

KINGDOM OF THAILAND
ROYAL THAI POLICE
AND MUNICIPALITY OF CHIANG MAI

JAPAN INTERNATIONAL COOPERATION
AGENCY

THE STUDY ON
IMPROVEMENT OF ROAD
TRAFFIC ENVIRONMENT
IN CHIANG MAI CITY
IN THE KINGDOM OF
THAILAND

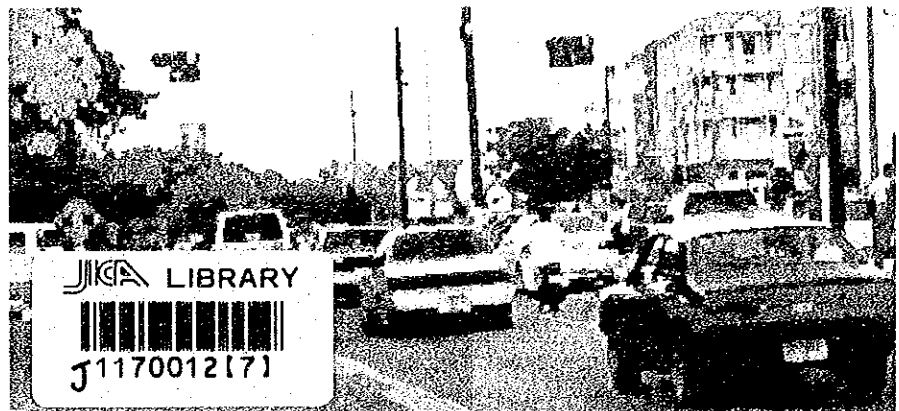
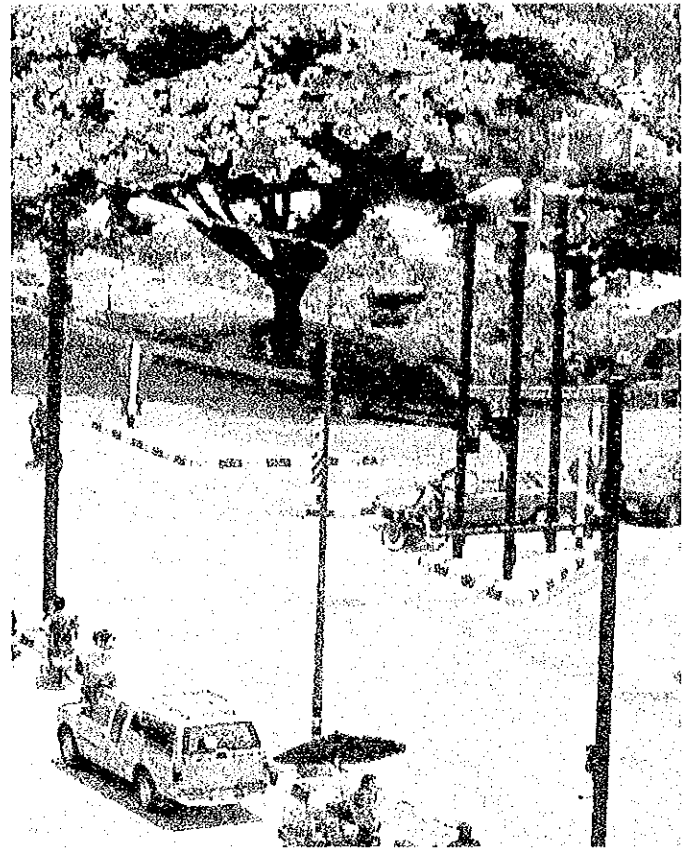
Final Report
Appendix

September 2002

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THE STUDY ON IMPROVEMENT OF ROAD
TRAFFIC ENVIRONMENT IN CHIANG MAI CITY
IN THE KINGDOM OF THAILAND

FINAL REPORT
APPENDIX

SEPTEMBER 2002

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ROYAL THAI POLICE
AND MUNICIPALITY OF CHIANG MAI***

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***Final Report
Appendix***

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*For the currency conversion, in case necessary
Exchange rate in July 2002 is applied*

JPY 1 = THB 0.35



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APPENDIX

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Appendix A

TOR for Traffic Surveys

The TOR for traffic surveys which are conducted in this study are shown in the following.

- (1) Terms of Reference on Intersection Traffic and Queue Length Surveys
- (2) Terms of Reference on Traffic Volume Survey, Parking and School Trip Surveys
- (3) Terms of Reference on Traffic Surveys at Wat Chet Yod Intersection (After Civil Works)
- (4) Terms of Reference on Traffic Surveys at Wat Chet Yod Intersection (After Signal Installation)

Japan International Cooperation Agency

**Terms of Reference On Intersection Traffic and Queue Length
Surveys For The Study on Improvement of Road Traffic
Environment in Chiang Mai City in the Kingdom of Thailand**

31st July 2001

1. Background

This TOR is prepared for the Conduct of traffic volume counting and queue length survey at selected intersections in Chiang Mai City.

The conduct of this survey is one of the tasks required for the gathering of existing traffic data needed for the **Study on Improvement of Road Traffic Environment in Chiang Mai City** by the Japan International Cooperation Agency (JICA) under its ODA program for the Government of the Kingdom of Thailand.

2. Objectives

This TOR sets forth the basic requirements or scope of work for the proper conduct of the Survey mentioned above so as to satisfy the data requirements for the JICA Study. Although it is the intention of this TOR to cover all aspects in the conduct and management of these surveys, when doubts arise as to any inherent details of the work, reference should always be made to the JICA Study Team.

3. Scope of Work

The main purpose of this Intersection traffic movement (ITM, in short) survey is to assess the capacity of the intersection in handling the traffic demand. Traffic volumes at peak hours are essential data for the improvement of the geometric design of the intersections. Traffic demand pattern throughout the major part of the day is useful to help determine signal plans.

Queue length data of vehicles waiting at each approach of the intersection is a good indication of the degrees of delay experienced by road users at the intersection. These data are needed to design the appropriate location of vehicle detectors and signals as a measure to improve these junctions.

(1) Number of Survey Stations

A total of 20 intersections are to be surveyed. The location of these survey stations is shown in Figure 1.

Table 1: Intersection Survey Locations

No.	Name Intersecting Streets		Type of Intersection	Signalization
J-1	Chang Phuak Road	Chotana Niwet 2	T – junction	Not signalized
J-2	Super Highway	Soi Wat Chet Yod	T – Junction	Not signalized
J-3	Canal Road	Soi Chet Yod Khlan	Cross Junction	Not Signalized
J-4	Hadsadhi Sawee Road	Chang Phuak Soi 4	Cross Junction	Not Signalized
J-5	Mahidol Road	Haiya Road	T-Junction	Not Signalized
J-6	Thipanet Road	Wua Lai Road	Y-Junction	Not Signalized
J-7	Chiang Mai Land Road	Super Highway (Aom Muang Rd)	T-Junction	Not signalized
J-8	Chaing Mai Land Road Road / Soi 15	Chang Khlang Road	Cross junction (Off-set junction)	Not Signalized
J-9	Rakheng Road	Kampheng Din Road	Cross junction	Not Signalized
J-10	Rattanakosin Road	Tat Wong Road	T-junction	Not Signalized
J-11	Rattanakosin Road	Bumrung Rat Road	T-Junction	Not Signalized
J-12	Rattanakosin Road	Charoen Rat Road	Cross junction	Signalized
J-13	Rattanakosin Road	Muang Samut Road	Cross junction	Signalized
J-14	Ratchawithi Road	Ratchaphakhinai Road	Cross junction	Signalized
J-15	Ratchawithi Road	Phra Pokklao Road	Cross junction	Signalized
J-16	Inthawororot Road	Singharat Road	Cross junction	Signalized
J-17	Phra Sing Road	Phra Pokklao Road	Cross junction	Signalized
J-18	Thipanet Road	Sriping Muang Road	Cross junction	Signalized
J-19	Chang Khlang Road	Loi Kroh Road	Cross junction (2 one way st.)	Not Signalized
J-20	Rot Fai Road	Sa Na Lung Road	Cross junction	Not Signalized.

(2) Contents of Survey

The survey is to count the traffic volumes by types of vehicles by direction of movement at the intersection (through, left turn or right turn). Where U-turn movement is present, it should also be counted as a separate movement. (J-1, J-2, J-3, J-5, J-7).

Secondly, the survey is to measure the queue length during peak hours at these intersections. The length of vehicles waiting at each approach accumulated shall be counted at every 5 minutes intervals.

Thirdly, the survey is to count pedestrian traffic volume at 15 of the 20 intersections at all approaches for two directions. The 15 locations are J-3, J-4, J-6, J-8, J-9, J-11-J-20.

(3) Survey Duration and Dates

The intersection movement survey shall be conducted for 14 hours during weekdays (Monday to Friday except public holidays). The 14 hours shall be from 6:00 am to 8:00 pm).

For the queue length survey, the survey is to be conducted during the two peak hours, from 6:30 to 9:30 a.m. and from 4:30 to 7:30 p.m., as well as off peak hour between 13:00-14:00 hour, for a total of 7 hours.

For the pedestrian counting, the survey shall be conducted during the morning and evening peak hours (6:30-9:30 a.m. and 4:30-7:30 p.m.)

(4) Classification of Vehicles

The classification of vehicles for this survey shall be as follows:

Cars and Pickups (incl. 4 wheel drives/jeep/van)

Motorcycles

Minibuses

Buses and Coaches

Small trucks (2 axles)

Medium and Large trucks (three axles and above, bulldozers, trailers, etc)

Others (Tuk-tuk, tricycles, etc)

(5) Method of Survey

For the traffic volume counting survey at intersection, enumerators shall be stationed at the intersection and using mechanical counters, manually count the number of vehicles by different directions, such as through, right turning and left turning. The numbers of vehicles by different vehicle types are then recorded in the survey sheets by every 15 minutes.

For the queue length survey, the curb is first marked into distances by meters. Enumerators are then stationed towards the end of the queue to record down the distances of the queue. The survey is to record the longest queue on each approach irrespective of whether it is on which lane.

The queue length surveyed at each of the approach to the intersection shall be recorded every 5 minutes on the survey sheets.

The pedestrian counting shall be done at the intersection, taking the total number of persons crossing each of the approaches within 10 m from the intersection. These volumes shall also be recorded on the survey sheets at every 15 minutes intervals.

(6) Survey Organization

A survey organization, consisting of survey leader, survey supervisors, team supervisor and enumerators, must be organized to efficiently carry out the survey. For each intersection, depending on the size of the intersection, the number of enumerators will differ.

Basically, for a large intersection, separate enumerators are required at each approach for the through movement, right turn and left turn. At some of the T junctions along the Superhighway, U-Turn movement shall also be counted.

For a large intersection with multiple lanes and very heavy traffic, separate enumerators may be necessary to count the through traffic movement at each approach for the different lanes. For a small intersection, fewer enumerators will be needed to manage the counting by movement at each approach if the traffic is not heavy.

For the queue length survey, one enumerator is needed at each approach.

For the pedestrian counting, one person per direction per approach shall be sufficient.

(7) Data Recording

Data of the traffic counts by types of vehicles must be recorded clearly at 15 minutes intervals on the prepared survey sheets.

For the queue length survey, queue length in meter at each approach shall be recorded on the survey sheet in every 5 minutes intervals.

(8) Data Processing and Comments

Data obtained from the traffic movement survey are to be first checked for obvious errors if any, and then entered into computer using excel format. Data are then summed up by category by hour by direction by station. Summation tables shall be done in vehicles as well as in PCU.

Queue length results in distance shall first be entered into computer using excel format. The longest queue length in meter at 5 minutes interval per approach is to be entered into the form.

Pedestrian counting data shall also be input into the computer at 15 minutes intervals and summed up for the hourly total by direction per location.

Simple statistical analyses and comments shall also be prepared based on the results of the survey and submitted.

4. Survey Forms and Questionnaires

All the survey record forms will be prepared and provided by the JICA study team in English. The organizer shall however have to translate them into Thai if necessary.

5. Survey Time Period and Submission of Data

The surveys have to be completed within 6 weeks from the date of signing an agreement / contract with the JICA Study Team, unless there is reasonable cause for extension, which are beyond the control of the survey organization.

To enable the JICA study team members to use some of the collected data, the basic tabulations and summation tables of the survey data shall be submitted in parts as soon as they are completed and input into computer files after the actual field works.

Statistical analyses and comments on the results of survey can be submitted two weeks after the 6 weeks period.

6. Final Output of the Survey

The survey leader shall double-check the results of all the survey and where obvious errors are found, they must be rectified immediately. The final output of the survey shall be in the form of data spread sheets in MS Excel format. The JICA Study Team

shall specify the spreadsheet format for the data entry. The hand written survey sheets shall also be submitted to the JICA Study Team for inspection.

The data duly entered into properly coded files shall be stored in CD disc or floppy diskettes for submission to the JICA study team. Hard copies of the spreadsheets are also required.

7. Responsibility of the Consultant/Survey Organization

The Consultant/Survey Organization shall be fully responsible, in the course of carrying out the above scope of work, for the following:

- Recruitment and training of survey personnel,
- Proper conduct and behavior of all survey personnel,
- Safety of all the survey personnel,
- Supply of mechanical counters if using,
- Survey sheets, writing apparatus, etc,
- Formal permissions to conduct the surveys/interviews wherever they are needed from such institutions as the police, DOH, municipality.
- Transport of survey personnel to site,
- Supply and erection of any temporary shelter, lighting at night, safety equipment such as safety cones, signs, etc.

8. Proposal

The short-listed consultant/organization must submit a proposal on their recommended approach, method, organization of conducting the survey and the appropriately itemized costs, such as salaries of personnel, preparation costs (forms, counters, etc), transportation, data entry, professional management must be indicated.

If applicable, suggested survey forms may be appended in the proposal. A time schedule indicating the timing planned by the proponent in carrying out the work must be given. At the same time, the number of enumerators, team supervisors and other personnel planned for each survey must be clearly indicated in the proposal.

The proposal must be submitted to the JICA study team at the Study Office for the Study on Road Traffic Environment Improvement in Chiang Mai City, located at the Chiang Mai Provincial Police Office at Super Highway (next to the telecommunication office) not later than 7th August 2001 at 12:00 noon.

Japan International Cooperation Agency

Terms of Reference On Traffic Volume Survey, Parking and School Trip Surveys For The Study on Improvement of Road Traffic Environment in Chiang Mai City in the Kingdom of Thailand

31st July 2001

1. Background

This TOR is prepared for the Conduct of the following types of surveys in Chiang Mai City, namely:

- A Traffic Volume Survey (TVS),
- A Parking Facility and Utilization Survey (PUS),
- A School Trip Interview Survey (STS).

The conduct of these surveys is one of the tasks required for the gathering of existing traffic data needed for the **Study on Improvement of Road Traffic Environment in Chiang Mai City** by the Japan International Cooperation Agency (JICA) under its ODA program for the Government of the Kingdom of Thailand.

2. Objectives

This TOR sets forth the basic requirements or scope of work for the proper conduct of the said Surveys so as to satisfy the data requirements for the JICA Study. Although it is the intention of this TOR to cover all aspects in the conduct and management of these surveys, when doubts arise as to any inherent details of the work, reference should always be made to the JICA Study Team.

3. Scope of Work

3.1. Cross Section Traffic Volume Survey (TVS)

The main purpose of this survey is to provide a yardstick to update the previous OD data in the 1994 Chiang Mai Transport Masterplan. For this purpose, survey points along two screen lines are selected for counting the vehicle volumes and the vehicle occupancy rates. Some survey points are selected to coincide with those of the previous study to enable direct comparison.

(1) Number of Survey Stations

This survey is to be conducted at 26 locations at cross section of major roads, as indicated on Figure 1.

- Screen Line 1: Mae Ping River: 6 stations
- Screen Line 2: East-West Line: 10 stations
- Others: 10 stations

Table 1: Name and Number of Survey Stations

No	Station Number	Name of Stations	Survey Duration	Remarks
Mae Ping River Screen Line	TC-1	Super Highway North Bridge	Peak hours	4 lane divided
	TC-2	Chaloem Phra Kiat Bridge	6 hours	4 lane undivided
	TC-3	Nakhon Ping Bridge	14 hours	Heavy traffic on 4 lane undivided
	TC-4	Nawarat Bridge	24 hours	Heavy traffic on 4 lanes undivided
	TC-5	Mengrai Bridge	6 hours	2 lane undivided
	TC-6	Super Highway South Bridge	6 hours	4 lane divided
East-West Screen Line	TC-7	Canal (Chonprathan) Road	6 hours	4 lane divided
	TC-8	Nimmanhemin Road	6 hours	2 lane road
	TC-9#	Boonruangrit Road and Arrak Road	14 hours	Heavy traffic on a pair of one way streets
	TC-10	PhraPokglao Road	6 hours	2 lane road
	TC-11#	Moon Muang Road and Chaiyaphun Road	14 hours	Heavy traffic on a pair of one way streets
	TC-12	Charoen Rat Road	14 hours	Heavy traffic on two lane road
	TC-13	Bumrung Rat Road	6 hours	2 lane road
	TC-14	Thung Hotel Road	6 hours	2 lane road
	TC-15	Superhighway	14 hours	Heavy traffic on 4 lane divided
	TC-16	Wichayanon Road	6 hours	2 lane one way
Other Points	TC-17	Suthep Road	6 hours	4 lane undivided
	TC-18	Huay Keaw Road	6 hours	4 lane undivided
	TC-19	Chang Phuak Road	6 hours	4 lane
	TC-20#	Maneeoparat / Sri Phun Rd	6 hours	Pair of one way st.
	TC-21#	Bamrungburi/Changloh Rd	6 hours	Pair of one way st.
	TC-22	Sri Donchai Road	6 hours	2 lane
	TC-23	Tha Phae Road	6 hours	4 lanes
	TC-24	Kuangmane Rd	6 hours	2 lane
	TC-25	Charoen Muang Rd	6 hours	4 lanes
	TC-26	Chaing Mai Lamphun Rd	6 hours	2 lanes

Peak Hours = (6:30-9:30) and (16:30-19:30)

14 Hours = (6:00-20:00)

24 Hours = (6:00-6:00)

Note: # Care in selecting survey point to avoid double counting U-turn traffic.

(2) Contents of Survey

Data to be collected at the above survey stations are:

Traffic volume data by direction by vehicle types by hour,
Vehicle occupancy data (number of persons in the vehicles passing by the stations including driver) of 5-10% samples of the total traffic through the stations.

(3) Survey Duration and Days

Out of the total survey stations, 1 station shall be surveyed for 24 hours, 5 stations for 14 hours (from 6 am to 8 pm) and remaining 20 stations are to be surveyed for 6 hours,

3 in the morning peak hours of 6:30 to 9:30 am and evening peak hours from 4:30 to 7:30 pm.

These various stations are indicated in Figure 1.

This survey shall be conducted on **weekdays only** (i.e. from Monday to Friday) and not on weekends or any public holidays/school holidays.

(4) Classification of Vehicles

Vehicles to be counted at the stations according to their direction (Inbound or Outbound), for each hour and recorded on survey sheets in the following classes:

- Cars (incl. 4 wheel drives/jeep)
- Pickups and Vans
- Motorcycles
- Minibuses
- Buses and Coaches
- Small trucks (2 axles)
- Medium and Large trucks (three axles and above, bulldozers, trailers, etc)
- Others (Tuk-tuk, tricycles, etc)

The vehicle occupancy data shall therefore also follow these vehicle types.

(5) Method of Survey

Survey enumerators are to be posted at both sides of the road cross sections and using mechanical counters, they are to count the number of vehicles crossing the stations according to the above vehicle classification.

Separate survey enumerators are to be posted at the stations to gather the passenger occupancy data. Since only a sample of 5 to 10% is required, the enumerator may observe and record down the number of passengers in the vehicle at a rate of about 1 in every 10 vehicles that passed by. But he must make sure samples taken are reflective of all vehicle classes. Where it is difficult to count the exact number of passengers in the vehicle, (such as in the case of a bus), a close estimate is acceptable.

(6) Survey Organization

To ensure successful execution of such a survey, effective control and management of survey enumerators is very essential. This is particular so when considering that the survey may have to be conducted simultaneously at several survey stations and the survey has to be completed in a short time. The entire survey team should be well organized into survey leader, survey supervisors, team supervisors and survey enumerators. Training must be given to survey enumerators to ensure consistency in understanding vehicle types, method of counting and recording on the survey forms.

The number of survey enumerators required for each station depends largely on the traffic volume and size of the station. For a 4 lane divided highway with high traffic

volume, more enumerators will be required compared to a 2 lane undivided major road.

(7) Data Recording

The survey data must be entered clearly into the survey sheet by the survey enumerators. These sheets must be prepared before hand and handed out to the enumerators at the start of the survey by the team supervisor. The numbers of vehicles by types shall be clearly entered into the survey sheet by direction by station at every 15 minutes intervals.

For the vehicle occupancy survey, the number of passengers including the driver by vehicle types shall be entered into the proper category. Within an hour, many samples will be recorded and the average computed later.

(8) Data Processing and Comments

Data from the survey shall be entered into the computer using excel format. Total vehicle volumes will be first entered as 15 minutes total and then summed up by category into hourly traffic by direction. The total traffic volumes by hour shall also be converted into PCU. The PCU conversion factors shall follow those used in Thailand.

Suitable statistical analysis such as hourly fluctuation graphs and peak hours volume in vehicles and PCU, and other comments shall also be prepared and submitted.

For the vehicle occupancy data, the average occupancy (person/veh) by vehicle types shall be computed by hour. These values are then multiplied with the hourly classified vehicle counts to obtain the person trips at the survey stations.

3.2. Parking Facility and Utilization Survey (PUS)

One of the very congested areas in Chiang Mai city facing large parking demand is near the Warorot Market. Lack of off street parking facilities has resulted in many haphazard on- street parking by patrons to the market. This situation has resulted in a loss of road capacity, which cause chronic traffic congestion. Vehicles of shop owners also occupied many spaces on the frontage roads. Loading and unloading of goods have to be done on whatever space there is left on the road, often blocking the entire flow of traffic.

The Municipality of Chiang Mai City has embarked on the construction of a multi-storey car park near the market. This survey is therefore aimed at estimating the present daily parking demand near the market. This information will be useful in assessing the adequacy of the parking building and the need for providing other forms of parking or devising other measures.

(1) Scope of Parking Survey

(a) First, the survey is to find out the total number of legal parking lots presently provided by the Municipality, both as on street parking or off street parking within the survey area.

(b) Secondly, the survey is to find out the daily parking demand by hours in this area. This is done by observing and recording the number of vehicles (divided into cars, pickups and vans, m/c, minibus, light trucks and others) by hour that are parked on the streets and side lanes, and on the off-street parking lots. When recording, they are also to be differentiated between legal parking or illegal parking; and whether they are parked vehicles or loading/unloading vehicles. The minibuses waiting for passengers should also be counted and recorded.

(2) Survey Area, Duration and Dates

The parking survey area shall be the area around the Warorot Market, as defined by Tha Phae Road, Ping River, the Mae Kha Canal and Ta Wong Road. Survey shall be conducted for 14 hours during one of the weekdays from 6 am to 8 pm. This area is indicated in Figure 1.

(3) Classification of Vehicles

The types of vehicles surveyed in the parking utilization parking shall include the same classes of vehicles as in the traffic volume survey on page 4.

(4) Method of Survey

For the parking inventory survey, it is advisable to obtain the parking facilities (location and number of lots, type of collection and rate of parking) from the Municipality. If necessary this should be confirmed on site.

For parking demand, the total area is first subdivided into appropriate number of segments. One or two survey enumerators are then assigned to each segment. They are to survey as comprehensively as possible the total parked vehicles within that segment, identified into left or right side of the road, lanes, and parking plots and record them by every 30 minutes on the survey sheet.

(5) Data Recording

Data of the surveys are to be clearly recorded into the prepared survey sheets.

(6) Data Processing and Comments

Data from the parking inventory survey shall be input into the computer using excel format. Data will then be summed up into totals by streets and then the total for the study area.

Parking utilization data will also be input using excel format and summed up to provide hourly totals by streets by vehicle types and total area. Totals of illegal parking and legal parking; parking versus loading vehicles shall also be prepared.

Suitable statistical data analysis shall also be done on the results of this survey and comments given on such results.

3.3 School Traffic Situation Survey (STS)

Traffic congestion problem is a recognized issue in areas having a concentration of schools and colleges due to vehicles sending and fetching students to these institutions during the morning and evening hours. This survey is to be conducted to provide basic information to better understand this phenomenon in Chiang Mai. The aim is to suggest transport alternatives for sending and fetching of school children thus alleviating the congestion problem.

Two such areas in Chiang Mai City are identified as (1) Kaew Nawarat Road Area and (2) Charoen Prathet Road Area. These are shown in Figure 1.

The first area is along Kaew Nawarat Road from the Super highway up to Charoen Rat Road. Two major schools located here are:

- Dara Girls School
- Royal Prince College.

The second area is defined by Charoen Prathet Road, Sri Doncha Road, Pracha Sampha Road, Rakaeng Road, Chang Khlan Road and Chiang Mai Land Road.

The schools located here are:

- Chai Rot Secondary School
- Regina Secondary School
- Paharethai (Sacred Heart) Primary and Secondary School
- Monfort Primary School
- Soon Noi Primary School
- Wachirawit Secondary School
- Suntisuksa Nursery
- Suan Dek Nursery

(1) Contents of Survey

(a) The first is to measure the extent of vehicular traffic concentrating in these two areas during the school morning and evening hours. For area (1), counting shall be done at 5 locations. For area (2), counting shall be done at 6 locations. These are indicated in Figure 1.

(b) Secondly, the number of pupils to each school is to be obtained from the schools or Education Department.

(c) Thirdly, the school authorities are to be interviewed on: whether there is any form of collective transport modes arranged by the school at present (eg.using vans) to fetch and send the students. And if there is, the number of vans used, who own the vans and amount and form of payment by students.

If there is no such arrangement, ask if the school has or is considering introducing such special vehicles or school buses.

(d) Fourthly, some sample of the parents/guardians will be interviewed on their opinion of allowing their children to use special designated School Buses, vans, car pools or staggering hours of different schools in one area. About 10% of samples based on the total number of students shall be interviewed.

The coverage of the scope of work items (b) to (d) above shall only be conducted on three schools as test cases. One school from area (1) and two schools from area (2) shall be selected for this survey.

(2) Survey Duration and Dates

The traffic volume converging at these two areas is to be counted at selected locations during the morning school hours (6:00-8:30 a.m.) and evening hours (3:00 – 5:30 pm) only. Survey is to be conducted only on weekdays.

(3) Classification of Vehicles

The types of vehicles will basically follow the classification used in the traffic volume counting survey. (mainly cars, pickup and vans, motorcycles, some minibuses and others)

(4) Method of Survey

(a) Enumerators are to be stationed at the survey entry points to the identified two areas and manually count the traffic by classes by hour entering or leaving the areas at selected entry or exit points.

(b) Interviewers are to be dispatched with prepared questionnaires to interview with the school authorities on the number of students by grade and other information as stated in (1) above.

(c) For the interview survey with the sampled parents/guardians, questionnaire will be designed and with the help of the school authority, distributed proportionately to students who would take home for their parents to fill in the questionnaires. About 10% of the students shall be interviewed. To ensure good rate of return, the help of the school authority is essential. Questionnaire forms in excess of 10% must be distributed in anticipation of some who may decline to answer them. The teacher is also to be given a simple form to find out in each class, how many students came to school by themselves and how many were send by their parents, divided into the different transport modes.

(5) Data Recording

Data from this survey must be clearly entered into the prepared survey sheets. Traffic volume data shall be entered at every 15 minutes intervals. Interview questionnaires shall be fully completed.

(6) Data Processing and Comments

Traffic volume data obtained from the survey is to be entered into the computer using excel format and summed up by category of vehicles and by hours by station.

For the interview survey, suitable statistical data analyses shall be carried out on the answers to the questionnaires and some conclusions arrived at based on the results.

4. Survey Forms and Questionnaires

All the survey forms and questionnaires will be prepared and provided by the JICA study team in English. The consultant or organization shall however have to translate them into Thai if necessary. The forms may be modified such as on the layout, to suit the Consultant/ Organization needs for facilitating survey works, but prior consent must be obtained from the JICA Study Team.

5. Survey Time Period and Submission of Data

The surveys have to be completed within 6 weeks from the date of signing an agreement with the JICA Study Team. Extension will not be allowed without any reasonable valid causes, which are beyond the control of the survey organization.

To enable the JICA study team members to use some of the collected data, the basic tabulations and summation tables of the survey data shall be submitted in parts as soon as they are completely input into computer files after the actual field works.

Statistical analyses and comments on the results of survey can be submitted two weeks after the one-month period.

6. Final Output of the Survey

The survey leader shall double-check the results of all the survey and where obvious errors are found, they must be rectified immediately. The final output of the survey shall be in the form of data spread sheets in MS Excel format. The JICA Study Team shall specify the spreadsheet format for the data entry. The hand written survey sheets shall also be submitted to the JICA Study Team.

The data duly entered into properly coded files shall be stored in CD disc or floppy diskettes for submission to the JICA study team. Hard copies of the spreadsheets are also required.

7. Responsibility of the Consultant/Survey Organization

The Consultant/Survey Organization shall be fully responsible, in the course of carrying work the above scope of work, for the following:

- Recruitment and training of survey personnel,
- Proper conduct and behavior of all survey personnel,

- Safety of all the survey personnel,
- Supply of mechanical counters if using,
- Survey sheets, writing apparatus, etc,
- Formal permissions to conduct the surveys/interviews wherever they are needed from such institutions as the police, school authorities, bus cooperatives, etc.
- Transport of survey personnel to site,
- Supply and erection of any temporary shelter, lighting at night, safety equipment such as safety cones, signs, etc.

The Consultant/Organization shall be fully responsible for the quality of the survey results. If on submission, any errors are found and if they are due to negligence or poor management of the survey, the Consultant/Organization must make the good the errors or mistakes on its own expense when instructed by the JICA Study Team.

8. Proposal

The short-listed consultant/organization must submit a proposal on their recommended approach, method, organization of conducting these surveys and the appropriately itemized costs for these surveys given by each type of the 4 different surveys. For each type of survey, costs for salaries, preparation (forms, etc), transportation, data entry, professional management fees must be indicated.

Where appropriate, suggested survey forms may be appended in the proposal. A time schedule indicating the timing planned by the proponent in carrying out the work must be given. At the same time, the number of enumerators, team supervisors and other personnel planned for each survey must be clearly indicated in the proposal.

The proposal must be submitted to the JICA study team at the Study Office for the Study on Road Traffic Environment Improvement in Chiang Mai City, located at the Chiang Mai Provincial Police Office at Super Highway (next to the telecommunication office) not later than 7th, August 2001 at 12:00 noon.

Japan International Cooperation Agency

Terms of Reference On Intersection Improvement Study At Wat Chet Yod Intersection For The Study on Improvement of Road Traffic Environment in Chiang Mai City in the Kingdom of Thailand

December 7th, 2001

1. Background

This TOR is prepared for the conduct of various works in relation to an intersection improvement pilot project at Wat Chet Yod intersection in Chiang Mai City. This pilot project is based on the Phase 1 study results of the “**Study on Improvement of Road Traffic Environment in Chiang Mai City**” by the Japan International Cooperation Agency (JICA) from July to October 2001.

2. Objectives

This TOR sets forth the basic requirements and scope of work for the proper conduct of the various works mentioned above so as to satisfy the requirements by the Pilot Project. Although it is the intention of this TOR to cover all aspects in the conduct and management of the surveys and other preparatory works, when doubts arise as to any inherent details of the work, reference should always be made to the JICA Study Team.

3. Scope of Works

3.1 Intersection Improvement Works

Intersection improvement works under this TOR includes earthworks, pavement improvement, pavement marking, and installation of traffic safety devices. Details on these works are given in the Drawings in Appendix 1, and Specifications of Pavement Marking in Appendix 2.

3.2 Preparatory Works for Signal Installation

Preparatory works for signal installation under this TOR includes all necessary works prior to the actual installation of signal head, detectors, and local controller. The preparatory works here refers to works in construction of foundation for and erection of signal poles, foundation for signal controller and laying of conduits for wiring work. The details of these works are given in the Drawings in Appendix 1, and Specifications of Signal Installation in Appendix 3.

3.3 Traffic Survey

(1) Objectives

The purpose of the traffic surveys is to gather data at the pilot project site for the assessment of effect of the intersection improvement by way of a before and after comparison.

Five (5) kinds of traffic surveys are required, namely:

- 1) Intersection movement survey (ITM, in short),
- 2) Queue length survey (QLS),
- 3) Running time survey (RTS),
- 4) Observation of Conflicted Traffic (OCT), and
- 5) Inquiry survey for Motorcycle and Vehicle user (ISU).

ITM survey observes both traffic and pedestrian movement by direction by types of carrier.

QLS survey records length of queue at each direction. Queue length data of vehicles waiting at each approach of the intersection is a good indication of the degrees of delay experienced by road users at the intersection.

RTS measures running time between two specified points at the Wat Ched Yod intersection. By measuring the running times before and after the project, savings in travel time by types of vehicle and movement can be computed as a criterion in assessing traffic flow improvement at the intersection.

OCT records conflicted movements by types and approach at the intersection. Occurrence of such traffic movement conflicts is another criteria for assessing traffic safety at the intersection.

The **ISU** is to ask road user directly how do they perceive the level of safety at the intersection before and after the signal installation. Mainly the motorcyclists and drivers will be interviewed.

Except for the ISU, data indicative of traffic conditions at three time slots are required:

- Before the earthwork,
- After the earthwork, (intersection improvement works) and
- After start operation of signal system.

Similar ITM and QLS surveys were conducted in August 2001, the result of which will be used as indicative of condition 'Before the earthwork' of the pilot project. Surveys required under this TOR shall refer to conduct of surveys not carried out before in August 2001 for indicative conditions 'Before the earthwork' of the pilot project and all those 'After the earthwork'. Surveys for gathering data indicative of condition 'After start operation of signal system' of the pilot project shall be conducted only after the signal system is installed, scheduled to be in March 2002.

3.4 Scope of Work

(1) Survey Duration and Dates

The ITM survey shall be conducted for 14 hours during weekdays (Monday to Friday except public holidays.) from 6:00 am to 8:00 pm. For the pedestrian counting, the survey shall be conducted during the morning and evening peak hours only (6:30-9:30 a.m. and 4:30-7:30 p.m.) As mentioned above, ITM survey should be conducted only once under this TOR, i.e. when the earthwork has finished.

Similarly, for the QLS, the survey is to be conducted for 14 hours during weekdays (Monday to Friday except public holidays.) from 6:00 am to 8:00 pm. The QLS survey shall also be conducted only once, when the earthwork has finished.

The RTS and OCT shall be conducted during the morning and evening peak hours (6:30-9:30 a.m. and 4:30-7:30 p.m.) during weekdays (Monday to Friday except public holidays.) These two surveys shall be carried out twice under this TOR, i.e. before the earthwork started and when the earthwork has finished.

The ISU shall be conducted during the morning and evening peak hours (6:30-9:30 a.m. and 4:30-7:30 p.m.) during weekdays (Monday to Friday except public holidays.) ISU survey shall be conducted only once, i.e. when the earthwork has finished. In summary the surveys and their timings required are given in the Table 1 below:

Table 1: Summary of Survey and Timings

No.	Type of survey	Before Earthwork	After Earthwork	Survey Duration/sample size
1	ITM	*	●	Veh 14 hours/ ped.6 hours
2	QLS	*	●	14 hours
3	RTS	●	●	6 hours
4	OCT	●	●	6 hours
5	ISU	*	●	6 hours / 250 samples

*= results of surveys in Aug are to be used. ● = surveys to be conducted under this TOR.

(2) Method of Survey

For ITM survey at intersection, enumerators shall be stationed at the intersection and using mechanical counters, manually count the number of vehicles by different directions, such as through, right turning and left turning. The numbers of vehicles by different vehicle types are then recorded in the survey sheets by every 15 minutes. The classification of vehicles for this survey shall be similar to the previous survey, as follows:

1. Cars and Pickups (incl. 4 wheel drives/jeep/van)
2. Motorcycles
3. Minibuses
4. Buses and Coaches
5. Small trucks (2 axles)
6. Medium and Large trucks (three axles and above, bulldozers, trailers, etc)
7. Others (Tuk-tuk, tricycles, etc)

The pedestrian counting shall be done at the intersection, taking the total number of persons crossing by direction at the crossing. These volumes shall also be recorded on the survey sheets at every 15 minutes intervals.

For the QLS, the curb is first marked into distances by meters. Enumerators are then stationed towards the end of the queue to record down the distances of the queue. The

survey is to record the longest queue on each approach irrespective of whether it is on which lane.

The queue length surveyed at each of the approach to the intersection shall be recorded at every 5 minutes interval on the survey sheets.

For the **RTS**, pairs of markers for each direction are clearly marked, one before and one after crossing the intersection. Enumerators are position strategically, preferably from a high vantage point where he/she can observe and measures the running time by vehicle type using a stopwatch, from the time a vehicle's front runs over the first marking to that when its head runs over the second marking. The traffic movement stream by approach and the target vehicles for this survey are summarized in Table 2.

Table 2: Traffic Stream by Approach and Target Vehicles for RTS at Wat Chet Yod

Approach	Movement	Marking location in Figure 1	Target Vehicles			Pedestrian
			Motorcycle	Passenger car	Heavy truck, Trailer, Heavy Bus	
NE (Superhwy)	Right Turn	AA to CC	√	√		
	U-Turn	AA to AA	√	√	√	
	Thru	AA to BB	√	√	√	
SW (Superhwy)	U-Turn	BB to BB	√	√	√	
	Thru	BB to AA	√	√	√	
W (Minor Rd)	Left Turn	CC to AA	√	√		
	Right Turn	CC to BB	√	√		
Crossing the Superhwy	Pedestrian	D <->D				√

If this survey is to be done manually by observing and recording on site, then it must be noted that since it is difficult to measure running time for all vehicles during the survey time period, enumerators are to measure a sample of the target vehicles by direction. They are to take as many samples as they can manage.

Moreover, one person will be in-charge of observing both the right-turn and U-turn from the NE as the intention of the vehicle cannot be know until it make either a right turn or U-turn. Similarly, one person is to be in-charge of both the left and right turns from the Soi Wat Chet Yod.

Alternatively, the Contractor can choose to conduct the survey by video recording and measure the timings at the lab by observing the vehicles from playbacks of the video recordings.

For the **OCT**, enumerators are to record the time by location of all traffic conflict occurrences within 50 m of each approach of the intersection and within the survey time periods. Traffic conflicts may be classified into these 5 patterns;

- 1) Alert with horn and headlight blinking;
- 2) Lane changes to avoid collision/accident

- 3) Sudden stops to avoid collision/accident
- 4) Obstructing other traffic stream thus disrupting the flow, (eg. Stopping too far out into the junction thus hindering the through traffic flow.)
- 5) Collision/Accident
- 6) Others (detail situation should be noted)

The Contractor shall also record the traffic situation of the intersection on videotape during the survey time periods. 2 sets of Video cam and tripod can be made available by the Study Team for this work.

For the **ISU**, enumerators are stationed at the intersection and interview the road user (passenger car/pickup/van, truck and motorcycle) with ready questionnaires. The study team shall provide a sample questionnaire in English. The contractor shall translate it into Thai and make copies available for the work on site. 250 samples shall be collected.

(3) Survey Organization

A survey organization, consisting of survey leader, team supervisor and enumerators, must be organized to efficiently carry out the survey.

- For the **ITM** survey at Wat Ched Yod intersection, separate enumerators are required at each approach for the through movement, right turn and left turn. U-Turn movement shall also be counted. For the pedestrian counting, one person shall be sufficient.
- For the **QLS**, one enumerator is needed at each approach.
- For the **RTS**, one enumerator per vehicle type per movement will be required.
- For the **OCT**, two people per approach shall be sufficient, one in charge of each direction.
- For the **ISU**, two people per approach shall be sufficient.

(4) Data Recording

Data of the traffic counts by types of vehicles must be recorded clearly at 15 minutes intervals on the prepared survey sheets.

For the queue length survey, queue length in meter at each approach shall be recorded on the survey sheet in every 5 minutes intervals.

(5) Data Processing and Comments

Data obtained from the traffic movement survey are to be first checked for obvious errors if any, and then entered into computer using excel format. Data are then **summed** up by category by hour by direction by station. Summation tables shall be done in vehicles as well as in PCU.

Pedestrian counting data shall also be input into the computer at 15 minutes intervals and summed up for the hourly total by direction per location.

Queue length results in distance shall first be entered into computer using excel format. The longest queue length in meter at 5 minutes interval per approach is to be entered into the form. Delays shall be computed using the data and presented.

RTS data is to be analyzed by vehicle type by direction by hour. The average running time shall be computed to enable comparisons of such times before the earthwork and after the earthwork

The record of traffic movement conflicts by types and by direction shall be totaled up. These are to enable the comparison of the number and types of conflicts before and after the earthwork.

For the ISU, the responses by type of vehicles are to be analyzed and presented in statistical form.

3.5 Survey Forms and Questionnaires

All the survey record forms will be prepared and provided by the JICA study team in English. The contractor shall however have to translate them into Thai for the enumerators. Survey forms are to be prepared for the survey on site. Any summation forms if needed shall be prepared by the contractor.

3.6 Final Output of the Survey

The survey leader shall double-check the results of all the survey and where obvious errors are found, they must be rectified immediately. The final output of the survey shall be in the form of data spread sheets in MS Excel format. Where specified as above or appropriate, summation tables, graphs, and other statistical formats shall be used to present the results of the survey. The JICA Study Team shall specify the spreadsheet format for the data entry. The hand written survey sheets shall also be submitted to the JICA Study Team for inspection.

The data duly entered into properly coded files shall be stored in CD disc or floppy diskettes for submission to the JICA study team. Hard copies of the spreadsheets are also required.

To enable the JICA study team members to use some of the collected data, the basic tabulations and summation tables of the survey data shall be submitted in parts as soon as they are completed and input into computer files after the actual field works.

Japan International Cooperation Agency

Terms of Reference On Intersection Improvement Study At Wat Chet Yod Intersection For The Study on Improvement of Road Traffic Environment in Chiang Mai City in the Kingdom of Thailand

May 10th, 2002

1. Background

This TOR is prepared for the Conduct of intersection improvement study at Wat Chet Yod intersection in Chiang Mai City.

The conduct of this study is the task required for the pilot project in the **Study on Improvement of Road Traffic Environment in Chiang Mai City** by the Japan International Cooperation Agency (JICA) under its ODA program for the Government of the Kingdom of Thailand.

2. Objectives

This TOR sets forth the basic requirements or scope of work for the proper conduct of the Study mentioned above so as to satisfy the data requirements for the JICA Study. Although it is the intention of this TOR to cover all aspects in the conduct and management of these surveys, when doubts arise as to any inherent details of the work, reference should always be made to the JICA Study Team.

3. Scope of Works

3.1 Signal Installation Work

Signal installation works includes all necessary works for installation of signal head, detectors, and local controller. These works are specified by Specifications of Signal Installation Work (Appendix 2) and Drawings (Appendix 3).

3.2 Traffic Survey

(1) Objectives

The purpose of the traffic survey is to assess the effect of the intersection improvement by before/after comparison.

This survey includes five kinds of counting; 1) Intersection movement survey (ITM, in short), 2) Queue length survey (QLS), 3) Running time survey (RTS), 4) Observation of Conflicted Traffic (OCT), and 5) Inquiry survey for Motorcycle and Vehicle user (ISU).

ITM survey observes both traffic and pedestrian movement. Traffic volumes are essential data for the improvement of the geometric design of the intersections.

QLS survey records length of queue at each direction. Queue length data of vehicles waiting at each approach of the intersection is a good indication of the degrees of delay experienced by road users at the intersection. These two surveys are to be conducted twice within the survey period.

RTS measures running time between specified point in the Wat Ched Yod intersection. Running time is a criterion for traffic smoothness at intersection.

OCT records conflicted movement at the intersection. Occurrence of intricate traffic is another of criteria for traffic safety at intersection.

It is necessary to ask road user directly how do they feel the improvement. These surveys are to be conducted once within the survey period.

(2) Scope of Work

(1) Survey Duration and Dates

The ITM survey shall be conducted for 14 hours during weekdays (Monday to Friday except public holidays.) The 14 hours shall be from 6:00 am to 8:00 pm.) For the pedestrian counting, the survey shall be conducted during the morning and evening peak hours (6:30-9:30 a.m. and 4:30-7:30 p.m.) ITM survey should be done for twice; when the earthwork finished and when the signal system started.

For the QLS, the survey is to be conducted for 14 hours during weekdays (Monday to Friday except public holidays.) The 14 hours shall be from 6:00 am to 8:00 pm.) QLS survey should be done for twice; when the earthwork finished and when the signal system started.

For the RTS shall be conducted during the morning and evening peak hours (6:30-9:30 a.m. and 4:30-7:30 p.m.) during weekdays (Monday to Friday except public holidays.) This survey should be done for three times; before the earthwork started when the earthwork finished and when the signal system started.

For the OCT, the survey shall be conducted during the morning and evening peak hours (6:30-9:30 a.m. and 4:30-7:30 p.m.) during weekdays (Monday to Friday except public holidays.) OCT survey should be done for twice; when the earthwork finished and when the signal system started.

For the inquiry survey, the survey shall be conducted during the morning and evening peak hours (6:30-9:30 a.m. and 4:30-7:30 p.m.) during weekdays (Monday to Friday except public holidays.) ISU survey should be done for twice; when the earthwork finished and when the signal system started.

(2) Classification of Vehicles

The classification of vehicles for this survey shall be as follows:

1. Cars and Pickups (incl. 4 wheel drives/jeep/van)
2. Motorcycles
3. Minibuses

4. Buses and Coaches
5. Small trucks (2 axles)
6. Medium and Large trucks (three axles and above, bulldozers, trailers, etc)
7. Others (Tuk-tuk, tricycles, etc)

(3) Method of Survey

For ITM survey at intersection, enumerators shall be stationed at the intersection and using mechanical counters, manually count the number of vehicles by different directions, such as through, right turning and left turning. The numbers of vehicles by different vehicle types are then recorded in the survey sheets by every 15 minutes.

The pedestrian counting shall be done at the intersection, taking the total number of persons crossing at the crossing and out of the crossing. These volumes shall also be recorded on the survey sheets at every 15 minutes intervals.

For the QLS, the curb is first marked into distances by meters. Enumerators are then stationed towards the end of the queue to record down the distances of the queue. The survey is to record the longest queue on each approach irrespective of whether it is on which lane.

The queue length surveyed at each of the approach to the intersection shall be recorded every 5 minutes on the survey sheets.

For the RTS, the curb is first marked as instructed in the Figure 1. Enumerator measures running time with stopwatch, from the timing vehicle's head run over the first marking to the timing vehicle's head run over the second marking. The position of marking, objective, and target vehicles are summarize in the Table 1

Table 1 Instruction of Location for RTS

Approach	Direction	Marking location in Figure 1	Objective Vehicle	Pedestrian
			Passenger car Pickup Motorcycle Truck	
NE	Through	A-B	√	
	Turn Right	A-C	√	
	U-Turn	A-A	√	
SW	Through	B-A	√	
	U-Turn	B-B	√	
W	Turn Left	C-A	√	
	Turn Right	C-B	√	
Other	Pedestrian	D-D		√

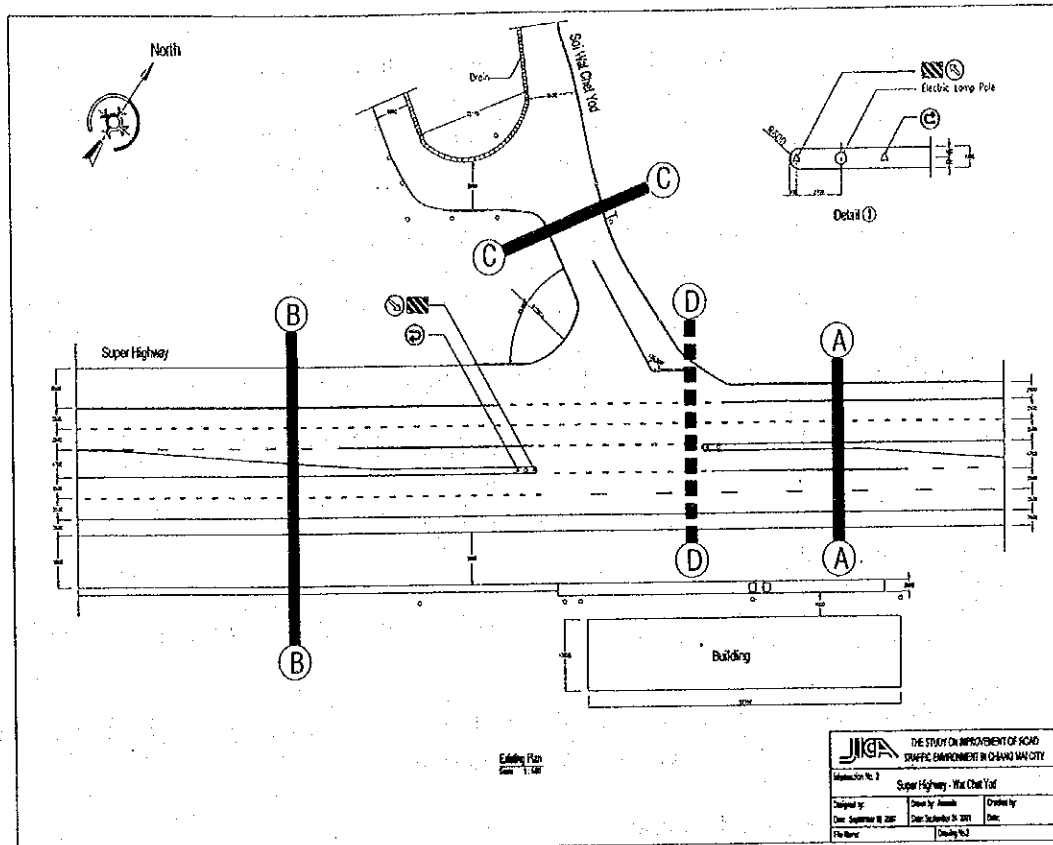


Figure 1 Designated Survey Point for RTS

For the OCT, enumerators record time and location of traffic conflict occurrence. Traffic conflict is classified into these 6 patterns;

- 1) Alert with horn and headlight blinking;
- 2) Lane changes to avoid collision/accident
- 3) Sudden stops to avoid collision/accident
- 4) Interference
- 5) Collision/Accident
- 6) Others (detail situation should be denoted)

Enumerators also record the situation of intersection on videotape during the survey. The study team can provide 2 sets of Video cam and tripod.

For ISU, enumerators ask road user (passenger car and motorcycle) with questionnaires. The study team provides a sample questionnaire. The contractor translate it into Thai and make copies. The contractor summarizes the answer with simple analysis. 250 samples should be collected.

(4) Survey Organization

A survey organization, consisting of survey leader, team supervisor and enumerators, must be organized to efficiently carry out the survey. For each intersection, depending on the size of the intersection, the number of enumerators will differ.

Basically, for the Wat Ched Yod intersection, separate enumerators are required at each approach for the through movement, right turn and left turn. U-Turn movement shall also be counted.

For multiple lanes and very heavy traffic, separate enumerators may be necessary to count the through traffic movement at each approach for the different lanes, and different kinds of vehicle. For a small approach, fewer enumerators will be needed to manage the counting by movement if the traffic is not heavy.

For the QLS, one enumerator is needed at each approach.

For the pedestrian counting, one person shall be sufficient.

For the RTS, three people per approach shall be sufficient.

For the OCT, two people per approach shall be sufficient.

For the ISU, two people per approach shall be sufficient.

(5) Data Recording

Data of the traffic counts by types of vehicles must be recorded clearly at 15 minutes intervals on the prepared survey sheets.

For the queue length survey, queue length in meter at each approach shall be recorded on the survey sheet in every 5 minutes intervals.

Data Processing and Comments

Data obtained from the traffic movement survey are to be first checked for obvious errors if any, and then entered into computer using excel format. Data are then summed up by category by hour by direction by station. Summation tables shall be done in vehicles as well as in PCU.

Pedestrian counting data shall also be input into the computer at 15 minutes intervals and summed up for the hourly total by direction per location.

Queue length results in distance shall first be entered into computer using excel format. The longest queue length in meter at 5 minutes interval per approach is to be entered into the form.

RTS data is to be aggregated and conducted a simple analysis to clear a difference among the three timings (before the earthwork, after the earthwork, and after signal installation.)

Record of confliction should be summarized by its pattern. Photos captured from video recordings should be attached for each record. The study team can provide a PC-based capturing system.

Interview survey is to be aggregated and conducted a simple analysis.

(3) Survey Forms and Questionnaires

All the survey record forms will be prepared and provided by the JICA study team in English. The organizer shall however have to translate them into Thai if necessary.

(4) Final Output of the Survey

The survey leader shall double-check the results of all the survey and where obvious errors are found, they must be rectified immediately. The final output of the survey shall be in the form of data spread sheets in MS Excel format. The JICA Study Team shall specify the spreadsheet format for the data entry. The hand written survey sheets shall also be submitted to the JICA Study Team for inspection.

The data duly entered into properly coded files shall be stored in CD disc or floppy diskettes for submission to the JICA study team. Hard copies of the spreadsheets are also required.

To enable the JICA study team members to use some of the collected data, the basic tabulations and summation tables of the survey data shall be submitted in parts as soon as they are completed and input into computer files after the actual field works.

4. Work Schedule

Works schedule is planned as shown in Appendix 1. The intended completion date for the signal installation work is within 15 days of start date of works. The traffic surveys have to be conducted after it completes. Statistical analyses and comments on the results of survey can be submitted two weeks after the survey.

Appendix B

Survey Forms

Forms of surveys used in this study are shown in following.:

- (1) Questionnaire for Chiang Mai Public Transport Passenger Interview
- (2) Traffic Volume Counting Survey Form
- (3) Vehicle Occupancy Survey Form
- (4) Intersection Traffic Movement Survey Form
- (5) Non-signalized Intersection Queue Length Survey Form
- (6) Signalized Intersection Queue Length Survey
- (7) Pedestrian Traffic Volume Counting Survey Form
- (8) On Street Parking Inventory Survey Form
- (9) On Street Parking Demand Survey Form
- (10) School Trip Questionnaire Survey Form for Parents
- (11) School Trip Behavior Survey Form for Teachers
- (12) Minibus Passenger Interview Survey Form

Questionnaire for Chiang Mai Public Transport Passenger Interview

Questionnaire Number.....

For Surveyor Practice to be Observed

- Ask all questions
- Do not push for quick answers
- Interview passenger over range of status (Age, Sex, Occupation)
- Be polite to passenger
- Make sure passengers have time for interview (on bus)

Filed by Surveyor

1. Survey Date / Month / Year
2. Interview Hour

<input type="checkbox"/> 6.00-7.00	<input type="checkbox"/> 7.00-8.00	<input type="checkbox"/> 8.00-9.00
<input type="checkbox"/> 9.00-10.00	<input type="checkbox"/> 10.00-11.00	<input type="checkbox"/> 11.00-12.00
<input type="checkbox"/> 12.00-13.00	<input type="checkbox"/> 13.00-14.00	<input type="checkbox"/> 14.00-15.00
<input type="checkbox"/> 15.00-16.00	<input type="checkbox"/> 16.00-17.00	<input type="checkbox"/> 17.00-18.00
3. Place of interview(Zone)
4. Passenger on vehicle type

<input type="checkbox"/> Minibus	<input type="checkbox"/> Bus
----------------------------------	------------------------------
5. Route (for fixed route only)

<input type="checkbox"/> San Sai/Doi Saket-Kad Luang
<input type="checkbox"/> Phang-Mae Rim-Chang Phueak
<input type="checkbox"/> Lamphoon-Saraphi-Sri Prakad
<input type="checkbox"/> Hang Dong-Chom Tong-Hod-Chiang Mai Gate
<input type="checkbox"/> Sun Kamphang-Warorot Market
<input type="checkbox"/> Phrao-Praisanee Kao

Passenger Data

Part 1 General Data

1. Sex

<input type="checkbox"/> Male	<input type="checkbox"/> Female
-------------------------------	---------------------------------
2. Age

<input type="checkbox"/> ≤ 20 year	<input type="checkbox"/> 21-30	<input type="checkbox"/> 31-40
<input type="checkbox"/> 41-50	<input type="checkbox"/> 51-60	<input type="checkbox"/> > 60
3. Occupation

<input type="checkbox"/> Unemployed	<input type="checkbox"/> Civil Servant/State employee	
<input type="checkbox"/> Private employee	<input type="checkbox"/> Labour	<input type="checkbox"/> Skilled labour
<input type="checkbox"/> Trader	<input type="checkbox"/> Student	<input type="checkbox"/> Businessman
<input type="checkbox"/> Agriculturer	<input type="checkbox"/> Retired	
4. Educational level

<input type="checkbox"/> ≤ Grade 7	<input type="checkbox"/> Grade 7-9	<input type="checkbox"/> Grade 10-12
<input type="checkbox"/> Certificate	<input type="checkbox"/> College	

Part 2 Socio-economic status of passenger

5. Monthly income
 ≤ 3000 Baht 3001-5000 5001-7000
 7001-9000 ≥ 9001
6. No. of travel Household member 1 member 2-3 > 3
7. Own vehicle Yes No
8. Type of vehicle owned
 No vehicle Motorcycle Car
 Pickup More than 1 type
9. If own vehicle why take minibus
 No vehicle Economic Do not want to drive
 No parking place (garage), Congestion Others
10. Address Tumbon..... Amphoe(Zone)

Part 3 Travel Data

11. Zone origin
 Zone destination
12. Travel time(minute)
13. Purpose of trip
 Work Return home Schooling
 Shopping Visiting friend Others
14. Usage frequency
 1-2 trips/day 3-4 trips/day Once a week
 Not frequent Others
15. Fare(Baht)
16. Waiting time (minute)
17. Vehicle changed Change Not change
18. If change vehicle
 : Place of change vehicle(Zone)
 : Type of system for changing
 Fixed route Flexible route Others
19. Is public transport safe Yes No Not sure
20. Problems in using service
 Not convenient, slow, impolite driver
 Long wait, not enough vehicles, no seat available
 High fare, fare not appropriate
 Few vehicle for the rouge, poor access by vehicle
 Others
21. Preferred type of public transport system
 Fixed route Flexible (as red minibus)
22. Preferred type of vehicle
 Minibus 12 seats van 24 seats bus
 40 seats bus Others
23. Vehicle air conditioning Yes No
24. Appropriate fare(Air conditioning bus)(No air conditioning)
25. Satisfaction Yes No

VEHICLE OCCUPANCY SURVEY FORM

Station: _____

Name of Enumerator: _____

Date: _____

	1	2	3	4	5	6	7	8
Time	Car/ 4WD/Jeep	Pickup/Van	M/C	Minibus	Large Bus	Light Truck	Medium & Large Truck	Others
06:00 - 07:00								
07:00 - 08:00								
08:00 - 09:00								
09:00 - 10:00								
10:00 - 11:00								

B-5

NON-SIGNALIZED INTERSECTION QUEUE LENGTH SURVEY FORM

Intersection Nos :

Name of Enumerator:

Date:

Direction: Approach from

HOUR	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min	45 min	50 min	55 min	60 min.
6:00 - 7:00												
7:00 - 8:00												
8:00 - 9:00												
9:00 - 10:00												
13:00 - 14:00												
16:00 - 17:00												
17:00 - 18:00												
18:00 - 19:00												
19:00 - 20:00												

SIGNALIZED INTERSECTION QUEUE LENGTH SURVEY FORM

Intersection Nos :

Name of Enumerator:

Date:

Direction: Approach from

HOUR	Queue	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min	45 min	50 min	55 min	60 min.
6:00 - 7:00	Start of												
	End of												
7:00 - 8:00	Start of												
	End of												
8:00 - 9:00	Start of												
	End of												
9:00 - 10:00	Start of												
	End of												
13:00 - 14:00	Start of												
	End of												
16:00 - 17:00	Start of												
	End of												
17:00 - 18:00	Start of												
	End of												
18:00 - 19:00	Start of												
	End of												
19:00 - 20:00	Start of												
	End of												

ON STREET PARKING INVENTORY SURVEY FORM

Segment No:

Name of Enumerator:

Date:

N O.	Name of Road	Approx. Length in m	Starting Point (Road Name)	Ending Point (Road Name)	Number of Legal On Street Parking Lot		
					Left	Right	Total
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

JICA STUDY ON ROAD TRAFFIC ENVIRONMENT IMPROVEMENT IN CHIANG MAI CITY

ON STREET PARKING DEMAND SURVEY FORM

Segment No:

Name of Enumerator:

Date:

Road Name:

Time	Sides of Road	Legally Parked Vehicles					Illegally Parked Vehicles					Loading / Unloading Trucks	Waiting Minibuses
		Cars	Pickups/Vans	Trucks	M/C	Others	Cars	Pickups/Vans	Trucks	M/C	Others		
	Left Hand												
	Right Hand												
	Left Hand												
	Right Hand												
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SCHOOL TRIP QUESTIONNAIRE SURVEY FORM FOR PARENTS

Dear Parents/Guardians :

Traffic congestion near the schools in the morning and evening is a worsening problem faced by all parents sending or fetching their children to and from schools. To solve this problem effectively there must be cooperation from all parties involved, the schools, the parents, the traffic police and the city government. To help us plan for a workable solution to this problem, we sincerely request your kind cooperation in answering the following questions. Your answers to these questions will be treated as confidential and will only be used for planning purpose only.

Question (1): In which district/sub-district do you live? Code :
 Answer: _____

Question (2) : How much time do you spend a day for sending your children to school?
 Answer : _____ minutes

Question (3) : How much time do you spend a day fetching your children from school?
 Answer : _____ minutes

Question (4) : Do you feel that the congestion on the road is a serious problem to you?
 Answer : 1. Yes 2. No 3. Sometimes only 4. Not sure.

Question (5) : How many children do you have to send to school per day?
 Answer: 1 / 2 / 3 / 4 / more than 4

Question (6) : What kind of transport do you used to send your children?
 Answer: 1.Car 2.4WD 3.Pickup or Van 4.Motorcycle 5.Bicycle ?

Question (7) : To alleviate congestion on the road, one of ways is for students to share vehicles such as bus or vans. If a safe transport is provided for your child to take from your home to the school in the morning and back in the evening, would you allow your children to use it?
 Answer : 1. Yes 2. No 3. Not Sure

Question (8) : If your answer to (7) above is YES, which type of transport do you prefer ?
 Answer : 1. School Bus (24 seats) 2. Vans (12 seats)
 3. Others (please specify) _____

Question (9) : If your answer to (7) above is YES, what amount of fare could you pay for the transport ?
 Answer : Baht / Month for one child.

Question (10) : If your answer to (7) above is NO, please tell us why?
 Answer : 1. I still do not feel safe for my child to go on bus or van.
2. I do not mind the traffic congestion and the time spent sending my child to school.
3. Others, please
 specify : _____

SCHOOL TRIP BEHAVIOR SURVEY FORM FOR TEACHERS

Dear Teacher :

Traffic congestion near the schools in the morning and evening is a worsening problem faced by all schools and parents sending or fetching their children to and from schools. To solve this problem effectively there must be cooperation from all parties involved, the schools, the parents, the traffic police and the city government. To help us plan for a workable solution to this problem, we sincerely request your kind cooperation in filling out this form by asking the students in your class on their mode of transport to attend school.

Question (1): How many students are there in your class?

Code :

Answer: _____ students.

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Question (2) : What is the grade of your class?

Answer : Primary (_____) or Secondary (_____).

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Question (3) : How many students are sent to school by their parents?

- Answer :
1. By cars/jeep/4WD. _____ students.
 2. By Vans/ pickups _____ students.
 3. By minibus _____ students.
 4. By motorcycles _____ students.
 5. By bicycles _____ students.
 6. On foot _____ students.
 7. Othes (specify _____) _____ students.

Question (4) : How many students go to school by themselves?

- Answer :
1. By cars/jeep/4WD. _____ students.
 2. By Vans/ pickups _____ students.
 3. By minibus _____ students.
 4. By motorcycles _____ students.
 5. By bicycles _____ students.
 6. On foot _____ students.
 7. Othes (specify _____) _____ students.

Question (5) : How many students used the special school bus or van (if there is)?

Answer: _____ students.

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Total Number of Questionnaires to Parents distributed.

Total Number of Questionnaires to Parents returned.

Complete
Incomplete

MINIBUS PASSENGER INTERVIEW SURVEY FORM

To: Interviewers

Please complete every question on this form,
 # Be random when choosing persons to interview,
 (do not choose only one or two particular types, include as many different types as possible:
 young, old, male, female, office workers, laborers, etc.)
 # Do not prompt the person to give you the answer,
 # Be polite to the person at all times,

Characteristics of the person you are interviewing:

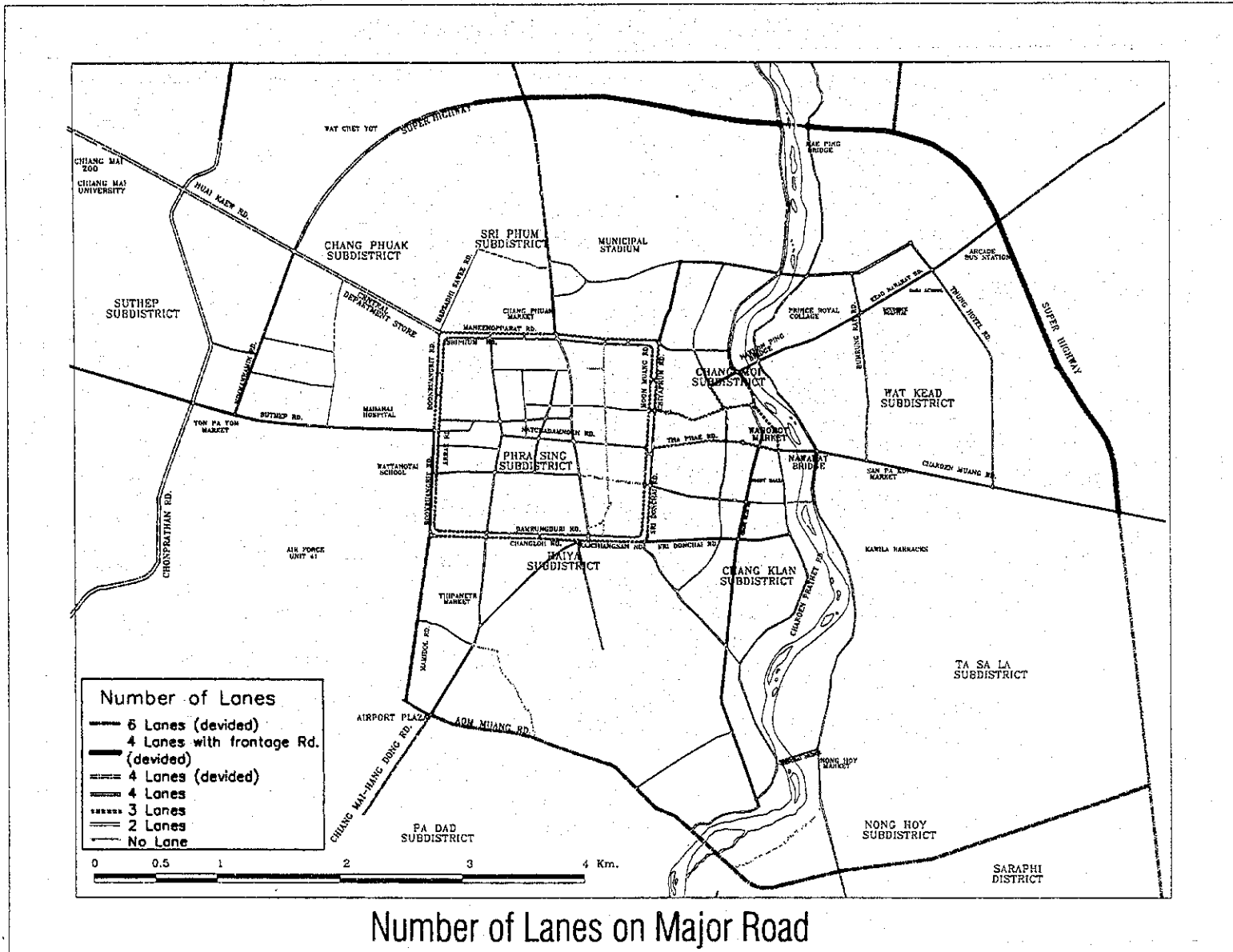
	Code
1. Male / Female.	<input style="width: 60px; height: 15px;" type="text"/>
2. Age: 1. Less than 20 2. 20-30 years 3. 30-40 years 4. 40-50 years 5. 50-60 years 6. More than 60 years.	<input style="width: 60px; height: 15px;" type="text"/>
3. Occupation: 1. Manager/Professionals, 2. Other office workers, 3. Clerks, Typists 4. Shop Assistants 5. Students 6. Housewives 7. Laborers 8. Others	<input style="width: 60px; height: 15px;" type="text"/>
Question (1): In which district/sub-district do you live? Answer:	<input style="width: 60px; height: 15px;" type="text"/>
Question (2) : Where are you going? Answer : Address: _____ sub-district	<input style="width: 60px; height: 15px;" type="text"/>
Question (3) : What is the purpose of this trip ? Answer : 1. To work 2. To Home 3. To shopping 4. To school 5. To visit friends 6. Others	<input style="width: 60px; height: 15px;" type="text"/>
Question (4) : How long does it takes normally for you to reach the destination? Answer : _____ minutes.	<input style="width: 60px; height: 15px;" type="text"/>
Question (5) : How often do you use this bus? Answer : 1. Twice a Day 2. Once a Day 3. Once in 1 or 2 days 4. Once in 3-4 5. Once in a week 6. Sometimes only	<input style="width: 60px; height: 15px;" type="text"/>
Question (6) : How much do you pay to reach the destination? Answer: _____ Baht	<input style="width: 60px; height: 15px;" type="text"/>
Question (7) : Do you have to make a transfer to another bus to get to the destination ? Answer: 1. Yes 2. No	<input style="width: 60px; height: 15px;" type="text"/>
Question (8) : If YES to Question (7), where do you make the transfer and to what kind of bus? Answer : Where ? _____ What Bus? _____	<input style="width: 60px; height: 15px;" type="text"/> <input style="width: 60px; height: 15px;" type="text"/>
Question (9) : If your answer to (7) above is YES, which type of transport do you prefer ? Answer : 1. School Bus (24 seats) 2. Vans (12 seats) 3. Others (please specify)	<input style="width: 60px; height: 15px;" type="text"/>
Question (10) : Do you feel safe in taking this bus? Answer : 1. Yes 2. No 3. Not Sure.	
Question (11) : What are type of problems do you face in taking bus in Chiang Mai ? Answer :	<input style="width: 60px; height: 15px;" type="text"/> <input style="width: 60px; height: 15px;" type="text"/> <input style="width: 60px; height: 15px;" type="text"/>

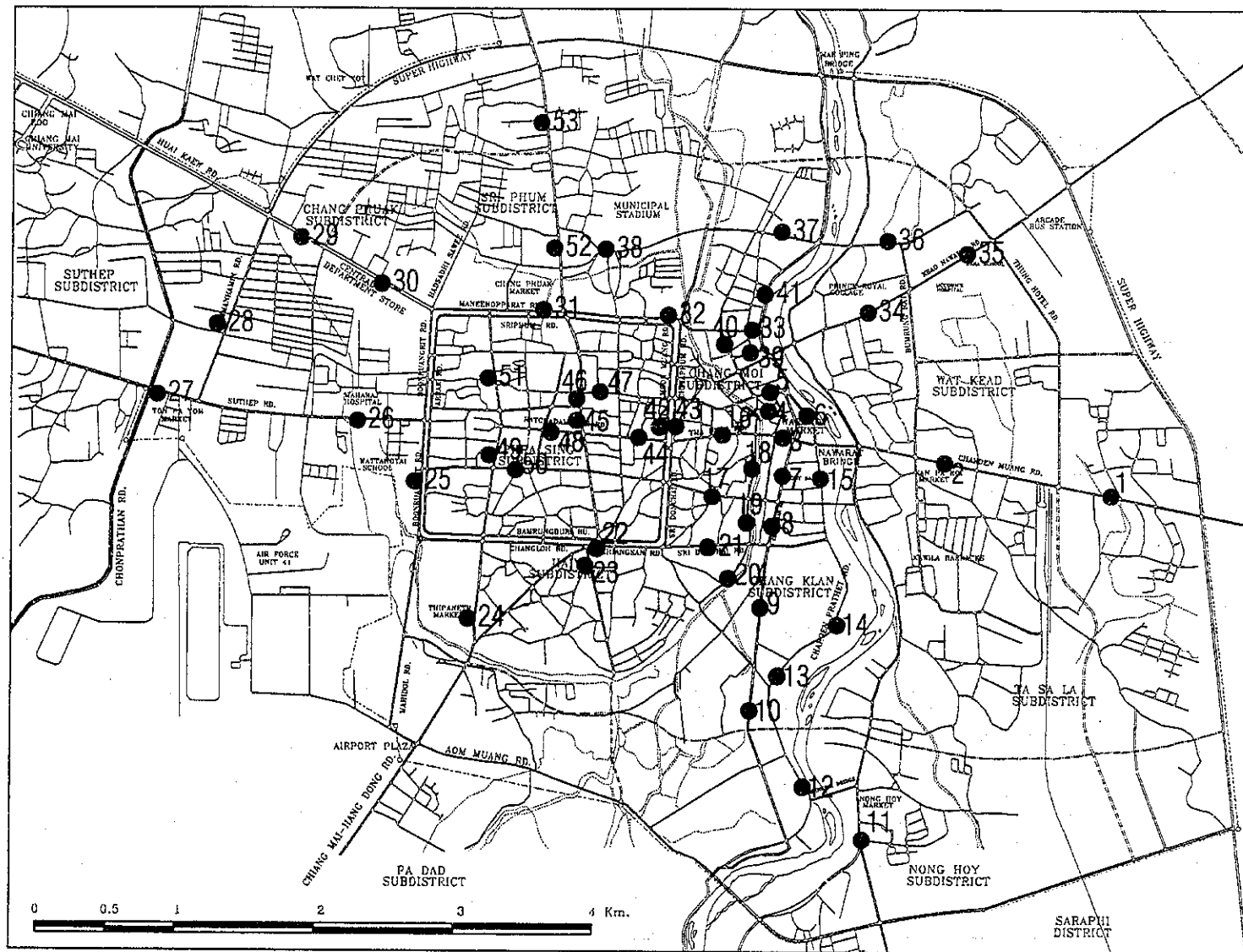
Appendix C

Maps and Drawings

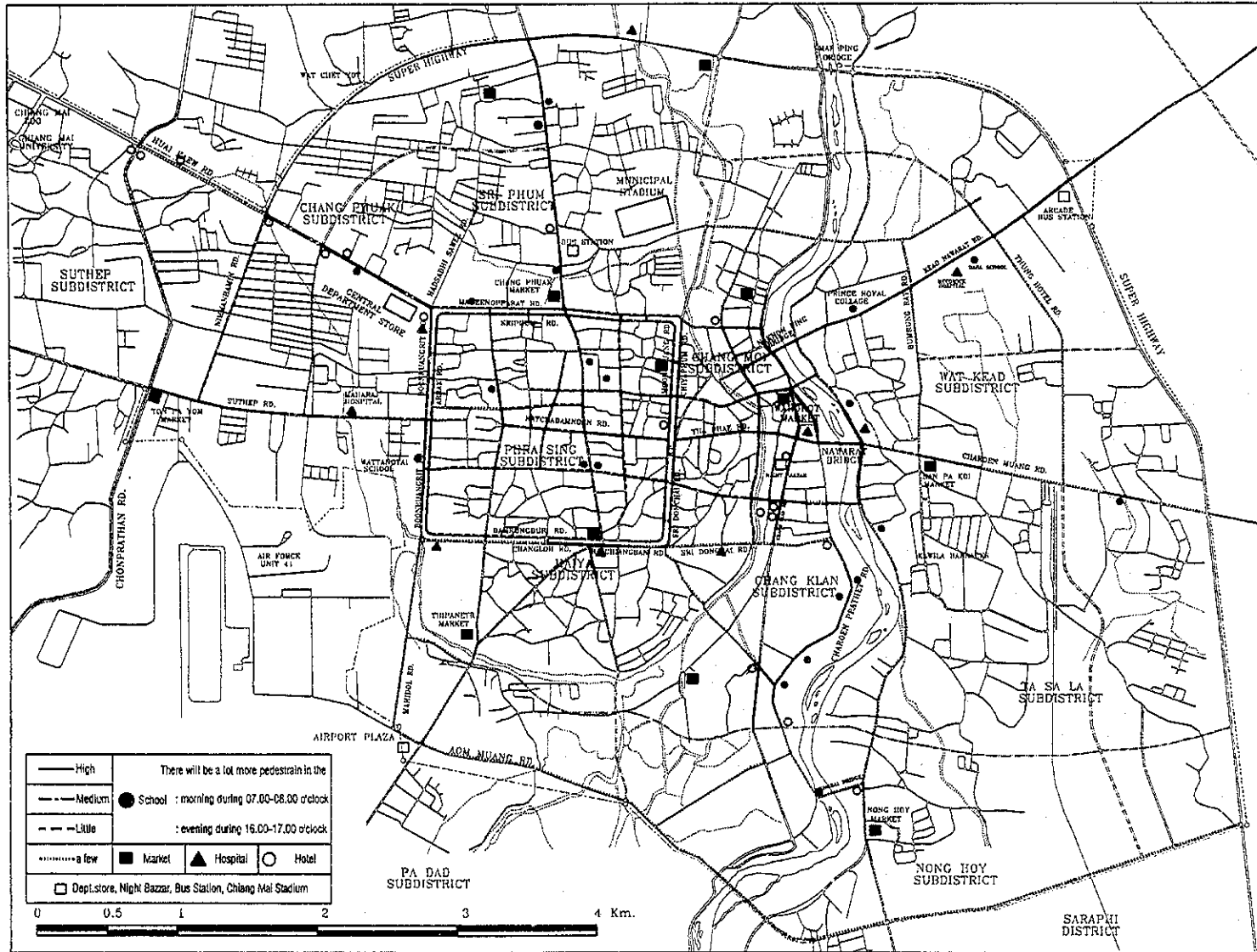
This appendix contains maps and drawings which are made by the Study Team.

- (1) 14-Hourly Traffic Volume
- (2) Number of Lane on Major Road
- (3) Survey Point of Sidewalk Condition
- (4) Pedestrian Traffic Demand
- (5) Traffic Accident Record Form
- (6) Sidewalk Improvement Plans
- (7) Road Improvement Plan for Chang Klan Road - Night bazaar area –





Survey Point of Sidewalk Condition



Pedestrian Traffic Demand

(5) Traffic Accident Record Form

Traffic Accident Report Form

Fill in the form and mark around [] in front of a correspondent message to the event (can mark more than 1)

1. **Date of accident:**Month.....Year.....Time.....O'Clock.
2. **Place of accident:** junction/soi.....road.....highway.....km.....
clear reference place.....direction.....distance (km/m.) sub-district.....district.....Province.....
3. **Characteristic of accident** [1] cars crash [2] car crashes people [3] car crashes animals [4] car crashes train [5] car crashes other things (specify).....
[6] people fall from car [7] over turn car [8] car on fire [9] others (specify).....
4. **Accident area** [1] resident zone [2] school zone [3] commercial/business zone [4] Government zone [5] industrial zone [6] market [7] entertaining places [8] serviced place [9] others (specify)
5. **Site** [1] + junction [2] Y-junction [3] T-junction [4] more than 4 junction [5] straight road [6] curved road [7] narrow road [8] a road diversion [9] steep road [10] interchange ramps [11] U-turn way [12] railway crossing road [13] pedestrian crossing [14] pavement/ road shoulder [15] soi/place entrance [16] express way crossing point [17] median opening [18] median area [19] crowded bus way [20] bridge [21] circle [22] Bus-stop sign [23] parking space/ parking building [24] others.....
6. **Type and number of accident cars**
[1] private car.... [2] motorbike....[3] tuk tuk.....[4] taxi.....[5] pick-up....
[6] van..... [7] bus.....[8] school bus..... [9] bicycle.....[10] tricycle.....
[11] six-wheel truck....[12] ten-wheel truck.....[13] trailer.....[14] half-trailer....
[15] agricultural vehicle.... [16] others (specify type and number).....
7. **Details of vehicles/drivers**

Details of people involved in the accident	Car # 1 (potential party at fault)	Car # 2	Car # 3
[1] Type of vehicle (refer to No. 6)	.....	.....	.....
[2] Registration number	.....	.....	.....
[3] Gender of driver/age	[1] male [2] female age.....year	[1] male [2] female age.....year	[1] male [2] female age.....year

8. Cause of Accident

8.1 Cause of Accident through the Actions of Driver (the one that potentially caused the accident)
 [1] overloading [2] drinking [3] using drug (i.e. amphetamines, etc.) [4] broken down car without warning sign
 [5] suddenly ill [6] stopping outside of the zone [7] driving between lane marking lines [8] sudden deceleration or
 stopping [9] overtaking illegally [10] following too close [11] cutting across in front of another car within a very
 short distance [12] driving in the wrong lane [13] driving with no skill [14] violating sign/traffic signal
 [15] speeding [16] sleepy driving [17] driving in a designated bus lane route [18] using a mobile phone [19] using
 the wrong signal [20] not yielding to car with right-of-way [21] failing to lock the back of the pick-up [22] failing
 to close the bus door [23] failing to turn on lights at night [24] failing to stop at the pedestrian crossing [25] failing
 to use parking/turning signal [26] others (specify).....

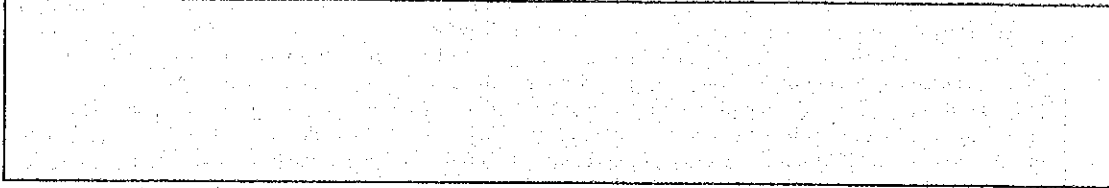
8.2 Cause of Accident through Faulty Vehicle/Equipment (the one that potentially caused the accident)
 [1] faulty braking system [2] faulty steering system [3] faulty electrical system [4] faulty engine [5] faulty
 engine cooling system [6] faulty gas system [7] flat tire [8] worn-out tire [9] wheel loss [10] hand brake
 failed [11] mirror is broken [12] front mirror is faulty [13] faulty door/ lid [14] faulty screen wiper [15] faulty
 safety equipment [16] illegally-attached dark film on screen/windows [17] illegally-altered car conditions
 [18] others(specify)

8.3 Environmental Causes of Accident
 [1] slippery road [2] poor road conditions [3] narrow road [4] poorly-lit road [5] unlighted road [6] raining
 [7] fog, smoke, dust [8] overcast weather [9] poor sight distance due to obstructions [10] glare from
 headlight [11] road under construction [12] obstructing objects [13] no traffic signal or out-of-order [14]
 people dashing in front of a passing car [15] animals crossing [16] lack of warning traffic sign [17] others
 (specify)

9. Conditions of Victims and Usage of Safety Belt/Helmet (for people in front seats)

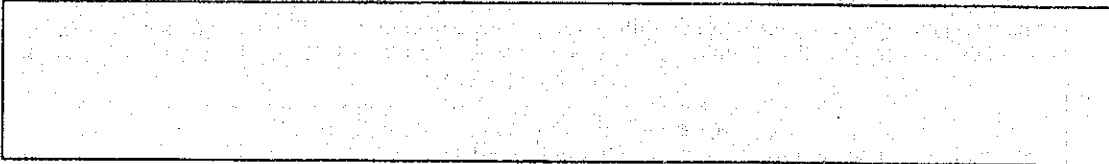
Details	Car # 1 (potential party at fault)	Car # 2	> Two Vehicles	Pedestrians
[1] Person(s) killed (# of)	..... person	..... person	..... person	.....person
[2] Injured person(s) (# of)	..... Person	..... person	..... person	..... person
[3] Usage of safety belt/ helmet	[1] person using. [2] do not use ....person [3] do not have [4] do not know	[1] .....person using. [2] do not use.....person [3] do not have [4] do not know	[1] .....person using. [2] do not use.....person [3] do not have [4] do not know	

10. Please sketch a map showing the approximate positions/characteristics of the accident (indicating road, direction, movement characteristics, position of signs/markings/traffic signals) and put the number code of the accident picture according to the attached paper on Page 3 (in the lower left-hand corner)



(Please sketch the map of the accident area for the purpose of improving the site)
Please put the number code

11. Additional suggestions (i.e. situation needing urgent improvements, site that has most accidents, etc)

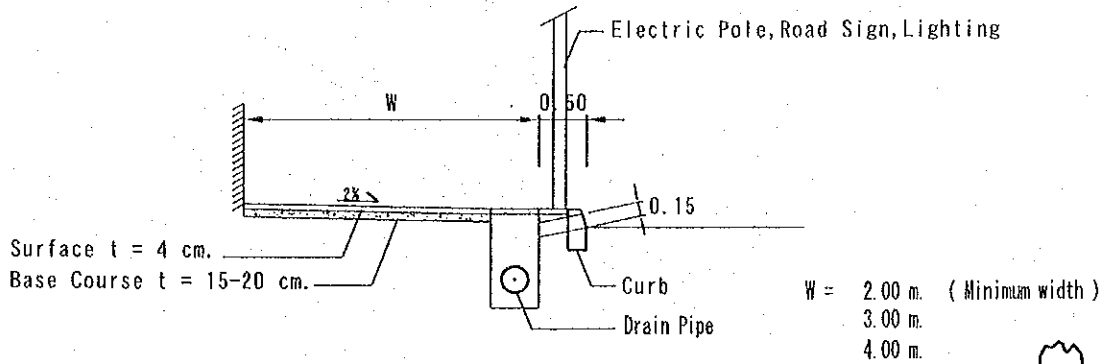


<u>Sign(Recorder)</u>	<u>Surname</u>
<u>Position</u>	<u>Organization</u>

Sidewalk Improvement Plan (1)

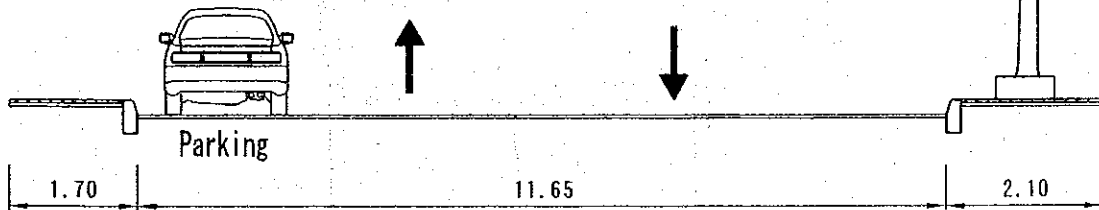
refer to chapter 9.4

① Side walk width

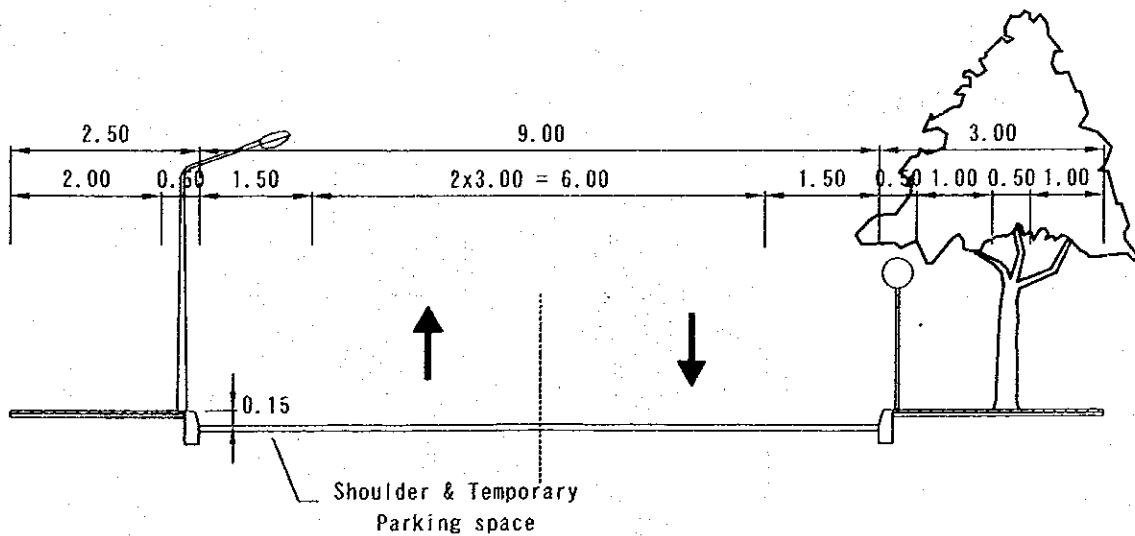


② Effective use for Road Width

Existing



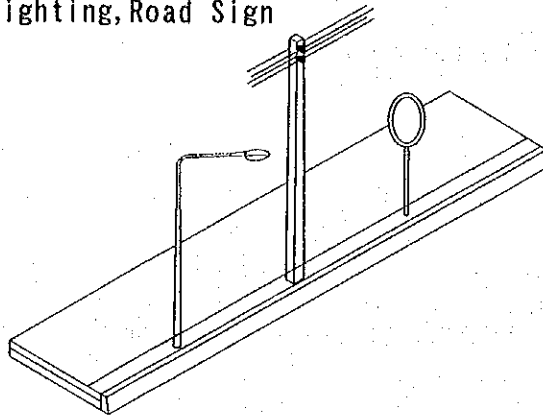
Improvement



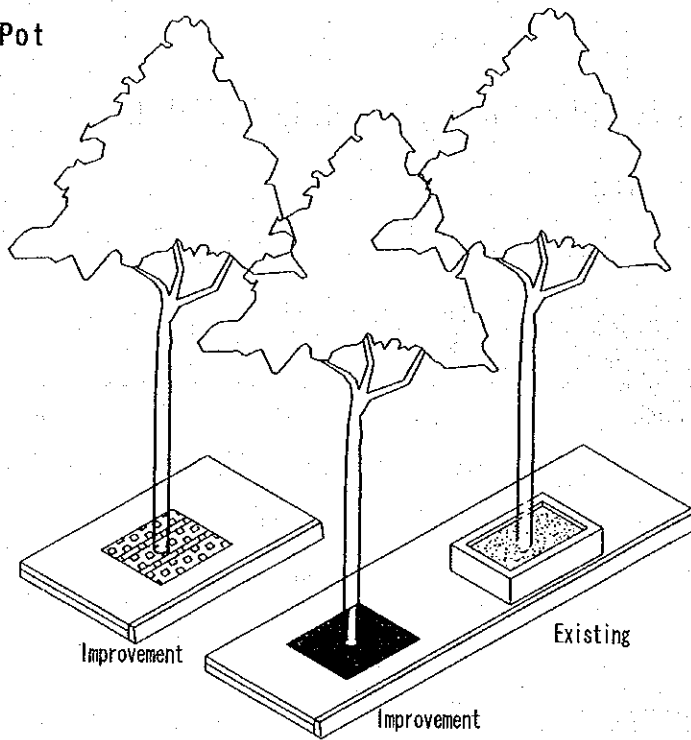
Sidewalk Improvement Plan (2)

③ Traffic Safety and Others

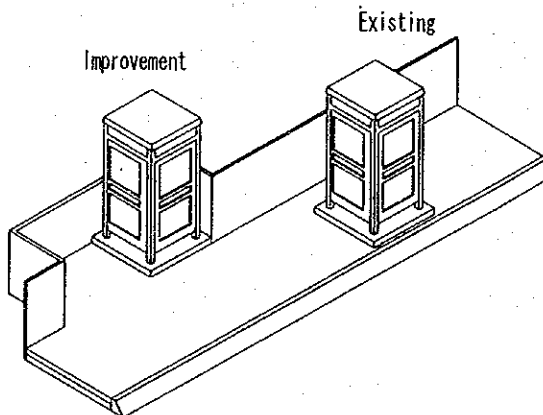
Electric Pole, Lighting, Road Sign



Tree and Pot



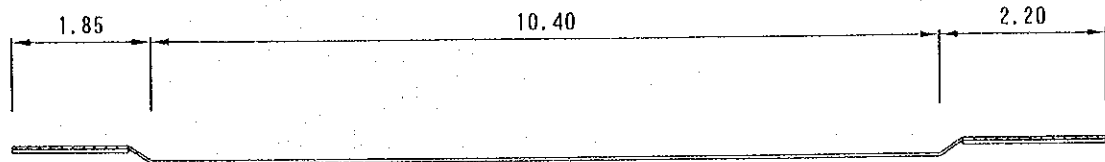
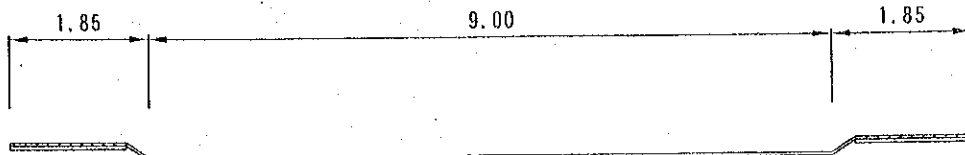
Telephone Box



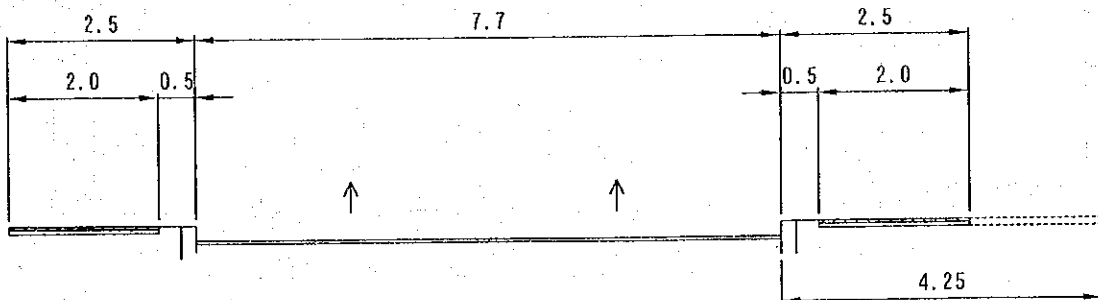
Sidewalk Improvement Plan (3)

Tha phae Road

Existing

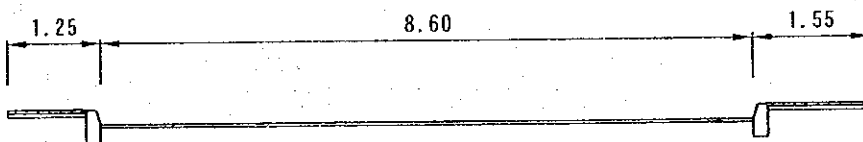


Improvement

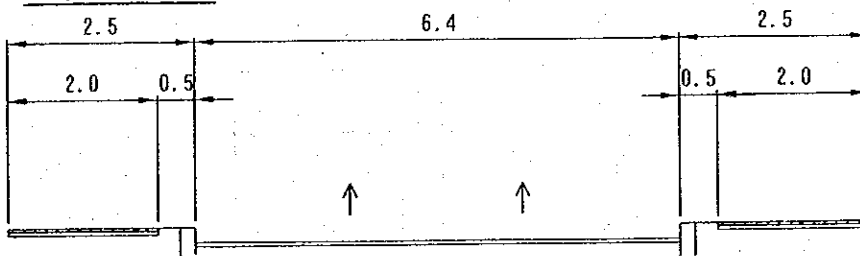


Charoen Prathet Road

Existing



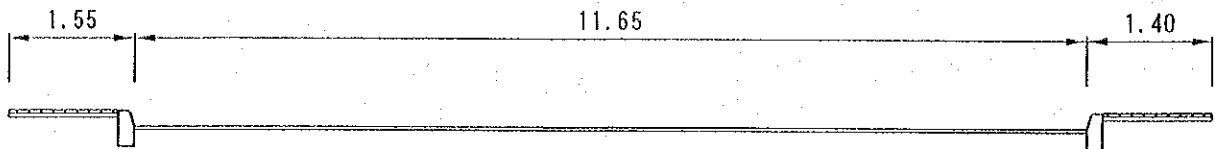
Improvement



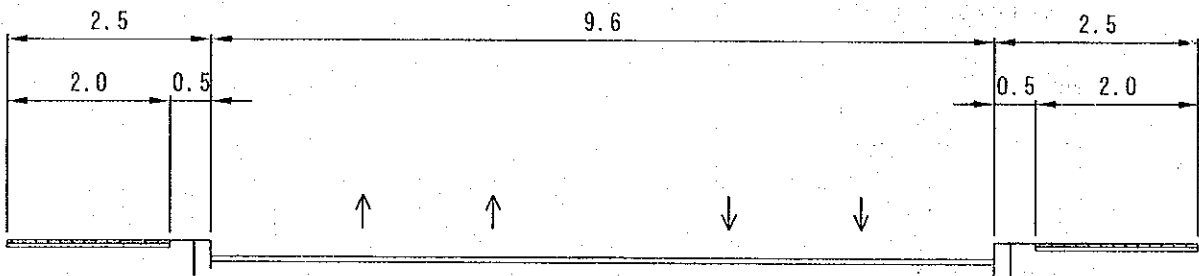
Sidewalk Improvement Plan (4)

Sri Donchai Road

Existing

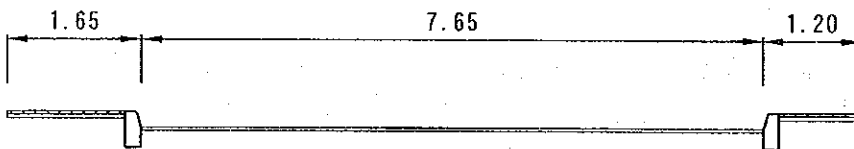


Improvement

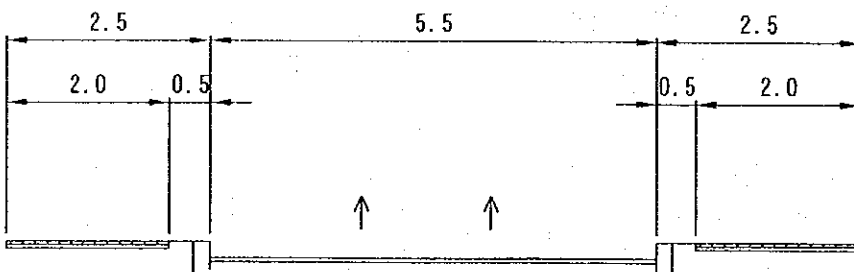


Loi Kroh Road

Existing

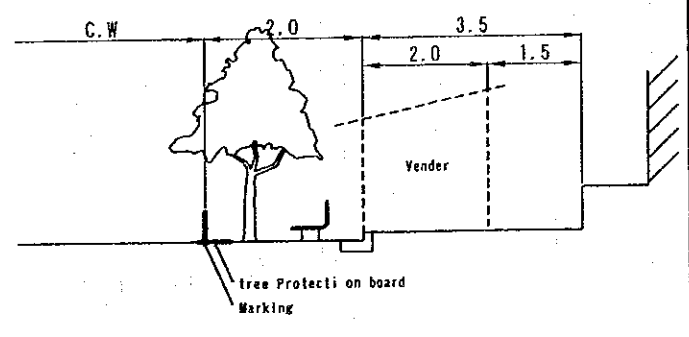
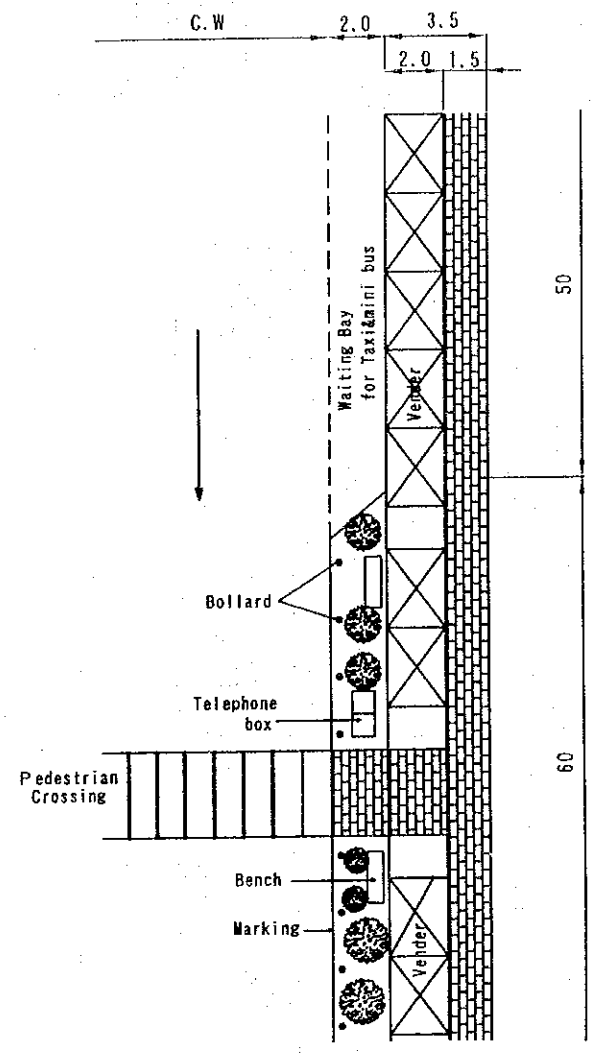
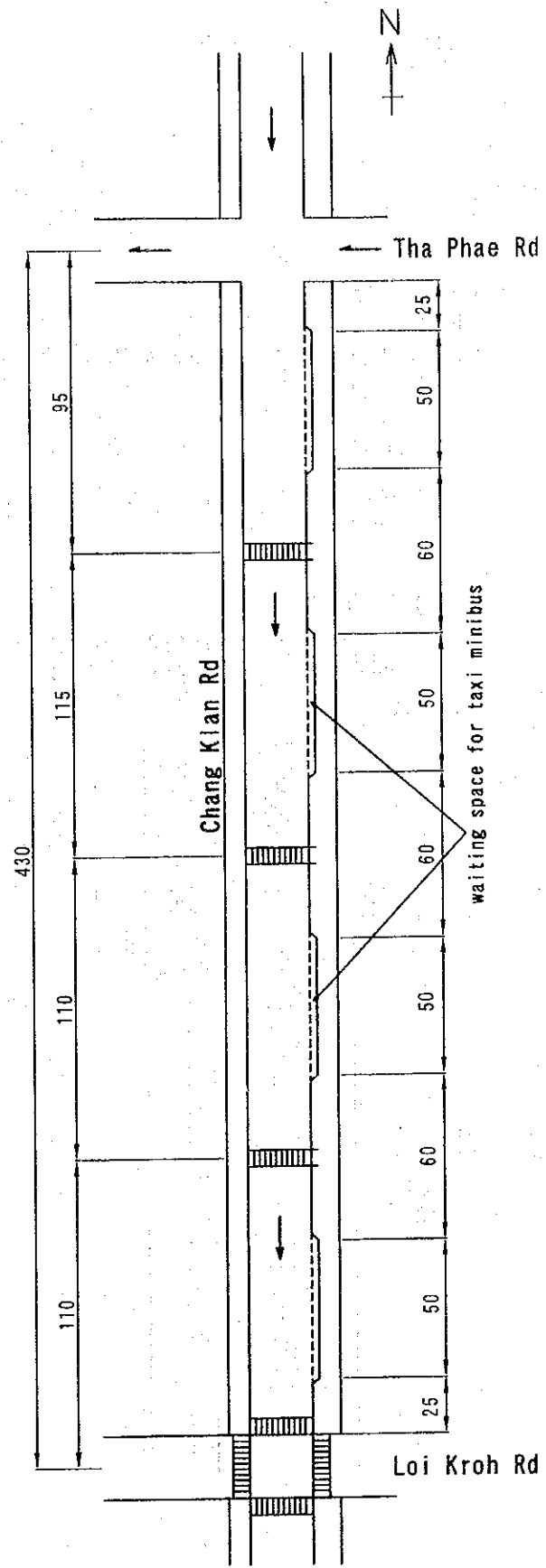


Improvement



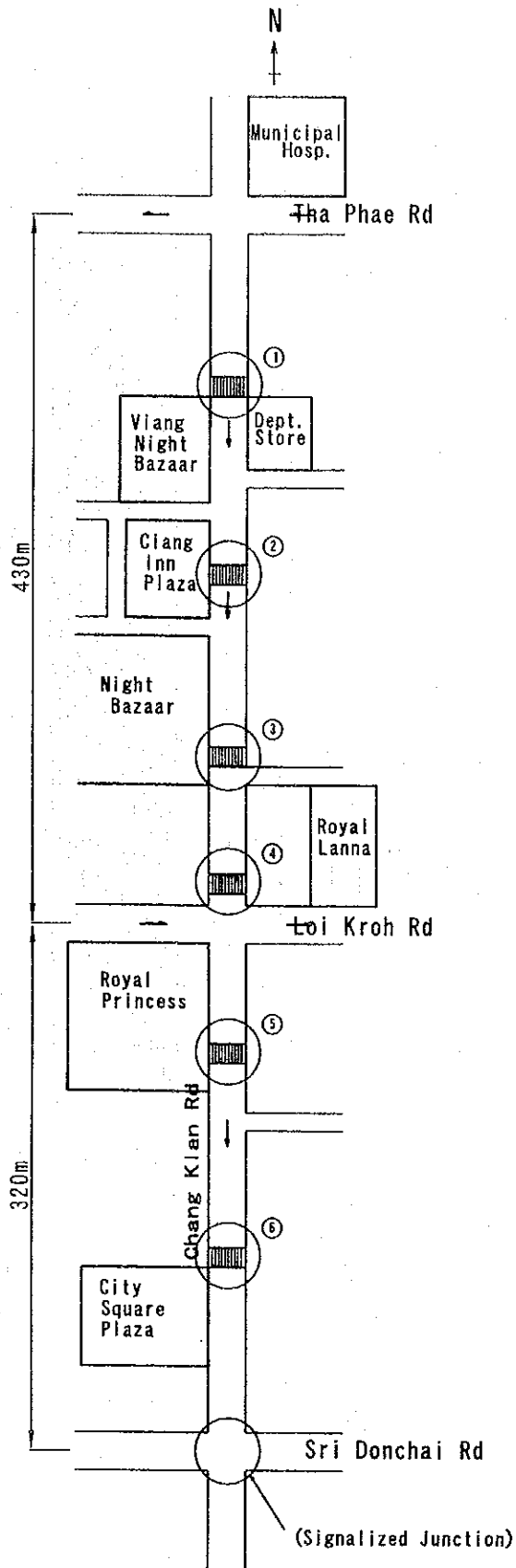
Chang Klan Road Improvement Plan (1)

refer to chapter 9.5

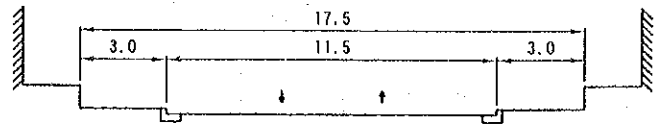


Chang Klan Road Improvement Plan (2)

Flattening at intersection

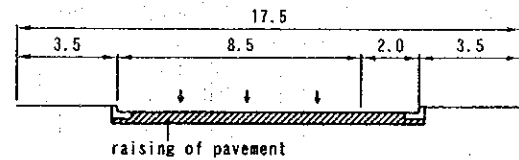


Existing Cross-section



Proposal Plan 1

- Widening of side walk
- Flattening of carriage way & sidewalk



Proposal Plan 2

- Alleviation of faulting between sidewalk and carriageway

Intersection ④

