



## CHAPTER 3

### ANALYSIS ON CURRENT TRAFFIC IN CHIANG MAI

#### 3.1 Introduction

Chiang Mai, as any medium size cities in developing countries, faces all sorts of problems such as population density, pollutions, and traffic congestion. The economic of the city is growing very rapidly in the past couple of years, after it has already fully recovered from the economic crisis of late 1990s. The development causes the city to expand in every direction, as a result places are distant. Going from place to place become more difficult, vehicles has become significant. In the past few years, the traffic congestion of the city has become the number one concern for the municipal government as well as for the people of Chiang Mai. It is the number one concern due to the effects of the problem, such as air pollution, noise pollution, waste of time and fuel, and the productivity of the city which is often overlooked. To really understand the problem of Chiang Mai's traffic congestion, it is wise to look back a few decades ago for some clues on the causes of the problem.

Decades ago, Chiang Mai was only a small city where most of the business districts were located inside the city wall and along Ping River near the ancient city area. The distance from Ping River to the other side of the city wall is less than 4 kilometers. The roads inside the ancient city area were mostly 1 lane road and could not be expanded due to the location of many historical sites. Such a short distance between places in the city and the condition of the roads, the most suitable public transportation at the time was minibus. Minibuses operate on non-fixed route and have no fixed schedule. They usually run around the crowded areas to pick up passengers. The minibus was very convenience to serve the demand at that time since people only travel in short distance, origins and destinations were scattered all over the business districts, and the roads were not suitable for the bus operation. However, as time went by the city expanded to outside the city wall. Without an appropriate city plan, active points such as schools, malls, markets, and hospitals were located disorderly, spread all around the area outside the city wall. As a result, the distance from places became greater. A fixed route could not be set up since the demand was not high enough for any single route due to the scattered of the active points. Minibus remained the main mode of public transport for the people of Chiang Mai. The unreliable characteristics of minibus began to cause problems as the demand was greater. The main problem with the minibus's operation is the quality of the service. The fare is not fixed, it depends on the negotiation skill only while distance has

nothing to do with it. On-board passengers are not guaranteed that they would get to the destination. Furthermore, if destination is located in less crowded area, the low demand areas, minibus drivers often deny the service. The poor quality of minibus plus the improvement in the economy of the city drove people to personal transport either cars, pick-up trucks, or motorcycles since they were more convenience.

Nowadays, Chiang Mai faces serious traffic congestion problem as a result from the recovery of the economy. The statistic on number of registered vehicles shows rapid growth in the past few years. Within 5 years, the number of registered vehicle increased by about 500,000. **Table 3.1** shows the number of registered vehicles. Approximately 90% of the total vehicle in Chiang Mai is personal vehicle. The number of each type of personal vehicle is shown in **Table 3.2** below.

Total number of vehicle	Years				
	2000	2001	2002	2003	2004
	695,172	854,716	870,997	936,168	1,167,279

**Table 3.1: Total number of vehicle in Chiang Mai**  
Source: Chiang Mai Land Transportation Department

Type of Vehicle	Years				
	2000	2001	2002	2003	2004
7 Seated personal car	67703	87625	90320	99855	115057
Over 7 Seated personal car	9934	11186	10758	10945	12814
Personal Truck	100974	139019	135863	142424	181600
Motorcycle	510974	614198	631430	680162	854746
<b>Total</b>	<b>689585</b>	<b>852028</b>	<b>868371</b>	<b>933386</b>	<b>1164217</b>

**Table 3.2: Number of personal vehicle in Chiang Mai**  
Source: Chiang Mai Land Transportation Department

The increasing number of vehicle has caused many problems to the city, some has already shown their effects while some are long term problems. The effects of increasing number of vehicles are :

1. **Environmental and health problems:** The common problems found in big cities with traffic problem are air and noise pollution. The emissions from most of the vehicles are combination of carbon monoxide (CO) and other dust particles. These are the basic cause of respiratory track disease such as allergy and lung cancer.

2. **Traffic problem:** Traffic jam is another common problem found in big city, Chiang Mai is no exception. The morning and evening rush hours are the period of the worse traffic jam. The area that experiences the worse traffic problem is the inner ring area with approximately forty square kilometers. The research conducted by Information Technology Service Center (ITSC) Chiang Mai University found that the ration of using personal vehicle is more than 90% of total number of transportation in Chiang Mai. Further more with this alarming rate of increasing vehicle, by the year 2007 the average speed of travel of vehicles within the city plan would not exceed 20 kilometer per hour.

3. **Fuel consumption:** Increasing number of vehicle simply mean increase fuel consumption rate. The rate is also exaggerated by the traffic problem. With the oil crisis experienced by most part of the world, it causes economic depression. Thai government has to spend billions of baht to freeze the fuel price, preventing even worse economic depression. As a result, fuel consumption problem must not only be considered as local problem but must be considered as national problem.

If this alarming rate of increasing in number of personal vehicle continued into the future, Chiang Mai University has predicted that by the year 2007 during the peak hours the speed that vehicle could travel in the city area would be less than 20 kilometer per hour. Further more it would also worsen the three effects above. Apart from those problems, another major concern is on the government budget issue. Municipal government would focus on solving the traffic congestion problem as its first priority. Major part of the budget would be spent on construction and improvement of streets to try to solve traffic problems. However, there are other problems that needed to be taken care of such as education and social issues that would bring more benefits to the community in the long run. Therefore, when looking back to the origin of the problem, one of the major causes of the problem was the lack of sufficient public transportation service that drove people to personal vehicle. Looking other medium size cities in Thailand such as Khon Kaen (center of Northeastern Thailand region) and Phitsanulok (center of lower Northern Thailand region). Those cities have fixed-route public transit systems. The comparison between Chiang Mai and the two cities is shown in **Table 3.3** below.

Province	Public Transportation System		
	Non fixed - route minibus	Fixed- route minibus	City Bus
Chiang Mai	yes	No	No
Khon Kaen	No	Yes	Yes
Phitsanulok	No	Yes	Yes

**Table 3.3: Public Transportation System in Thailand Medium Size Cities**

As the non-fixed route and schedule are the major concerns of minibus users, a new public transit system is needed to solve these problems. Bus transit is the system that suitable for those needs. As the roads' condition and the demand are now improved greatly, therefore, it should be possible for the bus to start its operation once again in Chiang Mai city area. However as bus transit was once operated before it went bankrupt during the economic crisis, a careful plan must be conducted to prevent the repeat of history. Co-investment between government and private investors on city bus transit project could prove to be the way to guarantee the success future of the system while maintaining the social service characteristic of the system.

The success of the co-investment bus transit project depends greatly on demand of passengers and attractiveness of the project to investors. The route for co-investment should be carefully selected demand wise, not to ensure the profitable future of the project but to create attractiveness to private investors as well. Apart from demand, conditions of co-investment such as benefits given to investors could also help attract investments.

This thesis can be divided into 2 main parts, the determination of the suitable route(s) for co-investment and the formation of co-investment manner and policy. The outcome of this thesis relies heavily on data analysis, therefore the accuracy of the data is crucial. The data can be acquired from 2 main ways; content analysis and field research.

For the content analysis, the data are provincial and municipality on transportation and public transportation, academic researches on Chiang Mai's public transportation system. Furthermore, the data are coming from various media like newspaper and internet.

Field research is conducted mainly through interview with authorities and academic researchers. The questions during the interview for the authorities are based on the laws and regulation of co-investment policy and manner, as well as the question related to the operation

and cost of the existing bus transit system. The questions for the academic researchers are focused on the route selection and theories related. Also the researchers are questioned about various topics related to the establishment of Chiang Mai's public transportation.

### **3.2 Current bus transit service in Chiang Mai**

Only recently, after series of changes and delays, bus transit service is up and running in Chiang Mai city area. The service is called Chiang Mai Bus or CMB for short. In this part, the discussion on CMB and the comparison between the current system and the proposed system is presented.

#### **3.2.1 Chiang Mai Bus ( CMB )**

The CMB project actually started nearly 3 years ago, as the central government has past the policy to make Chiang Mai the center of northern Thailand region as well as the gate way to other countries in this region. The municipal government has adopted the policy, and worked hard to develop the city in every way possible. Poor public transportation is one of the major problems that the city is facing. All means of public transport the city had before the introduction of CMB several months ago was operated on non-fixed route and non-fixed schedule. These means of public transportation at that time were minibus, Tuk-Tuk, motorcycle, and taxi. Minibus is the main mean of public transit that people of Chiang Mai rely on, however, its service is unreliable. The municipal government wanted to solve these problems and provide a more reliable public transit service for the people of Chiang Mai and the visitors. The municipal government has asked ITSC Chiang Mai University to design and plan for a more reliable and better service quality public transit of Chiang Mai city area.

ITSC Chiang Mai University has proposed a 3 stage public transit plan to the municipal government. In the 1<sup>st</sup> stage, the plan is to reorganize the service of minibus. The minibuses will be operated on fixed routes and fixed schedule. In the 2<sup>nd</sup> stage, in some of the high demand routes, the minibuses will be replaced by buses. And in the 3<sup>rd</sup> stage, the final stage, a mass rail transit will be built to transport people from suburb into the city area. The research team, led by Arjan Chaithawat Saowapol, has laid out 33 routes for the operation in the 1<sup>st</sup> and 2<sup>nd</sup> stages. The 33 routes were carefully designed based on the studies of needs of passenger, demand estimation, coverage area, land used, and the physical of the roads. The research of ITSC has been proposed to the municipal government with present of the Mayor,

Chiang Mai's Member of Assembly, and the Mr. Nikorn Chumnong (Minister of Transport and Communication at that time).

After series of changes and delays, the municipal government has launched the bus transit service which is believed to be able to solve the current public transit problem as well as to improve the standard of the city's current public transit. The CMB project has nothing related to the research that ITSC Chiang Mai University has proposed.

The CMB operates on 2 routes, route number 2 and route number 6. Route 2 is started from Nong Hoi and finish at the 700<sup>th</sup> anniversary Stadium via new Chiang Mai City Hall. This route is based on the route designed by Land Transportation Department 2 decades ago. A major modification has been made to the original design, which was the new route 2 that CMB operates on has avoided the inner city area. The distance for one round trip is 24 kilometers. Another route CMB operates on is route 6 which starts at the airport and run in a complete circle to finish at airport again. Route 6 uses the inner ring road as the main road to operate on. Again, route 6 is based on the outdated design from Land Transportation. Route 6 is the original route that the bus transit was once operated on before it went bankruptcy during economic crisis period. Route 6 is approximately 35.4 kilometers for one round trip. The 2 routes of CMB and the original routes designed by Land Transportation Department are presented in Appendix A. The routes have covered some of the important active points in Chiang Mai such as the airport, the city hall, some of the popular schools, and hospitals. However, the routes are nowhere near the important business districts of Chiang Mai. As stated earlier, the routes are based on those routes designed by the Land Transportation Department 2 decades ago. Therefore it may not be appropriate to the current situation of traffic and demand of the passengers on those routes. Observing the 2 routes that the CMB is currently operating on, it can be said that the purpose of the CMB operation is to provide the public transport in those areas where minibuses are not willing to operate. The 2 routes provide the connection around the city via ring road, where as the minibuses are still remains the main source of public transportation of the city area.

There are 25 thirty-seated air-conditioned Mitsubishi EUROII buses in the fleet of CMB. The buses were purchased long before the operation is up and running. There were series of changes, for example the changes in routes, time of operation, and the headway, after the 25 buses were purchased. The changes especially with routes and the headway are very important since these 2 are the factors used in determining the appropriate number of bus for the operation. Therefore, since the buses were purchased long before the project has been agreed, the number of bus in the fleet at present may not be appropriate for the operation. If

the number of bus is too low, the operation could not guarantee a good service quality to the transit users. If the number of bus is too high, the money spend on them are wasted. The money is wasted on the actual cost of the buses and also the maintenance of those unused buses.

The bus fare for CMB project is at flat rate of 10 Baht per trip for adult and 5 Baht for students under age of 23 years old. Comparing the bus fare to the minimum fare for the minibus of 15 Baht, the bus fare is prove to be worth the value for money of the passenger. However, with consideration that the CMB is a service provided by the municipal government as a social benefit for the people of Chiang Mai, the income of the operation must be able to support itself in the long run without having to rely on the support from the municipal government for budget. The income of the bus transit operation is from only 2 sources, the bus fare and the advertisement. The bus fare is the major income of the bus transit operation. The income would be enough to run the operation in the long run or not is roughly determined by the fare times by the line capacity, assuming the operation is running at 100%. The fare which is set at flat rate 10 Baht per trip with discount of 50% for students would surely be attractive and worth the value of money when comparing to the minimum fare of the minibuses. However when consider the capacity of the line, calculated from the frequency and maximum capacity of a bus, the income from the fare may not be enough for the operation to survive without any support from the municipal government.

The CMB operates from 5:30am in the morning to 10:00pm at night. The headway or the time interval for each round is 15 minutes throughout the day regardless to the morning and evening peak hours. The research of ITSC on traffic condition shows that the traffic of Chiang Mai city area is congested heavily during 2 periods of the day which are in the morning from 7:00am to 8:00am in the morning and again in the evening from 4:30 pm to 6:00pm. These intervals are considered as peak hour of traffic congestion of the city area. The headway of CMB operation completely neglects these peak hour intervals and operates on a single headway of 15 minutes. The traffic congestion during peak hours could cause the delay and extend the interval of each bus to more than 15 minutes. This could lead to the lost of passengers, since the waiting time between each bus is too long. The headway of 15 minutes means that there are only 4 rounds in 1 hour. The 4 rounds may be enough to supply the demand during the non-peak period, however, during the peak periods the 4 rounds may not be enough. The passengers may not be able to get on a bus and have to wait for the next round which maybe delayed due to the traffic congestion of peak period. As the result, the waited passengers may be forced to use other means of transport instead of wasting time waiting to get on a bus. The study on the needs of public transit passengers conducted by the ITSC

clearly shows that majority of passengers feel that the appropriate waiting time is between 5 to 10 minutes. Without taking the needs of passenger into consideration may cause the loss of customers. Further more the same study shows that majority of the passengers are students and working class people who must reach there destination before 8:00 am. The headway of 15 minutes and the delay due to the traffic congestion in the peak period could cause the delay for these passengers, which could leads to the decreasing in number of passengers. Observing the places that the 2 routes pass through, the majority of these places are schools and governmental offices. Schools and governmental offices are often closed before 6 o'clock in the evening. Therefore, there the number of demand on these routes would sharply drop after 6:00pm especially for route 2. Attention on the needs of passengers must be paid in order to attract transit users. If the needs of the current public transit users are not appropriately supply, the number of user of this new system would be low and the income generated would not be enough to keep the operation running.

As stated earlier the majority of the income generates by CMB project is from the bus fare. Advertisement fee is only another source of income from the operation, however, advertisement fee for CMB project is only a small amount. The government has no plan to put advertise on the actual bus, while the small bus stops do not provide any space for advertisement. Only spaces available for advertises are the space on the park and ride stops, which only 6 of them are constructed for the 2 routes.

The income from bus fare can be estimated roughly by multiply the line capacity to fare charge. The line capacity is calculated from the equation below:

$$\text{Line Capacity} = \text{Vehicle Capacity} \times \text{Frequency}$$

As the headway of the 2 route is 15 minutes throughout the day, therefore, the frequency is equal to 66 trips per day for each route. The vehicle capacity is equal to 50 passengers, 30 seated and 20 standing. The line capacity for each route of the CMB project is equal to 3300 passengers per day. Since the estimated demand for passengers along the 2 routes are higher than the service can cope, therefore, to estimate the total income when CMB project is operating at 100% efficiency it can be assumed that the number of passengers per day is equal to the line capacity. As the result, the estimated income from bus fare of the 2 routes is equal to 66,000 Baht per day maximum. The total income from bus fare only is equal to the maximum of 24,090,000 Baht per year. Another source of income is from advertisement on 6 park and ride stops, which charge 30,000 Baht per advertise per month, is



equal to 2,160,000 Baht per year. Therefore, the total income of the whole CMB operation annually is equal to the maximum of 26,250,000 Baht per year.

The operation cost of the CMB project includes fuel cost labor cost, personnel cost, marketing cost, insurance cost, maintenance cost, over head cost, and etc. The estimated operation cost for CMB project is equal to 28,674,000 Baht per annual. The operation cost can be divided as follow:

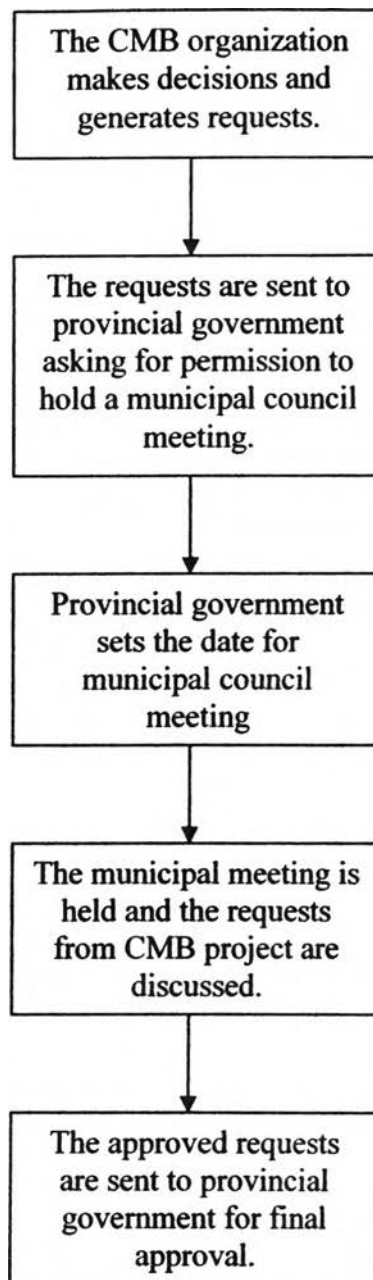
1. Fuel is at 3.857 Baht per kilometer, assuming that the consumption rate of a bus is 7 kilometers per liter and the diesel price is at 27 Baht per liter. The CMB operates 66 trips per day for each route. The total length for a round trip of route 2 is 24 kilometers, which is equal to 1584 kilometers per day. A round trip for route 6 is 35 kilometers, the total running distance per day is equal to 2310 kilometers. Therefore, the total distance per day of CMB operation is 3894 kilometers. As a result, the total fuel cost per day is 15,020 Baht, or 5,482,000 Baht per year.
2. Labor cost is estimated to be 5,548,000 Baht per year as there are 20 bus drivers and 20 bus hostesses hired by the CMB project. Bus driver is paid 205 Baht per day and the hostess is paid 175 Baht per day.
3. Salary for other personnel in the operation is equal to 4,764,000 Baht per annual. There are 8 administration personnel and 2 human resource personnel who receive 15,000 Baht per month on average. There are 7 finance and marketing personnel who received, on average, 25,000 Baht per month. There are 8 mechanics hired for the maintenance of buses with salary of 9,000 Baht per month.
4. Insurance cost is estimated to be 23,000 Baht per bus per year. With the fleet size of 25 buses, the total insurance cost is equal to 575,000 Baht per annual.
5. The maintenance cost for a bus is estimated to be 25,000 Baht per year. There are 25 buses, therefore the maintenance cost is totaled to 625,000 Baht per annual.
6. The overhead cost is estimated to be 50,000 Baht per month, which is equal to 600,000 Baht per year.

Comparing the maximum possible total income from CMB operation of 26,250,000 Baht per annual to the operation expense of 28,674,000 Baht per year, the operation would expect to generate a loss of over 2 million Baht each year. The 2 million Baht loss must be paid by the municipal government as the project is totally under their responsibility. If the municipal government could not cope with this lost the project would once again be terminated.

For the management of the CMB project, the municipal government has full responsibility in the project. A new department has been created in order to control and manage the CMB project. The project is 100% rely on the support of the municipal government. Being the social service may mask the important of generating profit to keep the project survive. If the project should generates lost, to keep the project running, the municipal government must provided the budget for the project's survival.

Because the CMB is totally under municipal government control, the management of the project must follow the governmental manner. Time is precious in today's business. Business decisions must be made as quick as possible in the fast pace business of today. Being under government control the decisions may not be made soon enough. Any decisions related to the CMB project must past through series protocol. In case of urgent and important issues the process of decision making could be as long as 60 days. The decision process flow of CMB project is shown in **Figure 3.1** below:

The decision process of CMB project is as shown in **Figure 3.1** above where every decision related to the CMB project must pass through all these steps. For example, if CMB decided that it needs more money to maintain the operation, first of all it must sent this issue to provincial government asking permission to hold a meeting of municipal council. The provincial would then set the date for the meeting. The issue is then discussed in the meeting of municipal council. If the municipal council agreed to the request according to the proposed issue, the decision of the municipal assembly is then again sent to the provincial government for final approval. As stated earlier, the whole process normally takes up to 60 days to complete. However, the process could take longer depend on the date of municipal council meeting set by the provincial government. This is a big disadvantage for the organization comparing to other business organization as the CMB organization' business decisions take too long to be approved and even worse when these decisions are being made by other parties outside the organization.



**Figure 3.1: Decision flow of CMB project**

### **3.2.2 The proposed bus transit system**

The proposed bus transit system in this thesis adopt some purposes from the CMB project of solving the traffic congestion of Chiang Mai city area, at the same time, improving the standard of the public transportation of the city while keep in mind that the proposed service must be the social service provided as the benefit for the people of Chiang Mai. However, there are several major differences in the proposed project. These differences are made with concerns to the survival of the project. The major different are the profit orientated

manner, the customer orientated manner, and the organization and management of the project. There are several other minor differences under these 3 major one, which is discussed in the following paragraphs.

First of all, bus is selected as the most suitable means of public transportation for Chiang Mai's city area. It is the most suitable because of its efficiency and the way it is operated could answer the needs of the current public transit users. However, it is the fact that bus transit service was once operated in Chiang Mai but it went bankrupt during the economic crisis. The main purpose of this thesis is to provide the solution to prevent the history repeating itself on the proposed system. The proposed project is carefully designed to be able to cope with the expenses generated by the operation as well as generating some profit to attract the private investors. Another important purpose of the proposed system is to solve the traffic congestion which rooted from the poor quality of public transit service. The proposed project, unlike the CMB project which operates in those areas that the minibuses are not operate, aims to replace the minibus as the main mean of public transit in the city area of people of Chiang Mai. Although the proposed project is very much profit orientated because it has to survive on its own without any support from the government, it is still very much under consideration that it is the social service provided to the people of Chiang Mai.

As stated time and time again that the proposed project is profit orientated, everything related to the income and expense are carefully reviewed. And since the major income of the proposed project is from the bus fare, hence from the number of passengers, the project must answer the needs of passengers correctly in order to generate the number of passengers enough to survive and make some profit. Combining the profit orientated and the customer orientated manners of the project, the outcome is reflected through these following aspects: the route to operate, the waiting time interval or the headway, the number of bus used, and the bus fare. These aspects are very much different from those of the CMB project which will be discussed in the following paragraphs.

The route that the proposed project is operated on is selected based on the estimated demand of passengers on the 33 routes designed by the ITSC Chiang Mai University. The 33 routes are design based on most recent data unlike those routes used in the CMB which are based on the 20 year old design. The route with the highest estimated demand is select and use as the route for the proposed bus transit operation. Demand is estimated through widely used and widely accepted sequential model. The model simulates the decision process of the passenger in choosing the transportation. The model together with the recent and accurate data, provide a precise estimation of the demand on each routes. The route with the highest

estimated demand is selected to be the operation route for the proposed project. As a result it could guarantee that there will be enough demand to generate income to keep the proposed operation to survive without undergoing bankruptcy in the future. The selected route for the operation starts at Chiang Mai's most important business district area Waroros Market, passes through the most crowded area of inner city where most of the trips generated from and attracted to. It goes on to another business district area along Suthep road and finishes at the biggest education place in Chiang Mai of Chiang Mai University.

As stated earlier, the proposed project is customer orientated. The study of needs of the current public transit passenger is taken into consideration. The study shows that acceptable waiting is between 5 to 10 minutes. Also it shows that the majority of the passengers are the students and working class people. The headway of the proposed operation is set to most suitable with these needs of the passenger. However, the proposed project also takes peak hour periods into consideration. The headway of the proposed operation is set to be 5 minutes during peak hour periods and 10 minutes during non-peak hour period. The previous headway is used for weekday and Saturday, since in Chiang Mai it is common for working on Saturday. The headway for Sunday is 20 minutes throughout the day, since there is no peak period. The operation time is from 6:00am to 9:00pm. The waiting time interval is designed to most suitable to the target customer of the students and the working class people as they are the majority in current public transit passengers.

As the proposed project is profit orientated, there should be no money wasted in any areas. The purchase of buses is determined to be the major expenditure in capital cost since a bus cost as high as 2 million Baht. The number of bus needed for the operation is determined from the mathematical formula with consideration of headway and the route (the time to complete the route to be precise). It is determined that 18 buses are needed for the proposed operation to be able to provide the passengers with only 5 minutes of waiting time during the peak hour period. However, 20 of them are purchased in order to keep the smooth running of the operation, in case of malfunction, accident, or any unexpected difficulties.

The bus fare of the proposed project is actually higher than the bus fare of CMB project. However, from an interview with Mr. Panyapol, the bus fare of the propose project is within the municipal government acceptable range. The bus fare of the proposed is at flat rate 15 Baht per trip, which is equal to the original bus fare of the CMB project. At the price, when the propose operation operate at 100% efficiency, it is believed that the operation not only could it survive but could also generate attractive amount of profit. When comparing the bus fare to the minibus minimum fare it is at the same level. Actually the bus fare has an

advantage of being flat rate at 15 baht for the whole trip, while for the minibus 15 baht could only take a passenger several kilometers, for further distance the fare is depend on negotiation skill.

The proposed project is profit orientated, however, it must be able to maintain the social service manner of the operation. Therefore, the best way to ensure the service remain a social service is that it must be under government supervision. However, to cope with the fast pace business stream of today, the organization that control and manage the proposed project could not be operated under government manner. The organization should be independent and operates under fully business like manner. Therefore the most suitable combination of the two is the government enterprise organization. It is suggested that the proposed project is controlled and operated by a governmental enterprise. A governmental enterprise would operate in fully business manner, however as it is still in control of the government, the proposed service will remain a social service not being to profit orientated. Another advantage of the government enterprise is the loads of work and responsibilities especially budget wise is shared between government and private investors.

The differences between the current CMB project and the proposed bus transit project is summarized and presented on Table 3.4 below along with the advantages that the proposed has over the current CMB project.

<b>Differences</b>	<b>CMB</b>	<b>Proposed Project</b>	<b>Advantages of Proposed Project</b>
Purpose	<ul style="list-style-type: none"> <li>• Provide a more reliable mean of public transport.</li> <li>• Improve standard of Chiang Mai's public transport</li> <li>• Create connections from around the city area to the city area.</li> </ul>	<ul style="list-style-type: none"> <li>• Provide a more reliable mean of public transport.</li> <li>• Improve standard of Chiang Mai's public transport</li> <li>• Make the proposed bus transit the main mean of public transit for city people instead of minibus</li> </ul>	<ul style="list-style-type: none"> <li>• The proposed bus system would replace minibus and become the main public transit for people of Chiang Mai.</li> </ul>
Profit Oriented	<ul style="list-style-type: none"> <li>• Non profit orientated operation</li> <li>• Social benefit provider</li> </ul>	<ul style="list-style-type: none"> <li>• Profit orientated under strictly government supervision</li> <li>• Maintain social service manner</li> </ul>	<ul style="list-style-type: none"> <li>• Being profit orientated organization would strengthen the financial status.</li> </ul>

Customer Orientated	<ul style="list-style-type: none"> <li>• Low level of customer orientated</li> <li>• Little attention is paid to customer's needs</li> <li>• Bus fare is the only aspect suitable for the needs of customers</li> </ul>	<ul style="list-style-type: none"> <li>• Customer orientated operation</li> <li>• Attention is given fully to supply the needs of customer in every way</li> <li>• Waiting time, fare, service quality, and coverage area are the main aspects that the proposed project answers directly to the passenger's needs</li> </ul>	<ul style="list-style-type: none"> <li>• Better supply for the needs of current transit users in those issues of waiting time, service quality, and coverage area</li> </ul>
Number of Buses	<ul style="list-style-type: none"> <li>• Inappropriate number of bus purchased since the 25 buses were purchased way before the CMB project was finalized</li> </ul>	<ul style="list-style-type: none"> <li>• The number of bus needed for the proposed operation is carefully calculated with consideration of the length of the selected route, the time taking to complete the round trip in both peak hour and non-peak hour, and the headway which is within the acceptable range of the passengers</li> </ul>	<ul style="list-style-type: none"> <li>• Number of bus purchased is appropriated for the operation. No money is waste on excess buses.</li> </ul>



Waiting Time or Headway	<ul style="list-style-type: none"> <li>• Neglecting the needs of passenger</li> </ul>	<ul style="list-style-type: none"> <li>• The headway is within the acceptable range of passengers determined from the study on the needs of transit users</li> </ul>	<ul style="list-style-type: none"> <li>• Waiting time of 5 minutes during peak hour periods and 10 minutes during non-peak hour is within the acceptable range of the current transit user</li> </ul>
Coverage Area	<ul style="list-style-type: none"> <li>• Passes through some of the city's most active points</li> <li>• Way off the important business districts</li> </ul>	<ul style="list-style-type: none"> <li>• Passes through some of the city's most active points</li> <li>• Also passes through the major business districts</li> </ul>	<ul style="list-style-type: none"> <li>• Proposed project passes through more populated area and the 2 most important business district of Chiang Mai</li> </ul>
Fare	<ul style="list-style-type: none"> <li>• Flat rate 10 Baht for adult and 5 Baht for student</li> </ul>	<ul style="list-style-type: none"> <li>• Flat rate 15 Baht for adult and 10 Baht for student and elder</li> </ul>	<ul style="list-style-type: none"> <li>• 15 Baht fare is a disadvantage comparing to the fare of CMB of 10 Baht</li> </ul>
Organization and Management Style	<ul style="list-style-type: none"> <li>• Own by government</li> <li>• Business decision cannot be made quickly</li> <li>• Business decisions are being made by other parties outside the organization</li> <li>• Governmental management style</li> </ul>	<ul style="list-style-type: none"> <li>• Co-investment between government and private investor with 51% and 49% accordingly</li> <li>• Fully business management style</li> </ul>	<ul style="list-style-type: none"> <li>• Business decisions are made faster</li> <li>• Cope better with the fast pace business stream of today</li> </ul>

**Table 3.4: Comparison between CMB and Proposed Bus Transit System**

### **3.2 Bus Routes**

Chiang Mai is selected as the area of study, to be more specific the municipal is the area that this thesis is focusing on. The study of Information Technology Service Center of Chiang Mai University by Saowapol and Therarattanaket (2004), has determined 33 routes which was designed to cover most of the municipal area. The routes were originally for the operation of minibus, however they were adopted to use for bus transit operation in this thesis.

The 33 routes were divided into 3 categories; main route, sub-route, and feeder route or “Soi” route (side street route).

In main route category, it contains 13 routes show in figure 3.1. Sub-route contains 7 routes and Soi route contains 13 routes, they are shown figure 3.2 and 3.3 accordingly.

These 33 routes were established based on the classic four-step model. From these routes the suitable route(s) for co-investment will be determined.

### **3.3 Data Collection**

As stated earlier, there are 2 ways of acquiring the relevant data according to the source of information. The source of information for the first part of the thesis is based on mainly studies from various researchers. For the second part, the data is based on interviews with authorities and the review of government enterprises’ annual reports.

In the first part of the thesis, the determination of suitable route(s), relevant data is collected through series of interviews with academic researchers of ITSC Chiang Mai University. The interviews mainly focus on the formation of the 33 routes and the theories and advice on route selection, demand estimation, and total cost estimation method.

In the second part, co-investment policy and manner formation, parts of the data are from researches and studies on Chiang Mai public transportation system. The main data in this part is gain through aeries of formal interviews with authority, municipal lawyer to be precise, who is in charge of the current city bus transit system. The interviews focus on the law and regulation related to co-investment issues and public transportation issue. The expectation from the municipal government’s point of view is also considered as one of the

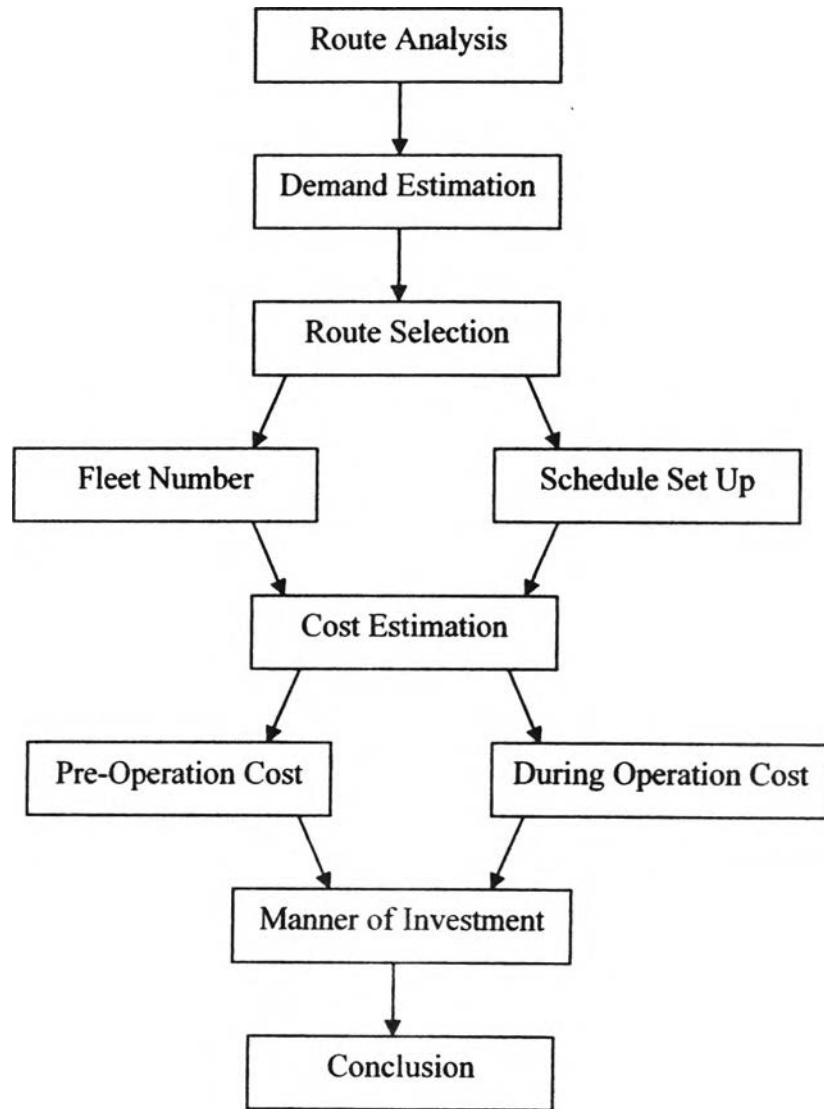
major topics in the interview. Apart from the interviews, the information and guideline on establishment of a government enterprise can be acquire from various sources such as government enterprises' annual reports and government contracts and agreements.

### **3.4 Data Analysis**

The collected data are analyzed and arrange into tables and graphics for clearer understanding. The analyzed data are used for determination of route, estimation the total cost, and formation of government enterprise.

### **3.5 Research Action Step**

The research action step is put into flow chart for better understanding. The flowchart is shown in **Figure 3.2** below.



**Figure 3.2: Research Action Step**