the share of long-haul vehicles, parked for more than 3 hours, is approximately 50% on Jr. Puno.

In this context, many parked vehicles in on-street parking lots along the principal roads are observed during the midday and evening peak periods, and most of the parking is shorter than 1 hour in duration. There are many parked cars in parking lots along the principal roads. During peak periods, the conflict of merging and diverging traffic, from/to parking lots along the street is observed in the study area. This leads to the beginning of traffic congestion. It is, therefore, highly recommended that the prohibition of parking along principal roads and the installation of charged on-street parking lots on minor streets should be implemented simultaneously, in order to avoid conflict with the traffic flow and mitigate congestion on the principal streets.

11.5.4. PLAN DESCRIPTION OF IMPROVEMENT PLAN

(1) Concept of the On-Street Parking Control System

The improvement plan of the parking control system focuses on the charged on-street parking lot on minor streets, by introducing a parking ticket system.

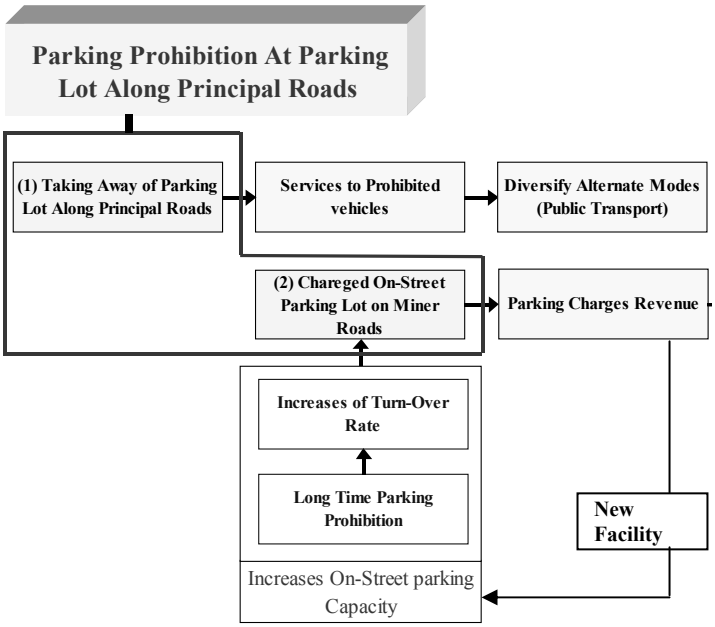

Figure 11.5-8 Concept of Parking Control System

(2) Planning Location and On-Street Measure

Two kinds of prohibition measures will be recommended; one is the prohibition of on-street parking on the principal roads between 6:00 and 21:00, and the other is to charge all vehicles on the minor streets. These two measures ought to be applied at the same time within one system. The location for parking control system is considered as;

- On the principal roads, prohibition of on-street parking between 6:00 and 21:00
- Toll on-street parking facility is located on the minor streets behind the principal roads, in order to increase turn over rate, on-street parking is charged.
- In the surrounding area of the principal roads, on-street parking lots are installed on the minor streets within one block behind the principal roads.

- Target present parking demand on the principal road will be considered; 181 vehicles/hour on Av. Angamos Este, and 224 vehicles/hour on Av. Saenz Peña.
- Present parking demand on minor streets will be included.

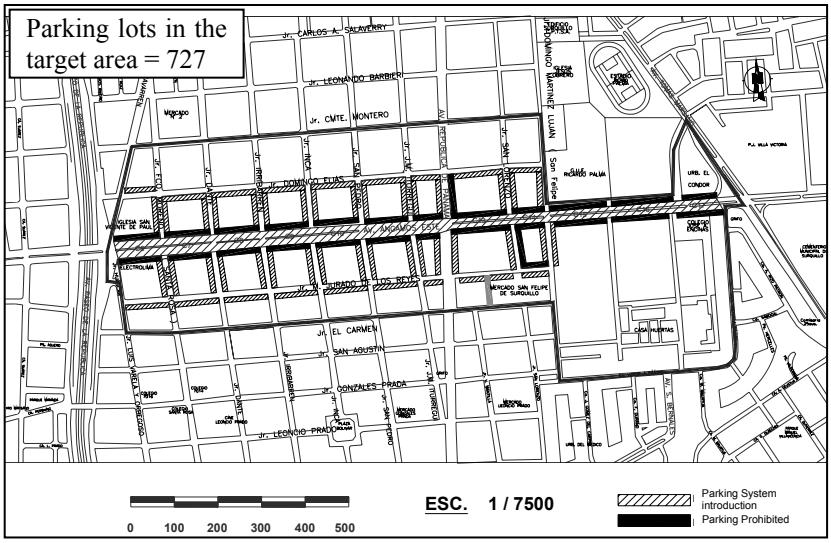

Figure 11.5-9 Planning Location of Parking Control System in Av. Angamos Este Area

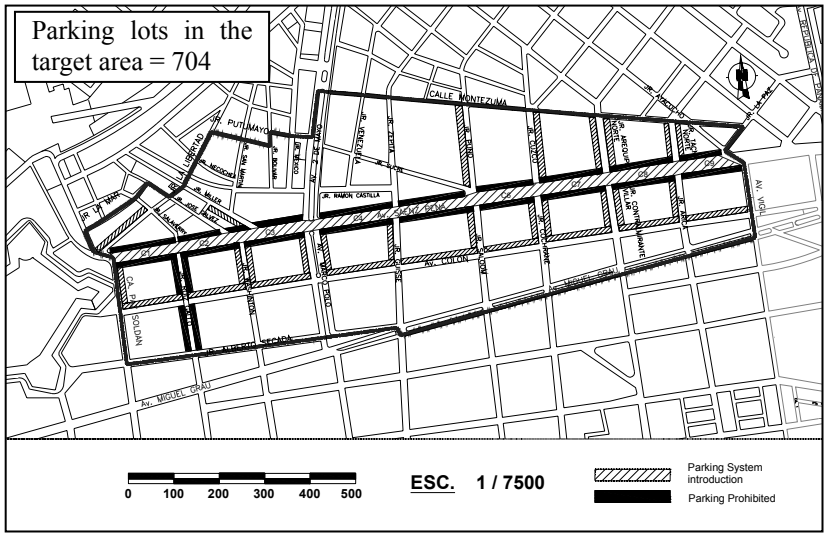

Figure 11.5-10 Planning Location of Parking Control System in Av. Saenz Peña Area

(3) Operation System and Facility Plan

1) Control Method

Installation of automatic parking ticket vending machines is the most common way to enforce parking time control. However, it requires a considerable amount of initial cost and maintenance cost compared to the parking charges collected.

Figure 11.5-11 shows an automatic parking ticket vending machine on-street in Japan. In an area where these machines are installed, the parking lot is marked on the roadside in the same way as a common on-street parking lot. Parking at these lots is charged from 8:00 to 20:00. A driver buys a ticket from this machine and puts it on the vehicle dashboard.

Figure 11.5-11 Parking Ticket Machine in Japan

The amount of initial cost and maintenance cost compared to the parking charged collected must be considered. However, when the recommended parking system is widely diffused, it is recommended to adopt the parking ticket system which is economic and does not use any machine or instrument. A driver buys a ticket from an inspector or the shop authorized by the implementation organization.

An inspector will be responsible for the sale of tickets, and for patrolling to check for violators, the inspector will stick a traffic violation ticket on the car to inform the driver of his or her offence. The outline of the parking ticket system is shown in Figure 11.5-12.

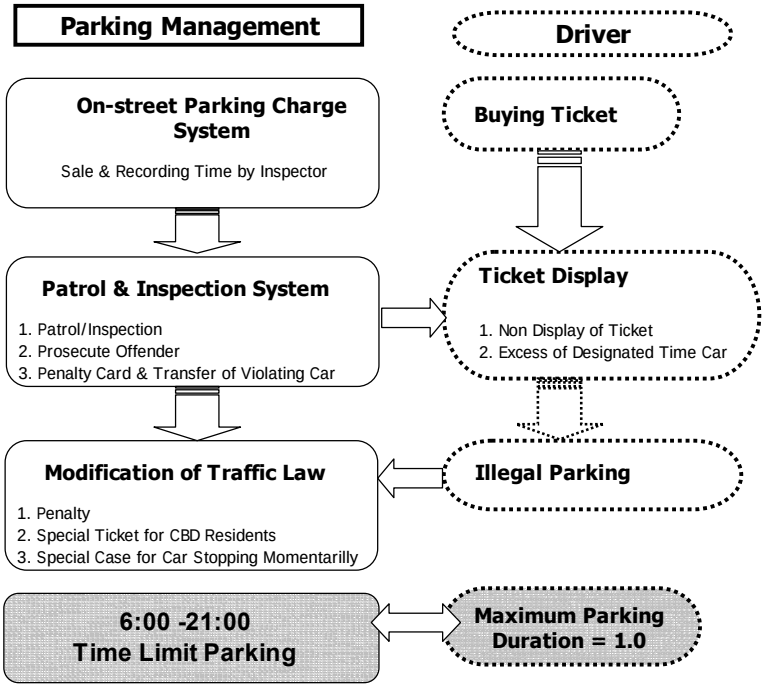

Figure 11.5-12 Outline of Control Method of Parking Ticket System

2) Parking Ticket

In order to introduce the united system easily and to satisfy short time use parking vehicle demand, only one (1) hour tickets should be introduced. An example of a parking ticket is shown in Figure 11.5-13. A driver should buy a ticket from the authorized shop or an inspector who is patrolling on the road. The inspector will record the date and parking duration and sign the ticket.

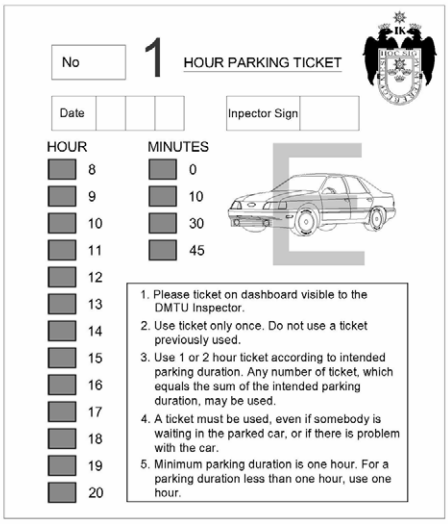

Figure 11.5-13 A Sample Design of Parking Ticket

3) Parking Charge

If the parking charge is too heavy a burden upon drivers, public opinion will be against the new system and a serious social problem may result. On the other hand, if the rate of parking charge is set at a very low level, the abovementioned goals of the management system cannot be attained. A detailed investigation will be needed to estimate the amount of the parking charge. The following items may provide a basis for setting the rate of parking charge.

- Car owners generally belong to the middle or higher classes;
- The rate must be suitable to avoid long-term parking;
- Consideration of the current rate of public parking charge; (official parking inspector: S/.1.0 per hour, unofficial parking: S/.0.5-1.0 per time as a tip)
- What rate would help someone to decide whether to take a taxi to the city center area or to drive his car and then pay the parking charge?

Based on parking survey results and foregoing considerations, the rate of parking charge may be assumed to be between S/.1.0 and S/.1.5 per hour.

4) Patrol and Inspection

An inspector, who is a person assigned by the traffic police or the District Municipality will patrol once every hour to check if there are violators. An inspector's sphere of activities will be a section between 100 m and 200 m in length, on a daily shift basis. The duties of an inspector are; ticket sales, patrol and inspection, enforcement of parking violation and regulations, giving a notice of penalty card, and the transfer of violating cars using a removal truck.

5) Regulation of Parking Violation

A driver violating the parking system will be punished in accordance with traffic law and regulations. After the inspector informs the driver of his or her offence, a series of procedures will be taken by the office of the traffic police. There are two kinds of parking violation penalties as follows; one is the payment of an excess charge in the case of the parking time violation being less than 1.0 hour, and the other is the transfer of a violating car by removal truck when the time exceeds 1.0 hour. The procedure for regulation of parking violation is shown in Figure 11.5-14.

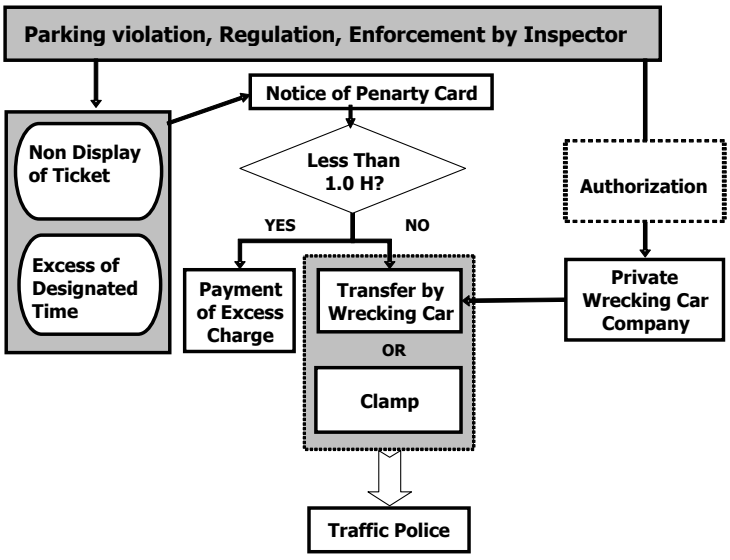

Figure 11.5-14 Procedure for Regulation of Parking Violation

6) Implementation and Organization

It is recommended that the implementation organization will be same as the current organization, namely, Surquillo and San Borja District Municipality in Av. Angamos Este and the surrounding area, and Callao City Municipality in Av. Saenz Peña and the surrounding area as shown in Figure 11.5-15 and Figure 11.5-16.

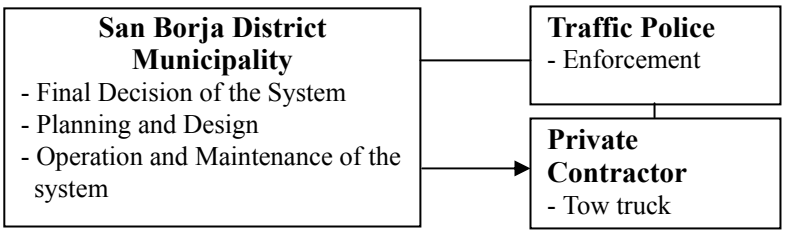

Figure 11.5-15 Organization of Parking Ticket System in the Parking System of Av. Angamos Este

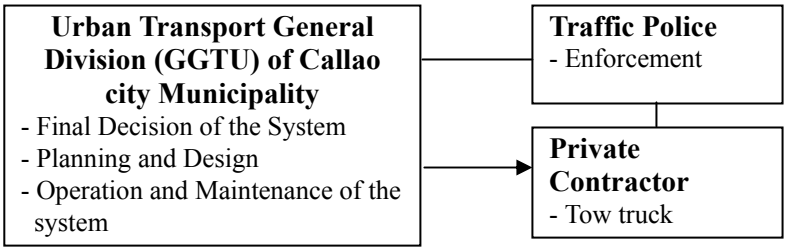

Figure 11.5-16 Organization of Parking Ticket System on Av. Saenz Penaame one as the current organization, whw

7) Facility Plan

The local facility for the on-street parking charge system is composed of parking spaces and guidance signs. The layout of the parking spaces and guidance signs will be designed so that drivers can clearly identify them and easily follow the guidance information. These facilities are provided for parking vehicles on designated parking streets. The parking space will be designated by the use of road markings. The unit parking area is 11.5 square meters (5.0m x 2.25 m). Parking vehicles are directed by the guidance sign along the street. The guidance sign should be installed at 50 to 100 m intervals along the designated street. The standard designs of the parking space and the guideanc sign for the on-street parking charge system area are shown in Figure 11.5-17.

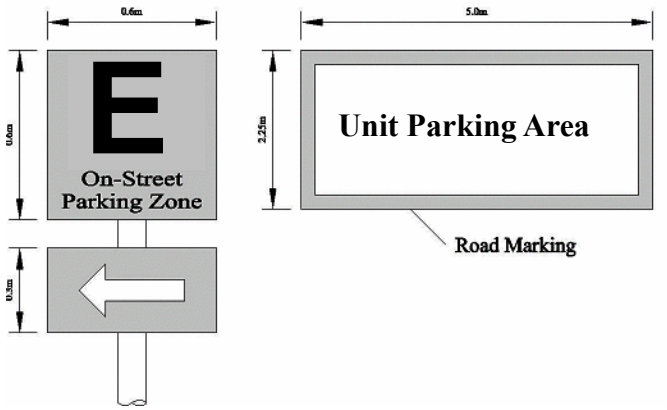

Figure 11.5-17 Standard Design of Unit Parking Area and Guide Sign

(4) Impact and Effect

1) Turnover and Parking Duration

The average turnover is approx. 4.5 times for Av. Angamos Este and approx. 2.2 times for Av. Saenz Peña respectively. It is not foreseeable, at this stage, to what extent the turnover rate will be raised by the parking ticket system. However, the following facts suggest that the parking ticket system will bring about a considerably higher turnover.

- According to the prohibition of curb parking on the principal roads strongly, those affected vehicles will have to seek their parking spaces on nearby principal roads, therefore, the parking demand for toll on-street parking facility may increase.
- By selling only one hour parking tickets, current long parked vehicles will either shorten their parking time or charge their mode, especially the vehicle with three-hour parking or more.
- Accordingly, the average parking duration will shorten and the turnover rate will become higher. It is also expected that the parking duration of vehicles, which presently park for a duration of three hours or less, will tend to become shorter. The parking purpose of such vehicles is mostly considered to be for business or shopping.
- For example, in the central area of Asuncion City in Paraguay or Bogotá City in Colombia, where the parking ticket was developed, the average turnover rate is as high as 6.0 to 8.0 times per day.

2) Estimate of Total Annual Revenue

At present, the parking control in Av. Angamos Este area is charged by the authorized checker. While, for Av. Saenz Peña area, there are no official checkers and charges are not implemented in Av. Saenz Peña. Table 11.5-2 shows rough estimation of total annual revenue in each target area based on the present demand.

Table 11.5-2 Rough Estimation of Total Annual Revenue in target area

Items	Av. Angamos Este area	Av. Saenz Pena area
Total parking capacity of parking ticket system (lots)	727	704
Average turnover rate*1 (times/day)	7.0	7.0
Management time period (hrs)	(15)	(15)
Rate of charge per hour (S/.)	1.0	1.0
Days per month (excluding Saturday and Sunday) (Days)	22	22
Months per year (Month)	12	12
Total annual revenue (Million S/.)	1.34	1.30
Total Annual Revenue (Million US$)	0.42	0.41
Total Annual Revenue with adjustment factor*2 (Million S/.)	0.67	0.65
Total Annual Revenue with adjustment factor*2 (Thousand US$)	209.9	203.2

Note:*1 Average turnover rate is considered as 7.0 times according to the other country's practical accomplishment
*2 Adjustment factor is the factor considering
1) Diversion to another traffic mode
2) Change of the location of parking in case of the parking system introduction (= set as 0.5 temporarily)

11.5.5. IMPLEMENTATION PLAN

Based on the project description, the implementation schedule for the on-street parking system is proposed in Figure 11.5-18. The project is scheduled to start in the second quarter of 2007 and be completed by the fourth quarter of 2007. The task of final design and tender document will be completed within 3 months; the construction of facility work is expected to be implemented with effect from the fourth quarter of 2007. The operation and maintenance management by the operating body may start in the first quarter of 2008.

Task Name	2007				2008			
	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12
1. Final design and tender document		▬						
2. Bidding			▬					
3. Facility work				▬				
4. Operation					● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●
5. Maintenance management					● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●

Figure 11.5-18 Implementation Schedule for On-street Parking Improvement Plan

11.5.6. COST ESTIMATES

The project cost for the on-street parking improvement plan consists of 1) road marking for the on-street toll parking facility, and 2) traffic signs for prohibition of curb parking on the principal road, and on-street toll parking facility, based on the contract package during 1 years. The project cost by items is shown in Table 11.5-3. The operation cost for traffic demand management during 1 year is shown in Table 11.5-4.

Table 11.5-3 Project Cost for On-Street parking Improvement Project

Investment Items	Project Cost (x 1,000 USD)
1. Road marking for on-street toll parking facility	33
1-1 Av. Angaomos Este area	17
1-2 Av. Saenz Peña area	16
2. Traffic signs for prohibition of curb parking on the principal road, and on-street toll parking facility	7
2-1 Av. Angaomos Este area	4
2-2 Av. Saenz Peña area	3
Total	40
Engineering Cost (Totalx10%)	4
Administration Cost (Totalx10%)	4
Contingencies Cost (Totalx15%)	6
Grand total	54

Table 11.5-4 Operation Cost for On-Street parking Improvement Project

Operation Items	Cost (x 1,000 USD)
1. Printing of parking ticket for both areas during one year	83
2. Annual personnel expenses for tool collectors in Av. Angaomos Este area	175
3. Annual personnel expenses for tool collectors in Av. Saenz Peña area	126
Total	384

Notes: The operation cost for on-street parking improvement project during 1 year

CHAPTER 12
Action Plan for
Road Accident Monitoring Plan

12. ACTION PLAN FOR ROAD ACCIDENT MONITORING PLAN

12.1. GENERAL

The action plan for road accident monitoring plan was identified as the most effective plan from among five traffic management strategies, requested by the Peru Technical Counterpart committee. In this study, in order to clarify the technique of road accident monitoring and implementing methods, the following practical action plans will be prepared.

- Preparation of institutional organization for road accident measures
- Preparation of a guideline for road accident monitoring system
- Implementation of seminar for road accident monitoring system

12.2. PLAN DESCRIPTION

12.2.1. PREPARATION OF INSTITUTIONAL ORGANIZATION FOR ROAD ACCIDENT MEASURES

(1) Objectives

The preparation of institutional organization for road accident measures is to establish a sustainable organization system with clear mechanisms and functions of the relevant agencies, in order to prevent traffic accidents.

(2) Recommendation of Sustainable Organization

1) Mechanism and Function

As previously analyzed in the plans of road safety education and road accident monitoring system, current organization of the coordination and management of road safety has been chaired by the CNSV, and relevant agencies conduct the strategic planning and other Terms of Reference established for them by the CNSV (See Figure 12.2-1)

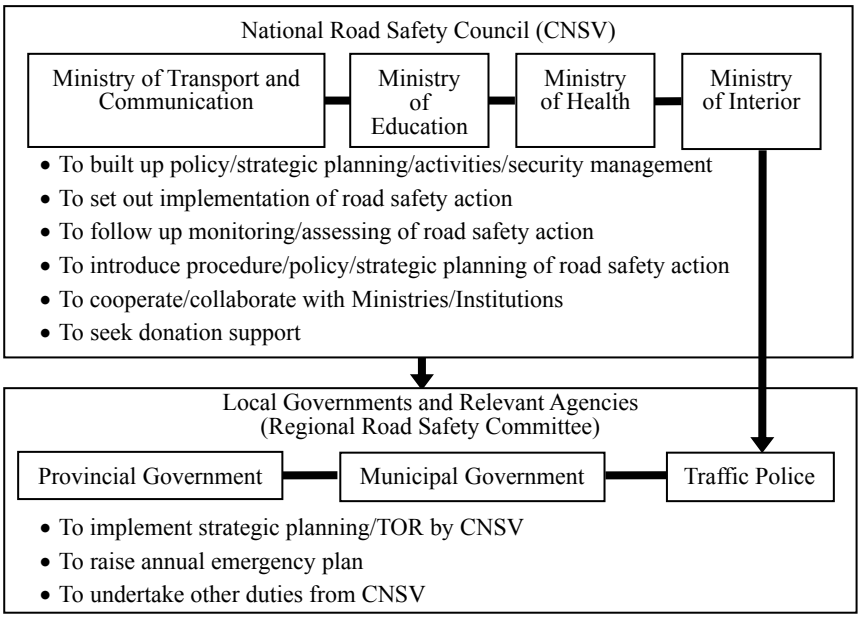

Figure 12.2-1 Mechanism and Function of Road Safety

The mechanism and function of current organization is generally suitable, covering national activities for preventing traffic accidents and road safety. However, as pointed out in the analysis of current CNSV, CNSV should be enhanced by an increase in the annual budget for promoting its activities and developing the skills of CNSV staff and enhancing its institutional staffing capacity.

2) Role of Relevant Activities for Road Accident Monitoring

a) Major Role of Relevant Agencies for Road Accident

In order to prevent traffic accidents, it is necessary to implement a sustainable institutional system clearly establishing the mechanisms and functions of the relevant agencies. The relevant agencies currently consist of CNSV, Lima Municipality (Municipalidad de Lima), Callao Municipality (Municipalidad de Callao), administrative regions (Municiplidades Distritales), Traffic Police, and school/university.

With regard to road accident monitoring, it is necessary for each relevant agency to have its general role; CNSV is responsible for development and promotion of road safety education programs, and management and coordination with other relevant agencies, training in road safety, and development of human resources; Municipalidad de Lima, Municipalidad de Callao, and Municipalidades Distritales are responsible for traffic accident data analysis, analysis of causes at black spots, black spots improvement plans, and implementation of improvements, and the Traffic Police is responsible for data collection, preparing of accident statistics, extraction of black spots, traffic enforcement, and road safety campaigns, School/University are responsible for road safety education and training new professional teachers.

For the role of Municipalidad de Lima, Municipalidad de Callao, and Municipalidades Distritales, it is highly recommended that a road accident countermeasure unit should be established in each municipality, in order to implement their duties of road accident prevention. In addition, the staff for the unit will be composed of seconded staff from the existing Municipality. The major role of relevant road accident agencies is shown in Figure 12.2-2.

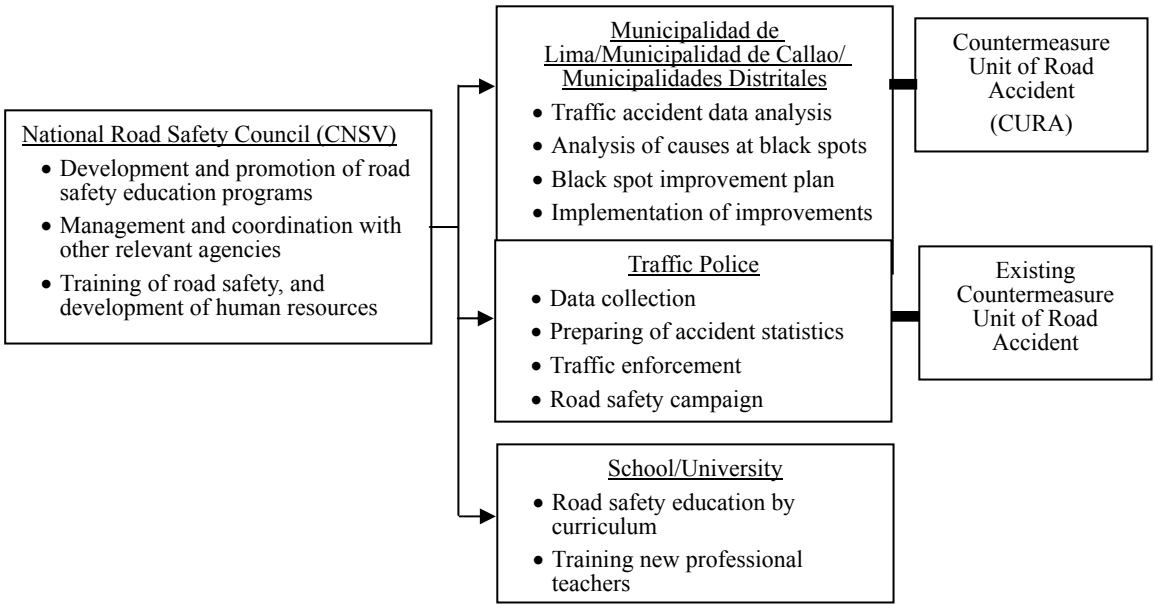

Figure 12.2-2 Major Role of Relevant Agencies for Road Accidents

b) Coordination and Management of Road Accident Monitoring System

Based on the major role of relevant agencies and their activities for the road accident monitoring system, CNSV should oversee implementing activities and coordinating efforts of the different agencies to produce a road accident monitoring system. Each agency should prepare within its own sphere of activity. In terms of the effectiveness and the implementation process, the CNSV reviews the completed works and assesses their efficiency, and makes revisions if necessary. The information produced will be reported to other agencies based on the formulated procedure (See Figure 12.2-3).

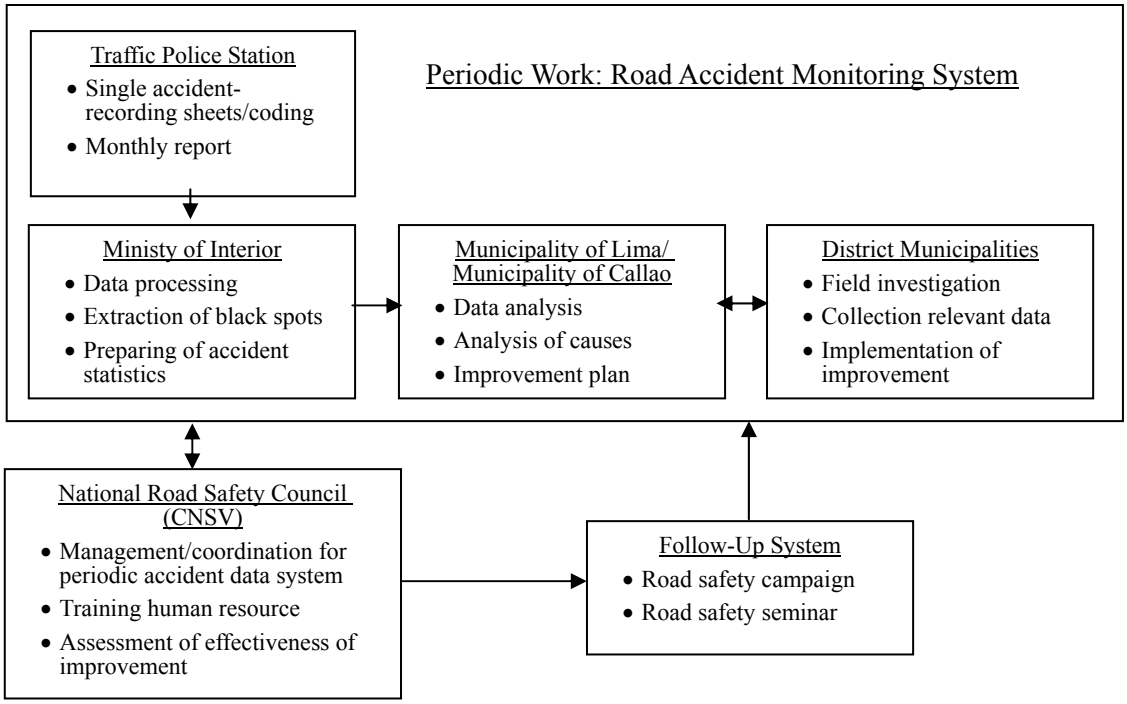

Figure 12.2-3 Periodic Work Procedure for Road Accident Monitoring System

12.2.2. PREPARATION OF GUIDLINE FOR ROAD ACCIDENT MONITORING SYSTEM

(1) Objectives

The objective of preparation of a guideline for the road accident monitoring system is to establish a basic procedure from database to planning of accident measures.

(2) Preparation of a Guideline

This guideline has been compiled as a reference guide to the prevention of road traffic accident program. It explains why a monitoring system for traffic safety such as routine work system for traffic accident is needed to encourage road planners, engineers, and traffic police, and how they can contribute in building safety.

The guideline was prepared in accordance with the strategy plan of road accident monitoring; the guideline consists of five (5) chapters, which are equipped with practical examples of traffic accident.

A complete set of guidelines for road accident of monitoring system is referred to in the Supplementary volume. The table of contents for the guideline is described in Table 12.2-1.

Table 12.2-1 Table of Contents for Guideline

Chapter	Section	Item	Practical examples
1. Investigation and data base system	• Study of accident statistics	• Coded items for accident-recording sheet • Guideline of coded items for accident-recording sheet • Accident storage and retrieval system • Computer software package analysis facilities	• Selection of target area/locations • Collection of single accident-recording data • Compilation of accident data by location
	• Extraction of hazardous locations (black spots)	• Definition of black spots • Area to be covered by investigation	• Extraction of black spots
2. Analysis system on hazardous locations and confirmation of problems	• Interpretation of accident records	• Interpretation of traffic accident-recording sheets • Statements of drivers/pedestrians concerned and views of police	• Interpretation of accident records • Field investigation • Problems and issues identified
	• Collection of relevant materials	• Road conditions • Traffic conditions • Signal control conditions	• Road map and photo
	• Field investigation	• Initial preparation for target location • Key points of field observation	• Field investigation
	• Extraction of frequent accident pattern	• Collision diagram	• Analysis of accident record
	• Presumption of Accident Causes	• Preliminary analysis by accident pattern frequently • Site investigation analysis by specialist accident investigators • Overall judgment by preliminary analysis and site investigation analysis	• Problems and issues identified
3. Planning measures system	• Selection of measures corresponding to presumed causes	• Basic conditions of the intersection • Actual traffic flow • Presumed measures by type of accident	• Remedial measures corresponding to presumed causes
	• Examination of applicability of measures		• Introduction of typical improvement plan
	• Clarification of effects and side effects of measures		
	• Examination of combination of measures		
4. Implementation of measures	• Cost estimation for measures/ examination of finance/ consultation with agencies concerned /explanation to residents/implementation		• NA
5. Follow-up system	• Measurement of effects of countermeasures • Comparison of before/after surveys • Execution of campaign and enforcement		• NA

12.2.3. IMPLEMENTATION OF SEMINAR FOR ROAD ACCIDENT MONITORING SYSTEM

(1) Objectives

The implementation of seminars for the road accident monitoring system aims at the development of human resources by introducing an actual seminar, in order to examine and identify the influence and effect of the proposed road accident monitoring plan.

(2) Implementation Guidance

The implementation guidance for the seminar is described below:

1) Introduction

The seminar was conducted by using text material (refer to a guideline for road accident monitoring plan), which was prepared by the JICA study team. The seminar material includes the text material prepared in Spanish and schematic figures to help participants easily understand the meaning of the text.

2) Target Audience

The target audience for the seminar of the road accident monitoring system is divided into two (2) groups; a) road planners and engineers of relevant government agencies, and b) traffic police such as investigating police and statistics police as well as traffic police.

3) Seminar Schedule

The venue of the seminar is the Technical Secretariat of the Transport Council of Lima and Callao at the meeting hall. The seminar was held on 28th and 29th November 2006. Table 12.2-2 shows the detailed schedule of the seminar. Five (5) lectures were presented during the day. In addition, the examination of actual accidents in video films was introduced. During the presentation, participants were given the chance to ask and discuss key issues; it is believed that such interaction has greatly helped the participants to comprehend the presentation material.

Table 12.2-2 Seminar Schedule

Time	Lecture	Detail item
9:30-10:10	1) Investigation and data base system	a) Study of accident statistics b) Extraction of hazardous location (black spot)
	Question and answer	
10:15-10:55	2) Analysis system of hazardous locations and confirmation of problems	a) Interpretation of accident records b) Collection of relevant materials c) Field investigation d) Extraction of frequent accident pattern e) Presumption of accident causes
	Question and answer	
11:00-11:20	3) Actual accident examination	a) **Video film:** "Effects of seat belt"
11:25-12:00	Coffee break	
12:05-12:45	4) Planning measures system	a) Selection of measures corresponding to presumed causes b) Examination of applicability of measures c) Clarification of effects and side effects of measures d) Examination of combination of measures
	Question and answer	
12:50-13:20	5) Actual accident examination	a) **Video film**: "Documentary: Protection of other people's lives and our life by foresight of accident"
13:25-14:00	6) Implementation of measures and follow-up system	a) Implementation of measures b) Follow-up system c) Activities for road safety
	Question and answer	

(3) Seminar Materials

1) Text for Seminar

The text material of the guideline and video film for seminar were prepared by the JICA Study Team, as mentioned above, the guideline consists of five (5) chapters. Figure 12.2-4 shows a sample of the Spanish text that was distributed to all participants.

2) Presentation

Five lecture presentations were prepared. The presentations were prepared in power point format with the aid of many pictures and schematics. Figure 12.2-5 shows a sample of one slide of the presentation.

3) Participants

The seminar participants are classified into two groups a) Traffic police, and b) road planners and engineers. The breakdown of the 81 seminar participants is shown below:

- Group of Traffic Police: Total number of participants in the seminar was 55 polices from 46 police stations of the Metropolitan Lima and Callao Area.
- Group of Road Planners and Engineers: Total number of participants in the seminar was 26 road planners and engineers form Ministry of Transportation and Communication, Municipality of Lima, Municipality of Callao, and District Municipalities.,


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Ministerio de Transportes y Comunicaciones
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Estudio de Factibilidad de Transporte Urbano
Para el Área Metropolitana de Lima y Callao
en la República del Perú

Pautas para
El Sistema de Monitoreo de
Accidentes de Tránsito

Noviembre 2006

YACHIYO ENGINEERING CO.,LTD.
CHODAI CO.,LTD.

Figure 12.2-4 A Sample of Spanish Text

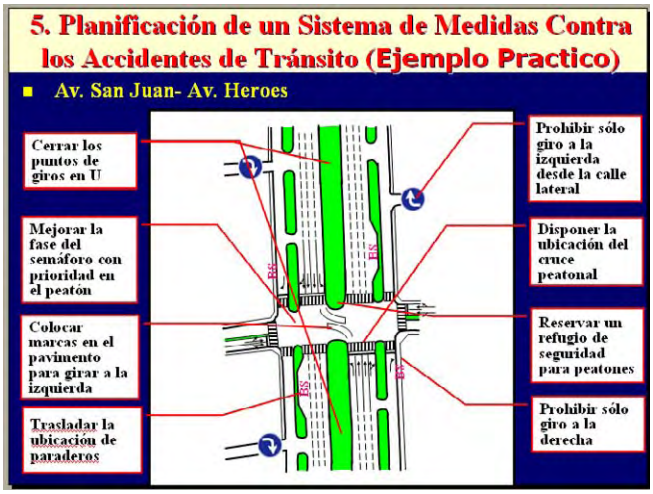

Figure 12.2-5 A Sample of One Slide of Presentation

(4) Implementation of Seminar

The seminar was held on two days (28th and 29th of November, 2006). Figure 12.2-6 shows some pictures from the actual seminar.

Group of Traffic Polices

Group of Road Planners and Engineers

Figure 12.2-6 Scenes from Seminar Implementation

CHAPTER 13
Para-Transit Study

13. PARA-TRANSIT STUDY

13.1. GENERAL

Paratransit modes such as taxis, Colectivos and Mototaxis share passengers under the keen competition of fare rates, operation speeds and convenience due to the excessive number of vehicles on the supply side. Therefore, when the trunk bus system is introduced on the east-west major corridor of Av. Venezuela and Carretera Central, those paratransit systems must be reorganized into the transportation mix.

This section focuses on the paratransit system composed of taxi, Colectivo, and Mototaxi in the Lima and Callao metropolitan area. At first, the present conditions are analyzed based on the data collected from the field survey conducted in May and June, 2006. And then, the problems and issues are disclosed. Second, the technical analysis is carried out based on the future oriented policy shown in the issues. Finally, development strategy is planned based on the present conditions and technical analysis.

13.2. TAXI STUDY

13.2.1. CURRENT CONDITIONS

(1) General

In order to identify present taxi characteristics from the viewpoint of user and driver, the taxi survey was carried out during May and June 2006. The number of samples is approximately 160 samples in the taxi users and drivers, respectively. In the F/S Study, the survey focuses on the taxi transfer information and operation area, since general information such as registered vehicles, trip characteristics, taxi user opinion, taxi driver conditions and taxi companies were already collected and analyzed in the Master Plan study.

(2) Number of Taxis

Table 13.2-1 shows the registered number of taxis in Lima and Callao, figures of which correspond to 2004 and 2006. The number of taxis in 2006 is approximately 72,000 vehicles, in contrast to 31,000 in 2004. The growth ratio of taxis in 2006 to that in 2004 is 2.33 times, equivalent to the increase ratio of 52% per annum. The increase ratio in Callao is remarkable.

Figure 13.2-1 shows the age distribution of taxis in Lima, which compares both data in 2004 and 2006. The ratio of taxis, with an age of 15 years or less to the total, reaches 90% in 2006, in contrast to 75% in 2004. After 2004, the number of vehicles which were manufactured within the last 10-14 years increase. This shows that vehicles of relatively later models are operated in Lima, compared with the situation in 2004.

Table 13.2-1 Number of Registered Taxis in Lima and Callao

Year	Lima	Callao	Total
2004	30,031	1,150	31,181
2006	66,021	6,487	72,508
2006/2004	2.20	5.64	2.33
Growth Ratio/Year	48.3%	137.5%	52.5%

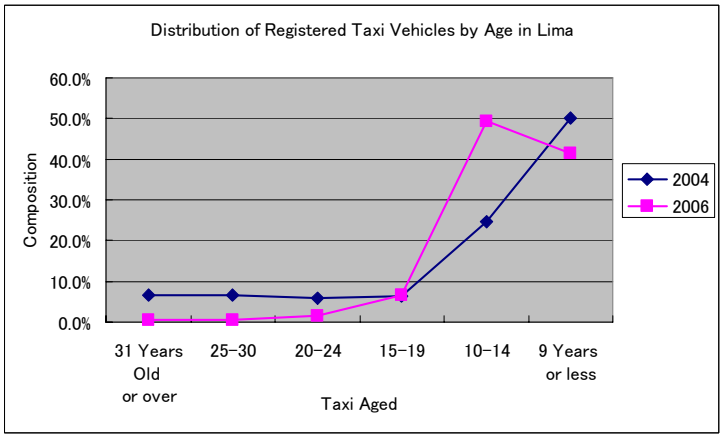

Figure 13.2-1 Age Distribution of Taxis in Lima

(3) Taxi User's Conditions

1) Independent Use of Taxi and Transfer from/to Other Modes

Taxi user is classified into two; one is independent use which uses only a taxi. The other is transfer use which transfers a taxi from/to other modes. The characteristics of the taxi use are shown in next. Table 13.2-2 shows the selected modes before and after passengers get into or out of a taxi. Before and after the use of taxis, walking modes are predominant in percentage. The bus mode is somewhat high before the use of taxis. After getting out of a taxi, the ratio of Colectivos is only 3%.

Approximately 20% of users transfer to a taxi from other modes. On the other hand, independent users, to which a passenger does not transfer, are approximately 70% of total.

Table 13.2-3 shows the average travel time of modes before getting into a taxi. The travel times of buses and Colectivos are approximately 10-20 minutes.

Table 13.2-2 Taxi Transfer from/to Other Modes

	Before	After
Walking	83.7%	97.1%
Mototaxi	3.3%	0.0%
Colectivo	2.6%	2.9%
Bus	9.8%	0.0%
Car	0.0%	0.0%
Others	0.7%	0.0%
	100.0%	100.0%

Table 13.2-3 Average Travel Time of Modes Used Before Taking a Taxi

Transfer	Travel Time (min)
Bus	10-20
Combi	10
Colectivo	10-15

2) Travel Time

Figure 13.2-2 shows the distribution of total and taxi travel times. The former is the time between the origin and destination of the trip and the latter is only the time of use of the taxi. As it can be seen, approximately 70% of the total have a total travel time of less than 30 minutes, while the taxi travel time within 30 minutes is 90% of the total. In consideration of that bus passengers who have the travel time with 60 minutes or more are 45% bus passenger of the total, the taxi passengers use taxis for a medium travel or distance trip.

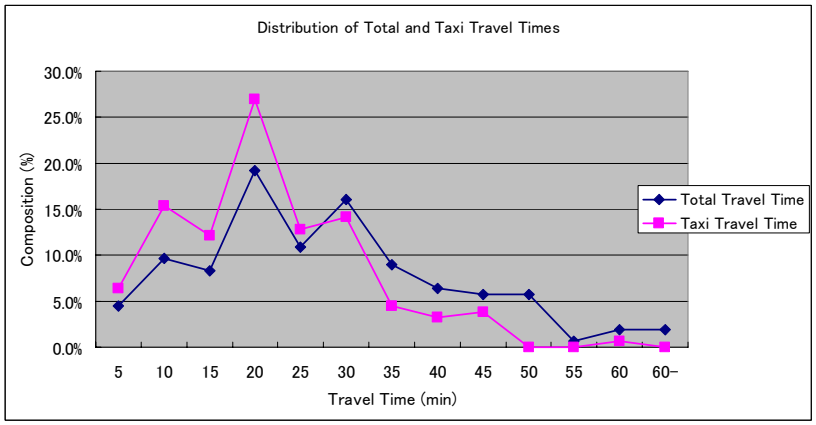

Figure 13.2-2 Distribution of Total and Taxi Travel Times

The taxi travel time conditions of the independent and transfer uses are clearly different. Figure 13.2-3 shows the travel time according to independent and transfer uses. The travel time of independent use is predominant at 20 minutes, while the transfer is divided into three (3) time ranges with a peak of 10 minutes, 20 minutes and 30 minutes. It seems that passengers use taxis for short distances and transfer to other modes such as the bus. And also, taxis are used for rather long distances and then Combis and Colectivos are used.

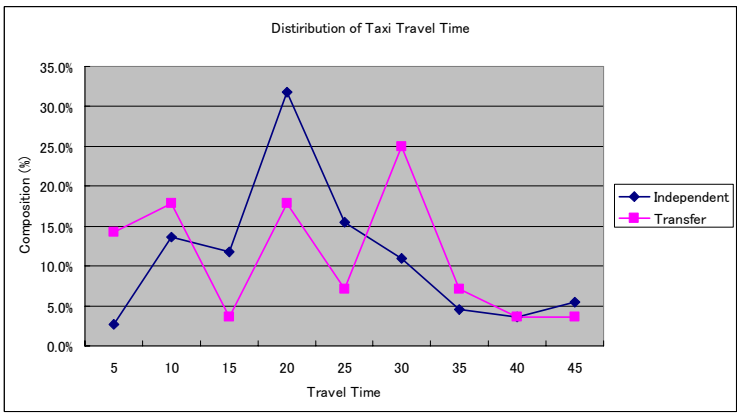

Figure 13.2-3 Distribution of Taxi Travel Time by Independent Use and Transfer from/to Others

3) User Conditions

a) Fare, Reasons of Taxi use, Alternative Modes

Figure 13.2-4 shows the distribution of the taxi fee paid in the morning peak hour. As can be seen, approximately 85% of the total fares are less than S/. 10.0. This fare rate is approximately 5.0 times or more than a bus fare rate. Since the taxi rate is higher than that of bus, taxi is not used everyday. The survey data says that the ratio of passengers who use

taxis 1-2 times/week accounts for approximately 60% of the total. The ratio of the passenger who use taxis everyday is as low as 8%.

In consideration of bus service in which passengers are possible to go to everywhere in the study area, taxi passenger who pays a fare rate of 5.0 times to the bus demands a higher travel speed to taxi. According to the Interview Survey, “Faster than bus service” (65% of the total) takes the highest ratio of the reasons, followed by “others” (13%), and “Crowded in a bus” (10%). The main reason for taxi use is a higher travel speed.

At the present, the alternative modes of the taxi are bus and Colectivo. The survey data says that the public transport (Omnibus, Microbus and Camioneta) takes a higher ratio at 60% of the total in use. The second highest ratio is that of the Colectivo. Its figure is approximately 30%. The Colectivo is an important public transportation mode as an alternative to the taxi.

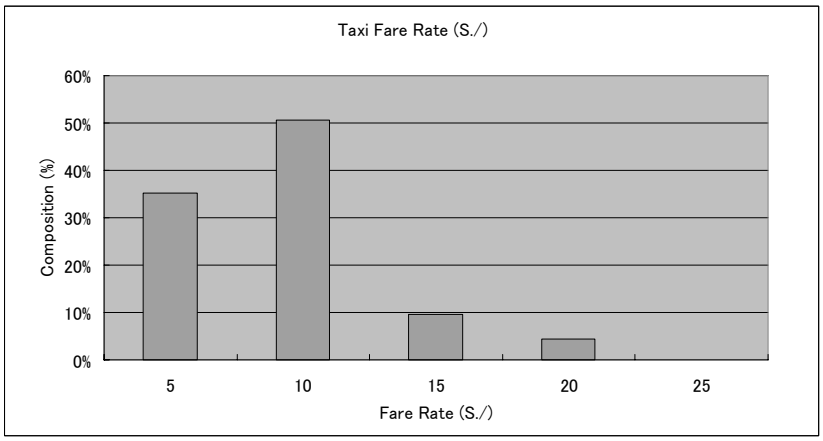

Figure 13.2-4 Distribution of Taxi Fare Rate

b) Problems of Taxis

The survey says that the problems of security and traffic safety take the higher ratio. Those figures are 46%, and 31% of the total, respectively. Those items are important issues in the future taxi policy. Those adopt into development strategy of taxi.

(4) Taxi Driver’s Operation Area

The taxi driver interview survey mainly investigated the driver’s operation area, which is the area where a driver operates a taxi on a daily basis. According to the survey, higher operation areas(10% or more of the total drivers) are zones No. 7, 11, 12, and 13 where middle or upper income range residents dwell, and business and commercial areas concentrate in the Lima metropolitan area.

The second higher group (8% of the total) is zones No. 8 and 9 which are located on the north side of the proposed East-West corridor trunk bus project. It is common for taxi drivers to operate within a territory of 4-5 zones. It is obvious that the taxi operates inside a relatively small area within a radius of 10km.

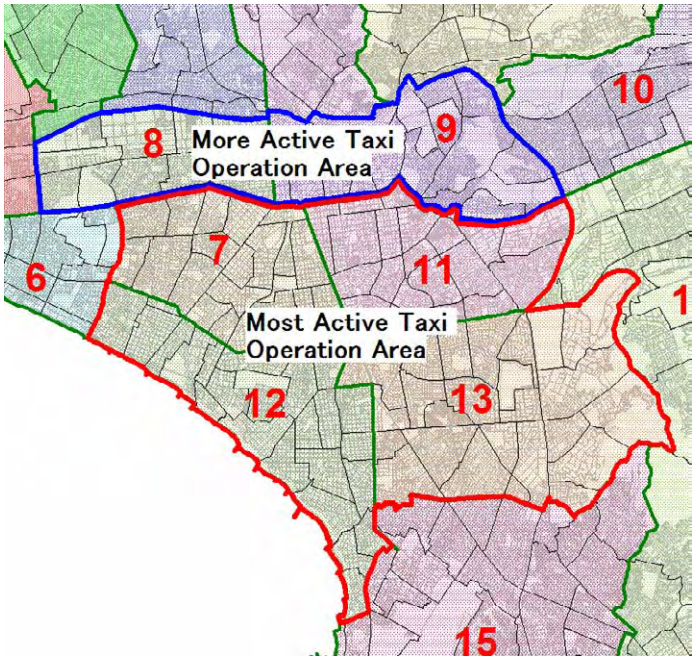

Figure 13.2-5 Most Active Taxi Operation Areas

(5) Summary of Taxi Travel Conditions

1) Summary

- The independent taxi use to which passengers do not transfer is approximately 70% of total. The remaining uses transfer to a taxi from other modes.
- The bus mode is high before the use of taxis.
- The passengers who go to a destination rapidly connect between a taxi and Colectivo (3% of the total). This coincides with the reasons for taxi use, “Faster than bus service”.
- The travel time of the independent use is predominant at 20 minutes, while the transfer is divided into three (3) time ranges with a peak of 10 minutes, 20 minutes and 30 minutes. This means that the taxi is used until arriving at a location where passengers can easily transfer.
- As for bus passengers, approximately 45% of the total bus passengers have a travel time of more than 60 minutes and the ratio of travel time exceeding 90 minutes is approximately 20% of the total. In comparison with the travel time of bus passengers, taxi passengers are in a range of short or medium travel time. Since the taxi fare rate is higher than others, passengers do not use taxis on long trips.
- Public bus transportation is predominant as an alternative mode to taxi.
- The taxi operation area is limited to 4-5 zones shown in Figure 13.2-5.

2) Direction of Taxi Policy

- According to the Person Trip survey in the Master Plan study, the taxi trip ratio of the total is approximately 7% in passenger units, while the bus is predominant at 80%.

- Taxis, which keep on increasing in number, function as higher speed transportation than buses in the Lima Metropolitan area.
- Taxis play an important role as a paratransit with short and medium trips.
- The control of only the number of taxis merely produces more inconvenience in the public transportation service.
- Therefore, in the future it is indispensable to elaborate a plan which combines the taxi policy (plan) with the trunk bus system with a high operation speed.

3) Possibility for Introduction of Station Taxi Operation System

- According to the analysis of the taxi operation zones and user' travel distance (time), the operation area is relatively limited.
- In future, the transportation system in the study area is composed of a railway, the trunk bus, the conventional bus and the paratransit systems. Those systems will structure a transportation hierarchy.
- Therefore, taxis function as a sub-mode of the railway and the trunk bus system which operates between origin or destination and a railway station or bus stop. This is a station taxi operation system in which taxis are operated between those locations. For example, taxis pick up passengers from/to the trunk bus stops. The trunk bus system carries out the travel from/to a destination.
- The possibility of this station taxi system is analyzed in the following section, technical analysis.

13.2.2. TECHNICAL ANALYSIS OF TAXI

(1) General

Figure 13.2-6 shows the illustration of the station taxi system in which the taxi passenger goes to a trunk bus stop, and gets on the trunk bus to go to a destination instead of going to the destination by a taxi when the trunk bus system is constructed.

In the section, the possibility of transfer to alternative route from taxi to the trunk bus is analyzed and its demand is forecast. Figure 13.2-7 shows the procedure of technical analysis. The detailed procedure is shown in the next section.

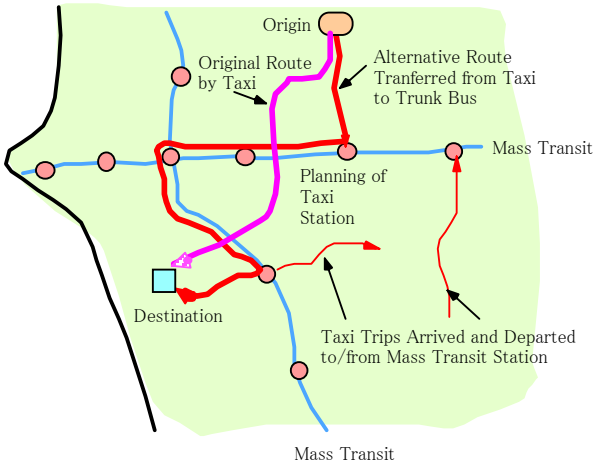

Figure 13.2-6 Illustration of Station Taxi System

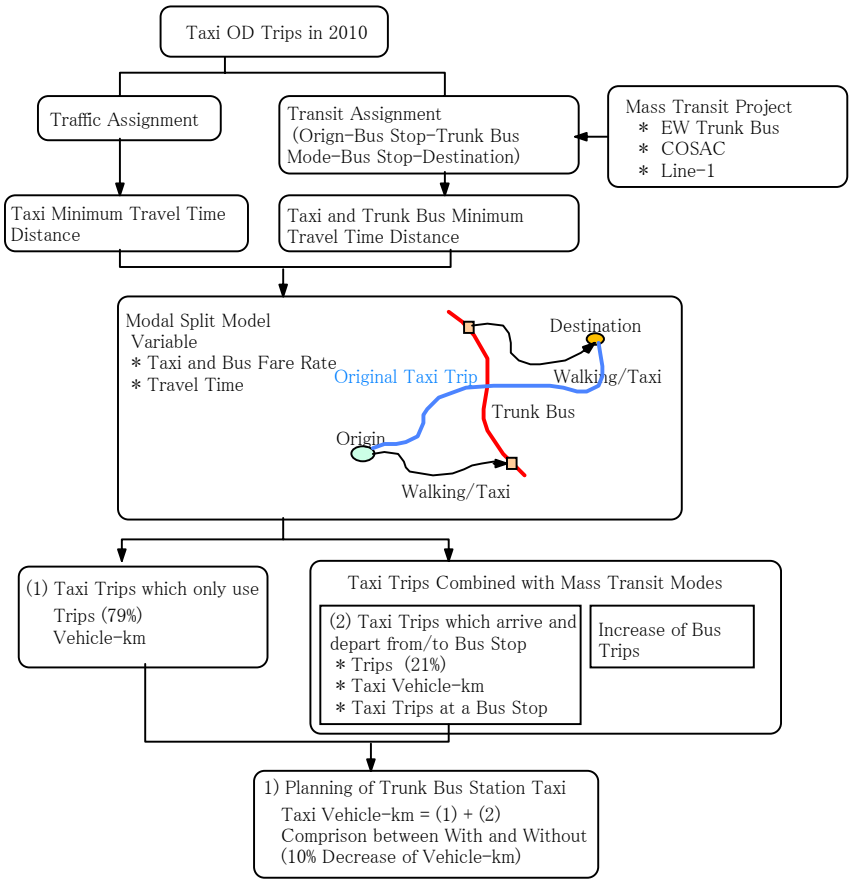

Figure 13.2-7 Procedure of Technical Analysis of Taxi

(2) Demand of Station Taxi

Figure 13.2-8 shows an illustration of original taxi and its alternative travel routes. Before the trunk bus system is introduced, a passenger uses a taxi only to go to a destination. After the completion of the trunk bus system, he/she has the potential to change the mode from the taxi to the trunk bus, taking into account the travel time and fare. Figure 13.2-9 shows the relationship between taxi and trunk bus related travel times. The taxi travel time is the minimum time path on the road network estimated by the traffic assignment model. On the other hand, the trunk bus related time in which a person go to a bus stop by taxi or walking to get on the trunk bus, and then goes to the destination by the trunk bus and other mode, is estimated by the transit assignment model. As can be seen, the trunk bus related travel time is approximately 1.6 times on average, compared to the taxi time.

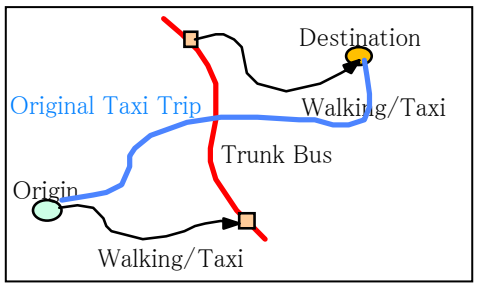

Figure 13.2-8 Illustration of Taxi and Its Alternative Travel Routes

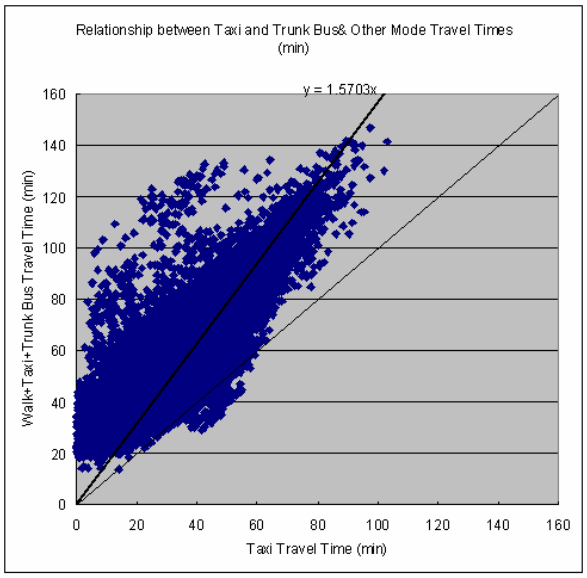

Figure 13.2-9 Relationship between Taxi and Trunk Bus & Other Mode Travel Times

The diversion ratio of taxi trips to the trunk bus system is forecast by using the modal split model developed in the Master Plan study on the assumption that the future mass transit system includes the east-west trunk bus, COSAC and Railway Line-1. Table 13.2-4 shows taxi trips transferred to the trunk bus system in the "with" case in which the three mass transit systems are operated. The taxi trips reduce to 20% of the total in the "with" case. That is, 20% of the taxi trips transfer to the trunk bus system. The taxi traffic volume on roads also reduces by approximately 10% in vehicle-km base (see Figure 13.2-10). The decrease ratio of taxi volume is low in comparison with that of trips. This is because people use the taxi as a sub-mode from/to the bus stop or railway station and this taxi travel is added on to the taxi travel which does not divert to the trunk bus mode.

The number of taxies which comes from/to the bus stop or railway station is approximately 280 vehicles/hr/station on average.

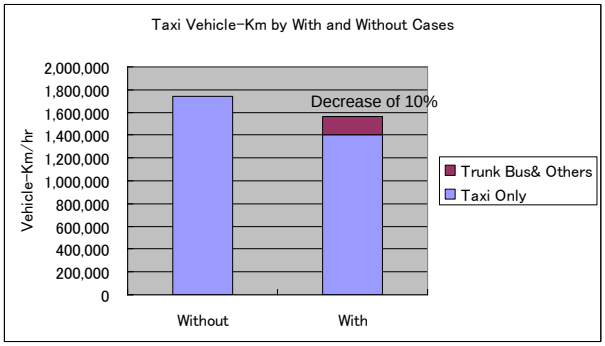

Figure 13.2-10 Taxi Vehicle-Km by With and Without Cases

Table 13.2-4 Taxi Trips Transferred to Trunk Bus System

Items	Without	With Projects			With/Without
		Taxi Only	Trunk Bus & Others	Sub-Total	
Trips/hr	122,644	97,209	25,435	122,644	
	–	0.79	0.21	1.00	
Vehcile-Km/hr	1,742,258	1,406,610	161,533	1,568,143	0.90
	–	0.90	0.10	1.00	–
Station Taxi Trips/hr		–	25,435	–	–
Average Station Taxi Trips /Station/hr		–	283	–	–

13.2.3. DEVELOPMENT STRATEGY

(1) Development Strategy of Taxi

At present, the public transportation in the study area has the conventional bus such as Omnibus, Minibus and Combi, and paratransit system such as taxis, Colectivos and Mototaxis. Public transportation is not obviously classified into the travel function as shown in Figure 13.2-11.

1) Strategy-1

Future public transportation hierarchy is organized as shown below (see Figure 13.2-12).

- Mass transit such as railway and trunk bus systems is placed on the top of the hierarchy. The conventional bus supports the mass transit.
- Taxi and Colectivo are operated as paratransit system, but both functions are divided.
- Taxi is functioned as a sub-mode of railway and the trunk bus system which operates between origin or destination and a railway station or bus stop. This is a station taxi operation system in which taxis are operated between those locations.
- By the introduction of the station taxi, it is possible to reduce the taxi traffic volume by 10% in comparison to the “without” case.

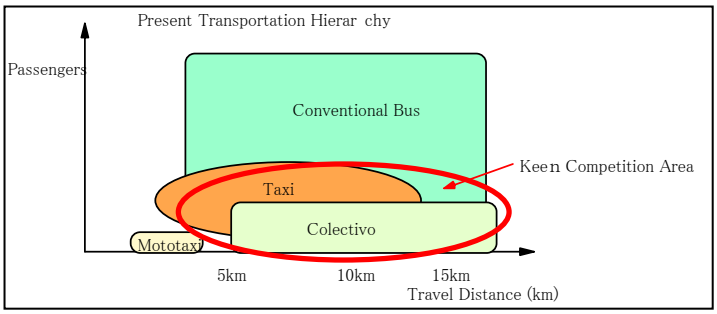

Figure 13.2-11 Present Transportation Hierarchy

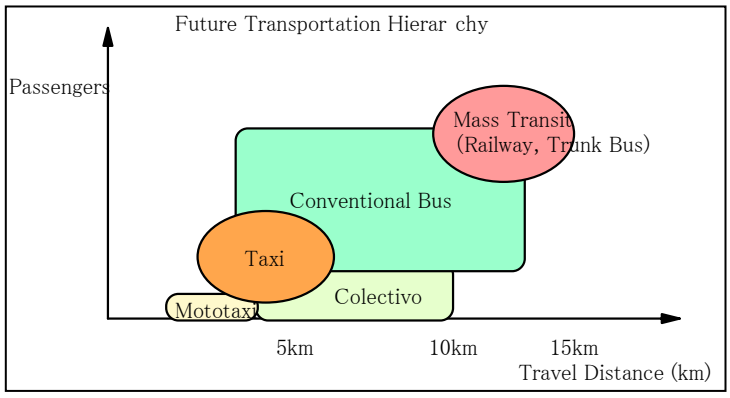

Figure 13.2-12 Future Transportation Hierarchy

2) Strategy-2

- Taxi introduces a registration system and all taxis are operated as authorized taxis.
- Registration is not restricted under the established standard.
- Taxi is operated under removal of restriction.

(2) Suggestion for Security and Traffic Safety

According to the surveyed taxi passenger' opinions regarding the current taxi problems, the problems of security and traffic safety take the higher ratio. The suggestions for security and traffic safety are shown below.

1) Improvement of Security
   - Require taxis to have a photograph of driver and number plate of taxi on board
   - Require the establishment of taxi meter equipment and issue of a receipt of fare rate
   - Require mention of company or association name on taxi body

2) Improvement of Traffic Safety
   - Require renewal of taxi license every year
   - Require a driver to attend a lecture of traffic safety education every year and to put its documentation on board
   - Strengthen traffic enforcements for roadside parking, speed limit, etc.
   - Require the inspection of taxi operation on roads by a third party

3) Suggestion of Taxi Facility

   In the future taxi strategy, the taxi functions as a sub-mode of the railway and the trunk bus system. Therefore, in order to facilitate the taxi operation at railway station and trunk bus stop, the construction of a taxi stand is proposed near a transfer point of transportation.

13.3. COLECTIVO STUDY

13.3.1. CURRENT CONDITIONS

(1) General

Although the Colectivo transportation service is not formally recognized either in Lima or Callao, the users use it in their daily life. The operation of Colectivos is unauthorized and it was placed on the market to compete with buses. The advantage of the Colectivo against bus transport is that it provides a rapid operation with seated passengers. Because of the unauthorized operation, the present operation characteristics are unidentified in terms of service routes, frequency, number of passengers, and fare rate. Since the municipalities of Lima and Callao do not collect the information, the administration areas do not have a proper policy for future Colectivos, the operation of which should be continued and discontinued.

In order to make a future policy plan for the Colectivo, the Colectivo operation survey was carried out in June and July, 2006. The survey was conducted by the Peruvian counterpart agency. ST/CTLC was responsible for the collection of further information and data concerning this issue. The collected information serves as input for the development of data processing, analysis and elaboration under the cooperation with the Peruvian counterpart agency.

A total of 2,273 interviews were taken as a sample to determine the users' characteristics of the 34 routes. The collected data was analyzed and evaluated, and the Colectivo user's conditions were identified. The contents of the summary card consist of general information (company, operation vehicle and operation characteristics), route location, origin and destination trip characteristics, service frequency, and fare rate by each route.

(2) Operation Conditions

1) Surveyed Route

In the survey, 34 Colectivo routes were identified, which represent an important part of the whole existing Colectivo service. Under the conditions of the level of informality and the uncertainty of routes (generated in a temporary, spontaneous and changeable manner), it is impossible to identify 100% of the Colectivo routes in the City.

It should be noted that even the 34 identified routes do not have a fixed and permanent itinerary, meaning that during operation, vehicle operation on a certain route may be shortened, or enlarged or modified, according to the users' requirements. The 34 identified routes are distributed throughout the entire Lima Metropolitan Area as shown in Figure 13.3-1.

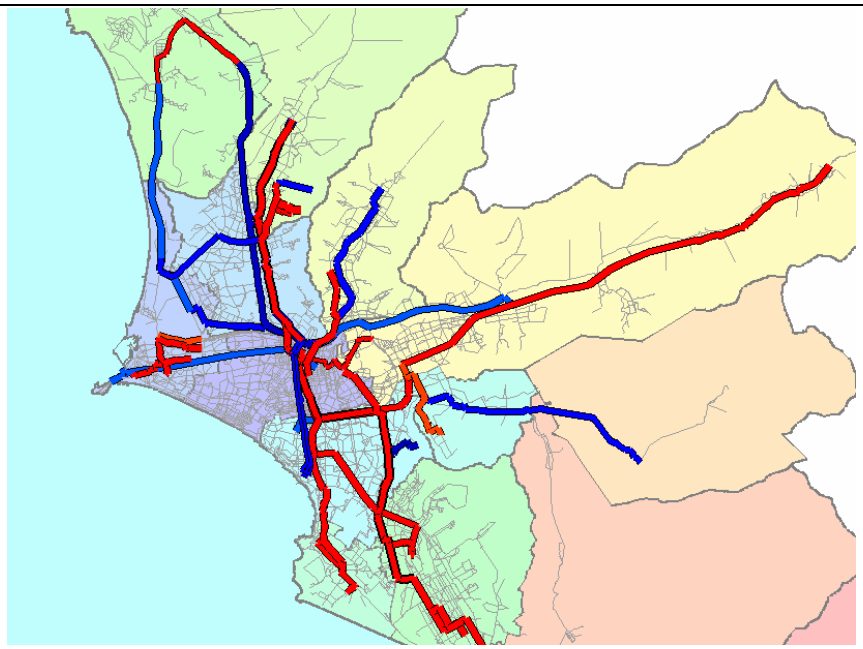

Figure 13.3-1 34 Studied Colectivo Routes

2) Colectivo Operator

The GTU does not authorize the operation of the Colectivo, but it recognizes the operation of Colectivos as a station taxi, not a Colectivo. The vehicle types are station wagon and sedan. Approximately 10 routes among the 34 routes, equivalent to 30% of the surveyed routes, are operated by organized companies but unauthorized by the GTU. On the remaining routes, company don't exist and the Colectivo is freely operated by an independent driver. The operation period is mainly from 5:00 a.m. to 12:00 p.m. It varies on each route.

3) Operation Conditions

Figure 13.3-2 shows the hourly distribution of the total Colectivo volumes on the routes. As can be seen, the Colectivo operation starts at 5:00 am. The peak hour occurs between 7:15 a.m. and 8:15 a.m. with an approximate volume of 4,000 vehicles per hour which is the added Colectivo volume on each route.

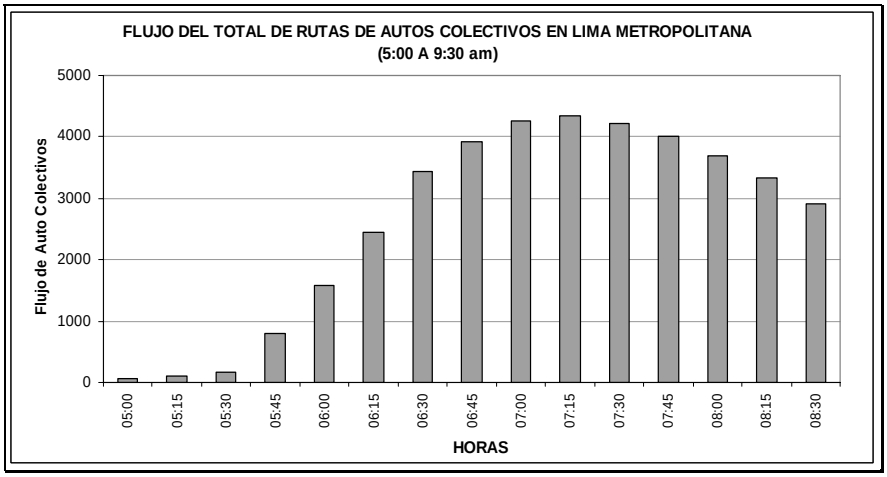

Figure 13.3-2 Hourly distribution of Total Colectivo Volumes

Figure 13.3-3 shows the route distribution of Colectivo volumes on each route. As can be seen, routes AC13, AC17 and AC22 are the heaviest volume routes among all surveyed routes. The routes AC13 (840 vehicles/3h), AC17 (880) and AC22 (530) serve from Puente Piedra to Ventanilla, Downtown Lima to Miraflores and from Ate to Downtown Lima, respectively. On the other hand, the volumes on other routes range between 100 and 300 vehicles during the 3 hours.

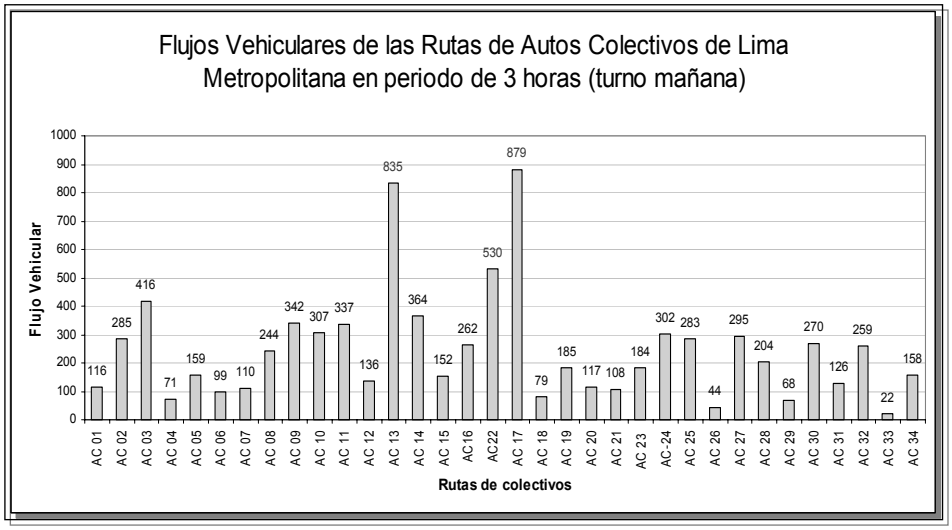

Figure 13.3-3 Route Distribution of Colectivo Volumes on Each Route

(3) Colectivo User' Conditions

1) Trip Purpose

Colectivo is an important public transport mode in the morning peak hour. The survey says that the most frequent trip purpose is "to work" with 78% of the total, followed by "study" and "shopping" with 10% and 5% respectively. All of Colectivo users use it for the "to work" purpose in the morning peak hour.

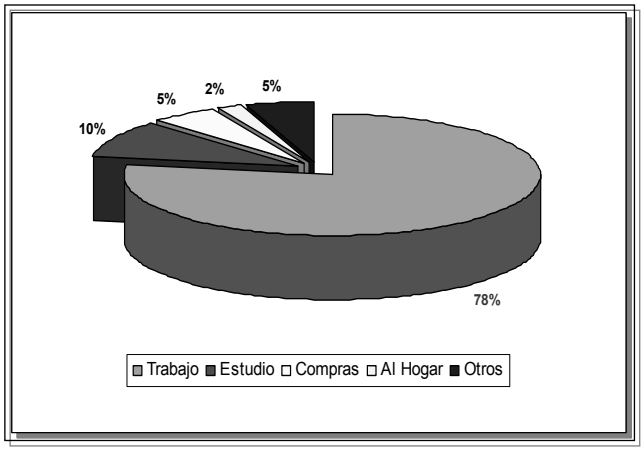

Figure 13.3-4 Composition Ratio of Trip Purposes of Colectivo Users

2) Frequency and Fare Rate

Approximately 75% of the interviewees answered that they use the Colectivo daily, Although the tariff of the Colectivo varies according to the route distance, approximately 25% of the interviewees pay the tariff between S/.2.10 and S/.2.50 (see Figure 13.3-5).

This tariff is twice as much as the bus fare rate. This is because the users request a higher service level, such as a rapid operation. Therefore, in order to stimulate a transfer to the trunk bus system, a rapid operation will be indispensable.

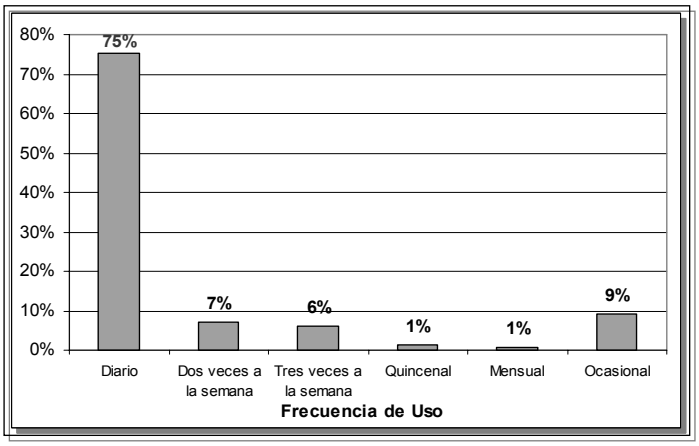

Figure 13.3-5 Composition Ratio of Frequency of Colectivo Use

3) User' activity and income level

Approximately 80% of the interviewees indicated that they were employees or connected to an economic activity as independent workers. Approximately 90% of interviewees have an income superior to S./600 soles. It seems that Colectivo users are in the middle range worker.

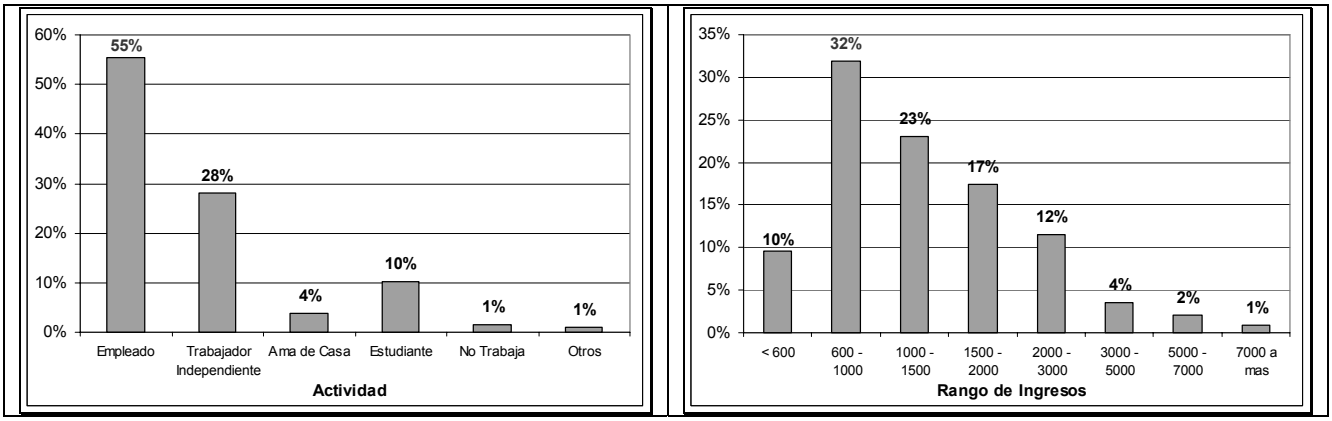

Figure 13.3-6 Occupation and Income Level of Colectivo Users

4) Alternative Modes

Considering the assumed case that the Colectivo service is restricted, the majority of interviewees would transfer to the regular public transportation provided by buses (73%). Approximately 20% of the interviewees would transfer to taxis and 3% would use their cars. At the present, a bus is a main alternative mode of Colectivo.

5) Travel Time

Approximately 80% of the interviewees indicated that their trips in Colectivo took less than 35 minutes. The average trip time of Colectivo users is 24 minutes, in contrast to 20 minutes of taxi. This average travel time is similar as taxi and shorter than that of the bus. According to the Master Plan study, approximately 45% of the total bus passengers have a

travel time of more than 60 minutes. It is observed that the Colectivo passengers use the Colectivo in short or medium term trips.

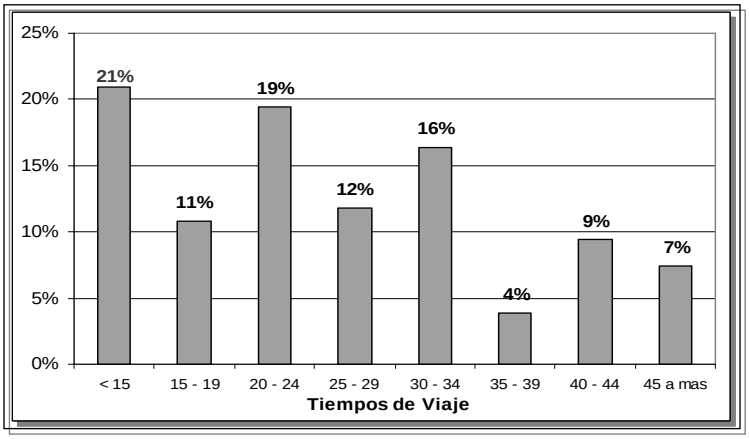

Figure 13.3-7 Distribution of Travel Time of Colectivo Users

(4) Traffic Conditions of the Colectivo

This section focuses on the influence of the Colectivo on traffic conditions in the morning peak hour. In general, it is said that the Colectivo flow rates are considerably higher on major roads and the volume and operation causes traffic congestion. This situation is one of the reasons for the control of the Colectivo operation. Therefore, the counting data in 2004 is analyzed and the influence is observed. The 2006 survey only counted the Colectivos, not all vehicle traffic. In order to see the situation of the composition ratio of the Colectivo to the total traffic, the 2004 counting data was analyzed, in which all types of vehicles were recorded in the Master Plan Study. The counting locations in 2006 are matched with the locations in 2004. However, since the operation routes of the Colectivo vary in accordance with passenger demand, the Colectivo volumes are somewhat different in both years. Therefore, the 2004 counting data does not coincide with that in 2006, as is shown in Figure 13.3-3.

Figure 13.3-8 shows the relationship between traffic volumes per hour per direction and the Colectivo composition ratios on roads in the morning peak hour based on the 2004 counting data. In this figure, directions 1 and 2 indicate the inbound and outbound directions to the central business area, respectively. The roads with traffic volume of 3,000 vehicles per direction or more show lower Colectivo ratios. On the other hand, the ratio is higher on the roads which have a volume in the range of 1,000 to 2,000 vehicles.

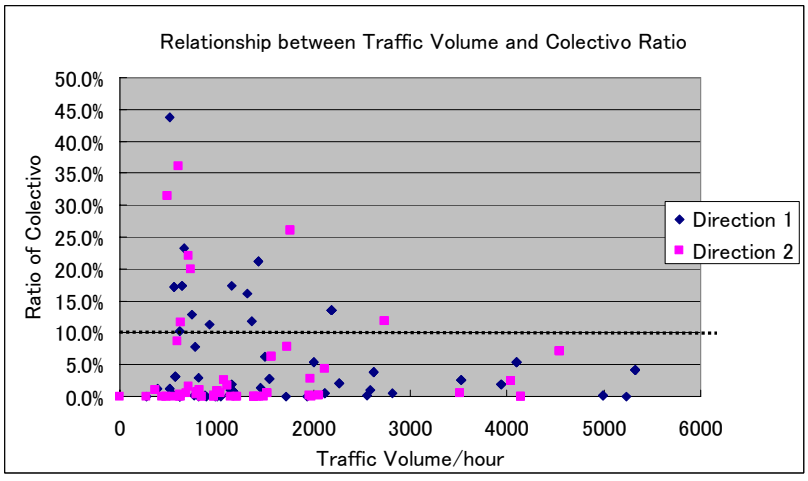

Figure 13.3-8 Relationship between Traffic Volume and Colectivo Composition Ratio on Roads

Figure 13.3-9 shows the accumulated percentage of the Colectivo volume ratio on each road, in which the horizontal axis shows the ratio of Colectivo to the total against the accumulated percentage on the vertical axis, which shows the number of roads with the same Colectivo ratio. This figure is made from Figure 13.3-9. As it can be seen, roads with a ratio of 0.1 or less account for approximately 85% of the total counting roads. This is shown by the horizontal dotted line in Figure 13.3-8, which draws on the ratio of 10% on the vertical axis in Figure 13.3-8. Almost all of the roads operated by Colectivos are low in the ratio of Colectivos.

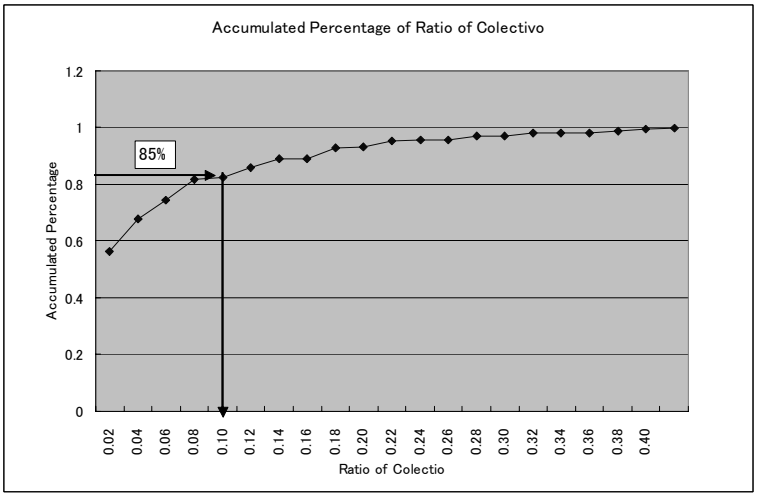

Figure 13.3-9 Accumulated Percentage of Colectivo Ratio on Each Road

Table 13.3-1 shows the number of all vehicles, Colectivo and its ratio of vehicles and passengers on the roads with the ratio of 10% or more which are selected from Figure 13.3-8. Figure 13.3-10 shows the relationship between the ratio of Colectivo and its passengers on those roads.

As can be seen, the roads with the ratio of 10% of more are focused on approximately 13 road segments of which the Panamericana Sur and Av. República de Panamá are higher in volume and ratio, and Carretera Ventanilla and Av. Santa Rosa/Colonial are higher in ratio. Those selected roads correspond to approximately 15% of all counting locations (82 locations).

As can be seen, the effect of the Colectivo operation on road traffic is lower in vehicle and passenger volumes. This is because almost all of the public transportation passengers are transported by bus.

Table 13.3-1 Roads with Higher Composition Ratio of Colectivo Volume by Direction

(Unit: peak hour volume)

No. in 2006	No. in 2004	Road Name	Direction-1				Direction-2			
			No. of Vehicles		Ratio of Colectivo		No. of Vehicles		Ratio of Colectivo	
			Total	Colectivo	Vehicle	Passenger	Total	Colectivo	Vehicle	Passenger
AC-13	CO-11	CARRETERA VENTANILLA	517	226	43.7%	8.7%	602	217	36.0%	6.5%
AC-14	CO-85	AV. SANTA ROSA / AV. COLONIAL	662	154	23.3%	7.3%	729	145	19.9%	6.0%
AC-19	CO-49	AV. REPUBLICA DE PANAMA	1430	302	21.1%	6.7%	1761	458	26.0%	5.2%
AC-34	CO-49	AV. REPUBLICA DE PANAMA	1430	302	21.1%	6.7%	1761	458	26.0%	5.2%
AC-12	CO-53	AV. PRIMAVERA	1161	202	17.4%	15.1%	1082	29	2.7%	1.0%
AC-14	CO-80	Nicolas de Pierola	642	111	17.3%	19.0%	493	155	31.4%	31.6%
AC-15	CO-80	Nicolas de Pierola	642	111	17.3%	19.0%	493	155	31.4%	31.6%
AC-16	CO-38	CARRETERA CENTRAL 3	565	97	17.2%	4.6%	370	4	1.1%	0.2%
AC-30	CO-04	AV. TUPAC AMARU 4	1316	213	16.2%	2.0%	684	3	0.4%	0.1%
AC-20	CO-47	PANAMERICANA SUR	2191	295	13.5%	3.4%	1008	9	0.9%	0.2%
AC-21	CO-47	PANAMERICANA SUR	2191	295	13.5%	3.4%	1008	9	0.9%	0.2%
AC-33	CO-47	PANAMERICANA SUR	2191	295	13.5%	3.4%	1008	9	0.9%	0.2%
AC-17	CO-98	AV. AREQUIPA Y AV. ALEJANDRO TIRADO	748	96	12.8%	1.4%	627	0	0.0%	0.0%
AC-14	CO-84	COLONIAL CON GERMAN AMENAZADA	1365	162	11.9%	4.7%	2121	93	4.4%	0.9%
AC-13	CO-09	Panamericana Norte	922	104	11.3%	2.1%	714	157	22.0%	4.0%
AC-17	CO-96	AV. AREQUIPA 1	618	63	10.2%	1.6%	634	74	11.7%	1.7%
AC-01	CO-41	AV. PROCERES DE LA INDEPENDENCIA	1158	22	1.9%	0.4%	2742	325	11.9%	1.9%
AC-03	CO-41	AV. PROCERES DE LA INDEPENDENCIA	1158	22	1.9%	0.4%	2742	325	11.9%	1.9%

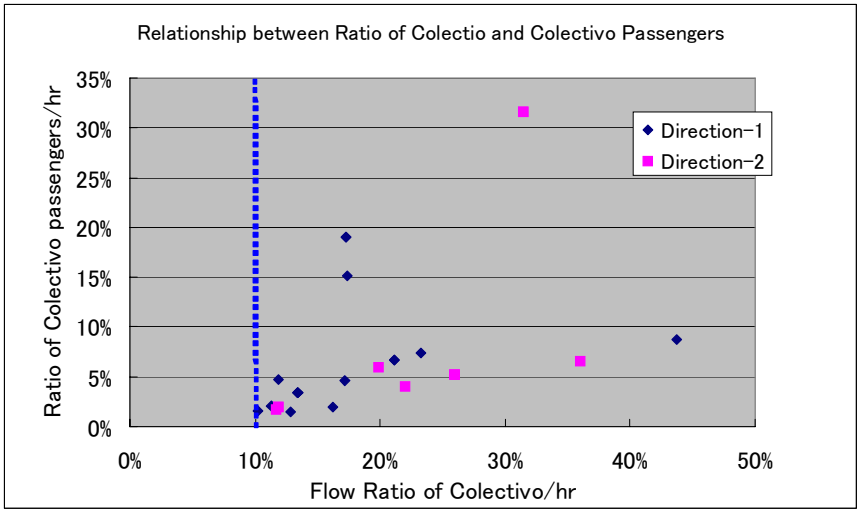

Figure 13.3-10 Relationship between the Ratio of Colectivo and its Passengers

(5) Summary

1) Present Conditions of Colectivo

- The Colectivo plays an important role among public transportation in the metropolitan area and it has the function of a fixed route taxi, like a bus, which provides a rapid operation with passenger seats.
- However, its transportation capacity is considerably lower than that of a bus.
- The passengers of Colectivos are middle range workers in income and they seek a comfortable and rapid transportation mode.
- Passengers use Colectivos on a daily basis and pay approximately twice the bus fare rate.
- The Colectivo is a rapid means of public transportation.

2) Influence on Road Traffic

- The effect of the Colectivo operation on road traffic is lower in vehicle and passenger volumes.
- The transportation capacity of the Colectivo is considerably lower than that of a bus.

3) Direction of the Colectivo Policy

- Although the Colectivo transportation service is not formally recognized in Lima or Callao, the users use it in their daily life. The Colectivo has civil rights.
- The Colectivo operation should remain in existence as a comfortable and rapid means of transportation under the company authorized by the GTU, which secures a reliable and safe operation service.
- The Colectivo operation should be discontinued on the roads of the introduced trunk bus system in return for a high level transportation which provides a comfortable and rapid operation.
- The direction of the Colectivo policy recommends that the discontinuation of the Colectivo operation coincides with the introduction of the trunk bus system, and operators on the discontinued route move from this route to other routes.
- The future demand of the Colectivo under the above recommendation is studied further in the next section. And then, the direction of the Colectivo policy is finally recommended.

13.3.2. TECHNICAL ANALYSIS OF COLECTIVO

(1) General

Figure 13.3-11 shows the procedure of technical analysis of Colectivo. The steps of analysis are follows.

1) Seven (7) Colectivo operating lines are eliminated from the 34 Colectivo lines overlapped with the mass transit routes, which are composed of EW trunk bus system, COSAC project and Railway Line-1 project, based on the same method as that of the conventional line which applies the overlapped ratio of 20% or more of the total.
2) The passenger demands on Colectivo, the trunk bus and conventional bus lines are forecast as a “with” case which has the 27 Colectivo lines, the mass transit lines and the conventional lines. And also, the demands in the “without” project case are forecast in which the 34 Colectivo and conventional bus line are served.
3) Since the relative travel speed between Colectivo and conventional bus will reduce due to the increment of future traffic volume, the relative reduction of the speed is taken into account when the transit assignment is carried out.
4) The direction of the Colectivo policy is shown from the results of the demand analysis.

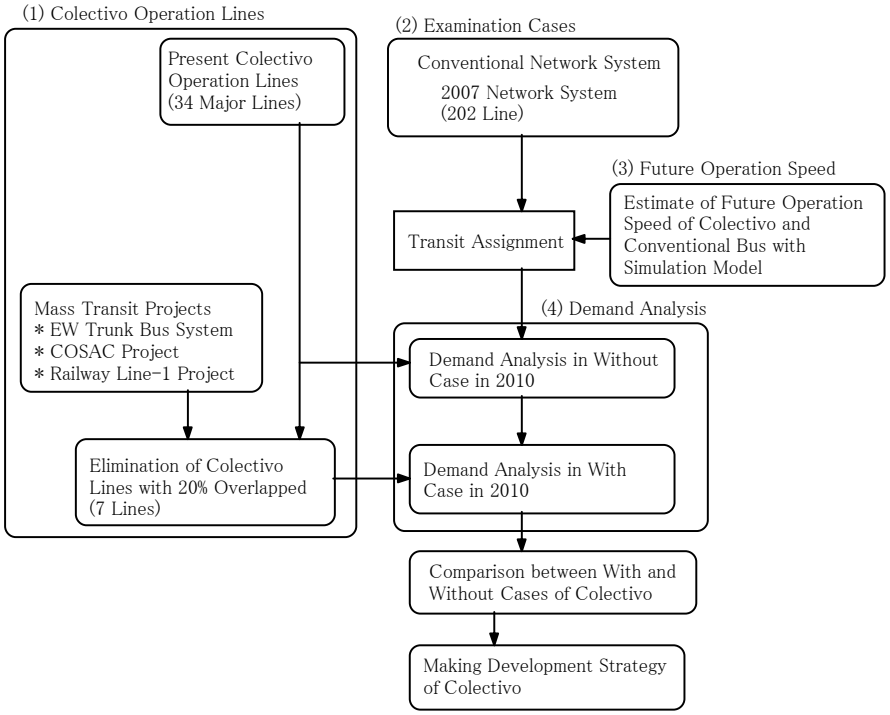

Figure 13.3-11 Procedure of Technical Analysis of Colectivo

(2) Colectivo Operation Lines

Figure 13.3-12 shows the 34 major Colectivo lines which are the same lines as those carried out in the Colectivo survey. The lines represent an important part of the whole existing Colectivo service. This Colectivo operation lines are used in the demand analysis. By applying the rule for the overlapped ratio of 20% or more of the total, seven (7) Colectivo operating lines which overlap with EW trunk bus system, COSAC project and Railway Line-1 project, are eliminated as shown in Figure 13.3-13.

Figure 13.3-12 34 Major Colectivo Lines

As can be seen in Figure 13.3-12, the Colectivo operation line overlapped with the East-West trunk bus line is only Line No.AC22 which is operated on Carretera Central. However, this line is not included among 7 lines eliminated by applying the rule for the overlapped ratio of 20% or more of the total as shown in Figure 13.3-13. Since there is no Colectivo line eliminated by the East-West trunk bus line, Colectivo operation is not influenced by the trunk bus line. For reference, Colectivo Line No.AC22 is shown in Figure 13.3-14.

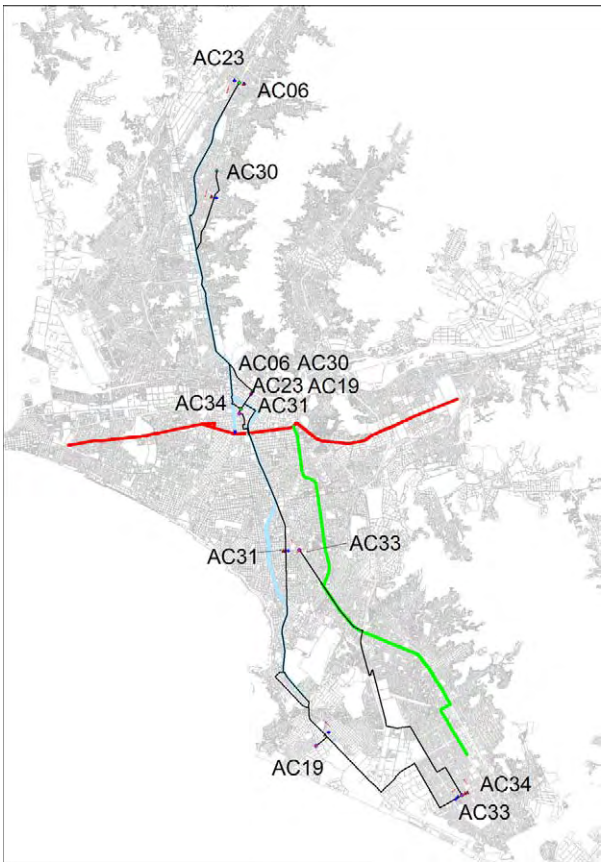

Figure 13.3-13 Elimination of Colectivo Lines with 20% Overlapped (7 Lines)

Figure 13.3-14 Colectivo Operation Line AC-22 pass on the East-West Trunk Bus Line

(3) Examination Cases

The demand analysis is carried out in two examination cases, “with” and “without” cases. The “with” case network is included for the 27 Colectivo lines, the conventional lines and the mass transit lines composed of EW trunk bus system, COSAC project and Railway Line-1 project.

The “without” case network consists of the 34 Colectivo lines and the conventional lines.

(4) Future Operation Speed

The Colectivo operating speed is an important factor for a Colectivo passenger who selects it has a higher operation speed than the bus. In future, since the traffic volume on roads rises, the operating speed decreases. As a result, the relative travel speed between Colectivo and conventional bus will reduce.

In order to see the reduction of travel speed in proportion to increment of traffic volume, the traffic performance on this mixed traffic lane is simulated on a computer by the TSIS simulation model. With the model, it is possible to predict the effect of operation performance, as expressed in terms of average vehicle speed.

Figure 13.3-15 shows reduction of relative speed on roads between Colectivo and conventional bus by the simulation model. The line graphs of both the Colectivo and bus speed show a decrease with increased traffic volume. The reduction of relative speed between both modes is forecasted.

The blue and red vertical lines in Figure 13.3-15 represent an average volume-capacity ratio of roads with Colectivo operation in 2004 and 2010. As can be seen, the relative ratio of the speed in 2010 to that in 2004 is approximately 0.7. The future relative operating speed between Colectivo and bus applies this value.

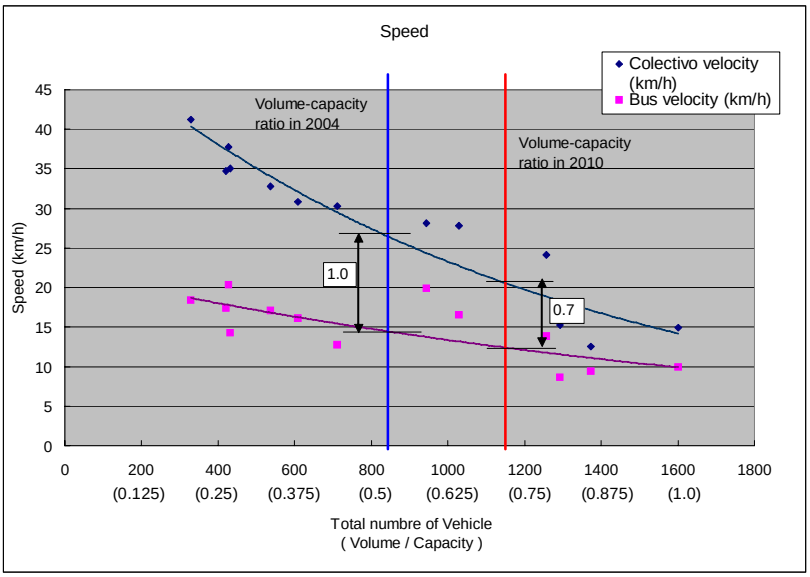

Figure 13.3-15 Reduction of Relative Speed on Road between Colectivo and Conventional Bus

(5) Demand Analysis

1) Colectivo Passengers and Operated Frequency

Table 13.3-2 shows the Colectivo passengers and frequency by the 2004, 2010 ”without” and “with” cases. Figure 13.3-16 shows the relationship of hourly operated frequency between 2004 and 2010 “Without” cases. As can be seen, the operated frequency on the 34

Colectivo lines in 2010 "Without" case rises considerably at 2.47 times in comparison to the 2004 case. The total Colectivo passengers also rise at 2.20 times. This is because the conventional bus lines in 2010 are 202 lines while, in 2004 there are 625 lines. By the decrease of the lines in 2010, the demand for Colectivo becomes higher.

In 2010 "with" case, the total passenger demand and operated frequency also rise at 1.65 and 1.68 times, respectively, in comparison to the 2004 case. In future, the demand for Colectivo will increase considerably.

When the Colectivo operators on the 7 eliminated lines move to other lines together with the introduction of the mass transit, the average passengers/frequency (mean operated Colectivo) are 3.0, in contrast to 4.4 in the 2010 "with" case.

Figure 13.3-17 shows the relationship between Colectivo total passengers and line distance by the 2004, 2010 "without" and "with" cases. In 2010, it is obvious that the total passengers are in proportion to the operation line distance. When the operated distance of mass transit projects extends in future, the Colectivo passengers will decrease in accordance with operated line distance.

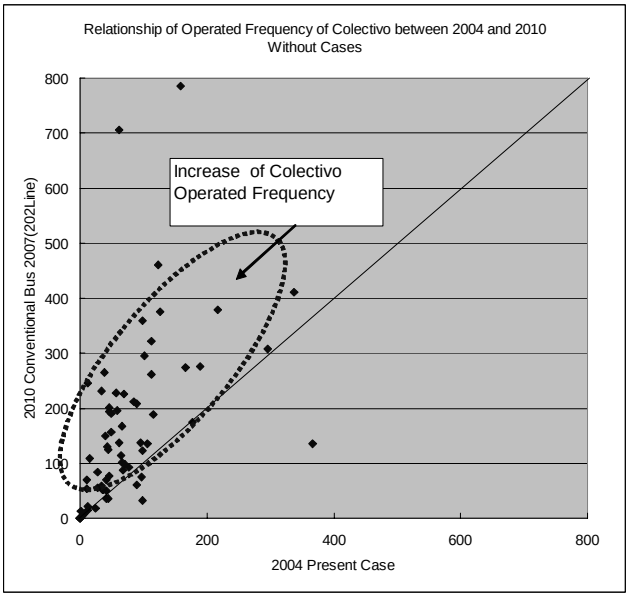

Figure 13.3-16 Relationship of Hourly Operated Frequency of Colectivo Lines between 2004 and 2010 "Without" Cases

Table 13.3-2 Colectivo Passengers and Frequency by the 2004, 2010 Without and With Cases

Items		2004	2010		Without/2004	With/2004	With/Without
			Without	With			
1)	Lines/loop	34	34	27	–	–	–
2)	No of Eliminated Lines	0	0	7	–	–	–
3)	Line Distance (km)	941	941	756	1.00	0.80	0.80
4)	Total Passengers/hr	46,464	102,243	76,611	2.20	1.65	0.75
5)	Frequency/hr of Colectivo	5156	12,737	8,646	2.47	1.68	0.68
6)	Passengers/hr/dir/line	683	1,504	1,419	2.20	2.08	0.94
7)	Passengers/hr/dir/ Frequency	4.5	4.0	4.4	0.89	0.98	1.10
8)	Passengers/hr/dir/ 2010Without Frequency			3.0			

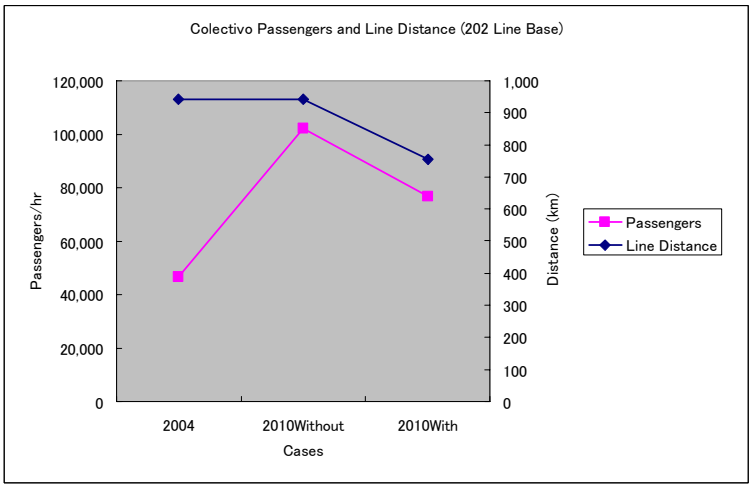

Figure 13.3-17 Colectivo Passengers and Line Distance by the 2004, 2010 Without and With Cases

2) Bus and Colectivo Passengers

The influence of Colectivo operation on bus operation is lower. Table 13.3-3 and Figure 13.3-18 show the total Colectivo and bus passengers by the 2004, 2010 "without" and "with" cases. As can be seen, the ratios of Colectivo passengers to the total by the cases are as low as 5-7%. The majority of public transport users are not Colectivo, but bus transportation.

Table 13.3-3 Total Colectivo and Bus Passengers by the 2004, 2010 Without and With Cases

Items	2004	2010		Without/2004	With/2004	With/Without
		Without	With			
Colectivo Passengers/hr	46,464	102,243	76,611	2.20	1.65	0.75
Conventional Bus Passengers/hr	854,900	1,325,520	1,117,150	1.55	1.31	0.84
Trunk Bus & Other Mass Transit Passengers/hr	–	–	223,178	–	–	–
Total Bus Passengers/hr	854,900	1,325,520	1,340,328	1.55	1.57	1.01
Total Passengers/hr	901,364	1,427,763	1,416,939	1.58	1.57	0.99
Ratio of Colectivo Passengers	5.2%	7.2%	5.4%			
Ratio of Bus Passengers	94.8%	92.8%	94.6%			
Total	100.0%	100.0%	100.0%			

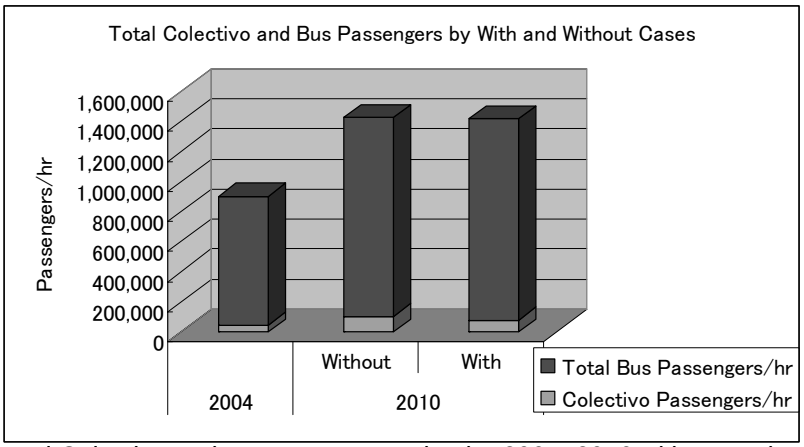

Figure 13.3-18 Total Colectivo and Bus Passengers by the 2004, 2010Without and With Cases

3) Summary of Demand Analysis

The demand analysis of Colectivo is summarized as shown in Figure 13.3-19.

- The future Colectivo operation conditions are relatively low in the advantage of operation speed due to reduction of relative speed between Colectivo and bus, and at the same time, time value of Colectivo because of a difference in fare rate between Colectivo and bus will be reduced.
- The operation conditions of Colectivo on the 202 conventional bus line system are relatively high in an advantage of the Colectivo system to supplement a coarse bus network.
- The future demand of Colectivo rises in passengers and operation frequency. The importance of Colectivo will be high.

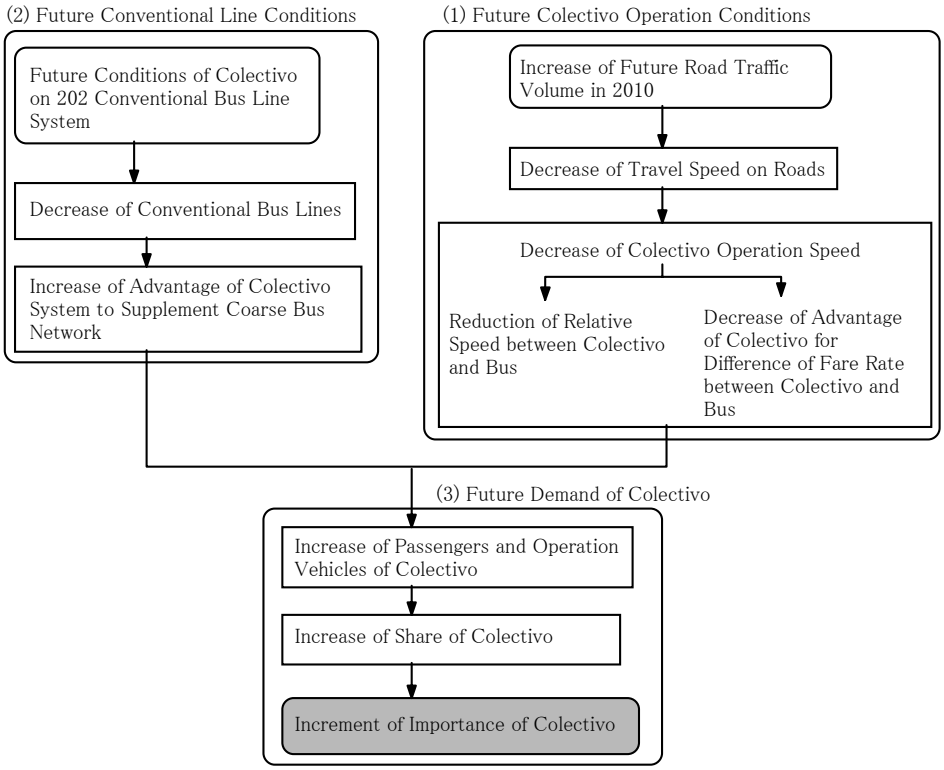

Figure 13.3-19 Summary of Demand Analysis

13.3.3. DEVELOPMENT STRATEGY OF COLECTIVO

(1) Strategy of Colectivo

1) Strategy-1

- Colectivo remains in existence as a paratransit system to support the trunk bus system.
- The operation line is eliminated by the introduction of the trunk bus system. The Colectivo operation line is removed from service with the future progress of the trunk bus and railway systems. The new Colectivo operation line is prohibited.
- Colectivo operators on lines eliminated by the trunk bus system have a right to move to other Colectivo lines.

2) Strategy-2

- In future, the Colectivo operation company and operator lose their jobs. Therefore, a right to join a consortium of trunk bus operation is given high priority.

3) Influence of Bus Business

Share of Colectivo is low and its user is the difference as that of bus. The effect on bus business is low.

(2) Suggestion

- After 2007, the conventional bus line system is drastically changed in number and configuration. A part of the Colectivo operation line will have to change with the conventional line system. Therefore, when the Colectivo operation is authorized by GTU, the line is also authorized in consideration of demand.
- Improvement of security and traffic safety should be required in the same manner of taxi operation.
- In order to facilitate the Colectivo operation, the construction of terminals is proposed near a transfer point of transportation.

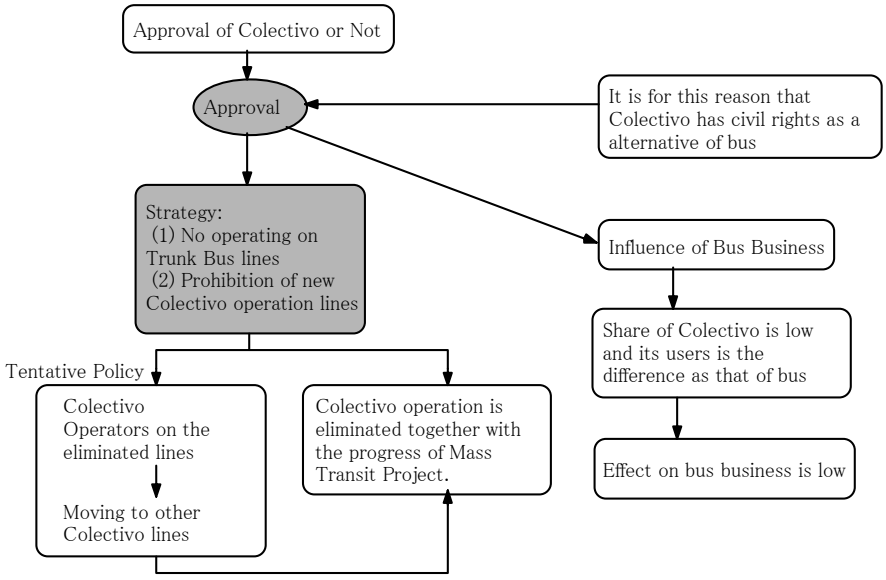

Figure 13.3-20 Future Development Strategy of Colectivo

Appendix13-1

13.3.4. COLECTIVO PASSENGER DEMAND ON THE 2004 PRESENT CONVENTIONAL BUS NETWORK SYSTEM

Colectivo passenger demand in 2010 rises due to the reduction in the conventional bus lines. The total demand in 2010 "without" case on the 2004 present conventional bus network system reduces at 0.93 times in comparison to 2004 case as shown in Figure 13.3-21 and Table 13.3-4. As can be seen in Figure 13.3-21, passenger demand (frequency) on some lines reduces due to loss of competitive power because of reduction of relative speed between Colectivo and bus.

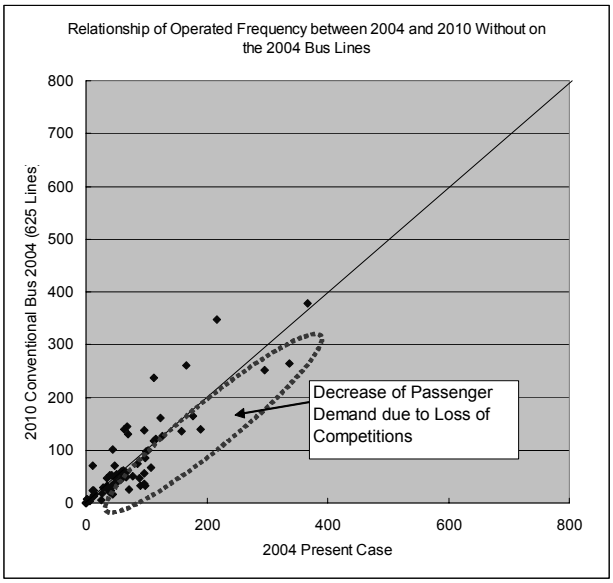

Figure 13.3-21 Relationship of Hourly Operated Frequency between 2004 and 2010 Without on the 2004 Bus Lines

Table 13.3-4 Colectivo Passengers and Frequency on the 2004 Conventional Bus Lines

Items		2004	2010 Without	Without/2004
1)	Lines/loop	34	34	-
2)	Total Passengers/hr	46,464	43,334	0.93
3)	Frequency/hr of Colectivo	5,156	5,225	1.01
4)	Passengers/hr/dir/line	683	637	0.93
5)	Passengers/hr/dir/ Frequency	4.5	4.1	0.92