### Zone 5 (The East of suburb)

Almost all traveling is the traveling between near zone. The incoming traveling numbers are 515,951 trips per day.

#### Zone 6 (The West of suburb)

The number of population is the third and the employment number is 8,068,097 people. The starting trip is around 1,996,197 trips per day. Even though, there is the highest employment ratio it does not mean that all of them live in this area.

#### Zone 7 (The East of Samutprakarn Province)

The starting traveling number is 946,951 trips per day that is divided into two types, within zone and outside zone. The incoming traveling in this area is 300,102 trips per day. This area is balancing the accommodation and the employment.

#### Zone 8 (The West of Samutprakarn Province)

The number of traveling within the zone is around 241,723 trips per day (53.8%). The Number of traveling out from this area is around 399,168 trips per day. Most of the travelers will travel to Zone 3-4 and 8. The number of the travelers from other zones is around 183,266 trips per day. There are around 183,266 (50.7%) trips per day who travel from Zone 4, 6 and 7.

#### Zone 9 (The East of Nontaburi Province)

There are around 642 trips per day which is 44.4% of the number of traveling within the zone for traveling to other zones such as Zone 3-4 and Zone 10-11. The number of traveling to the connecting area is around 262,623 trips per day (76.35%). The number of travelers from other zones is around 204,905 trips per day that are from Zone 3-4 and 10.

#### Zone 10 (The West side of Nontaburi Province)

The number of the traveling which started from this area is around 648,642 trips per day, of which the number of 43.2% is traveling within the zone and the rest are traveling to Zone 3, 6 and Zone 13. The number of traveling to Zone 4, the connecting area, is around 107,225 trips per day (50.5%). The number of traveling from other

zones is around 187,757 trips per day, from Zone 2-3 and 6 is around 79,341 trips per day (84.5%)

#### Zone 11 (The East of Pathumtani Province)

The number of the traveling which started from this area is around 590,597 trips per day, of which the number 67.7% is traveling within the zone and the rest are traveling to Zone 3-5 and Zone 12. The numbers of traveling between the connection areas are around 144,381 trips per day (75.76%) and from others zones are 285,337 trips per day, which are from Zone 3-4 and Zone 9, which equals to 229,311 trips per days (80.4%).

#### Zone 12 (The West of Pathumtani Province)

The number of the traveling which started from this area is around 142,546 trips per day, of which the number 53.4% is traveling within the zone and the rest are traveling to Zone 4 and Zone 10-11. The numbers of traveling between the connection areas are around 42,056 trips per day (63.3%) and from others zones are 96,454 trips per day, which are from Zone 4, 9 and Zone 11 which equal to 61,950 trips per days (64.2%).

#### Zone 13 (Nakornpatum Province)

The number of the traveling which started from this area is around 872,843 trips per day, of which the number of 85.4% is traveling within the zone and the rest are traveling to Zone 6, 10 and Zone 14. The numbers of traveling between the connection areas are around 97,113 trips per day (76.5%) and from others zones are 243,695 trips per day, which are from Zone 6,10 and Zone 14 which equal to 132,511 trips per days (54.4%).

Zone 14 (Samutprakarn Province)

The number of the traveling which started from this area is around 487,002 trips per day, of which the number 70.1% is traveling within the zone and the rest are traveling to Zone 3, 6 and Zone 13. The numbers of traveling between the connection areas are around 120,640 trips per day (83%) and from others zones are 254,136 trips per day, which are from Zone 2, 6 and Zone 13 which equal to 177,627 trips per days (69.9%).





Table 2.5. Area, Population, Employment and Size of Transportation within and Outside Traffic Zone in Bangkok and Urban in 1996.

Zone	Area (Kms)	Population (Person)	Employment (Person)	Intra zone (Trips/day)	Ratio %	Inter zone (Trips/day)	Ratio %
1	8.4607	378,552	309,806	302,557	40.2	450,685	59.8
2	40.2409	1,043,332	329,251	607,628	36.8	1,043,435	63.2
3	78.8022	2,024,782	1,270,171	2,285,233	60	1,521,949	40
4	476.4335	2,952,016	1,629,608	3,575,092	68	1,681,211	32
5	547.5951	402,770	190,943	288,777	56.4	222,907	43.6
6	419.7915	1,324,670	608,539	1,147,100	57.5	849,097	42.5
7	756.5292	703,603	462,500	602,419	63.6	344,532	36.4
8	251.4895	279,191	198,541	214,723	53.8	184,445	46.2
9	117.6641	395,106	152,088	274,651	44.4	343,991	55.6
10	523.228	273,820	126,771	161,459	43.2	212,342	56.8
11	1154.8192	470,953	298,266	400,028	67.7	190,569	32.3
12	341.9672	113,330	65,578	76,111	53.4	66,435	46.6
13	2142.701	721,917	411,091	745,813	85.4	127,030	14.6
14	872.96	367,689	296,560	341,327	70.1	145,675	29.9
Total	7732.6821	11,451,731	6,349,713	11,022,918	59.9	7,384,303	40.1

Source: The Transportation Database and Model Development Project of Department of Land Transportation in 1995.

In conclusion the major groups of the journey, within Bangkok and the urban area, are from Samutprakarn Province in Muang District, Bangplee District. The minor

groups are from Nontaburi Province in Muang District and Pakkred District and from Pathumtani Province from Khong Luang District, Tunyaburi District and Lumlukka District. For the major groups, which journey to outside Bangkok are going to Muang District and Bangplee District, Samutprakarn Province. The minor groups are going to Muang District and Pakkred District, Nontaburi Province and Bangbuathong District in Pathumtani Province.

## **2.15 Types of Transportation**

Type of transportation, within Bangkok and urban, can be divided in to three groups as follows:

### **(1) Private transportation**

Bangkok is faced with the traffic problem due to the number of cars registered increasing very rapidly. The Statistic of The Department of Land Transportation Department found that in 1992, the number of cars registered in Bangkok was 2,373,288 cars and increased to 3,549,803 cars in 1996 or equal to 6.63 % for each year. Type of transportation registered can be divided into for motorcycles 1,527,834 followed by the number of private cars, which the number of seated not exceeding 7 seats, were 1,026,233. The numbers of pick up cars were 482,803. From the mentioned number can be calculated in ratio as follows 43:29:13. The numbers of public vehicles were 215,632 or just only 15% of the overall transportation. For the buses, the important transportation for Bangkokian, had the number of percentage only 0.7 and the growth were only 1.02 % per year.

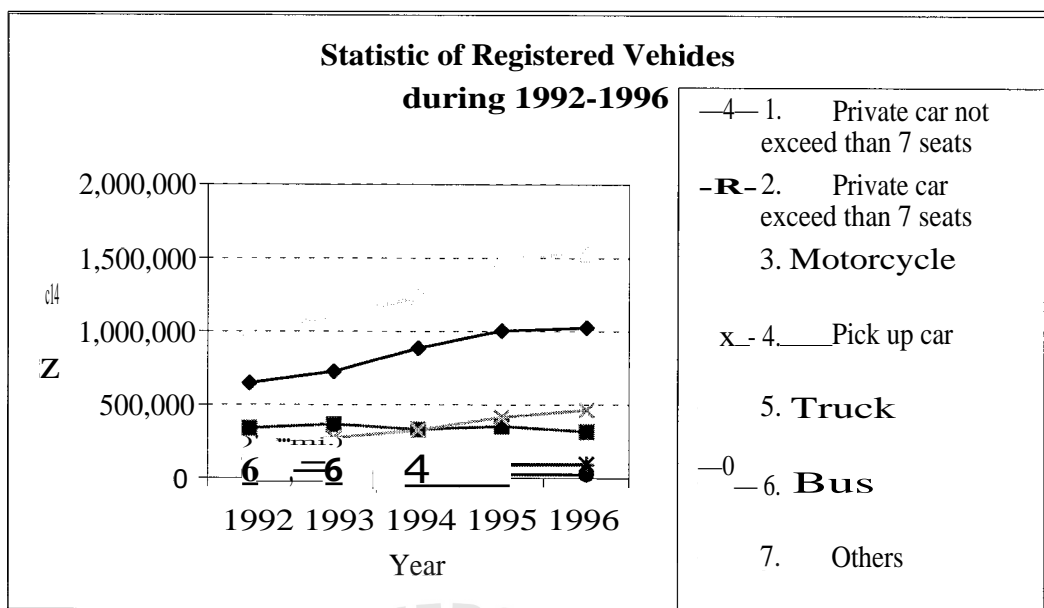
The major reasons of increasing the private car are from the problem of traffic jam and the demand of using buses is higher than the number of buses. From the research found that the number of people who would like

to use the public transportation is around 8.1 million people a day or around 60.4% of overall demand. Thus, using private car is another choice for the people who have medium to high income.

Table 2.6. Number of Cars Registered in Bangkok.

Type of vehicle registered	Number					Growth Ratio
	1992	1993	1994	1995	1996	
1. Private car not exceed than 7 seats	649,663	727,054	886,446	1,003,852	1,026,233	7.34
2. Private car exceed than 7 seats	338,336	364,782	328,481	351,689	316,580	-1.37
3. Motorcycle	1,006,302	1,105,084	1,233,503	1,491,226	1,527,834	6.83
4. Pick up car	217,336	272,190	323,902	415,286	462,803	10.61
5. Truck	84,328	90,349	83,250	96,332	98,234	2.83
6. Bus	23,394	24,074	13,888	26,312	24,647	1.02
7. Others	53,929	72,574	93,573	89,935	92,751	8.37
Total	2,373,288	2,656,107	2,963,043	3,474,632	3,549,082	6.63

The samples that support the reasons of using the private car could offer are the smooth, efficiency and comfort and the Door-to-Door such as able to park at home or near the home, able to park near the destination point. The increase of private cars brings the problem of crowded vehicles on the road. At the same time the growths of public utility does not conform to the number of vehicles. If compared to the areas of road in Bangkok that is around 38.4 Kilometers to the Bangkok area. The percentage of road is only 2.45 of the city area, which is less than the standard of the big cities. The standard percentages of road should be 15-20 to the city.



Source: Transportation Statistic Section, The Department of Land Transportation, The Ministry of Transport and Communication during 1992 — 1996.

Figure 2.1. The Statistic of Registered Vehicle during 1992 — 1996.

## (2) Public Transportation

There are many types of public transportation that is offered in Bangkok such as ship, train and bus. The public transport has the fixed route and schedule. The services from the beginning to the destination are quite low. The passengers have to travel from their home to station, pier or bus stop.

### 2.16 The Public Transport in Bangkok

#### (1) Boat

The water transport still has the important role and still could response to the needs of Bangkokian especially for the people who live near the Chaopraya River. Types of boat can be divided as follows:

- (a) Express boat: - offer the traveling from urban to Bangkok area through Chaopraya River. There are 52 piers, for the North starting from Pakkred District, Nontaburi to Tok Road, Bangkok. The numbers of passengers in 1992 were around 84,700 passengers per weekday and 40,300 passengers per weekend day.
- (b) Ferry boat: - for the short journey from one bank to the opposite bank of Chaopraya River. There are 52 piers. This type of boat is the most popular. The Popular piers are Nontaburi Pier to Sukhapibansrimuang Pier, Petra Pier to Prapadang Pier, Sipraya Pier to Khongsarn Pier.
- (c) Hang-Yao Boat (Long tailed boat): - the journey is from urban to Bangkok area. There are 5 routes as follows: - Khong Sansap, Khong Ladproud, Khong Prakanong, Khong Pradungkrungkasem, and Khong Pasicharoen. For route of Khong Sansap and Khong Ladproud, the average of the passengers are around 62,200 and 25,300.

The water transport between Bangkok and urban support the demands of passengers but the weak point is it could not link to land transportation.

## (2) Train

The train transportation is the service between the urban areas to Bangkok area. The major stations in the North of Bangkok are Hua-lum-pong station, Samsen Station, Bangsue Station, Bangkhen Station, Donmuang Station and Rangsit Station. The route to urban area does not exceed 150 Kilometers.

There are 4 main routes as follows:

- (a) The North route starting from Bangkok to Lopburi
- (b) The East route starting from Bangkok to Prachineburi

- (c) The South route starting from Bangkok to Rajchaburi
- (d) The station from Wong-wien Yai to Mahachai

The popular route is the North route from Hua-lum-pong Station to Donmuang Station.

The average number of the passengers who travel from urban to Bangkok is around 97,800 passengers per day or equal to 25% of the total number of the passengers who travel by train. The reasons that passengers choose the train as another choice of vehicle are fixed schedule, low price and able to reach the center of Bangkok. The weak point is it could not cover all the area in Bangkok.

### (3) Bus

The bus service could cover the service area much more than other types of public transportation. The services could cover all the areas in Bangkok and some parts of Nontaburi province, Pathumtani province, Nakornpathom province, Samutprakarn province and Samutsakorn province. In 1992 there were 393 routes of the services. There were 155 routes serviced by The Bangkok Mass Transit Authority, which had the number of buses around 4,624 buses. There were 238 routes serviced by private sector, which had 6,843 buses.

The network of the route can be divided into the Northern, the Eastern, the Western and the Southern part of Bangkok. The service routes may overlap to others routes.

Routes of buses can be divided into 4 groups as follows:

- (a) The routes that have the starting point or destination within the town center, which consist of 72 routes.



- (b) The routes that have the starting point or destination outside town center, which consist of 88 routes.
- (c) The routes that get through the center, which have the starting point and the destination outside the center, which consist of 17 routes.
- (d) The cycle routes that have the starting point and the destination at the same station, which consist of 8 routes.

Most of the routes cover the north area of Bangkok. The services are crowded in the center and the number of services is reduced when covered the urban area. The reasons that most of the services are cover in the town center are because education areas, financial businesses and center of commercial are located in the town center. The major bus stops in Bangkok are the area of Monument, Sanamluang and Wong-wien Yai.

Compared to others type public transportation, it is found that the problem of traveling by buses waste time on traveling, on waiting, the overlapping of the route, inconvenient and uncomfortable due the traffic jam. These problems could not eliminate even the Government using the Bus Lanes or other special offer for the passengers who travel on the bus.

#### (4) Para Transit

The Pam transit in Bangkok can be divided as follows:

##### (a) **Taxi**

It is the Para transit that is able to respond to the needs of the passengers. There are 2 types of arranging the fare. Firstly, the fare that is negotiated between the passenger and the driver, which depends on the distance and the crowded uses of the traffic. Secondly, the fare that related to the meter. Normally traveling by taxi is more

expensive than other types of transportation but it offers the comfort, rapid, more private and able to travel from the starting point to the destination.

The weak points of taxi are most of the service areas covered only the town center and not for the long distance journey because it is too expensive.

(b) Hired Mini 4 wheels

There are around 8,483 of hired mini 4 wheels which the services covered only some areas such as big residential areas and the industrial areas. Normally it will service only the short journey, the fare is about 3-5 Baht and have to wait until the car is full.

(c) Tricycle (Tuk-Tuk)

There are around 7,406 Tuk-Tuk in Bangkok. The service is similar to taxi. The Government will control the number of Tuk-Tuk not to exceed 8,000 Tuk-Tuk. The management of the Tuk-Tuk is in the form of cooperative. The fare depends on the negotiation between the driver and the passenger. Normally, Tuk-Tuk will service only within the center of Bangkok.

(d) Hired-Motorcycle

The starting of the hired motorcycle just appeared in Bangkok not so long ago, due to the heavy traffic in Bangkok and the passengers' need to travel to the destination as quick as possible. Normally, the motorcycle will park near the alley or the main road that connects the minor road. The service is similar to taxi and Tuk-Tuk, the route depends on the negotiation between the driver and the

passenger. The fare depends on the distance, which normally around 5-10 Baht. The weak point is the safety.

(e) **Van**

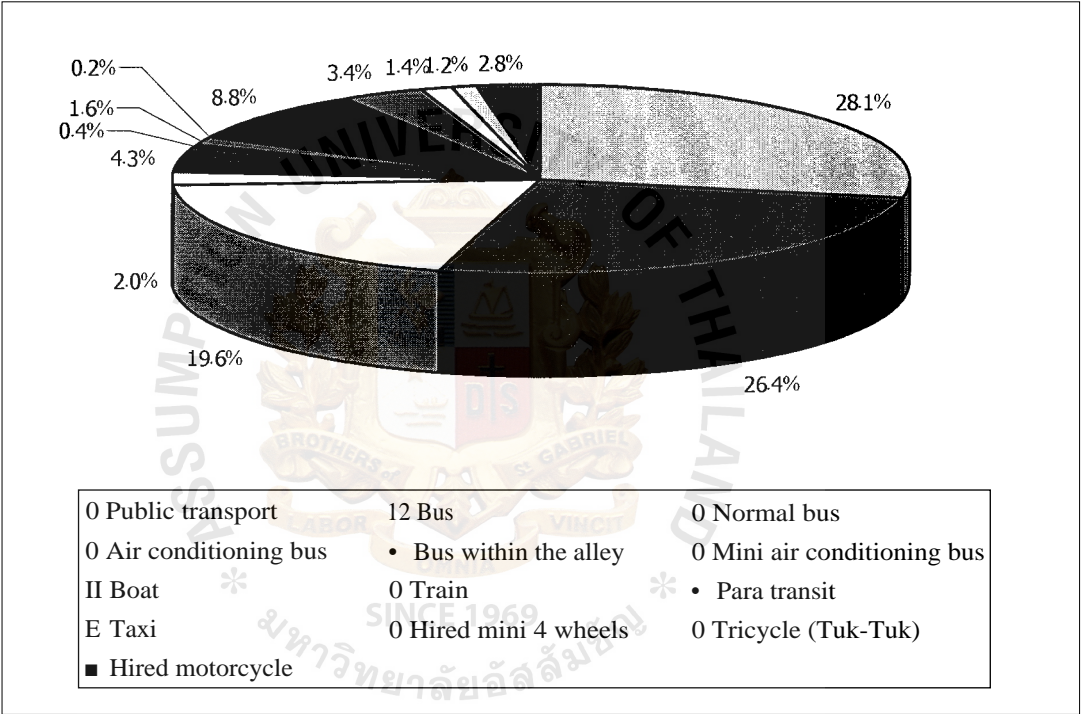
Today there are 116 routes of van service, which includes 2,980 vans (The Bangkok Mass Transit Authority), the service started since 1992. The routes of the service are fixed and also have the station or van stops like bus stops. Normally, they serve the long journey and use the expressway for saving time of traveling. One van can carry 11-14 passengers and does not allow passengers to stand during the journey. The numbers of the passengers are around 6,990,000 passengers or around 72% of all public transportation passengers.

Table 2.7. Percentage of Passengers for Each Type of Public Transportation.

Type	Number of passengers (x 1,000)	Percentage
Public transport	7,442	76.2
Bus	6,990	71.6
Normal bus	5,200	53.2
Air conditioning bus	540	5.5
Bus within the alley	1,150	11.8
Mini air conditioning bus	100	1.0
Boat	412	4.2
Train	40	0.4
Para transit	2,325	23.8
Taxi	900	9.2
Hired mini 4 wheels	360	3.7

Table 2.7. Percentage of Passengers for Each Type of Public Transportation.  
(Continued)

Type	Number of passengers (x 1,000)	Percentage
Tricycle (Tuk-Tuk)	330	3.4
Hired motorcycle	735	7.5
Total	9,767	100



Source: "The project of studying the public transport" by Land Transport Council in 1995, pp. 2-15.

Figure 2.2. Percentage of Passengers for Each Type of Public Transportation.

The routes of services cover most of the area in Bangkok and the nearby provinces much more than other types of public transportation. The research of the Committee of

Land Transport Council management of Bangkok in 1995 the ratio of traveling by public transportation is 45% and another 55% is the private transportation. The number of passengers who use the public transportation is around 9.77 million passengers. The number of passengers who travel by buses is 6.99 passengers or 72% of the public transportation passengers. Meanwhile the Bangkok Mass Transit Authority could support the service around 3.3 million passengers per day or 47.8% of the overall demands on using buses. That means the number of the demands are higher than the supply. There were 11,578 buses in 1995, which is divided into 2,249 Air conditioning buses and 9,329 normal buses. The service routes have 219 service lines.

The Para transit could carry around 2,325,000 passengers per day or 24% of all passengers. This figure does not include the van transportation.

The Public transport and the Para transit that serve Bangkok and nearby provinces will have difference roles. The decision making of the passengers are based on the individual objective including the attitude.

Gary & Hoel (1987: 135) recommended the good characteristic of the public transport or SCARCE should consist of:

- (1) Safety: - such as safety from accident, from crime, the hazard from the engine, etc.
- (2) Comfortable: - the seat should be well organized, easy to enter and exit, lack of noise and air pollution, etc.
- (3) Accessibility: - able to cover all areas, provide sufficient number of bus, able to reach the destination as much as possible
- (4) Reliability: - have the fully response to the needs of passengers such as provide the service for the whole day and extend the service time in case

that area still have a lot of passenger, provide the short waiting time of the passengers.

- (5) Cost: - reasonable fare, offer the special right for disabled people, elderly people, etc.
- (6) Efficiency: - high speed, etc.

The following table is summarized the services of the transportation in Bangkok by using the above characteristics.

Table 2.7. Compare the Characteristic of Transportation in Bangkok.

Type of transport	Safety	Comfortable	Accessibility	Reliability	Cost	Efficiency
Private						
1. Private car	O	O	O	O	X	O
Public						
2. Bus	X	X	X	X	O	X
3. Boat	X	O	X	X	O	X
4. Train	O	O	X	O	O	X
5. Song-Taew	O	X	X	X	X	X
Para transit						
6. Taxi						
7. Hired Motorcy cle	X	O	O	O	X	O
	X	X	O	O	X	O
8. Van	X	O	X	X	X	O

Remark: - O = Satisfied                      X = Unsatisfied



From the comparison of the characteristic of each transport type found that the Para transit gained more satisfaction than the Public transit

### **2.17 Conclusion of Public Transportation**

Bangkok has rapid development which also brings the development of public utility. The growth of population and the development of economy bring the growth of the city. Some residential areas have changed to office buildings and some agriculture areas have changed to residential areas. Thus, the center of Bangkok is the center of employment. The rapid change brings the imbalance of public utility. The Government has to invest a lot on the expansion of the public utilities especially for the public transportation. Nowadays, the public transportations are still unqualified and have not enough transports to support the passengers' needs. All these reasons bring the new type of transportation, which is managed privately such as Micro Bus, Vans, etc. which offer more routes and more efficiency.

### III. RESEARCH METHODOLOGY

Today, there are many types of public transportation services which are provided by Government sector and private sector. Most passengers are familiar with the transportation provided by Government such as bus, air-condition bus because of the low cost. The public van is the new service that is provided by private sector. At the beginning, the numbers of the passengers who travel with the public van are still low because the costs are quite expensive when compared with buses or air condition bus. Today the numbers of the passengers who travel with public van are getting high due to convenience and the speed that they can provide.

In this project, we will focus on the public van service. The purposes are to improve the services and the security. Today the computer technology is helpful and not costly. Thus, the computer technology will be selected to improve the public van service to be more efficient. The computer system will be kept in the database of the public van, the owners and the drivers. In case the passengers or anyone who queries to know any data about the public vans, they can search from the database.

Nowadays most of the public vans are under the control of private sectors. Thus, the services that are provided may be not good enough. Sometime when passengers complaint about the services, it is quite difficult to search for the detail about that public van. The public van owners may face the problem of controlling them under the illegal rule and have to pay money to the gangster. Thus, after using the public van, this method can eliminate the mentioned problems. When the public van registers with the Control Center, the Control Center will keep the data in the database and manage the service route to meet the demand of the passengers.

Before creating the system to control the public van, all the data about the services transportation will be kept to analyze the present services. The reason is to collect the data apart from the public van to compare the benefit of the public van and other types of public transport.

First of all we have to understand the overall of the transportation services. After the process of gathering the data and analyze the service are done, the outcome will be the new system to make the public van to provide more efficient services. The information of the transportation can be searched from the theories and the meaning from books, related documents and research by emphasis on type of trips. The characteristic and factors of Para transit behaviors are collected from the passengers who travel by Para transit including the way to make the decision of selecting the type of Para transit services. Furthermore, the information is also gathered from the Para transit of others countries in order to analyze the conditions and the factors for van transportation in Bangkok. The areas of the passengers are covered in Bangkok and nearby urban areas.

Some data are collected by surveying the demands of van passenger by using the questionnaires. The questionnaires will evaluate the potential and comparison for each area for analyzing behavior and attitude of passenger.

After processing and analyzing, we conclude the study phase of factors and conditions that caused the van transportation. Then we will recommend the regulations and the services to improve the public van services.

Research methodologies are varied, the majority using some form of correlation and multiple regression analysis to test the relationship between changes in accessibility and changes in other variables such as trip rates (the number of trips per unit time), the area under cultivation with using recent technological innovations, vehicle ownership

and household incomes. This kind of methodology has its limitations, being dependent on many estimated values (whether by respondents or researchers), omitting many wider social values which frequently lead researchers unjustifiably to infer causation from statistical association.

Nowadays, most of the public van services have been run predominantly by the private sector. Sometimes they have held an effective monopoly and in other places there has been competition between public and private operators, although frequently not on even terms as a result of subsidies or other advantages. Several studies have shown that public van operations provide generally more efficient and sometimes cheaper services, with quicker turnarounds and less overstaffing.

The aim of this project is to control the current public van and set the regulations. The point is that, while careful liberalization and/or privatization in accordance with local conditions may well lead to improved performance and better overall public transport system.

#### IV. PUBLIC VAN TRANSPORTATION

Van is a vehicle, of middle size that is developed from the traveling car and the public car that travel between other provinces. Nowadays the van transportation is the one important kind of public transportation, which is well known and popular in Bangkok and suburb an area.

##### The Characteristic of Van Transportation

The van is the middle transportation that can contain passengers around seven to fifteen seats and also can access all areas like the private cars. Up to today the van is taken for traveling from one place to the other places especially form suburb to the city. The van transportation service is similar to the bus service such as the starting point, the destination and correct lines. For the lifetime of van transportation is quite different by starting from one year to six years and price of van ranges from 150,000.00 Bahts to 720,000.00 Bahts, which depends on the lifetime. The model of van, which is popular, is NISSAN, TOYOTA and ISUZU. In Thailand, van transportation is the Para transit, which is the support system for public transportation system.

##### The Types of Van Transportation

There are many types of van transportation such as the van that service between Bangkok and the nearest province that looks like the public transportation service provided by the Transport Company Limited and the van transportation service between the city and suburb. Nowadays this transportation is very well known and popular as they can provide the demand of passenger in Bangkok and suburb very well.

#### **4.1 Development of Van Transportation**

The van transportation services in the city are developed from the public vans servicing between the other provinces such as Nakornnayok, Uthaitanee, Ayudhaya and Nakomrajsrima that provided service for fifteen to twenty years. For this service, it has provided since 1992 by the van in the Pata Department Store, Pinkrao branch.

The van transportation in Bangkok is developed from the student van service in the morning and evening. In the mid day, this transportation will provide service from University of Thai Chamber of Commerce to other department stores. From this reason, the number of van transportation increases as they can provide the demand of passengers very well.

#### **4.2 Management of Van Transportation**

The management for this transportation at present looks like the management for public motorcycle transportation service that is called "win" that means the group of van drivers. There is one win for servicing in each of route by controlling the transportation fees and releasing each van by sequence. Each win has to absorb the official fees. From the interview Mr. Ramet, Lardpraw-Tanumnon win July 11, 2001, all vans owners are drivers who can support car maintenance.

The van driver transportation that joins with the van owner has to absorb expense, 20,000.00 Bahts to 100,000.00 Bahts, for van number that can be passed to other drivers. If the demand for this transportation in the route is high, the van number fees will also increase. At the month end, van owner has to absorb expense, which is around 2,000.00 Bahts to 4,000.00 Bahts per van including the petroleum expense. Even though, the car owner has to absorb high expense they are still willing to pay because the service without win cannot be provided for passenger.



The type of route will start with appropriate route. The van owner still provides service if they get benefit.

#### **4.3 The Typical of Service for Van Transportation**

The route of van transportation in Bangkok in 1998 is 116, which has different types of service as follows:

- (1) Van transportation route via the express way

For this route, the van stop will be located near the expressway, which has total routes of 41 that is equivalent to 36 percent of total routes.

- (2) Van transportation route not via the expressway

The van stop is the same place as the bus with the total route of 75 that is equivalent to 64 percents.

Normally the van transportation service will be provided for all day but there are a few routes that will provide in the rush hour during the morning and the evening because of the demand of traveling at that time has high volumes especially suburbs and business areas such as Silom road and Sathorn road. Most passengers journey from urban to work in center of Bangkok. Thus, there are around 2-4 trips a day for the routes that services between urban and center of Bangkok such as Silom-Bangna, Silom-Ramintra and Monument-Big C Changwattana, etc. The service hours are during 6:00 — 9:00 am and 15:00 — 19:00 pm.

#### 4.4 The Advantage of Van Transportation

Normally the services will be provided during the specific hours but the routes from departure to destination may be varied. In case there is a traffic jam, the driver will change the route by using short cut or others to arrive the destination as fast as possible.

##### To Assign the Departure and the Destination of the Service

The crowded areas are the target group of the public vans service by carrying numbers of passengers from the urban residence areas to the department store, commercial areas, schools, etc. Most of the passengers are working people or students. Normally, one or two public vans will park around the department store, in the parking lot of the department store, petrol station, bus stop, etc. The van terminals are alleys, or rented the parking lots from the private sector, parking lot of the department store, the area beneath the expressway, etc.

##### Ability of Public Van Transportation

For the frequency of releasing the public van from the departure terminal to destination is based on the number of passengers. If that van is full of passengers, then the public van will start immediately. Normally it takes around 5-30 minutes for the full passengers. Sometime the vans may be released from the terminal every 3-5 minutes and pick up the passengers during the route.

Normally one van consists of 3-4 rows, which can take **11-14** passengers and 2 more seats beside the driver.

The distances of the service depend on the routes. The shortest route is from Central Department Store, Lardpraw Branch to Rama sixth Road 7 Kilometers. The longest route is from Talad Khong 16 to Bangapi (Flat 21), which is 80 Kilometers. The average distance is 24 Kilometers.

## To Arrange the Route of Public Van

Due to Public vans being informal services, the owners can set the routes as they like. At the beginning the owner or the driver will try the target route and adapt to serve the majority demands of the passengers. Normally the service route is the connection between the urban and the center of Bangkok.

Public vans influence the life style of the passengers who travel among urban and Bangkok. The routes change very quickly as the Government does not issue the law on this matter. In July 1997 there were 44 routes, the numbers of public vans were around 1,000 vans with 40,000 passengers per day. There were 8 — 10 trips per day. The fare was around 10 — 30 Bahts. The survey of the Bangkok Mass Transit Authority in 1998, found that the numbers of vans increased to 116 routes with 2,980 public vans. There were 250,000 passengers per day. There were 2 — 15 trips per day depending upon the number of the passengers, routes and the numbers of servicing public vans. The fare was 10 — 50 Bahts. The estimated revenue from the public vans was around 3.554 million Bahts per day. Within one year, the routes increase to 69 routes and the numbers of public vans increased to 1,830 vans. The number of passengers increased to 150,000 passengers. Thus, the public vans expand very rapidly and were very popular. The reasons public vans become the new choice of transportation is because the center of working, studying and most of the commercial business are still located in the center at the same time the residence area moved to urban areas. The Government could not arrange enough the public utility.

The survey of the Bangkok Mass Transit Authority in 1998 found that the number of routes was 116 routes of which 80% of the whole routes overlap the bus service routes. Twenty percent were the new routes. It means that the origins of the public van routes were based on bus service routes.

The 116 routes found that they cover almost all areas of Bangkok and urban. Normally, the public vans will service the vehicle connecting point, community, market, village, etc., as the public vans are illegal and the service route overlap the route of buses.

Node of the city means center or the activity area such as bus terminal, market, or any connection place to other type of transport and normally the public vans will park near that location such as in front of the department store, etc.

Divide the route by using direction it can be divided into 2 groups; North and South of Bangkok. 1998 found that the North of Bangkok consisted of 54 service routes with 1,507 public vans or 51% of all routes. There were 10,404 trips a day, which could take 145,656 passengers a day. The major station or van stop was Victory Monument.

There were 62 routes servicing the South of Bangkok with 1,473 public vans or 49% of all routes. There were 7,406 trips a day, which can take 103,684 passengers a day. The major station or van stop was Pin-Kraw Road.

The expansion of the routes will be based on the city expansion based on the major roads such as Vipavadee-Rangsit Road, Changwattana Road, Ngamwongwarn Road, Paholyothin Road, Ramindra Road, Lardpraw Road, Bangna Road, Rama H Road, Petchkaseam Road and Prapradang Road.

The transit points are located around the changing point to buses, department stores area, market, bus terminal and commercial areas, etc.

#### **4.5 Public Van Servicing Period**

Servicing period of public van in each win is similar in starting at 5.30 am. to 11.00 pm. everyday. Normally public vans will be provided service around eight to fifteen times per day. Some of public vans emphasize servicing on Monday to Saturday

or beginning period for semester such as the route from Lardpraw to Thammasat University (Rangsit Campus) and the route from Lardpraw to Bangkok University. For the route that is not popular and have a few passengers, the public van will provide service in period 5.30 am. to 9.00 am., 3.00 pm. to 9.00 pm. and rush hour. In the morning, the passengers have to work in the city by using the public van. In mid day almost all public vans will park until evening to take the passenger from the city to urban area. These routes where the public van provided service is the expressway so they cannot be take the passenger during the way. In the leisure time, almost all public vans will become travel car for touring to other provinces.

The fee and commission of public van is standard by fixing around 10 Baht to 50 Baht that depends on the distance and the type of route such as the route using the expressway will become 20 Baht to 30 Baht instead of 10 Baht to 20 Baht. However, the fee and commission for van transportation will increase to 40 Baht to 50 Baht if they use the expressway and have long distance.

#### Comparison between the Bus Route and Van Route

The comparison of growth for bus and van shows that the number of van route has increased 163.6 percent and the bus route only 2.68 percent. The number of passengers who use the bus tends growth of 0.52 percent. On the other hand the number of van growth is 400 percent (Table 4.1). Until now, the public bus transportation is the main typical service that is essential for the city and suburban passenger. The rapid increase of the figure can show the inefficiency of public bus and the demand of public transportation, which still remains.

Table 4.1. Route, Number and Ratio of Public Bus and Van.

Route	Van			Bus	
	Cost	Time	Number	Cost	Time
Lardpraw- Nontaburi	12	0.30-0.45	63	3.5	No record
Victory Monument-Future park (Rangsit)	20	0.30-0.45	Por Aor 4, Por Aor 44	16,18	No record
Victory Monument- Pakkred	20	0.30-0.45	Por Aor 24	16	No record
Ngamwongsewarn -Ramkhamkeng	17	0.45-1.15	--	--	No record
Meanburi- Ngamwongwarn	20	1.00-1.30	--	--	No record
Meanburi- Rangsit	20	1.00-1.30	--	--	No record
Meanburi- Bangkhen	15	0.30-0.45	26	3.5	No record

Source: The interview with the van driver in July 11, 2001.

The Bangkok Mass Transit Authority in 2000.

The bus route has expanded from the city zone to suburban zone providing some convenience to passengers. In the present, there is the expanding of accommodation,



commercial, industrial and government offices to the suburbs, which leads to the public transportation public increases.

The research of Committee of Land Transport Council (1998) said that the route of public bus overlaps such as Phahonyothin Road where there are 19 buses on this route, Petchburi and Rajpralop where there are 14 buses, Taksin Road and Rama I Road 11 buses. The Bangkok Mass Transit Authority is the organization that met many problems from the overlap route, which does not meet the break-even point including the efficient bus transportations.

A number of public buses are crowded in the city from start to destination and covered most of the area in Bangkok and urban. The number of van transportation is crowded in the connection point that is the starting point and end point. The van connection points expanded to urban in many directions that are follows:

West: - the connection point starts at Salaya district, Nakornprathom, Bangbuathong district, Nonthaburi and Muang district, Samutsakorn

North: - the connection point is at Lumlukka district, Prathumthanee

East: the connection is at Bangplee district

South: - It starts at Prapradaeng district, Samutprakarn

The van transportation used the main road and the expressway to reduce the time and emphasize in servicing. The Public vans do not necessarily to pick up the passenger in every van stop if all seats are occupied. On the other hand the public bus have to pick up the passenger in every bus stop.

Almost all public bus routes are expanded according to the expansion of city where there are the connection points in Victory Monument, Wongweinyai and Sanamluang. For the starting point and destination of public bus is not crowded like the van transportation so the number of bus stops is much more than the number of van

stops. That is the welfare that is organized by government to provide service for all passengers. The private organization emphasizes the number of passengers who use the van transportation in specified routes to gain maximized profit. If the number of service demand is less than the standard, the owner or private organization will eliminate that route because there are no budgets for support from government.

#### The Characteristic of Travel for Van Transportation

#### The Selection of Sampling

The research of the factor which effects the characteristic of travel by van in the north of Bangkok has the main objective for studying the behavior of passengers to adjust into the new transportation model by using the survey research. This research has the objective to set the behavior factor and attitude that affects the travel by fixing the route and passenger sampling within the education area. This method is used for analyzing the factor that affects the management and improvement of routes in future.

### **4.6 The Specification Number of Route and the Number of Sampling**

#### The Division of Route Number

The specification of route and sampling from the target group is the passenger who uses the van transportation in the north of Bangkok and urban area by setting the starting area from Victory Monument that is the large van stop and connection point with the other vehicles. The public van transportation provided service to the north by using Paholyothin Road and Vipavadee Rangsit Road. These are the sampling van stops in Bangkok which consist of:

##### (1) Victory Monument

This point is the center, which can connect the other places easily by using three main routes, Phayathai Road, Radvithee Road and Paholyothin

Road, taken to the North and Northeast. This area is the complete point because

There are many buses, which pass around 45 lines and the station of Sky train.

(2) The Central Department store (Lardpraw Branch)

This area covers Mochit bus terminal where the van stop for two areas is quite near. There are two main routes, Paholyothin road and Vipavadee Rangsit road, taken to the north and northeast including can connect to the inside area such as Bangkapi, Bangkhen and Lardpraw and the outside area such as Laksi, Donmuang, Pakkred by using the first and second step of express way, toll way and ring road. This area that consists of the commercial area and office building such as The Petroleum Thailand Public Co., Ltd., Thai Military Bank Public Company, Department of Land Transportation and Jatujak Shopping center which attractive place can take other people into this area.

(3) The Mall Department store (Ngamwongwarn Branch)

This area is the connection point between Jatujak district and Don Muang district or Bangkok and Muang district, Nontaburi where commerce is crowded including two large department stores, The Mall Department store and Banglumpoo Department store, that is near the second step express way. This area consists of the large hospital, Nontawet hospital, Breast hospital and Bumrajnaradon hospital.

(4) Meanburi

This area is the West Point that connects with Chachoengsao Province by starting the crowded industrial areas. From the establishment of Bangchang Industrial Settlement and the large Department store, Welco Department store.

Today, the growth and development of this area increased rapidly as this area can link to the other areas easily such as New Nimit Road which connects to Lumlukka district, Prathumthanee that can go through Prachienburi and Nakhonratchasima province, Suwinthawongse road that connects to Chachoengsao Province. In the future, Meanburi will become the center of the potential area.

To get different interviewees from the selection of four-van stop sampling, which difference can take the sampling for research, factors that affect the public van transportation, that use the following principles:

(1) The Transportation Network

It means he/she interception of road, pier and system network, which is the area that consists of many activities.

(2) Economic activity

It means cover the originated of travel area including the number of traveling and the center for commerce in area.

(3) The difference of van transportation route

This means the route between starting point and destination that cannot pick up passengers during the trip.

#### 4.7 Types of the Public Van Center Point That Located in the North of Bangkok

(1) Meanburi Parking point:

To the following destination: - Pakkred, Rangsit Khong 1, Nongjok/  
Wat Lum Toi, Kehamromkow/ Hua Ta-Ke and Mochit/ Kasetsart  
University.

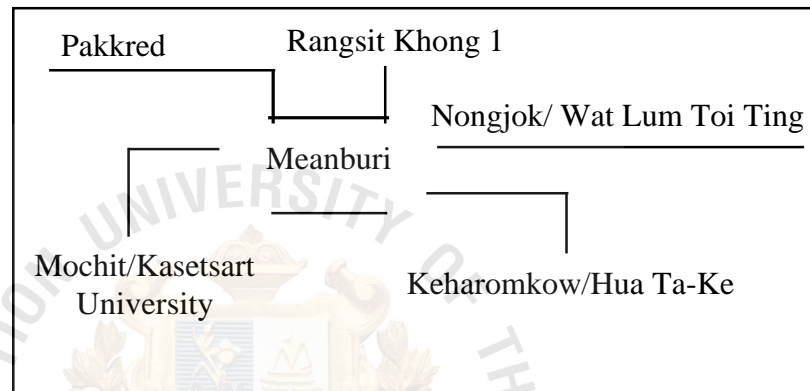


Figure 4.1. Meanburi Parking Point.

(a) Meanburi-Rangsit

From the last ten years the area in Rangsit is rapidly growing especially residence areas. Rangsit area consisted of wholesale market, the shops around the university, big department stores, and terminal around Khnog Luang for the wholesale fresh food. These areas compared as border town that consisted of the Paholyothin Road, Toll way, the 2<sup>nd</sup> step of expressway and the railway to the North of Thailand. The areas that consisted the high number of travelers are Tunyaburi District, Lumlookka District and Khong Luang District, which are according to the growth of the numbers of

residence. The routes for public vans in these areas do not overlap to other types of public transportation. Furthermore, Rangsit is the transit point between public vans and buses that travel to other provinces.

(b) Meanburi-Bangkhen

Bangkhen area consists many universities Kasetsart University, Sripratum University, Rajchapat Institution and many Government Organizations such as Forestry Department, Expressway Rapid Transportation, Scientific Research and Technology Institution of Thailand, etc. The area covers from Laksi conjunction to the Bangkhen Road. It is the transit point to the center of Bangkok and to Nontaburi Province.

(c) Meanburi-Ngamwongwarn

There are two big department stores on this route, Banglumpoo Depailment Store and the Mall Department, established at the end of the Ngamwongwarn road. It is connected with Rattanatibet Road, Prachachuen Road and the 2<sup>nd</sup> of the expressway.

(d) Meanburi-Mochit (Mochit Bus Terminal)

Mochit is located on Kampangetch Road near Bangsue station. This is the changing points between train, bus and bus to the provinces. This area consisted of Jatujak weekend Market, Aor Tor Kor Market and Jatujak Public Park. Kampangetch Road, Paholyothin Road and Vipavadee-Rangsit Road are connected to these areas. The Bangkok Mass Transit System Public Company Limited is

also located in this area. Thus, the trend of passengers who have to transit in this point is high.

(2) Lardpraw Parking point

To the following destination: - Thammasat U. Rangsit Campus/  
Rangsit Khong 1, Hua Mark, Rama VI/ Non Pier, Bangbuathong and  
Pakkred.

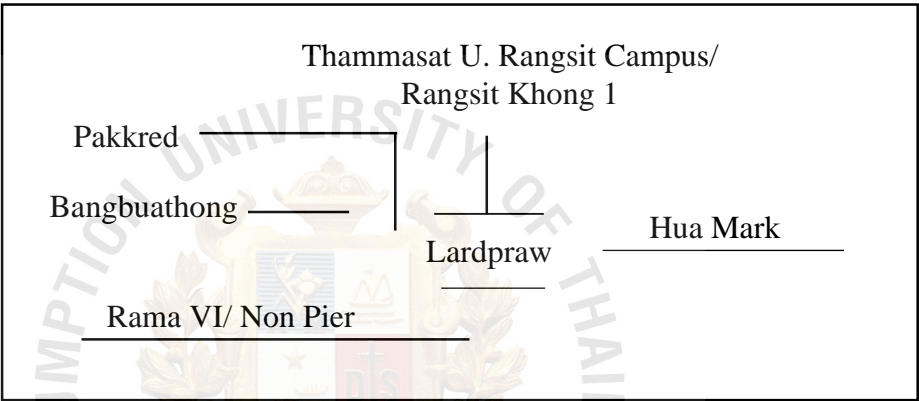


Figure 4.2. Lardpraw Parking Point.

(a) Central Lardpraw - Non Pier

Non Pier is a big pier, which is the connection point between land transportation and water transportation. There are the Government sectors, King MITT and Bang Kwan Jail located around there. It is also connected with the 2<sup>nd</sup> step expressway, Rattanatibet Road, Sanambinnum Road and Pibulsongkarm Road. The public vans serviced this area since 1998.



(3) Ngamwongwarn Parking point

To the following destination: - Pakkred, Saparn Mai, Ramkumhang and Bangbuathong.

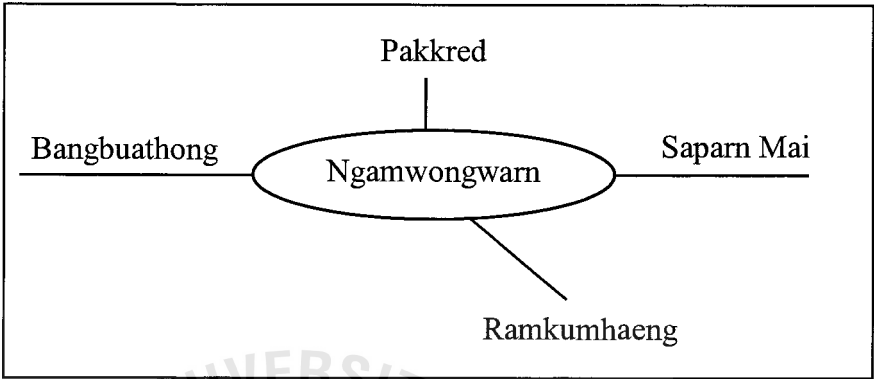


Figure 4.3. Ngamwongwarn Parking Point.

(a) The Mall Ngamwongwarn — Ramkumhang

Ramkumhang Road consisted of many residence areas, many department stores, Central Department Store, Welco Department Store, the Mall 3 & 4 Department Store, 2 universities, Ramkumhang University and Assumption University and Rachamungkala Stadium. This area is connected with Bungkum District, Huang Kwang District, Suang Luang District and Meanburi District. The major roads are Ramkumhang Road, Srinakarin Road, Sukhapiban 2 & 3 Road. This is the starting point of public van services and the service routes do not overlap with bus service.

(4) Victory Monument Parking Point

To the following destination: - Thammasat U./ Rangsit/ Saparnmai, Samia, Ramkumhaeng U., Bangbuathong, Muangthong/ Pakkred and Bangkoowat Conjunction.

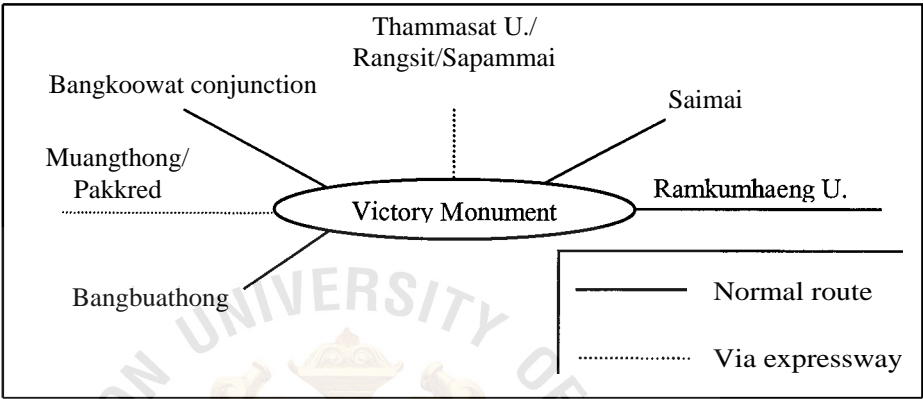


Figure 4.4. Victory Monument.

(a) Victory Monument — Future Park Department Store Rangsit

\* The north of Rangsit area is connected with Nontaburi Province and Pathumtani Province. Rangsit area consisted of commercial area, big department store, institutions — Thammasat University, Asia Institution Information Technology and residence area, the whole sale of fresh fruit and vegetable. The potential of the population growth is high including the development in education area.

(b) Victory Monument — Pakkred

Pakkred is located in Nontaburi Province. It is the changing point between boat and public vans. Pakkred Pier is the most crowded pier. There are around 285,500 passengers a day. The city expanded

rapidly since 1993 due to the fact that it is located not far from Bangkok.



V. CHARACTERISTICS AND BEHAVIORS OF VAN PASSENGERS

The appropriate sampling size is calculated by using the data from the whole number of public vans, number of trips per day and the capacity of the public van for each route. The Bangkok Mass Transit Authority set the average number of passenger of public van at 10 passengers per trip. The total numbers of the passengers are 104,040 passengers. The number of the variance is 8%.

To calculate the sample size by using the Yamane (1973) formula:

$$\frac{N}{1+Ne^2}$$

By N = Number of population

e = variance which fixed at ±8%

Thus  $\frac{104,040}{1+104,040 \times 8\%^2} = 156.25$

The number of sampling size in this project is 156 passengers with 95% of confidence. Each route will consist of the different numbers of passengers so we could not use the same ratio to find the sampling size. To find the number of sampling size for each route, it will concern the figure of public vans of each route and the number of passengers. The table below will show the number of sampling size of each route.

Table 5.1. Number of Sample Size of Each Route.

Departure — Destination	Number
Victory Monument	38
Ladprow	32
Ngamwongwarn	20
Meanburi	66
Total	156

One hundred and fifty six sets of the questionnaires were distributed during 28<sup>th</sup> of June 2001 to 4<sup>th</sup> of July 2001 during 6:00 am to 18:00.

The questionnaires consisted of 3 parts:

- (1) General data about the interviewee
- (2) Traveling data
- (3) Reason of using public vans

The results of the questionnaires can be concluded as follows:

The economics and social status of interviewee

(1) **Sex**

The number of females is higher than the numbers of males from 156 interviewees. The number of female is equivalent to 64 percent and the number of male is equivalent to 36 percent.

Table 5.2. Sex of Van Passenger.

Sex	Number	Percent
Male	58	37.2
Female	98	62.8
Total	156	100.0

(2) Age

The ages of interviewees are around 13-56 years old and the average is 26 years old. Most of the interviewees are 21 years old.

(3) Occupation

The occupations of the interviewees are working people, housewives, students and unemployed people. Most of the interviewees are students or 48.7%. The following groups are Government officers or 13.5%, merchants or 6.4%, workers or 5.8%. (Table 5.3.)

(4) Income

Most of the passengers have income less than 5,000 Bahts per month or 43.6%. The passengers who have income around 5,000 — 10,000 Bahts per month or 28.2% and only 1.3% earn more than 50,000 Bahts. The reason that the average of income was quite low is because most of the interviewees were students. (Table 5.4.)

Table 5.3. Occupation of Interviewees.

Occupation	Number of interviewees	Percent
Students	76	48.7
Government officers	21	13.5
Merchants	10	6.4
Craftsman	9	5.8
Private sector officers	8	5.1
Housewives	6	3.8
Professionals	5	3.2
Clerks	5	3.2
Workers	5	3.2
Unemployed people	4	2.6
Service staff	4	2.6
State Enterprise officers	2	1.3
Agriculture	1	0.6
Total	156	100.0



Table 5.4. Income of the Interviewees.

Income	Number of interviewees	Percent
Less than 5,000 Bahts	68	43.6
5,000 — 10,000 Bahts	44	28.2
10,001 — 20,000 Bahts	24	15.4
20,001 — 30,000 Bahts	12	7.7
30,001 — 40,000 Bahts	6	3.8
40,001 — 50,000 Bahts	0	0.0
More than 50,000 Bahts	2	1.3
Total	156	100.0

(5) Family size and Number of private vehicles

The average family size is 4.55 people that means most are small family sizes. There are 75 percent that own their private vehicles. The average of owning the private car is 1.63 cars or 1 car for 1 family. The average of owning the motorcycle is 1.33 motorcycle or 1 motorcycle for 1 family. These figures mean that all the family members cannot use the private car some have to use the public transportation like buses, taxis, etc.

(6) The private car for the interviewees

Seventy seven percent of all interviewees did not own any type of vehicles. Only 23 percent had their private vehicles — 14 percent own the motorcycles and 6 percent own the private cars and 3 percent own both

motorcycles and private cars. Most of the interviewees have low to medium income and most of them still study.

Table 5.5. The Economics and Social Status of Interviewees.

Economics and social status	Average	Variance	Lowest point	Highest point
1. Age	26.32	0.72	13	56
2. Number of member in family	4.55	0.14	1	10
3. Family that own the vehicles	0.75	0.03	0	1
- Private car	0.41	0.03	0	1
- Motorcycle	0.14	0.02	0	1
- Cars and motorcycle	0.2	0.03	0	1
- No. of cars	1.63	0.09	1	6
- No. of motorcycle	1.33	0.08	1	3
4. Individual that own the vehicles	0.23	0.03	0	1
- Private car	0.14	0.02	0	1
- Motorcycle	0.06	0.01	0	1
- Cars and motorcycle	0.03	0.01	0	1

If we consider the relationship between the owner of the private vehicles and frequency of public van services, we found that the passengers who do not own cars will travel by public vans around 9-10 trips per week or 28.7 percent. Around 10 trips per weeks or 19.1 percent are the group of public vans traveling more than 1 connection. The percentages of the

passengers who travel 1-2 trips per week or not certain are around 13 percent.

Almost all passengers who use the van transportation are the people who do not own any vehicle and still have the demand for efficiency of Para transit transportation. The people who have own vehicle prefer to select the private car more than van because of the expense, accessibility, safety and comfort.

(7) The characteristic of interviewee's trip

The area of interview covered within 1-5 kilometers from the van stop destination. The van route can be classified as follows:

(a) Lardpraw- Non Pier

The accommodation of passenger is crowded in Piboonsongkram Road, Charunsanitwongse and Muang district, Nonthaburi.

(b) Victory Monument-Future Park (Rangsit)

Almost all passengers in this area is crowded in the Laksi. Pakkred and Rangsit-Pathumthane Road.

(c) Ngamwongwarn-Ramkumhaeng

The Passengers in this area live in the Changwattana, Ngamwongwarn and Bangbuathong.

(d) Victory Monument-Pakkred

The passenger who use the van transportation is in Pakkred, Patumtanee and Changwattana

- (e) Meanburi-Ngamwongwarn

The passenger for this route is crowded in Ramintra, Bangkapi and Ramkumhaeng.

- (f) Meanburi-Rangsit

The passengers in this route live near Ramintra, Kubon and Nongchok.

- (g) Meanburi-Bangkhen

The passenger in this area is in Ramintra

The route of van transportation will provide service through the land where the passenger accommodation is which consisted of the medium and large industry, education institutions that are attractive areas for travel. From the consideration of classification by route shows that the route where cross the crowded, more accommodation and more factories, can make the demand ratio increase.

- (a) Lardpraw — Non Pier

This route starts from large department store and the accommodation area by crossing KMIT education institution. Almost all passengers in this route are the students and the people who shop at the Central (Lardpraw) department store.

- (b) Victory Monument-Future Park (Rangsit)

The start point is Victory Monument to Future Park Rangsit by using the expressway and Donmunag Toll way. The first van stop is Laksi Junction along Rangsit. In order to distribute passengers in Patumtanee and Nontaburi we use the area around Rangsit Market as the change point for other vehicles between the van, the bus and

coach. Victory Monument is the changing point between the van and the bus that access into the city.

- (c) Meanburi-Nganwongwarn, Meanburi-Bangkhen and Meanburi-Rangsit

The service areas covered the inner and outbound zone. It will pick up the passengers from the starting point at the van stations, which covers area around the Meanburi market and Ramindra Road. These 3 service routes overlap from Ramintra Road to Meanburi. The pick up point starts from Raksi by using the bus station. Furthermore, Meanburi market is the connecting point among buses and vans for traveling to Nong-Jok area and Ladkrabung.

- (d) Pakkred Pier-Victory Monument

It is the pattern of traveling between urban and center of Bangkok. Victory Monument is the major changing point for passengers. Pakkred is the major residence areas. Thus, this route can carry number of passengers.

- (e) Ngamwongwarn- Ramkumhaeng

This service route is served between the middle zone and the outbound zone. Ramkamhaeng University and Assumption University are the important institutions in this area. Ngamwongwarn is the changing point for traveling to residence area in Nontaburi Province.

The Table 5.7 shows that most passengers start their journeys from the urban to the destination in central Bangkok in the morning. The destinations in the evening are urban areas. Due to the working area and

business areas are located in Bangkok center. The objective for traveling back to home is 44.2%, for is working 27.6% and for studying is 12.8%.

Table 5.6. The Objective of Traveling.

Objective of traveling	Studying	Working	Shopping	Relax	Doing business	Go home	Total
Ladprow-Non Pier	19	2	0	2	0	9	32
Ngamwongwarn-Ramkamhaeng	12	1	6	1	0	0	20
Victory Monument-Pakkred	2	4	4	0	2	5	17
Victory Monument-Future Park	2	8	4	0	0	7	21
Meanburi-Ngamwongwarn	2	0	2	0	0	17	21
Meanburi-Rangsit	3	0	0	0	0	18	21
Meanburi-Bangkheng	3	5	3	0	0	13	24
Total	43	20	19	3	2	69	156
Percentage	27.6	12.8	12.2	1.9	1.3	44.2	100

The average time of traveling from the starting point to the van stop takes around 15.9 minutes. The average time of traveling from van stop to the destination takes around 12.7 minutes. Most of passengers are walking before and after used the public van services or 41.7%. The second is traveling by buses with which 34% are traveling before using public van and 19.2 are traveling by buses after using the public vans.

traveling by buses with which 34% are traveling before using public van and 19.2 are traveling by buses after using the public vans.

The Table 5.7 shows the pattern of traveling which used the difference of time consumed depending on type of transportation, capacity of each type. The survey found that traveling by foot, before and after using the public vans, took the least time consuming or 6.4 minutes before using and 7.2 minutes after using the public vans. Traveling by buses took the longest time consuming or 29 minutes before using and 31 minutes after using the public vans. The mentioned figures show that half of the passengers do not need to travel by others type of transport for traveling to the destination.

Table 5.7.     Type of Traveling and the Average of Time Consuming before and after Using Public Vans.

Type of traveling	Before using public vans		After using public vans		Average time (minutes)	
	Frequency	Percentage	Frequency	Percentage	Before	After
Walk	65	41.7	91	58.3	6.4	7.2
Buses	53	34.0	30	19.2	28.8	31.0
Public vans	11	7.1	12	7.7	28.5	27.3
Motorcycle	9	5.8	15	9.6	8.3	8.13
Private car	8	5.1	1	0.6	14.4	30.0
Minibus	6	3.8	5	3.4	22.5	20.0
Taxi	3	1.9	1	0.6	18.3	20.0
Boat	1	0.6	1	0.6	15.0	35.0
Total	156	100.0	156	100.0		



The survey found that the types of traveling of each route are varied. Some routes connect water and land. Some routes connect public vans and minor type of transportation the public vans may park in front of the village, the passengers have to use others type of transport to arrive their homes. Some routes are the connection point between public vans and buses or other public vans. Thus, to reach the residence area or business areas they have to use the varied type of traveling.



Table 5.8. Type of Traveling after Using Public Vans.

Route	Type of traveling after using public van								Total
	Walk	Bus	Moto recycle	Minibus	Van	Boat	Car	Taxi	
Ladpraw- Nontaburi	15.7	36.8	6.7	0.0	18.2	100.0	50.0	0.0	20.4
Victory Monument- Pakkred	13.3	7.9	6.7	0.0	9.1	0.0	50.0	0.0	10.9
Victory-Future Park	8.4	21.1	20.0	40.0	0.0	0.0	0.0	100.0	13.5
Ngamwongwarn- Ramkhumhaeng	20.5	7.9	0.0	0.0	0.0	0.0	0.0	0.0	12.8
Meanburi- Bangkhen	21.7	5.3	6.7	20.0	18.2	0.0	0.0	0.0	15.4
Meanburi-Rangsit	9.6	18.4	13.3	0.0	36.3	0.0	0.0	0.0	13.5
Meanburi- Ngamwongwarn	10.8	2.6	46.6	40.0	18.2	0.0	0.0	0.0	13.5
Total	100	100	100	100	100	100	100	100	100
No. of passengers	83	38	15	5	11	1	2	1	156

There are 2 types of traveling as follows:

- (a) Using only the public van (One trip):

There are 30 percent of all passengers and it takes less than 20 minutes for one trip or around 1-1.5 kilometers.

- (b) Using public van and combine with others type of traveling

There are around 70 percent of the passengers who use the public vans. The numbers of passengers who are using the public vans combine with walking are 23 percent and 8.33 percent for combining with buses. The main reason for using public vans combine with others type of journey is public vans cannot offer the door-to-door service. The passengers still need to use other types of transport. For example if passengers would like to travel from Ngamwongwarn Road to Chaipayruk Village which is located on Ramindra Km. 4 Road, that passenger has to walk to the van stop then take the van and hire the motorcycle to the village.

Thus, to select the type of traveling from the starting point to the van stop and from van stop to destination will depend on the location of the van stop. Normally, if the distance is less than 1 kilometer, passengers will walk.

Table 5.9. Type of Traveling.

Type of traveling	Frequency	Percentage
Walk-van-walk	46	29.49
Bus-van-van	5	3.21
Motorcycle-van-walk	11	7.05
Walk-van-bus	36	23.08
Car-van-walk	6	3.85
Bus-van-bus	13	8.33
Minibus-van-walk	4	2.56
Minibus-van-bus	3	1.92
Car-van-bus	2	1.28
Bus-van-motorcycle	4	2.56
Walk-van-van	9	5.77
Others	17	10.90
Total *	156	100.00

The Expense and Period of Time of Pubic Vans and Buses

The Table 5.10 shows the expense and the period of time, which are the major factors of selecting the type of traveling. If compared the cost of public van and bus service on the same route, the normal bus fare is cheaper than the public van, but for the air-conditioned bus, it is cheaper just a little bit. The intervals of traveling by public van are around 30 minutes to one and a half hours depending on the distance of that route. Moreover, 60 percent of the bus service routes take the round trip 2 to 4 hours and 37 percent of the service routes take more than 4 hours for round trip due to the

traffic jam. Thus, this is the main reason that passengers prefer to pay more for less time of traveling.

Table 5.10. Compare the Expense and the Interval of Traveling by Public Vans with Buses.

Service Routes	Van		Bus		
	Cost (Baht/trip)	Time (Hour/trip) <sup>1</sup>	Bus Number	Cost (Baht/trip)	Time (Hour/trip) <sup>2</sup>
Lardpraw-Nontaburi	12	0.30-0.45	63	3.50	No record
Victory Monument- Future Park (Rangsit)	20	0.30-0.45	Por Aor 4, Por Aor 44	16, 18	No record
Victory Monument- Pakkred	20	0.30-0.45	Por Aor 24	16	No record
Ngamwongwarn- Ramkhamhaeng	17	0.45-1.15			No record
Meanburi- Ngamwongwarn	20	1.001.30			No record
Meanburi- Rangsit	20	1.001.30			No record
Meanburi-Bangkhen	15	0.30-0.45	26	3.50	No record

- Resource: 1. Interview with vans drivers on July 11, 2001.
2. The Bangkok Mass Transit Authority in 2000.

The interval of using public vans depend on the service routes and distance. The average is around 41 minutes. Passengers will spend around 49 Bahts per day for their traveling. The frequency of public vans and buses are quite similar.

Table 5.11. The Characteristic on Traveling of the Interviewees.

Characteristic on traveling of the interviewees	Average	Variance	Minimum	Maximum
1. During traveling by vans (Minutes)	41.38	1.66	10	100
2. During traveling by others vehicles	30.05	1.97	5	125
3. Average the expense per day (Baht)	49.35	2.32	10	240
4. Frequency of using bus (per week)	7.82	0.59	1	40
5. Frequency of using van (per week)	6.87	0.39	1	20

Most of the sampling interviewees used the public vans for going to school. The public vans are mostly used during the rush hour or between 6:00 — 9:00 am (29.4%) and 3:00-6:00 pm (28.9%) for more details see the following table.

Table 5.12. Objective and Period of Using Public Vans.

Period	School	Work	Shop- ping	Busi- ness	Relax	Home	Home -work	Home- school	Home- business	Total	
Before 6.00	1	2	0	0	0	1	0	0	0	4	2.57
6:00-9:00	10	6	3	1	1	0	1	3	0	25	16.03
9:00-15:00	10	5	0	1	6	5	2	2	1	32	20.51
15:00-8:00	4	0	5	0	1	5	1	6	0	22	14.10
From 18:00	1	0	1	0	1	6	0	0	0	9	5.77
9:00-15:00 & 15:00- 18:00	0	2	1	0	1	0	3	3	0	10	6.41
9:00-15:00 & from 18:00	0	2	0	0	0	0	0	0	0	2	1.28
Before 6:00 & 15:00- 18:00	0	1	0	0	0	0	2	1	0	4	2.57
Before 6:00 & From 8:00	1	1	0	0	1	0	0	0	0	3	1.92
6:00-9:00 & 15:00-18:00	6	3	0	0	2	5	7	9	0	32	20.51
6:00-9:00 & from 18:00	1	0	0	0	0	1	3	2	0	7	4.49
6:00-9:00 & 9:00-15:00	1	0	0	0	0	0	0	1	0	2	1.28
Depend	0	1	0	0	0	1	0	2	0	4	2.56
Total no. of passengers	35	23	10	2	13	24	19	29	1	156	100.00
Percentage	22.44	14.74	6.42	1.28	8.33	15.38	12.18	18.59	0.64		100.00



Apart from the public vans, the interviewees used both Para transit and private transportation. Most of them used buses or 75 percent of the interviewees. Due to buses are the major Public transportation in Bangkok.

Table 5.13. Others Alternative Vehicles Apart from Public Vans.

Type of vehicles	Frequency	Percentage
Private car	20	12.8
Bus	117	75.0
Taxi	8	5.1
Hired-motorcycle	4	2.6
Not answer	4	2.6
Others	3	1.9
Total	156	100.0

If we divided the interviewees into 2 groups, group of passengers who own their vehicles and the group who do not own any vehicles, found that most of the passengers who do not own any type of vehicles will use the public transportation or 69%.

Table 5.14. The Relationship between Occupying the Vehicle and Type of Selecting Vehicles Apart from the Public Vans.

Type of vehicles	Family that . ..... . vehicle		Total
	Own	Not own	
Bus	69.4	44.2	50.0
Private car	0.0	15.0	11.5
Taxi	8.3	5.0	5.8
Bus + private car	0.0	20.0	15.4
Bus + other vehicle	22.3	15.8	17.3
Total	100.0	100.0	100.0
No. of passengers	36	120	156

From the survey, around 94.9 percent of the interviewees said they could use other type of public transportations instead of public vans. They said most of the public vans serve nearly the same routes as buses serve.

Table 5.15. Other Alternative Transports Apart from Public Van.

Other alternative transports	Frequency	Percentage
Able to substitute by	148	94.9
Bus	144	92.3
Train	0	0.0
Boat	0	0.0
Others	4	2.6
Not able to substitute because	8	5.1
No other type of the public transport in the area	5	3.2
Other transport serve only the specific period	3	1.9
Total	156	100.00

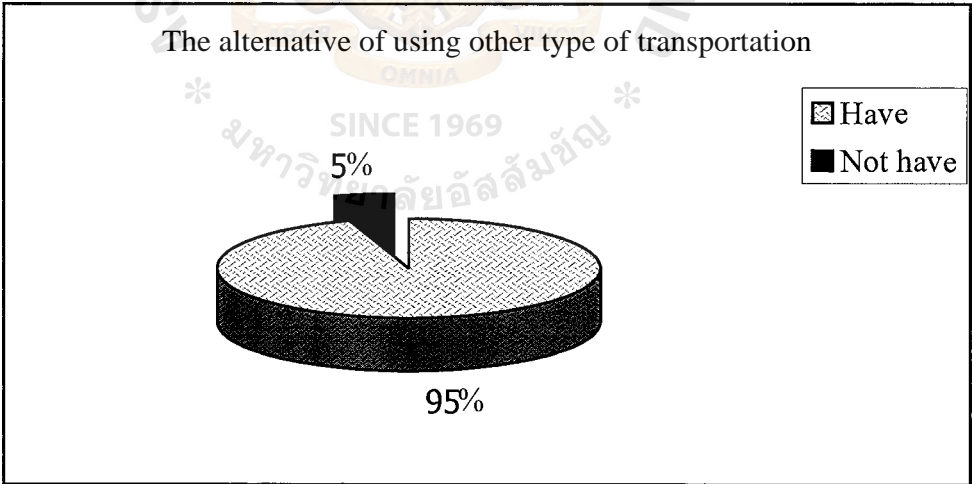


Figure 5.1. The Alternative of Using Other Type of Transportation Instead of Public Vans.

Around 85 percent of the interviewees traveled by buses before taking the public vans. 11 percent used private cars and 4 percent took taxi.

Table 5.16. Pattern of Traveling before Taking the Public Vans.

Type of vehicle	No. of interviewees	Percentage
Private car	17	10.9
Bus	133	85.3
Taxi	6	3.8
Total	156	100.0

Table 5.17. The Relationship between the Passengers, Who Own the Cars, and the Pattern of Traveling before Taking the Public Vans.

Type to transportation before taking the public van	Status of car occupied (Percent)	
	Not Own	Own
Private car	5.9	27.0
Bus	80.7	43.2
Taxi	3.4	5.4
Bus and private car	10.0	24.4
Total (Percent)	100.0	100.0
No. of interviewees	119	37

The above figure found that the number of passengers who do not have private cars and used the buses service is the highest because buses are public transportations which support the people who live in Bangkok for a long time.

The main reasons that the interviewees choose to travel by public vans are the speed of the service including the waiting time, the frequency of releasing the next public vans for which these are one character of the Para transit which is quite similar to taxi. The second reason is the convenience such as having the specific seat, air-conditioning, etc. The third reason is the reasonable service fare. For more details see Table 5.18.

The services provided by public vans are fast, convenient with reasonable fare. These advantage points bring the comparison of the passengers whether to take public vans or any other type of public transportations. Around 71.8 percent of the interviewees said they were satisfied with the speed of the public vans service. Around 60.3 percent are satisfied with the convenience and 50.6 percent are satisfied with the distance and the connection points with other transportation services such as bus stop, pier, etc. Most of them mentioned about the safety, the fare, the manner of the driver, frequency of releasing public vans, distance of the service, size of the vans, waiting time period, vans conditioned were in the rank of medium. Especially the safety was quite poor due to drivers would like to make more money. The frequency of releasing the public vans depends on the reason of each win. If the driver cannot pick up the passengers during the way to the destination, the driver will wait until the passengers are full at the starting point where the passengers had to waste their time on waiting. Mostly the passengers will waste their waiting time only during the rush time. For more details see the Table 5.19.

Table 5.18. The Reason of Selecting Public Van.

Reason of taking public van	1 <sup>s</sup> ranking		2nd		3rd	%
			ranking		ranking	
1. Speed	119	76.3	17	10.9	10	6.4
2. Safety	1	0.6	11	7.1	6	3.8
3. Able to fix the schedule	4	2.6	19	12.2	28	17.9
4. Convenience	23	14.7	80	51.3	19	12.2
5. Reasonable fare	1	0.6	11	7.1	30	19.2
6. Reach the destination	6	3.8	11	7.1	32	20.5
7. No choice	1	0.6	1	0.6	9	5.8
8. Convenience in connecting with other vehicle	0	0.0	3	1.9	14	9.0
9. Other	1	0.6	0	0.0	0	0.0
10. Not answer	0	0.0	3	1.9	8	5.1

Table 5.19. Ranking of the Public Vans Service.

Service	Ranking of the services (%)				Total (%)
	Good	Moderate	Should improve	Not answer	
Fare	24.4	67.3	8.3	0.0	100
Speed	71.8	26.3	1.9	0.0	100
Safety	22.4	62.8	14.8	0.0	100
Convenience	60.3	33.3	6.4	0.0	100
Driver manner	32.0	55.8	12.2	0.0	100
Frequency of releasing	39.1	41.7	17.9	1.3	100
Service distance	50.6	37.2	9.6	2.6	100
Size of van	32.7	53.2	11.5	2.6	100
Waiting time	25.0	56.4	17.3	1.3	100
Vans conditioned	24.4	61.5	13.5	0.6	100
Van stop	25.6	50.0	19.9	4.5	100
Connect to others transportation	50.6	36.5	5.1	7.8	100

The interviewees found that the unfair collection of the van fare, pick up the numbers of the passengers more than the capacity of the vans, driven too fast and illegal, concerned with the speed more than the safety and the poor condition of the air-condition.



Furthermore, the interviewees recommended some points that the public vans should improve. They suggested that the service should cover more areas in Bangkok and nearby provinces. The public vans should set up the same standard of size, condition, the van stop and the safety. They should set up the schedule of the service and route of the services.

The characteristic of the passengers and the factors of selecting type of transport service are based on many reasons. The factors can be classified by sex, age, and income of the interviewees that is shown in Table 5.20.

Both females and males said the first reason that they chose the public vans because it was fast. The second reason was convenience. The third reason, female said the public vans could reach the destination while male said because the fare was reasonable. Mostly the factors of using public vans between female and male are quite similar.

The survey found that the income does not affect choosing public vans. The interviewees, who earn less and high income, have the same reason that they travel by public vans is convenience. (Table 5.21.)

Table 5.20. The Relationship between Sex and Reasons of Choosing Public Van.

Reason of choosing van	1 <sup>st</sup> rank		2 <sup>n</sup> d rank		3 <sup>r</sup> d rank	
	Female	Male	Female	Male	Female	Male
1. Fast	74.0	79.0	12.0	8.6	6.1	6.9
2. Safety	0.0	1.0	7.0	6.9	4.1	3.4
3. Able to set their schedule	1.0	5.0	11.0	13.8	17.3	19.0
4. Convenience	17.0	10.0	53.0	44.8	10.2	15.5
5. Reasonable fare	1.0	0.0	3.0	13.9	18.4	20.7
6. Reach the destination	4.0	3.0	7.0	6.9	21.4	19.0
7. No choice	1.0	0.0	1.0	0.0	8.2	1.7
8. Easy to connect other transport	0.0	0.0	2.0	3.4	9.2	8.6
9. Others	1.0	0.0	0.0	0.0	0.0	0.0
10. Not answer	0.0	0.0	1.0	1.7	5.1	5.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

Table 5.21. The Relationship between Income and Reasons of Choosing Public Van.

Reason of choosing van	Income per month					
	(B ahts)					
	1-5,000	5,001-10,000	10,001-20,000	20,001-30,000	30,001-40,000	50,000 up
1. Fast	73.5	77.2	83.2	75.1	83.3	50.0
2. Safety	1.5	0.0	0.0	0.0	0.0	0.0
3. Able to set their schedule	2.9	0.0	4.2	8.3	0.0	0.0
4. Convenience	19.2	18.2	4.2	8.3	0.0	0.0
5. Reasonable fare	0.0	2.3	0.0	0.0	0.0	0.0
6. Reach the destination	2.9	2.3	4.2	0.0	16.7	50.0
7. No choice	0.0	0.0	0.0	0.0	0.0	0.0
8. Easy to connect other transport	0.0	0.0	4.2	0.0	0.0	0.0
9. Others	0.0	0.0	0.0	8.3	0.0	0.0
Total (Percentage)	100.0	100.0	100.0	100.0	100.0	100.0
No. of interviewees	68	44	24	12	6	2

Total No. of interviewees 156

Moreover if we consider the relationship between the private car occupied and the reason of traveling by public vans, we found that to occupy the private car does not influence traveling by public van. The main reason that both passengers, who own and does not own the private car, is the speed that public van can provide.

Table 5.22. The Relationship between Owner of the Private Car and the Reason of Traveling by Public Van.

Reason of choosing van	Status of occupy the private car	
	Own	Not own
1. Fast	73.0	77.3
2. Safety	0.0	0.8
3. Able to set their schedule	0.0	3.4
4. Convenience	16.2	14.3
5. Reasonable fare	0.0	0.8
6. Reach the destination	5.4	3.4
7. No choice	2.7	0.0
8. Easy to connect other transport	0.0	0.0
9. Others	2.7	0.0
Total	100.0	100.0
No. of interviewees	37	119

If we consider objective as the factor of travel by public van, we found that there is no difference in deciding to use the public van. The main reason that they choose public van is the speed.

Table 5.23. The Relationship between Objective and the Reason of Traveling by Public Van.

Reason of choosing van	Objective on traveling						Total
	Home	Business	Relax	School	Shopping	Working	
1. Fast	51	2	3	30	15	18	119
2. Safety	0	0	0	1	0	0	1
3. Able to set their schedule	1	0	0	2	1	0	4
4. Convenience	14	0	0	7	2	0	23
5. Reasonable fare	0	0	0	0	1	0	1
6. Reach the destination	4	0	0	2	0	0	6
7. No choice	0	0	0	0	0	1	1
8. Easy to connect other transport	0	0	0	0	0	0	0
9. Others	0	1	0	0	0	0	1
Total	70	3	3	42	19	19	156

The Frequency of Traveling and the Character of the Passengers

From the survey on the relationship between frequency and the objective of traveling by public van we found that the passengers travel by public vans around 10 times a week for working, studying and going back home. They travel to do the business, shopping and relax around 1 or 2 times a week.

Table 5.24. The Relationship between Frequency and the Objective of Traveling.

Frequency  Times/week	Purpose of traveling (%)					
	Home	Business	Relax	School	Shopping	Working
1-2	22.9	33.3	33.3	21.4	36.8	10.5
3-4	8.6	0.0	33.4	2.4	15.8	5.2
5-6	15.7	0.0	0.0	19.0	10.5	31.6
7-8	4.3	0.0	0.0	4.8	0.0	10.5
9-10	27.1	0.0	0.0	26.2	0.0	21.1
11-12	1.4	0.0	0.0	2.4	5.3	5.3
13-14	5.7	0.0	0.0	7.1	5.3	0.0
15-16	1.4	0.0	0.0	2.4	0.0	0.0
17-18	0.0	0.0	0.0	2.4	0.0	0.0
19-20	0.0	0.0	0.0	4.8	0.0	5.3
Once in a while	12.9	66.7	33.3	7.1	26.3	10.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
No. of interviewees	70	3	3	42	19	19

The survey found that the average age of the interviewees are 26 years, which involve many vocations such as student, Government officer, private sector officer. The average income is 2,800.00 Bahts per month, which is quite low due to most of the interviewees are students. Most of the passengers are nearly of the same group as the passengers who travel by public transport.

Most interviewees said the distance that they traveled by public vans was around 1-5 Kilometers. They started their journey by walking to the van stop, which took around 5 minutes or taking the bus which took less than 30 minutes. The purposes of journey were to work, to school and back home. Even the fare of public van was higher than others type of public transports but they use less time during their journey or average time of traveling by public van was 30 minutes and they felt more comfortable.

#### Problems and Obstruction of Using Public Van

Public van can be categorized as other Para transit like taxi, Tricycle (Tuk-Tuk) and minibus. Nowadays, the public van is still illegal because there is no government sector to control it. It has only an act of legislation B.E. 2522 that controlled it, which government has to lose a lot of revenue on this type of Para transit. At the same time, the public vans increase very rapidly which affect directly to the buses. This brings to the competition between the public transportation, which are under control by government sector and Para transit, which is out of control of government bureau. The problems of the illegal transport are no standard regulation to control the service, fare and difficult to manage the discipline of waiting for the passengers at their van stops, which is the cause of traffic jam. To solve these problems, the Bangkok Metropolitan, the Bangkok Mass Transit Authority and the Transport Company Limited have consulted to find out the solution to control the public vans and to provide the standard, to set up the service routes and to manage the van stop and the benefit for the mass



passengers. Now the agreement and the condition are under construction among the mentioned government sectors and the van providers.

#### Problem of Traffic and Transportation

The survey found that most of the public vans that service Bangkok will wait for their customers around the department store, urban village, overlap the bus stops especially in the center area of Bangkok. That means several van service routes will park their vans around the bus stops such as around the Victory Monument, around Silom road area, etc. This brings the problem of traffic jam around the mentioned areas.

Furthermore, the drivers have to compete with another driver on the same service route to pick up passengers as much as possible. Thus, the drivers have to drive very fast which brings us to the insecurity of the passengers.

#### Quality of the Service

The survey found that there are some points that the public vans should improve. The problems that should be improved are fare, frequency, period of the service and especially on safety and the driver's manner. The public vans service are the transport that concerns on the speed that means the more trips the drivers can make, the more income they will get. As the public vans are the services by the private sectors that means there is no guarantee on the safety for the passengers. The fare is also set up by the providers, which is quite high for the passengers who earn less income or the passengers who do not earn any income such as students. The good points of the service are the frequency and the period of the services.

#### Guardian Expenses

As the public van service is illegal the owners have to pay the guardian expense. The guardian expenses are collected from the members or the drivers to pay to the influential people. The influential people will offer convenience in doing the illegal van

services, to monopolize the route, avoiding reduce the fare and so on. The guardian expenses will be counted as the cost of the investment.

#### The Routes that Overlap the Buses

Most public vans provide the service routes overlap the buses routes. The Bangkok Mass Transit Authority is the only organization that has the authority in set up the services routes, set for the buses. That means the public vans are the illegal services and also grab the passengers from the buses and bring loss of the revenue for the Government sector. At the same time the private sectors, which paid a lot of money for the concession to the Bangkok Mass Transit Authority, a lot of money on this matter.

The public van service is another selection of transportation in Bangkok. The services that are provided are different from bus and private car. It could offer the convenience, speed and the particular seat the same as private car. But the routes have been fixed so it could not reach the destination like the private car. Thus, the public van can be counted as the Para transit like taxi, tricycle (Tuk-Tuk) or motorcycle. The providers will set the service route but the weak point is there is no regulation to support it. The management set up the group as the queue or win, the drivers have to pay the guardian expenses to the influential people. There are 116 service routes, most of them services overlap the routes that is serviced by buses.

Most service routes are from the urban to the center of Bangkok and some may drive over the expressway and some may not. The starter and destination points are located in the center of that area. The changing points are around the department store area, villages or the area that consisted many people.

The growths of public vans are very rapid, not only the number of the public van but also the number of routes. Due to the residence area growth without planning and as most of them are located outbound, the business areas are located in center of

Bangkok. The buses could not cover all that residence areas so the public vans become more influential to life of Bangkokian.



## **VI. THE PROPOSED SYSTEM**

As today there is no specific computerized system to collect the information of the public vans, when passengers complained about the services of the public vans, it is quite difficult to follow up that particular public van. With the development of the information technology, the proposed system will be designed to cover all necessary data to support the user requirements.

The proposed system should have the following major processes:

### **(1) Create Public Van Route Record**

- (a) Receive new public van route information
- (b) Validate public van route
- (c) Update public van route information

### **(2) Create Public Van Record**

- (a) Input public van record
- (b) Check public van status
- (c) Update public van information

### **(3) Register Driver**

- (a) Input driver information
- (b) Check driver status
- (c) Add new driver information
- (d) Issue driver member card
- (e) Update driver information

#### (4) Create Public Van Schedule

- (a) Get information from route, public van and driver file
- (b) Create public van schedule

#### (5) Query

- (a) Receive request
- (b) Search information
- (c) Display information

### 6.1 Data Flow Diagram

Data Flow Diagram is one of the most important tools in a structured system analysis. It presents a method of establishing relationship between functions or processes of the system with the information it uses. Data Flow Diagram is a key component of the system requirement specification, because it determines what information is needed for the process before it is implemented.

Figure 6.1 shows the Context Diagram of the proposed system. The Public Van Information System will control all necessary information. The Public Van Control Center prepares all the public van routes by input data into the system. The Owners of the public vans provide the details of their public vans and submit to the Public Van Control Center. All the public vans drivers have to register with the Public Van Control Center by giving all the detail of themselves. The data will be input by Public Van Control Center and kept in the database. For the passengers or anyone who would like to know the information of public van, route or schedule except the drivers' detail, they just send their request via the system and it will be shown on the screen.

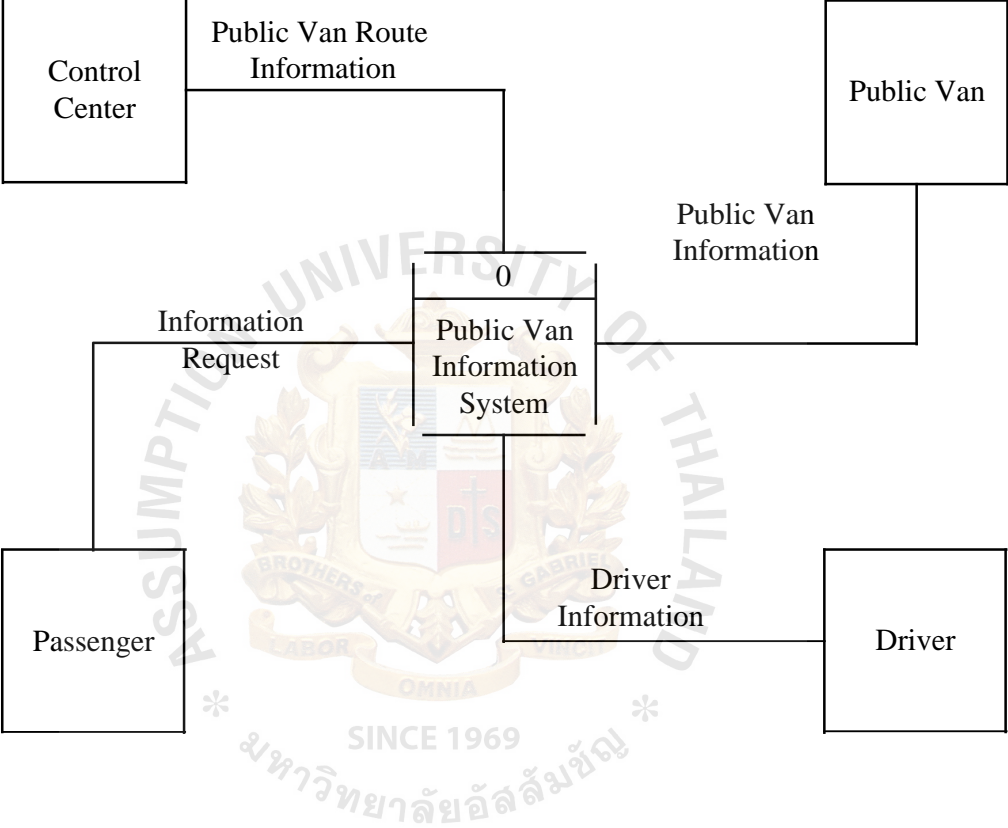


Figure 6.1. Context Diagram of the Proposed System.

Figure 6.2 shows the Level 0 Data Flow Diagram of the Proposed System. The Public Van Control Center prepares the information of the new route then record into the Public Van Route Database.

The second process is the public van owners register the details of their public vans. After that all details will be kept in the Public Van Database.

Drivers have to fill in the registration forms by giving all details of them. This information will be input to the system by Public Van Control Center.

The next step is the system will gather all the information from Public Van Route Database, Public Van Database and Driver Database and generate the schedules for each route.

General passengers who would like to know any information of route, public van or schedule can search their queries from this system. For security reason the general passengers are not allowed to search the information of the drivers. If passengers would like to know more details of the drivers, they have to contact Public Van Control Center. The passengers have to submit their requirement for approval.



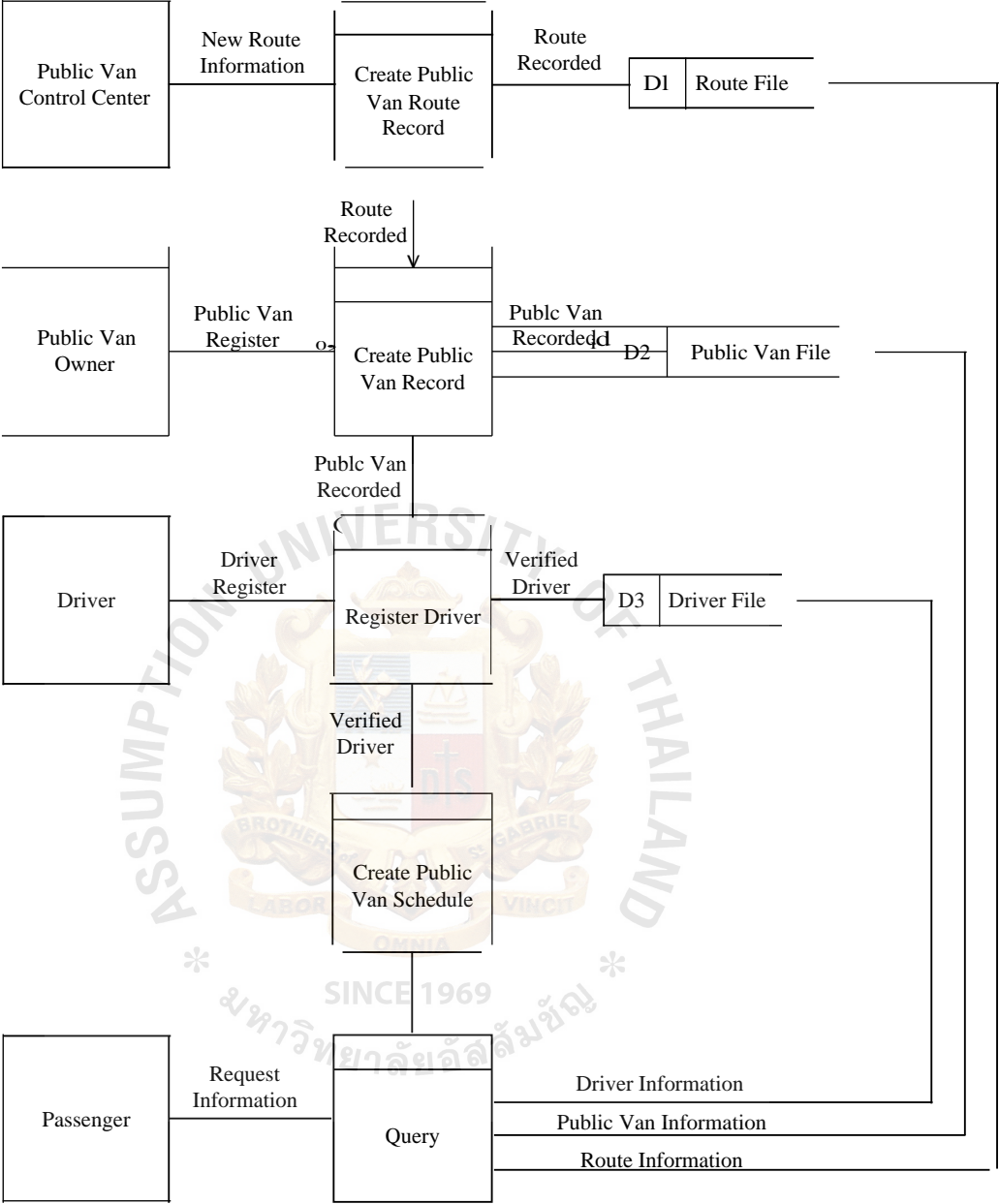


Figure 6.2. Level 0 Data Flow Diagram of the Proposed System.

Figure 6.3 shows the Level 1 of Data Flow Diagram of the proposed system. The Public Van Control Center input all public van routes into the system. The system will automatically compare the new information with the existing information. In case there is not exit, the system will add new information to the Database file. In case that the information exists, the system will inform the operation staff. The staff will check whether the new information overlaps or not if so he or she will abort from the system, if not he or she can modify the existing information. All the information will be kept into the Route Database.

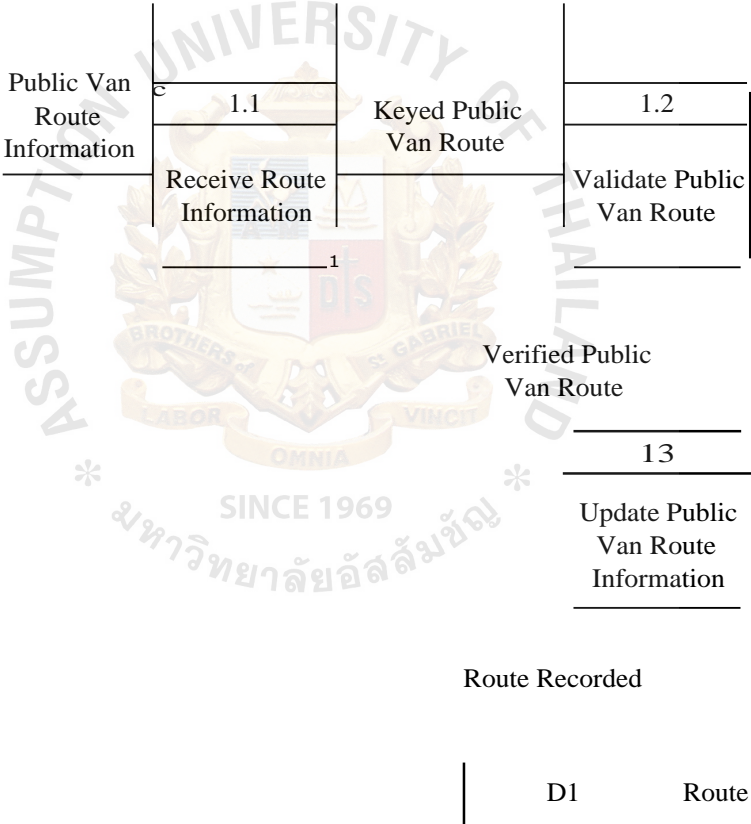


Figure 6.3. Level 1 Data Flow Diagram of the Proposed System.

Figure 6.4 shows the Level 2 Data Flow Diagram of the proposed system. The public vans owners have to fill in the application forms at the Public Van Control Center. The staff input the details to the system. The system will check the new information with the existed information. If the information is duplicated, the system will inform the operation staff. The staff checks the correctness if it is really duplicated, he or she will abort the system. In case the public van owners would like to update their data, the staff will retrieve the existed information and modify it. This information will be kept in Public Van Database.

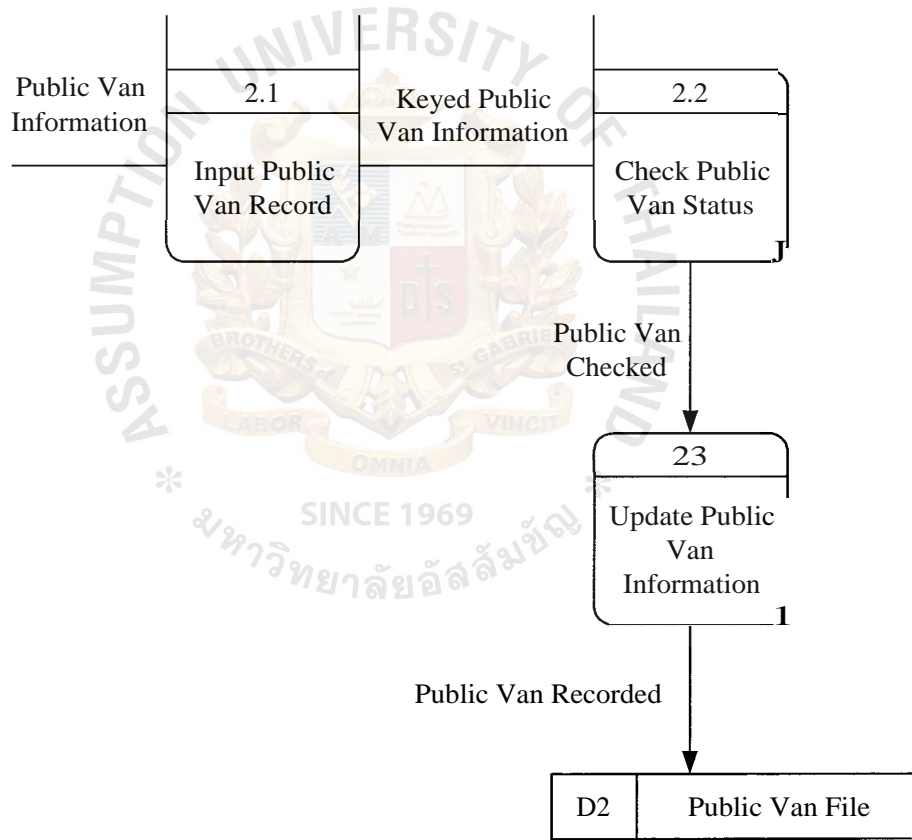


Figure 6.4. Level 2 Data Flow Diagram of the Proposed System.

Figure 6.5 shows the Level 3 Data Flow Diagram of the proposed system. The drivers have to fill in the application forms at the Public Van Control Center. The staff input the details to the system. The system will check the new information with the existed information. If the information is duplicated, the system will inform to the operation staff. If the information does not exist in the system, the system will add new information to the system and generate the member card for the drivers. If there is any changes of the drivers' details, the drivers just inform their ID number, the staff will modify their information. All the information will be kept into the Driver Database.

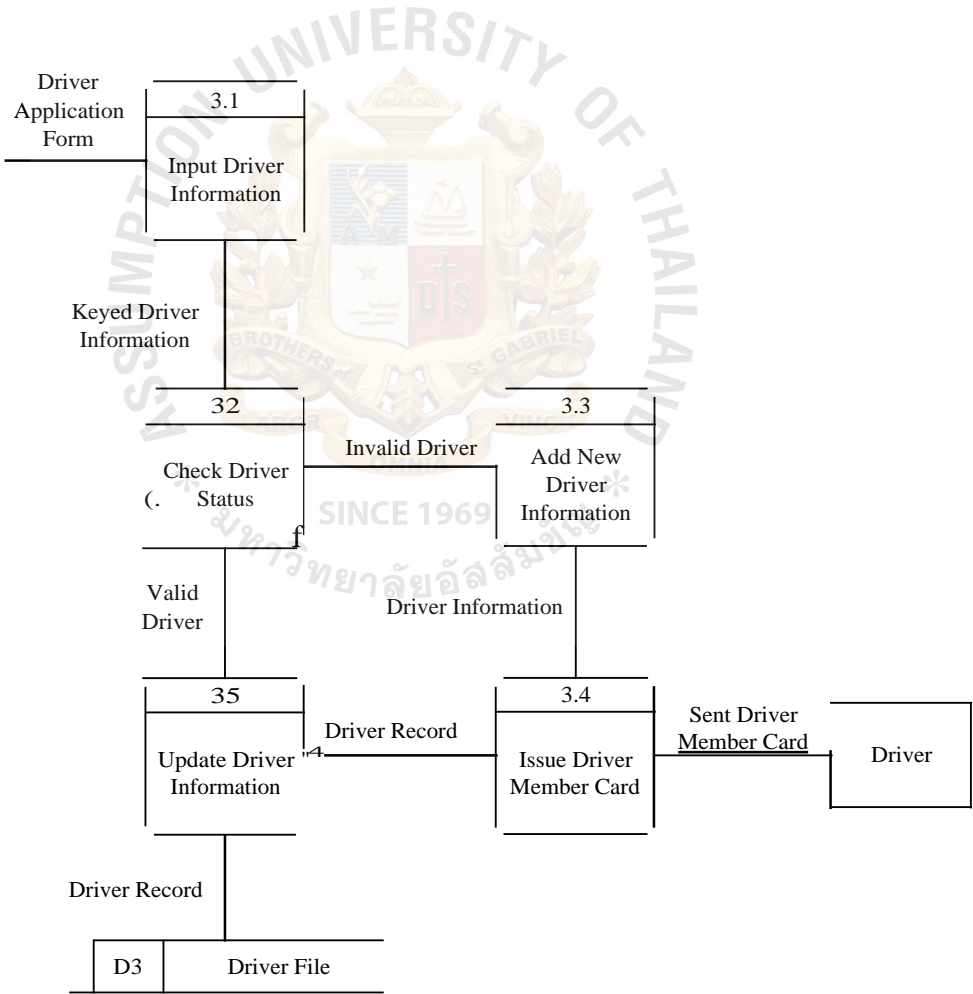


Figure 6.5. Level 3 Data Flow Diagram of the Proposed System.

Figure 6.6 shows the Level 4 of the Data Flow Diagram of the proposed system. This process, the information from Route database, Public Van database and Driver database will be retrieved by the system and generat the schedule of the Public Van. The information in this process will be kept in Schedule database.

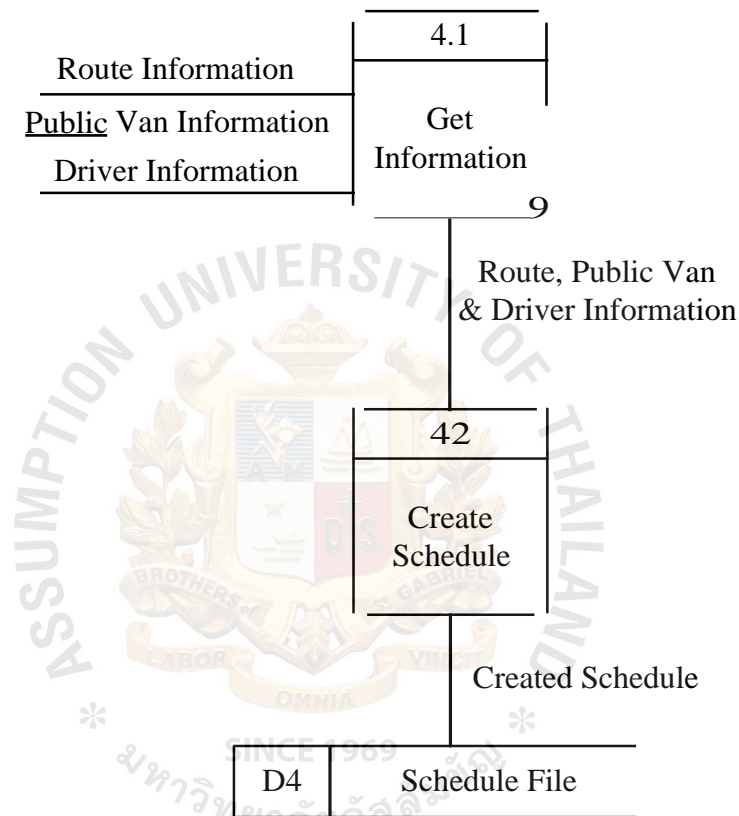


Figure 6.6. Level 4 Data Flow Diagram of the Proposed System.

Figure 6.7 shows the Level 5 of the Data Flow Diagram of the proposed system. This is the query process. Passengers or anyone who would like to know any information of the public vans will send their requested to the system. When the system receive that request, it will gather information from all database and display or print the requested information. General users are not allowed to access the driver database for the security reason. If he or she would like to know any information about the driver, he or she has to contact the Public Control Center by submitting their request for getting the approval.

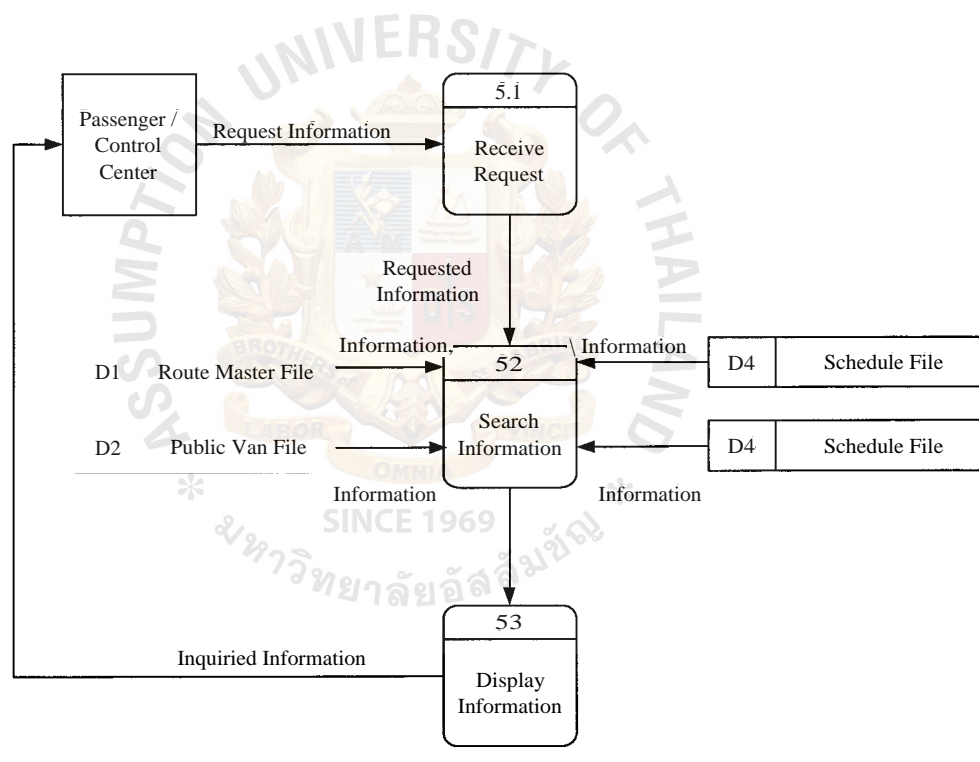


Figure 6.7. Level 5 Data Flow Diagram of the Proposed System.

6.2 Entity Relationship Diagram

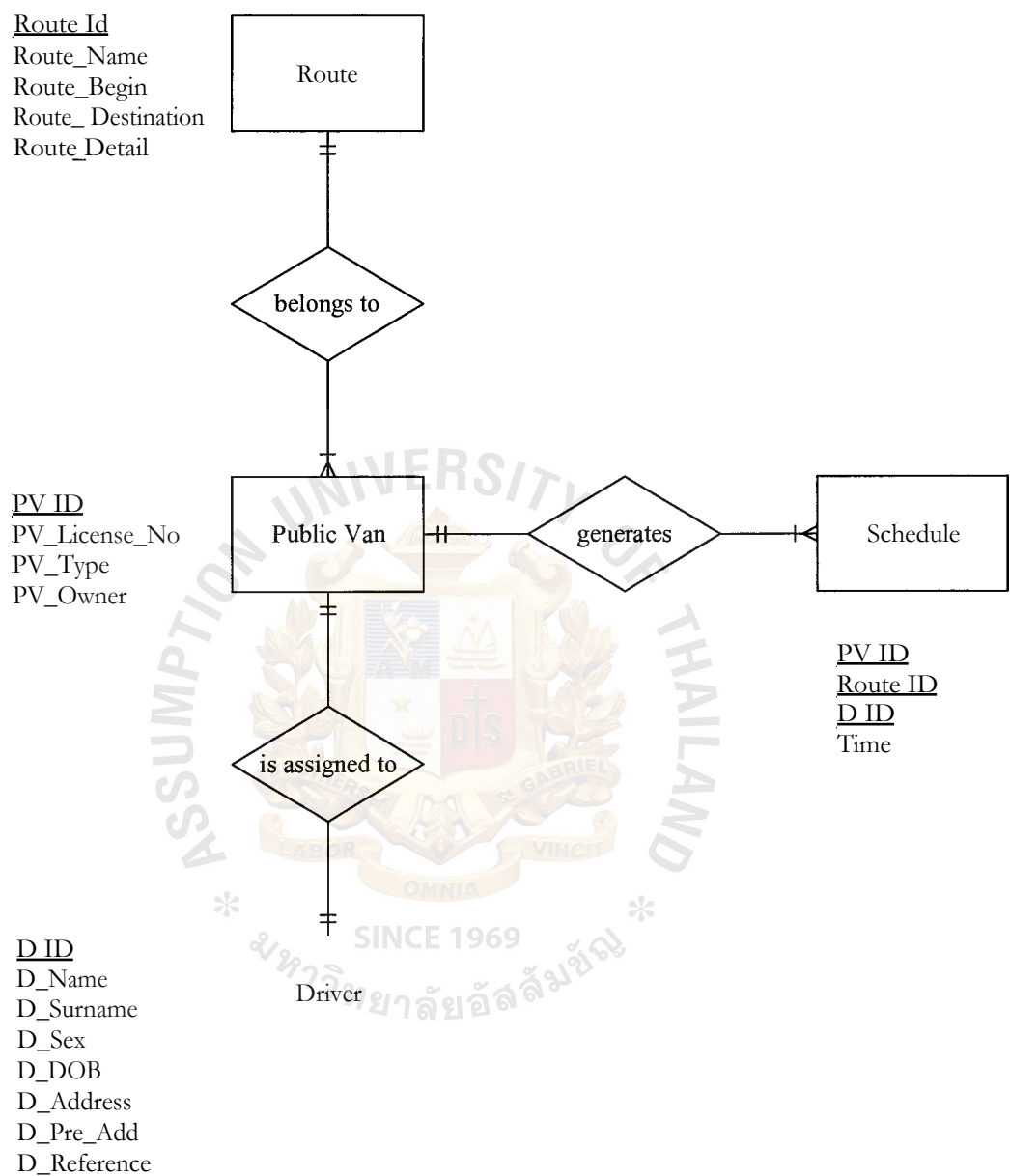


Figure 6.8. Entity Relationship Diagram.



### 6.3 Hardware and Software Requirements

#### Hardware Specification

- (1) Server : 1 set
- |                               |                           |
|-------------------------------|---------------------------|
| Processor/Speed (MHz)         | Pentium III/ 733          |
| Level 2 cache (per processor) | 256 KB                    |
| Hard disk capacity            | 9.1 GB x 3 SCSI Ultra 160 |
| Hard disk capacity            | 18.2 GB x 3 SCSI 160      |
| Raid Controller               | 1 channel                 |
| SCSI Controller               | : 2 channels              |
| Memory (MB)                   | : 256 SDRAM               |
| Media Device (speed/type)     | : 52x CD-ROM              |
| Monitor                       | 17 inches                 |
| LAN Card                      | 10/100 MB                 |
- (2) PC Client : 3 sets
- |                       |                              |
|-----------------------|------------------------------|
| Processor/Speed (MHz) | : CPU Intel Celeron 600 MHz. |
| Memory (MB)           | 64 SDRAM                     |
| Hard disk capacity    | 10.2 GB Ultra ATA-100        |
| Monitor               | 17 inches                    |
| LAN Card              | 10/100 MB                    |
- (3) Universal Power Supply 3000 VA : 2 sets
- (4) Network Peripheral
- |        |                    |
|--------|--------------------|
| Router | 1 LAN, 1 WAN       |
| Hub    | 10/100 MB 24 ports |
- (5) Office Automation
- |         |                             |
|---------|-----------------------------|
| Printer | HP Laser Jet 2100 M Printer |
|---------|-----------------------------|

Software Specification

- (1) Network Operating System : Microsoft Windows 2000 server
- (2) PC Operating System : Microsoft Windows 98 license
- (3) Application Software : Microsoft Office 2000

Security and Controls

Each staff at the Control Center have the ID number and password to access the system. There will be many levels of access to the system. In some parts of the data, the unauthorized users cannot modify or delete the data. The system will be accessed only by the authorized person.

6.4 Data Dictionary

The data dictionary is an organized listing of all the data elements pertinent to the system, with precise, rigorous definitions so that both user and systems analyst will have a common understanding of all inputs, outputs and components of stores. The data dictionaries of the proposed system contain data flow description, data process description and data store description.

Route ID	=	Route Identification Number
Route_Name	=	Route Name
Route_ Begin	=	Route Begin
Route Destination	=	Route Destination
Route Detail	=	Route Detail
PV ID	=	Public Van Identification Number
PV_License_No	=	Public Van License Number
PV_Type	=	Public Van Type
PV_Owner	=	Public Van Owner
D ID	=	Driver Identification Number

D Name	=	Driver Name
D Surname	=	Driver Surname
D Sex	=	Driver Sex
D DOB	=	Driver Date of Birth
D Address	=	Driver Address
D_Pre_Address	=	Driver Present Address
D_Reference	=	Driver Reference

### 6.5 Process Specification

Process Name	Create Public Van Route Record
Process Number	1.0
Description	<div> <div> - Received Route Information (New)</div> <div> - Verify Public Van Route</div> <div> - Update Public Van Route</div> <div> - Generate Approval Report to Management of Public Van Control Center</div> <div> - Send Route Public Van Information to process 2.0</div> </div>

Process Name	Create Public Van Record
Process Number	2.0
Description	<ul style="list-style-type: none"> <li>- Received Public Van Information (New)</li> <li>- Verify Public Van Information</li> <li>- Update Public Van Information</li> <li>- Generate Approval Report to Management of Public Van Control Center</li> <li>- Send Public Van Information to process 3.0</li> </ul>
Input	New Public Van Information
Output	Public Van File
Process Name	Register Driver
Process Number	3.0
Description	<ul style="list-style-type: none"> <li>- Received Driver Information (New)</li> <li>- Verify Driver status</li> <li>- Issue Driver member card</li> <li>- Update Public Van Route</li> <li>- Generate Approval Report to Management of Public Van Control Center</li> <li>- Send Route Public Van Information to process 4.0</li> </ul>
Input	New Driver Information
Output	<p>Driver ID</p> <p>Driver Member card</p>

Process Name	Create Public Van Schedule
Process Number	4.0
Description	<ul style="list-style-type: none"> <li>- Received Route Information</li> <li>- Received Public Van Information</li> <li>- Received Driver Information</li> <li>- Generate the new schedule</li> <li>- Generate Approval Report to Management of Public Van Control Center</li> </ul>

Input	Route Information Public Van Information Driver Information
Output	Schedule for each route

Process Name	Query
Process Number	5.0
Description	<ul style="list-style-type: none"> <li>- Received Request of Route Information</li> <li>- Received Request of Public Van Information</li> <li>- Received Request of Driver Information</li> <li>- Receive Request of Schedule</li> </ul>
Input	Request of Route Information Request of Public Van Information Request of Driver Information Request of Schedule
Output	Route Information Public Van Information

Driver Information

Schedule

Process Name	Receive Route Information
Process Number	1.1
Description	<ul style="list-style-type: none"><li>- Received Route Information</li><li>- Assign Route ID</li><li>- Send Route ID to process 1.2</li></ul>

Input	<ul style="list-style-type: none"><li>- Public Van Route name</li><li>- Public Van Route Information</li></ul>
-------	--

Process Name	Validate Pubic Van Route
Process Number	1.2
Description	<ul style="list-style-type: none"><li>- Received Route ID</li><li>- Received Route Information</li><li>- Verify Route ID</li><li>- Send Route ID to process 1.3</li></ul>

Input	<ul style="list-style-type: none"><li>- Public Van Route ID</li></ul>
-------	---

Process Name	Update Public Van Route Information
Process Number	1.3
Description	<ul style="list-style-type: none"><li>- Received verified Public Van Route</li><li>- Update Route Record to Route File</li></ul>
Input	<ul style="list-style-type: none"><li>- Verified Public Van Route</li></ul>

Process Name	Input Public Van Record
Process Number	2.1
Description	<ul style="list-style-type: none"><li>- Received Public Van Information</li><li>- Assign Public Van ID</li><li>- Send Public Van ID to process 2.2</li></ul>
Input	<ul style="list-style-type: none"><li>- Public Van name</li><li>- Public Van Information</li></ul>

Process Name	Check Public Van Status
Process Number	2.2
Description	<ul style="list-style-type: none"><li>- Received Public Van ID</li><li>- Received Public Van Information</li><li>- Verify Public Van ID</li><li>- Send Route ID to process 2.3</li></ul>
Input	<ul style="list-style-type: none"><li>- Public Van ID</li></ul>

Process Name	Update Public Van Information
Process Number	2.3
Description	<ul style="list-style-type: none"><li>- Received Public Van status check</li><li>- Update Public Van Record to Public Van File</li></ul>
Input	<ul style="list-style-type: none"><li>- Verified Public Van</li></ul>



Process Name	Input Driver Information
Process Number	3.1
Description	<ul style="list-style-type: none"> <li>- Received Driver Information</li> <li>- Assign Driver ID</li> <li>- Send Driver ID to process 2.2</li> </ul>
Input	<ul style="list-style-type: none"> <li>- Driver name</li> <li>- Driver Information</li> </ul>

Process Name	Check Driver Status
Process Number	3.2
Description	<ul style="list-style-type: none"> <li>- Received Driver ID</li> <li>- Received Driver Information</li> <li>- Verify Driver ID</li> <li>- Send Valid Driver to process 3.5</li> <li>- Send Invalid Driver to process 3.3</li> </ul>
Input	<ul style="list-style-type: none"> <li>- Driver ID</li> </ul>

Process Name	Add New Driver Information
Process Number	3.3
Description	<ul style="list-style-type: none"> <li>- Received new Driver Information</li> <li>- Add new Driver Information to the Driver file record</li> </ul>
Input	<ul style="list-style-type: none"> <li>- Driver name</li> <li>- Driver Information</li> </ul>
Output	<ul style="list-style-type: none"> <li>- Send new Driver Information to process 3.4</li> </ul>

Process Name	Issue Driver Member Card
Process Number	3.4
Description	<ul style="list-style-type: none"> <li>- Received Driver Information</li> <li>- Issue the member card</li> <li>- Send Driver Record to process 3.5</li> </ul>
Input	<ul style="list-style-type: none"> <li>- Driver ID</li> <li>- Driver Information</li> </ul>
Output	<ul style="list-style-type: none"> <li>- Member card</li> </ul>

Process Name	Update Driver Information
Process Number	3.5
Description	<ul style="list-style-type: none"> <li>- Received valid Driver Information</li> <li>- Received new Driver Information</li> <li>- Update Driver Record to Driver File</li> </ul>
Input	<ul style="list-style-type: none"> <li>- Valid Driver</li> <li>- New Driver Information</li> </ul>

Process Name	Get Information
Process Number	4.1
Description	<ul style="list-style-type: none"> <li>- Received Route Information</li> <li>- Received Public Van Information</li> <li>- Received Driver Information</li> <li>- Send to Process 4.2</li> </ul>
Input	<ul style="list-style-type: none"> <li>- Route Information</li> <li>- Public Van Information</li> </ul>

- Driver Information

Process Name	Create Schedule
Process Number	4.2
Description	<ul style="list-style-type: none"> <li>- Received Route, Public Van and Driver Information</li> <li>- Create the schedule</li> <li>- Add new Schedule Record to the Schedule file</li> </ul>

Input	<ul style="list-style-type: none"> <li>- Route Information</li> <li>- Public Van Information</li> <li>- Driver Information</li> </ul>
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Output	- Public Van Schedule
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Process Name	Receive Request
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Process Number	5.1
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Description	<ul style="list-style-type: none"> <li>- Received Request</li> <li>- Classify the information of the Request</li> <li>- Send the request to process 5.2</li> </ul>
-------------	--

Input	- Request Information
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Process Name	Search Information
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Process Number	5.2
----------------	-----

Description	<ul style="list-style-type: none"> <li>- Received Request</li> <li>- Gather the Information</li> <li>- Search Information</li> <li>- Send Information to process 5.3</li> </ul>
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Input	- Request Information
Process Name	Display Information
Process Number	5.3
Description	- Display the Information an user inquiry
Input	- Information
Output	- Request Information



## VII. COST AND BENEFIT ANALYSIS

### 7.1 Cost Analysis

There are three categories that must be taken into consideration when developing the proposed system. These three categories are:

#### (1) Investment Cost

##### Hardware Cost

(a) Server (1 set) 130,000.00 Bahts

- (1) CPU Intel Pentium III 733 MHz, 133 MHz
- (2) Cache LS 256 KB
- (3) ECC SDRAM 256 MB
- (4) Hard disk 9.1 GB SCSI Ultra 160
- (5) Hard disk 18.2 GB x 3 SCSI Ultra 160
- (6) Raid Controller 1 channel
- (7) SCSI Controller 2 channels
- (8) Monitor 17"
- (9) 52x CD-ROM
- (10) 10/100 MB LAN Card

(b) PC Client (3 sets) 99,000.00 Bahts

- (1) CPU Intel Celeron 600 MHz.
- (2) SDRAM 64 MB
- (3) Hard disk 10.2 GB
- (4) Monitor 17"
- (5) 10/100 MB LAN Card

(c) UPS 3000 VA (2 sets) 55,000.00 Bahts

(d) Network Peripheral	78,000.00 Bahts
(1) Router 1 LAN, 1 WAN	53,000.00 Bahts
(2) Hub 10/100 MB 24 ports	25,000.00 Bahts
(e) Office Automation	40,000.00 Bahts
HP Laser Jet 2100 M Printer	40,000.00 Bahts
Total Hardware Cost	402,000.00 Bahts

Software Cost

(a) Network Operating System	35,000.00 Bahts
Microsoft Windows 2000 Server	
(b) Operating System	8,000.00 Bahts
Microsoft Windows 98 License	
(c) Application Software	30,000.00 Bahts
Microsoft Office 2000	
Total Software Cost	73,000.00 Bahts

(2) Implement Cost

(a) Installing/ 1 day training	250,000.00 Bahts
(b) Training for IT Department	50,000.00 Bahts
(c) Training for end-user	30,000.00 Bahts
Total Implement Cost	330,000.00 Bahts
Total Investment Cost	805,000.00 Bahts

Remark: All the above price lists and implement cost are from NTTI (Thailand) Company Limited as of January 10, 2002.

7.2 Benefit Analysis

Benefits are classified as tangible and intangible. The proposed system provides benefits as follows:

7.2.1 Tangible Benefit

Tangible benefits can be measured in value. After the implementation of the new system, we can accrue annual benefit of the first year from the following topics.

(1)	Reduction of Manpower cost	360,000.00 Bahts
(2)	Reduction of Office Supplies	2,300.00 Bahts
(3)	Reduction of Miscellaneous	0.00 Bahts
	Total of Tangible Benefit	362,300.00 Bahts

7.2.2 Intangible Benefit

It is not a simple matter to define the value of intangible benefits. The proposed system provides the intangible benefits, which are summarized as follows:

- (1) Reduce work processing time
- (2) Provide the efficiency of the operation
- (3) Eliminate the duplication of work processes
- (4) Reduce human error from doing documentation
- (5) Provide service more quickly and efficiently
- (6) Increase more productivity in organization
- (7) Create a good image to the organization



7.3 Breakeven Analysis

It is reasonable to apply the concept of breakeven analysis to compare between the manual system and the proposed system.

(1) Costs of Manual System

Cost of manual system consists of operating cost, office supplies and miscellaneous cost. The miscellaneous is the budget which provided for the unexpected expense.

Table 7.1. Manual System Cost Analysis, Baht.

Cost items	Year				
	1	2	3	4	5
Operating Cost					
Salary Cost:					
Offers					
8 persons @10,000.00	80,000	88,000	96,800	106,480	117,128.00
Senior Staff I persons					
@15,000.00	15,000	16,500	18,150	19,965	21,961.50
Manager 1 person					
@25,000.00	25,000	27,500	30,250	33,275	36,602.50
Total Monthly Salary Cost	120,000	132,000	145,200	159,720	175,692.00
Total Annual Salary Cost	1,440,000	1,584,000	1,742,000	1,916,640	2,108,304.00
Office Supplies &					
Miscellaneous Cost					
Stationery Per Annual	16,000	17,600	19,360	21,296	23,425.60
Paper Per Annual	30,000	33,000	36,300	39,930	43,923.00
Utility Per Annual	17,000	18,700	20,570	22,627	24,889.70
Miscellaneous Annual	15,000	16,500	18,150	19,965	21,961.550
Total Annual Office supplies & Miscellaneous Cost	78,000	85,800	94,380	103,818	114,199.80
Total Annual Operating Cost	1,518,000	1,669,800	1,836,780	2,020,458	2,222,503.80
Total Manual System Cost	1,518,000	1,669,800	1,836,780	2,020,458	2,222,503.80

Table 7.2. Five Years Accumulated Manual System Cost, Baht.

Year	Total Manual Cost	Accumulated Cost
1	1,518,000.00	1,518,000.00
2	1,669,800.00	3,187,800.00
3	1,836,780.00	5,024,580.00
4	2,020,458.00	7,045,038.00
5	2,222,503.80	9,267,541.80
Total	9,267,541.80	

(2) Costs of the Computerized System

The cost of the computerized cost can be divided into fixed cost and operating cost. The amounts of the fixed cost included hardware, software and implementation costs which is offered by NTTI (Thailand) Company Limited. The operating costs included manpower cost, office supplies and miscellaneous cost. The number of manpower will be reduced. The estimation of the costs of the utility is increased due to the electricity consumption. The miscellaneous remain the same as the manual system for the unexpected expense.

Table 7.3. Computerized System Cost Analysis, Baht.

Cost items	Year				
	1	2	3	4	5
Fixed Cost					
Hardware Cost:					
Computer Server Cost	26,000.00	26,000.00	26,000.00	26,000.00	26,000.00
Workstation Cost	19,800.00	19,800.00	19,800.00	19,800.00	19,800.00
UPS Cost	11,000.00	11,000.00	11,000.00	11,000.00	11,000.00
Network Cost	15,600.00	15,600.00	15,600.00	15,600.00	15,600.00
Office Automation Cost	8,000.00	8,000.00	8,000.00	8,000.00	8,000.00
Total Hardware Cost	804,000.00	804,000.00	804,000.00	804,000.00	804,000.00
Maintenance Cost					
Maintenance Cost	0.00	0.00	0.00	6,000.00	6,000.00
Software Cost:					
Network Operating System	7,000.00	7,000.00	7,000.00	7,000.00	7,000.00
Operating System Cost	1,600.00	1,600.00	1,600.00	1,600.00	1,600.00
Application Software Cost	6,000.00	6,000.00	6,000.00	6,000.00	6,000.00
Total Software Cost	14,600.00	14,600.00	14,600.00	14,600.00	14,600.00
Implementation Cost:					
Installation Cost	250,000.00	0.00	0.00	0.00	0.00
Training for IT department	50,000.00	0.00	0.00	0.00	0.00
Training for end-user	30,000.00	0.00	0.00	0.00	0.00
Total Implementation	330,000.00	0.00	0.00	0.00	0.00
Total Fixed Cost	425,000.00	95,000.00	95,000.00	101,000.00	101,000.00
Operation Cost					
Offers 5 persons @10,000.00	50,000.00	55,000.00	60,500.00	65,550.00	73,205.00
Senior staff 1 person	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Manager 1 person	25,000.00	27,500.00	30,250.00	33,275.00	36,602.50
Total Monthly Salary Cost	90,000.00	99,000.00	108,900.00	119,790.00	131,769.00

Table 7.3. Computerized System Cost Analysis, Baht. (Continued)

Cost items	Year				
	1	2	3	4	5
Total Annual Salary Cost	1,080,000.00	1,188,000.00	1,306,800.00	1,437,480.00	1,581,228.00
Office Supplies & Miscellaneous Cost					
Stationery Per Annual	11,200.00	12,320.00	13,552.00	14,907.20	16,397.92
Paper Per Annual	24,500.00	26,950.00	29,645.00	32,609.50	35,970.45
Utility Per Annual	25,000.00	11,900.00	11,900.00	11,900.00	11,900.00
Miscellaneous Annual	15,000.00	16,500.00	18,150.00	19,965.00	21,961.50
Total Annual Office supplies & Miscellaneous Cost	75,700.00	67,670.00	73,247.00	79,381.70	86,129.87
Total Annual Operating Cost	1,155,700.00	1,255,670.00	1,380,047.00	1,516,861.70	1,667,357.87
Total Computerized System Cost	1,580,700.00	1,350,670.00	1,475,047.00	1,617,861.70	1,768,357.87

Table 7.4. Five Years Accumulated Computerized Cost, Baht.

Year	Total Computerized Cost	Accumulated Cost
1	1,580,700.00	1,580,700.00
2	1,350,670.00	2,931,370.00
3	1,475,047.00	4,406,417.00
4	1,617,861.70	6,024,278.70
5	1,768,357.87	7,792,636.57
Total	7,792,636.57	

Table 7.5.     The Comparison of the System Costs between the Computerized System and the Manual System.

Year	Accumulated Manual Cost	Accumulated Computerized Cost
1	1,518,000.00	1,580,700.00
2	3,187,800.00	2,931,370.00
3	5,024,580.00	4,406,417.00
4	7,045,038.00	6,024,278.70
5	9,267,541.80	7,792,636.57



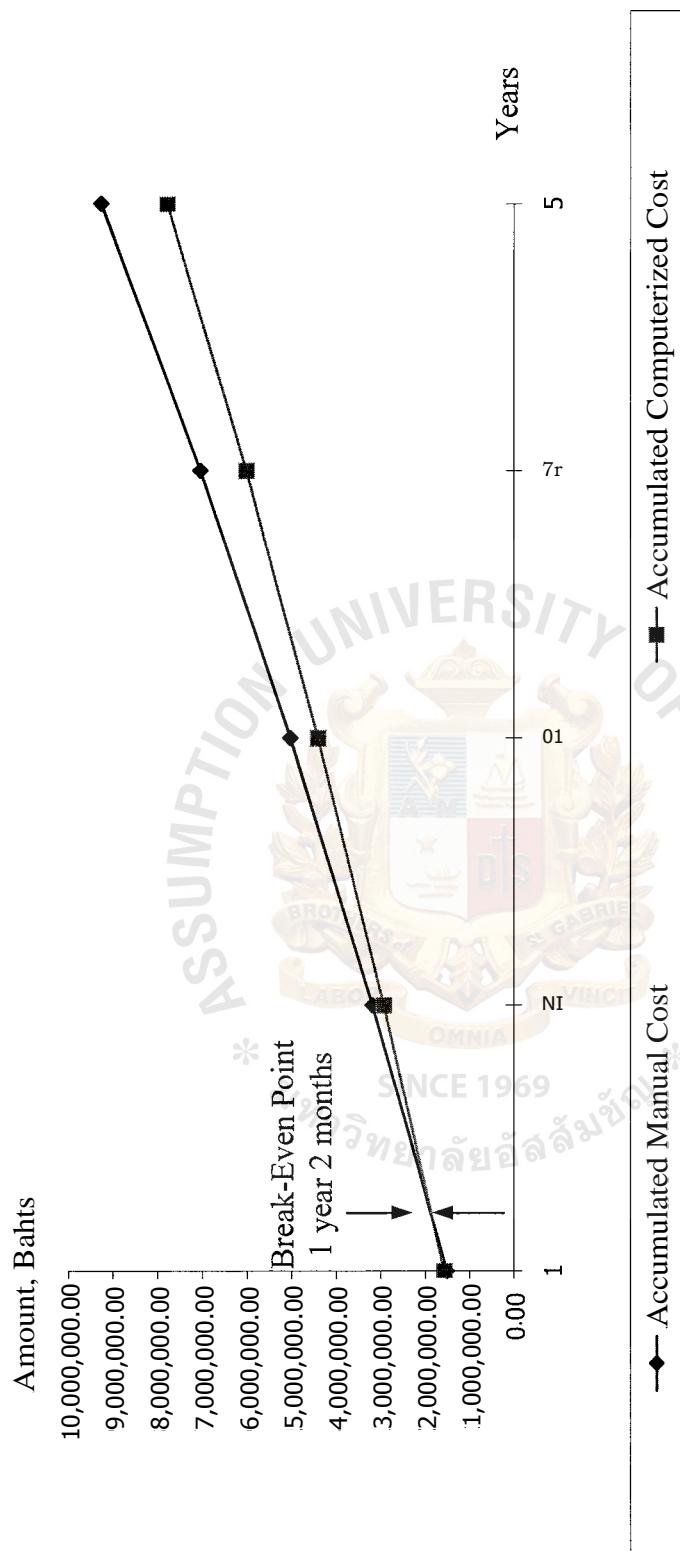
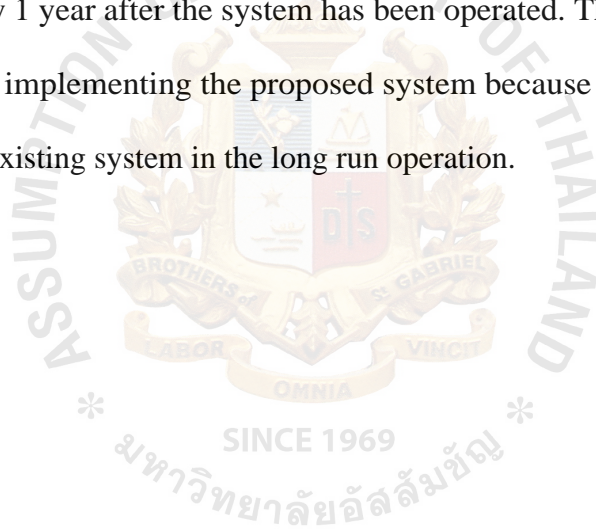


Figure 7.1. Cost Comparison between the Manual and the Proposed System.

Break-even Analysis shows the point where the accumulative cost of the existing system is equal to the accumulative cost of the proposed system. At the beginning, the cost of the computerized system is higher than the cost of the manual system. This difference comes from the development cost incurred at the first year of the new system implementation. But, in the long term, the proposed system can reduce the annual operating cost, especially salary cost and office supplies cost.

The break-even point of the proposed system is depicted on Figure 7.1. The proposed computerized system cost is less than the manual system cost when the time passes the second year. Thus, it can be concluded that the break-even point will occur approximately 1 year after the system has been operated. This result is satisfactory for investing and implementing the proposed system because it will incur less operating cost than the existing system in the long run operation.





## VIII. CONCLUSIONS AND RECOMMENDATIONS

### 8.1 Conclusions

Bangkok had rapid development which also brings the development of public utility. The growth of population and the development of economy bring the growth of the city. Some residence areas have changed to be the office buildings and some agriculture areas have changed to residence area. Thus, the center of Bangkok is the center of employment. The government has to invest a lot on the expansion of the public utility. The public transportation is still unqualified and there has not enough transports to support the passengers' need. All these reasons bring the new type of transportation, which is managed by private such as public van that offer more routes and more efficiency.

To make the system of public van transportation efficient, the proposed system is introduced to facilitate public van transportation process. This technology can increase work efficiency, and reduce operation cost.

Based on the cost-benefit analysis section, the existing system has lower operating cost than the proposed system during the first two year as indicated in the break-even point chart.

The details of how implementation of the proposed system can improve the operating time of each process can be summarized as the follows:

- (1) Reduce work processing time
- (2) Provide the efficiency of the operation
- (3) Eliminate the duplication of work processes
- (4) Reduce human error from doing documentation
- (5) Provide service more quickly and efficiently

- (6) Increase more productivity in organization
- (7) Create a good image to the organization.

## **8.2 Recommendations**

After the proposed system is launched, the systems performance must be evaluated to identify the difficulties that occurred during the operation. Then the system capacity standard should be compared with the actual process for evaluating the proposed system.

The technology trend should be considered as it grows very rapidly. Thus, the powerful system is necessary. This proposed system is the first change from actual, manual operating, to be an information system. The organization can get many benefits such as time deduction for operating, make quality of productivity and also create the good image for organization.

From the above mentioned, it shows the benefit to the organization. On the other hand, also the passengers of public van can get this benefit for inquiry on information of route, driver name and public van. If the passengers forget their belongings, the control center can search information of public van, driver name and immediately contact the drivers.

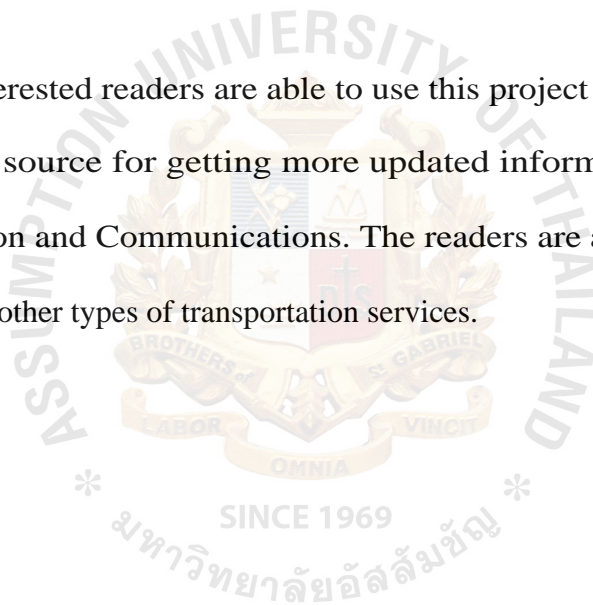
This proposed system might be the basic for the other systems that lead to improved performance and a better overall public transportation system.

Even though this project will focus on the public van transport it also provides information about other types of transportation as well. To improve the public transportation services, this project will show the strength and weakness of traveling on each type of transport. We also study the factors of van transportation in Bangkok.

Moreover, the studying of this project covered the information of Bangkok area, the physical information of city, habitat, population and economy, transportation network and other types of transportation.

Some data are searched from the government research that concerned on the characteristic of vans and developing of the route, distance and scope of the service, fee, van stop and relationship between the beginning point and the ending point and compared with other types of transportation. The main point of this phase is to find the advantages, disadvantages including sorting out the inefficiency of each type of transportation.

The interested readers are able to use this project as a guideline for further research. The source for getting more updated information is the Ministry of Transportation and Communications. The readers are able to use this project to compare with other types of transportation services.





APPENDIX A  
QUESTIONNAIRE

Questionnaire for Evaluate the Behavior and Characteristic of Traveling Public

Van

Name \_\_\_\_\_ Address \_\_\_\_\_

I. Personal Data

(1) Sex ☐ Male ☒ Female

(2) Age ☐ 15 —25 years old

☐ 26 — 35 years old

☐ 36 — 45 years old

☐ 45 — up

(3) Education

☐ Primary school ☐ Secondary school

☐ Undergraduate ☐ Graduated

☐ Higher

(4) Marriage status

☐ Single ☐ Married ☐ Devoice

(5) Occupation

☐ Student ☐ Government Officer

☐ Merchants ☐ Craftsman

☐ Private sector officer ☐ Housewife

☐ Professional ☐ Clerk

☐ Worker ☐ Unemployed

☐ Service staff ☐ State Enterprise officer

☐ Agriculture

(6) Income (per month)

- |   |   |
|---|---|
| <input type="checkbox"/> Less than 5,000.00 Baht    | <input type="checkbox"/> 5,000.00 — 10,000.00 Baht  |
| <input type="checkbox"/> 10,001.00 — 20,000.00 Baht | <input type="checkbox"/> 20,001.00 — 30,000.00 Baht |
| <input type="checkbox"/> 30,001.00 — 40,000.00 Baht | <input type="checkbox"/> 40,001 — 50,000.00 Baht    |
| <input type="checkbox"/> More than 50,000.00 Baht   |   |
- 
- 

II. Survey Section

(1) Number of member in family

- |  |  |
|--|--|
| <input type="checkbox"/> 1 — 3 persons | <input type="checkbox"/> 4 — 6 persons |
| <input type="checkbox"/> 7 — 9 persons | <input type="checkbox"/> 10 persons up |

(2) Do you or your family have own car? (If yes, please specify)

- |                             |   |
|-----------------------------|---|
| <input type="checkbox"/> No | <input type="checkbox"/> Yes                |
|                             | <input type="checkbox"/> Private car        |
|                             | <input type="checkbox"/> Motorcycle         |
|                             | <input type="checkbox"/> Car and motorcycle |

(<sup>3</sup>) Number of car that your family own.

- ☐ 1
- ☐ 2
- ☐ more, please identify \_\_\_\_\_

(4) Number of motorcycle that your family own.

- ☐ 1
- ☐ 2
- ☐ more, please identify \_\_\_\_\_

(<sup>5</sup>) Which type of public transportation that you use (can choose more than 1)

- |   |                                     |
|---|-------------------------------------|
| <input type="checkbox"/> Bus/ Air conditioned bus | <input type="checkbox"/> Public Van |
| <input type="checkbox"/> Taxi                     | <input type="checkbox"/> Tuk Tuk    |
| <input type="checkbox"/> S ong-Taew               | <input type="checkbox"/> Motorcycle |
| <input type="checkbox"/> BTS                      |                                     |

(6) How often do you use public van?

- |  |  |
|--|--|
| <input type="checkbox"/> Once a day    | <input type="checkbox"/> 2 times a day           |
| <input type="checkbox"/> 4 times a day | <input type="checkbox"/> more than 4 times a day |

(<sup>7</sup>) What is the purpose of using public van?

- |                                   |                                  |
|-----------------------------------|----------------------------------|
| <input type="checkbox"/> Studying | <input type="checkbox"/> Working |
| <input type="checkbox"/> Shopping | <input type="checkbox"/> Relax   |
| <input type="checkbox"/> Business | <input type="checkbox"/> Go home |

(8) Before traveling by public van? What type of transportation that you use and how long does it take?

- |                                      |             |               |
|--------------------------------------|-------------|---------------|
| <input type="checkbox"/> Walk        | _____ hours | _____ minutes |
| <input type="checkbox"/> Bus         | _____ hours | _____ minutes |
| <input type="checkbox"/> Public van  | _____ hours | _____ minutes |
| <input type="checkbox"/> Motorcycle  | _____ hours | _____ minutes |
| <input type="checkbox"/> Private car | _____ hours | _____ minutes |
| <input type="checkbox"/> Minibus     | _____ hours | _____ minutes |
| <input type="checkbox"/> Taxi        | _____ hours | _____ minutes |
| <input type="checkbox"/> Boat        | _____ hours | _____ minutes |

(9) After traveling by public van? What type of transportation that you use and how long does it take?

- ☐ Walk \_\_\_\_\_ hours \_\_\_\_\_ minutes
- ☐ Bus \_\_\_\_\_ hours \_\_\_\_\_ minutes
- ☐ Public van \_\_\_\_\_ hours \_\_\_\_\_ minutes
- ☐ Motorcycle \_\_\_\_\_ hours \_\_\_\_\_ minutes
- ☐ Private car \_\_\_\_\_ hours \_\_\_\_\_ minutes
- ☐ Minibus \_\_\_\_\_ hours \_\_\_\_\_ minutes
- ☐ Taxi \_\_\_\_\_ hours \_\_\_\_\_ minutes
- ☐ Boat \_\_\_\_\_ hours \_\_\_\_\_ minutes

(10) Please select the route that you traveling by public van.

- ☐ Lardpraw — Nontaburi  
\_\_\_\_\_ hours \_\_\_\_\_ minutes
- ☐ Victory Monument — Future Park (Rangsit)  
\_\_\_\_\_ hours \_\_\_\_\_ minutes
- ☐ Victory Monument — Patched  
\_\_\_\_\_ hours \_\_\_\_\_ minutes
- ☐ Ngamwongwarn — Ramkhumhang  
\_\_\_\_\_ hours \_\_\_\_\_ minutes
- ☐ Meanburi — Ngamwongwarn  
\_\_\_\_\_ hours \_\_\_\_\_ minutes
- ☐ Meanburi — Rangsit  
\_\_\_\_\_ hours \_\_\_\_\_ minutes
- ☐ Meanburi — Bangkhen  
\_\_\_\_\_ hours \_\_\_\_\_ minutes





แบบสอบถามเพื่อประเมินพฤติกรรมและลักษณะการโดยสารรณัฐสาธารณะ

ชื่อ \_\_\_\_\_ ที่อยู่ \_\_\_\_\_

I. ข้อมูลส่วนบุคคล

(1) เพศ ☐ ชาย ☐ หญิง

(2) อายุ ☐ 15 – 25 ปี

☐ 26 – 35 ปี

☐ 36 – 45 ปี

☐ 45 ปี – ขึ้นไป

(3) จำนวนครั้งที่ทางสมาชิกครอบครัวคุณมีไว้ครอบครอง

☐ 1

☐ 2

☐ มากกว่า กรุณาระบุจำนวน \_\_\_\_\_

(4) จำนวนรถยนต์ไร้ที่ทางสมาชิกครอบครัวคุณมีไว้ครอบครอง

☐ 1

☐ 2

☐ มากกว่า กรุณาระบุจำนวน \_\_\_\_\_

(5) ชนิดของรถสาธารณะที่คุณใช้ (สามารถเลือกได้มากกว่า 1 รายการ)

- |   |  |
|---|--|
| <input type="checkbox"/> รถประจำทาง/รถปรับอากาศประจำทาง | <input type="checkbox"/> รถตู้สาธารณะ  |
| <input type="checkbox"/> รถแท็กซี่                      | <input type="checkbox"/> รถตุ๊ก ตุ๊ก   |
| <input type="checkbox"/> รถสองแถว                       | <input type="checkbox"/> รถมอเตอร์ไซด์ |
| <input type="checkbox"/> รถไฟฟ้า BTS                    |  |

(6) ความถี่ที่คุณใช้บริการรถสาธารณะ

- |  |  |
|--|--|
| <input type="checkbox"/> อาทิตย์ละครั้ง    | <input type="checkbox"/> 2 ครั้งต่ออาทิตย์         |
| <input type="checkbox"/> 4 ครั้งต่ออาทิตย์ | <input type="checkbox"/> มากกว่า 4 ครั้งต่ออาทิตย์ |

(7) วัตถุประสงค์ในการใช้บริการรถสาธารณะ

- |  |  |
|--|--|
| <input type="checkbox"/> เพื่อเดินทางไปศึกษา | <input type="checkbox"/> เพื่อไปทำงาน  |
| <input type="checkbox"/> เพื่อไปซื้อของ      | <input type="checkbox"/> เพื่อพักผ่อน  |
| <input type="checkbox"/> เพื่อไปทำธุระ       | <input type="checkbox"/> เพื่อกลับบ้าน |

(8) ชนิดของรถโดยสารที่คุณใช้ก่อนที่คุณจะโดยสารรถตู้สาธารณะต่อ และระยะเวลาที่ใช้

- |   |                          |
|---|--------------------------|
| <input type="checkbox"/> เดิน                           | _____ ชั่วโมง _____ นาที |
| <input type="checkbox"/> รถประจำทาง/รถปรับอากาศประจำทาง | _____ ชั่วโมง _____ นาที |
| <input type="checkbox"/> รถตู้สาธารณะ (เส้นทางอื่น)     | _____ ชั่วโมง _____ นาที |
| <input type="checkbox"/> รถมอเตอร์ไซด์                  | _____ ชั่วโมง _____ นาที |

- ☐ รถยนต์ส่วนบุคคล \_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที
- ☐ รถมินิบัส \_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที
- ☐ รถแท็กซี่ \_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที
- ☐ เรือ \_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที

(9) ชนิดของรถโดยสารที่คุณใช้หลังจากที่คุณจะโดยสารรถตู้สาธารณะ และระยะเวลาที่ใช้

- ☐ เดิน \_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที
- ☐ รถประจำทาง/รถปรับอากาศประจำทาง \_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที
- ☐ รถตู้สาธารณะ (เส้นทางอื่น) \_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที
- ☐ รถมอเตอร์ไซด์ \_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที
- ☐ รถยนต์ส่วนบุคคล \_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที
- ☐ รถมินิบัส \_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที
- ☐ รถแท็กซี่ \_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที
- ☐ เรือ \_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที

(10) กรุณาระบุเส้นทางที่คุณโดยสารรถผู้สาธารณะเป็นประจำ และระยะเวลาในการโดยสาร

☐ ตลาดพร้าว - นนทบุรี

\_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที

☐ อนุสาวรีย์ชัยสมรภูมิ — ฟิวเจอร์พาร์ครังสิต

\_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที

☐ อนุสาวรีย์ชัยสมรภูมิ — ปากเกร็ด

\_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที

☐ งามวงศ์วาน — รามคำแหง

\_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที

☐ มีนบุรี — งามวงศ์วาน

\_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที

☐ มีนบุรี — รังสิต

\_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที

☐ มีนบุรี — บางเขน

\_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที

(11) จากเส้นทางของข้อ 10 ที่ท่านเลือก อยากทราบว่าถ้าท่านโดยสารโดยสารอื่นท่านจะใช้เวลาในการเดินทางนานแค่ไหน

\_\_\_\_\_ ชั่วโมง \_\_\_\_\_ นาที

(12) เหตุผลที่ท่านเลือกโดยสารโดยสารผู้โดยสารณะ

- |   |  |
|---|--|
| <input type="checkbox"/> ความเร็ว         | <input type="checkbox"/> ความปลอดภัย       |
| <input type="checkbox"/> สามารถกะเวลาได้  | <input type="checkbox"/> สะดวกสบาย         |
| <input type="checkbox"/> ราคาสมเหตุสมผล   | <input type="checkbox"/> ถึงที่หมายปลายทาง |
| <input type="checkbox"/> ไม่มีทางเลือก    | <input type="checkbox"/> อื่น ๆ            |
| <input type="checkbox"/> สะดวกต่อการต่อรถ |  |

(13) ข้อเสนอแนะ

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