

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
TRANSPORT COUNCIL OF LIMA AND CALLAO
MINISTRY OF TRANSPORTATIONS AND COMMUNICATIONS OF THE REPUBLIC OF PERU

**THE MASTER PLAN FOR
LIMA AND CALLAO METROPOLITAN AREA
URBAN TRANSPORTATION IN
THE REPUBLIC OF PERU
(Phase 1)**

**FINAL REPORT
(Volume – I)**

AUGUST, 2005

**YACHIYO ENGINEERING CO., LTD
In Association With
PACIFIC CONSULTANTS INTERNATIONAL**

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Preface

In response to a request from the Government of the Republic of Peru, the Government of Japan decided to conduct the Master Plan for Lima and Callao Metropolitan Area Urban Transportation in the Republic of Peru (Phase 1) and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Koichi TSUZUKI of Yachiyo Engineering Co., Ltd., to Peru, seven times between January 2004 and May 2005. In addition, JICA set up an advisory committee headed by Dr. Hisao Uchiyama, Tokyo University of Science between January 2004 and May 2005, which examined the Study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of Peru and conducted a field survey in the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to officials concerned of the Government of the Republic of Peru for their close cooperation extended to the team.

August 2005

Kazuhisa MATSUOKA
Vice President
Japan International Cooperation Agency

Letter of Transmittal

August 2005

Mr. Kazuhisa MATSUOKA
Vice President
Japan International Cooperation Agency

Dear Sir:

It is a great honor for me to submit herewith the final reports of the Master Plan for Lima and Callao Metropolitan Area Urban Transportation in the Republic of Peru (Phase 1).

A study team, which consists of Yachiyo Engineering Co., Ltd. and Pacific Consultants International, and headed by myself, conducted field surveys, data analysis and planning works of the master plan study in Peru based on the terms of references instructed by the Japan International Cooperation Agency (JICA) from January 2004 to August 2005.

The study team held thorough discussions and investigations with officials concerned of the Government of Peru, accordingly, various traffic surveys, present conditions analysis, initial environmental examination, preparation of implementation program, and project evaluation. The results were compiled in the final report, main and summary volumes.

On behalf of the team, I wish to express my heartfelt appreciation to the officials concerned of the Government of Peru for their warm friendship and cooperation extended to us during our stay in Peru.

I also wish to express my sincere appreciation to JICA, Consejo de Transporte de Lima y Callao, Ministry of Transportations and Communications, the Embassy of Japan in Peru, and other concerned government authorities for their valuable advice and cooperation given to us in the course of the Study.

Yours Faithfully,

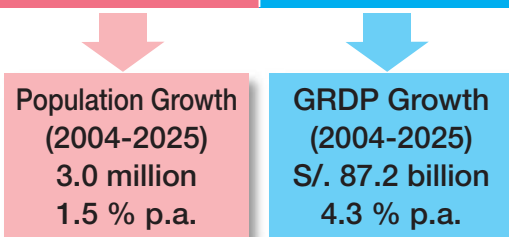
Koichi TSUZUKI
Team Leader,
The Master Plan for Lima and Callao
Metropolitan Area Urban Transportation in
the Republic of Peru (Phase 1)

SUMMARY

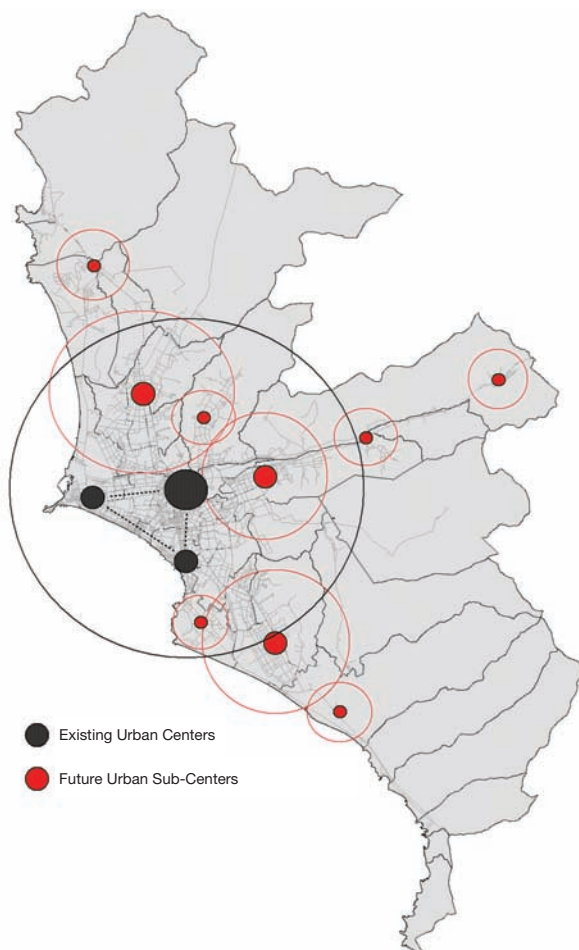
Lima and Callao Metropolitan Area in 2025 will be.....

Population will increase and GRDP will continue to grow. GRDP per capita also will be increased.

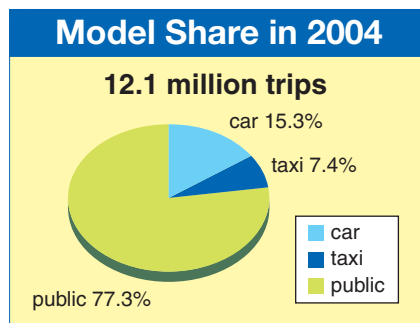
Year	Population (Million)	GRDP (S/. Billion)
2004	8.04	60.83
2005	10.99	148.05



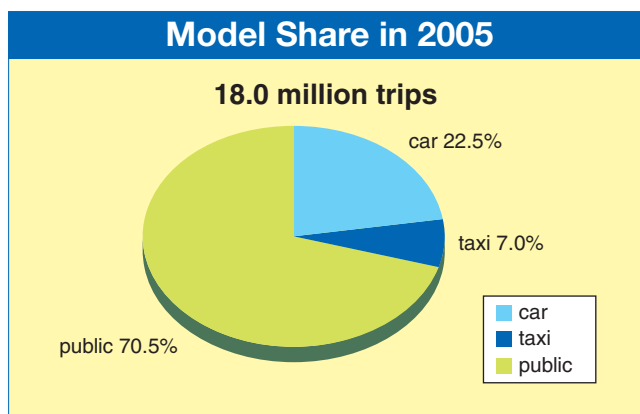
Existing Urban Centers and Future Decentralized Urban Sub-Centers



Motorization will be made progress toward the target year..

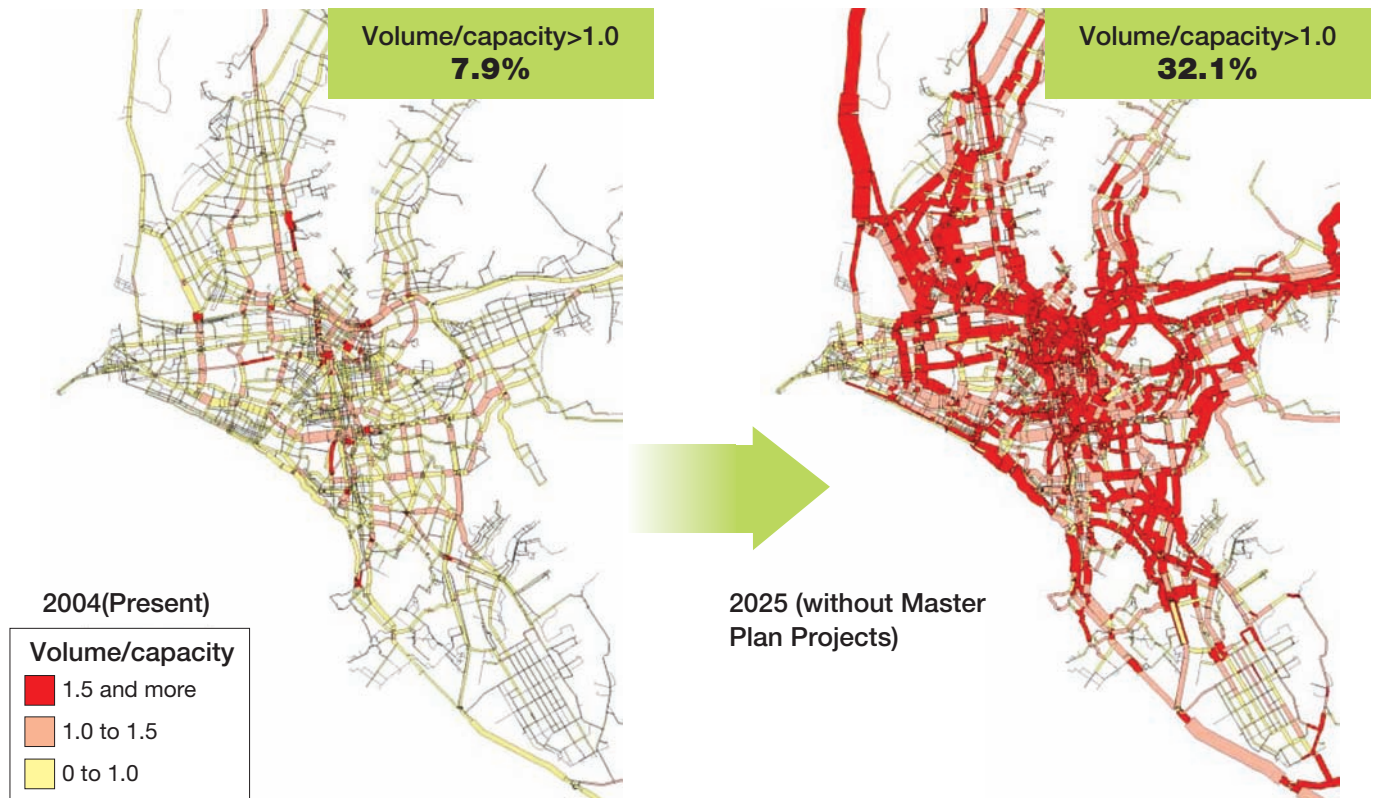


1.48 times
5.9 million trips
INCREASED



What are we confronted without master plan project ?

If there are only current committed project in the road and public transport sectors and no another project commission, the traffic situation of the study area must be worse.



Traffic Demand Increase...

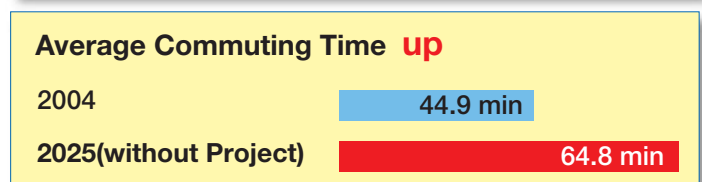
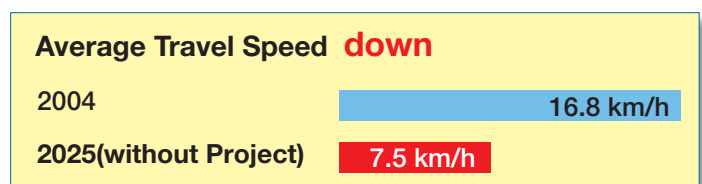
In 2004, the congestion ratio of mainly Central area is more than 1.5. However, as a result of Socio-economic growth and motorization, the congestion ratio of almost whole area will be more than 1.5 in 2025.

The future traffic condition will be very severe if no improvements are made in the transport network.

Other Negative impact will appear according to the congestion

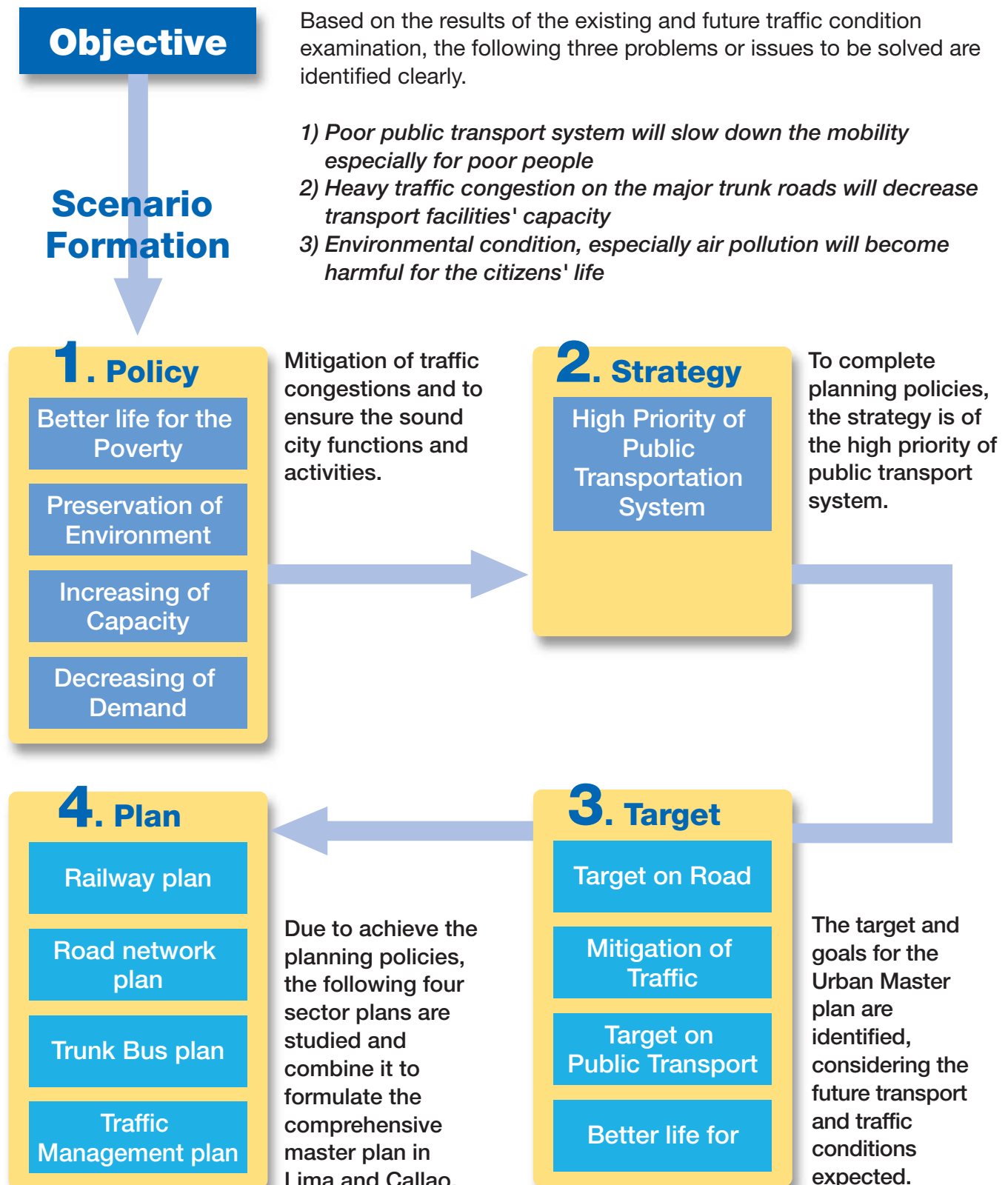
The congestion will cause the other negative impact which damages sustainable development.

- 1) Traffic speed will fall down.
- 2) Commuting time extends.
- 3) Environmental impact (especially CO₂) will worsen.
- 4) Service of the public transport will fall down.



Planning Policy and Strategy

Master plan must be formulated so as to deal with three main issues.



Comprehensive Master Plan in 2025

Based on the result of four sector (Railway, Trunk bus, road facility and traffic management) study plan, the projects for the master plan for Lima and Callao metropolitan area urban transportation in 2025 are identified.

Road Facility:

To formulate the Road Network to meet future transport demand, the project for road construction, road improvement, widening and rehabilitation will be implemented.

33 projects
2,374 US\$ Million

Railway:

4 line for commuting from the suburban area to the city center will be constructed.

7 projects
2,024 US\$ Million

Trunk Bus:

To form "trunk and feeder bus system", busway, bus lanes and bus terminals will be constructed.

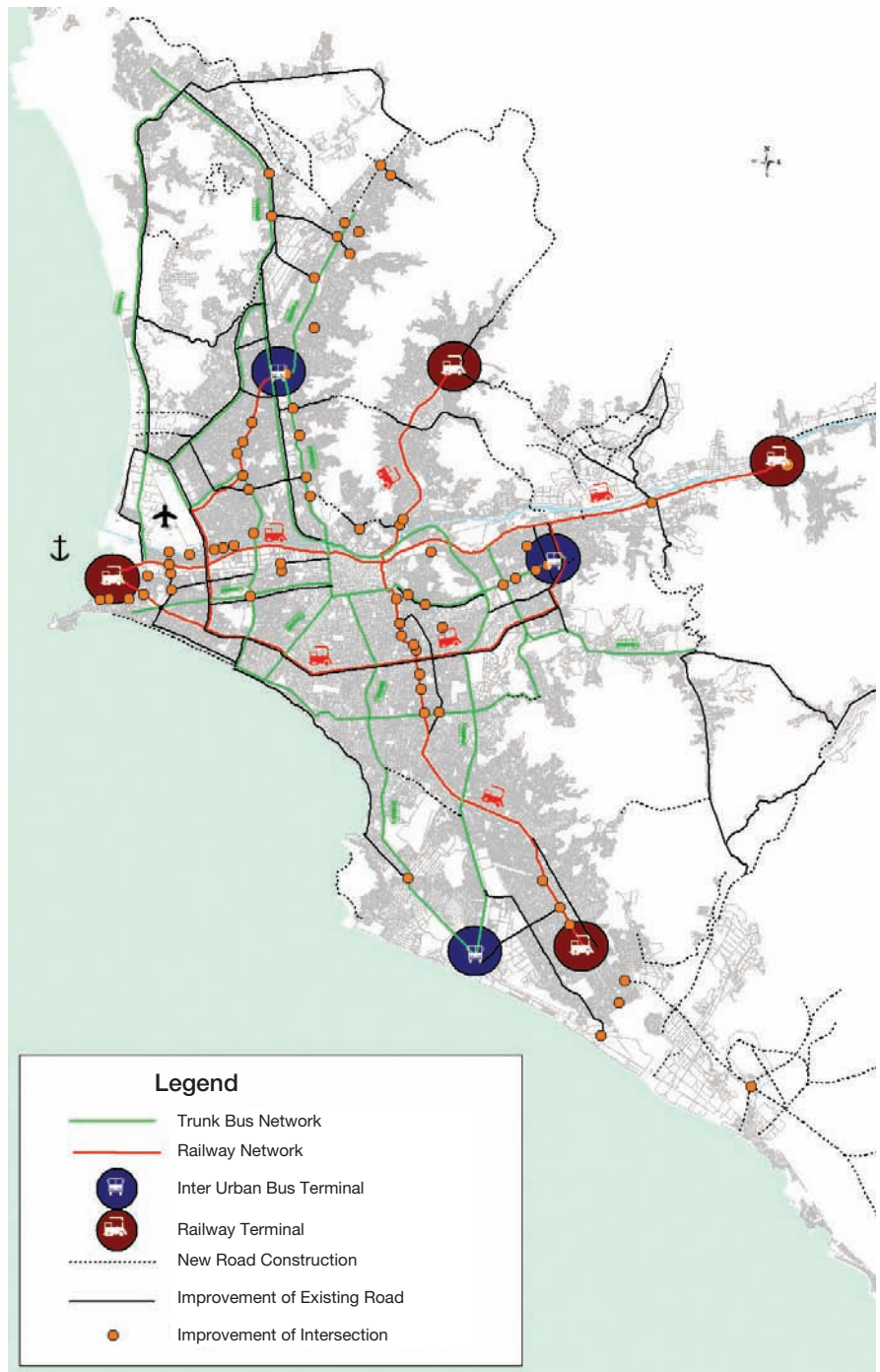
18 projects
981 US\$ Million

Traffic management:

To make use of the existing road facilities and to improve current road capacities,

- 1) Traffic control system will be improved
- 2) Intersection will be improved
- 3) Traffic Demand Management system will be introduced

10 projects
156 US\$ Million

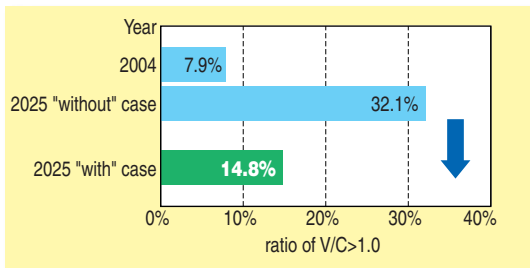


Total: 68 projects
5,535 US\$ Million

What the master plan brings to Lima and Callao in 2025

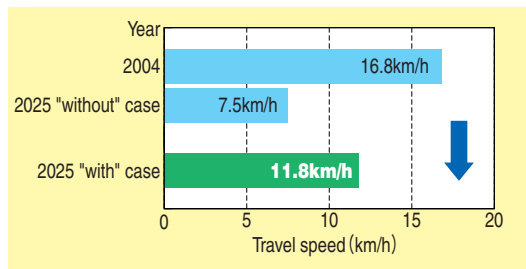
Implementation of the Master Plan as the schedule will mitigate the negative impact according to the increasing traffic volume and will improve People's mobility.

Traffic Congestion..... will be mitigated.



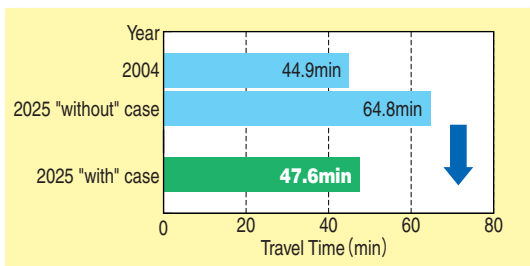
17.3% Mitigated!!

Average Travel Speed..... will be faster.



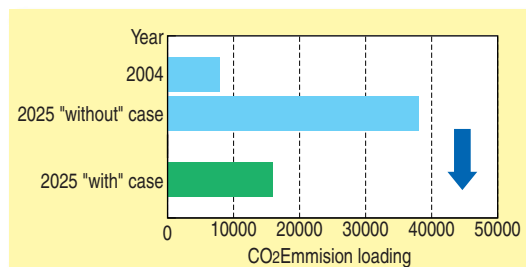
4.2 km/h Faster!!

Average Travel Time..... will be shortened.



17.2min Shortened!!

Air Pollution..... will be reduced.



57% Reduced!

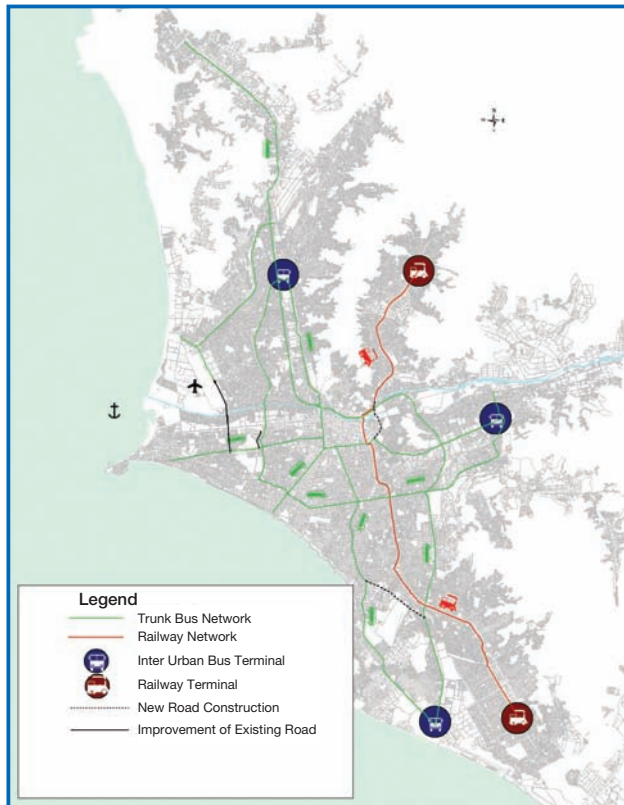
Economic evaluation..... evaluated "project is effective".

EIRR:	38.0 % (>12%)
Benefit/Cost Ratio	4.95 (>1.0)
Net Present Value(Discount rate=12%)	US\$ 11,160 Million (>0)



Short Term Plan in 2010

Short Term Plan Projects targeted in 2010 are selected for advancing the Master Plan and acquire the effect from the project.



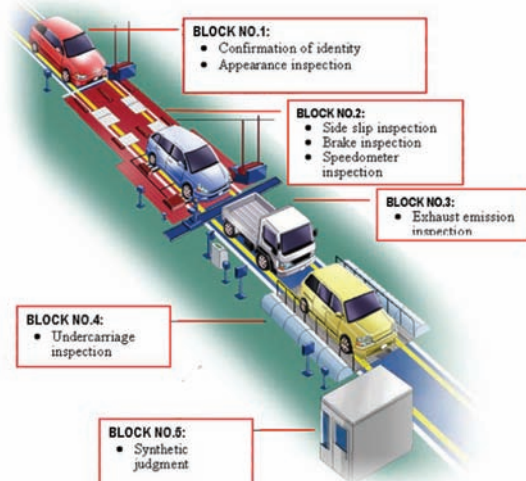
Trunk Bus



The trunk bus service is operated with higher operation speed. The feeder bus system operates in an area around a trunk bus terminal to carry passengers to and from the terminal. The conventional bus system operates the bus line other than the trunk bus and the feeder lines.

- 1) Carretera Central :8.36 km
- 2) Av. Venezuela: 9.05 km
- 3) Av. Panamericana Norte: 23.9 km
- 4) Av. Panamericana Sur: 25.6 km

Traffic Management



To mitigate traffic congestion with the small-scale investment, the following project will be implemented.

- 1) Traffic Signal Control
- 2) Intersection Improvement
- 3) Traffic Demand Management
- 4) Traffic Safety
- 5) Parking Control
- 6) Safety Education
- 7) Accident Monitoring
- 8) Vehicle Inspection

Railway



Traffic demand of Central-San Juan de Lurigancho and Central-Villa El Salvador in 2010 will exceed the trunk bus capacity. Therefore the present railway (Villa El Salvador-Atocongo) will be extended to decrease traffic congestion and to improve the level of service.

- 1) Railway Line 1 sec.1 :11.7 km (Atocongo-Hospital 2 de Mayo)
- 2) Railway Line 1 :13.0 km (2 de Mayo - S.J de Lurigancho)

Evaluation of the short term plan

TECHNICAL Evaluation

Travel Time
without project 56 Min → **shortened**
with Project **49 Min**

Travel Speed
without project 17 km/h → **faster**
with Project **14 km/h**

Economic Evaluation

EIRR = 34.7 %

B/C = 3.18

NPV = US\$ 2,688 million

FINANCIAL Evaluation

REVENUE

1,028 Million US\$

Train fare
Trunk bus Fare
Toll road
Vehicle Tonnage
Tax
Vehicle Owner Tax

COST

1,003 Million US\$

Project of Railway
Trunk Bus
Road
Traffic Management

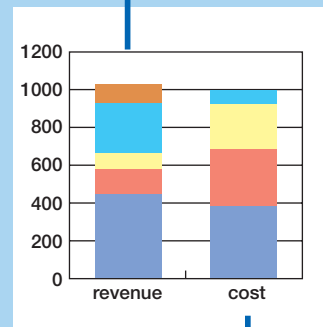


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List of Abbreviations

¥	Yen
AASHTO	American Association of State Highway and Transportation
AATE	Autonomous Authority of the Special Project of Electric Mass Transport System for Lima and Callao
ACI	American Concrete Institute
AIT	Asian Institute of Technology
AMETUR	Metropolitan Association of Urban Transport Enterprises
Art.	Article
ASETRAP	Association of Peruvian Transport Enterprises
ASETUM	Association of Mass Urban Transportation Companies from
ASETUP	Association of Urban Transportation Companies from Peru
ASPEC	Peruvian Association of Consumers and Users
ATC	Applied Technology Council
ATLM	Lima and Callao Metropolitan Transport Authority
ATP	Automatic Train Protection System
Av.	Avenue
CBD	Central Business District
CCTV	Closed Circuit Television System Camera
CEMTU - PERU	Urban Carriers Company Corporation from Peru
CEPAL	Economic Commission for Latin American and Caribe
CEPRI	Special Committee of Private Investment Promotion
CGT	General Confederation of Transport
CIDATT	Investigation and Advisory Center of Terrestrial Transport
CNG	Compressed Natural Gas
CNSV	National Road Safety Council
COFOPRI	Commission of Informal Property Formalization
CONAM	National Environmental Council
CONATA	National Assessment Council for Real Estate
CONATRAP	National Confederation of Public Transport Companies
CONECSA	Business Consortium of Callao
CONFIEP	National Confederation of Private Business Institutions
CORDELICA	Development Corporation for Lima and Callao
CORPAC	Peruvian Corporation of Airports and Commercial Aviation
COSAC	High Capacity Segregated Corridor
COSAC I	High Capacity Segregated Corridor Phase I
CPU	Central Processing Unit
CTC	Central Train Control System
CTLC	Transport Council of Lima and Callao

DC/CD	Direct Credit
dd-S	Subtropical Desiccated Desert
DESCO	Study and Development Promotion Center
DGAC	General Direction of Civil Aviation
DGAS	General Direction of Social Environmental Affairs
DGCF	General Direction of Railway Transportation
DGCT	General Direction of Ground Circulation
DGDU	General Direction of Urban Development
DGTA	General Direction of Marine Transportation
DGTE	General Direction of Transport
DGTO	General Direction of Transit
DGTU	General Direction of Urban Transport (Callao)
DMTU	Municipal Direction of Urban Transport (Lima)
DNI	National Identification Document
dp-PT	Tropical Low-mountain Semi-dry
ds-S	Subtropical Super-dry Desert
ECAs	Environmental Quality Standard Annual Program
EIA	Environmental Impact Assessment
EIA-d	Detailed Study of Environmental Impact
EIA-sd	Semi-detailed Study of Environmental Impact
EMAPE	Municipal Toll Administration Company
ENAPU	Port Services of Peru
ENATRU	National Corporation for Urban Transport
Ex.	Express Way (Freeway)
FINVER	Finver-Callao Investment Fund
FONAM	National Environmental Fund
FONCOMUN	Municipal Compensation Fund
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gases
GPS	Geographical Positioning System
GRDP	Gross Regional Domestic Product
HH	Household
HOV	High Occupancy Vehicle
IBRD/WB	International Bank for Reconstruction and Development /World Bank
ICAO	International Civil Aviation Organization
IDB	Inter-American Development Bank
IEE	Initial Environmental Examination
IFC/CFI	International Finance Corporation

IMP	Metropolitan Planning Institute
INC	National Institute of Culture
INDECI	National Institute of Civil Defense
INEI	National Institute for Statistics and Information
INVERMET	Metropolitan Investment Fund
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
LaeqT	Continuous Sound Pressure Level equivalent to that with Adjustment A
LCTA	Lima and Callao Metropolitan Transport Authority
Leq	Noise Parameter
M/C	Motorcycle
M/P	Master Plan for Lima and Callao Metropolitan Area Urban Transportation in the Republic of Peru
MEF	Ministry of Economy and Finance
MIGA/OMGI	Multilateral Investment Guarantee Agency
MML	Metropolitan Municipality of Lima
MOP	Ministry of the Presidency
MPC	Province Municipality of Callao
MTC	Ministry of Transportation and Communications
MTPE	Ministry of Work and Employment Promotion
NGO	Non-Governmental Organization
NMT	Non-motorized Transport
OD	Origin Destination
OECD	Organization for Economic Cooperation and Development
OGPP	Directorate of Management Information
OIT	Office of Technical Information
OPP	General Office of Planning and Budgets
PAR	Displaced People Return Support Program
PCU	Passenger Car Unit
PFI	Private Finance Initiative
PG/R	Progress Report
PISA	Integral Atmospheric Security Plan
PM	Particulate Matter
PNP	National Police
PPP	Public Private Partnership
PROINVERSION	Private Investment Promotion Agency
PROLIMA	Lima Historic Center Municipal Recuperation Program
PRONAA	National Program of Nourishment Assistance
PROTRANSPORTE	Investments Plan Elaboration Project for Lima's Metropolitan Transport

PROTUM	Metropolitan Urban Transport Project
PROVIAS	Special Project of Transport Infrastructure
PT	Person Trip
PTUL	Lima Urban Transport Program
RC	Reinforced Concrete
RIT	Integrated Transport Network
RTMS	Remote Detector Microwave Sensor
S/.	Soles
SAT	Tributary Administration Service
SEDAPAL	Drinking Water and Sewerage Service of Lima
SEIA	National System of Environmental Impact Evaluation
SERPOST	Postal Services of Peru
SETAME	Metropolitan Taxi Service
SITC	Southern Inter Tropical Convergence
SPM	Suspended Particulate Matter
SUNARP	National Superintendence of Public Registration
SUNAT	National Superintendence of Tributary Administration
TDM	Traffic Demand Management
TRANSMET	Metropolitan Transport Committee of Lima
TSAS	Traffic Safety Audit System
TTC	Travel Time Cost
TUPA	Unique Text of Administrative Procedure
UIC	International Union of Railways
UNESCO	United Nations Education, Science and Culture Organization
US\$	American Dollar
USTDA	Feasibility Study on Urban Railway Project in Lima
UTPM	Territorial Units of Metropolitan Planning
VOC	Vehicle Operation Cost
VIVD	Video Vehicle Detection System

CHAPTER 1

Introduction

1. INTRODUCTION

In response to the request of the Government of the Republic of Peru (hereinafter referred to as “Peru”), the Government of Japan has decided to conduct a Study on the Master Plan of Urban Transportation in the Metropolitan Area of Lima and Callao in the Republic of Peru (hereinafter referred to as “the Study”), in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as “JICA”), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, undertook the Study in close cooperation with the authorities concerned in Peru.

The Contact Mission, headed by Dr. Hisao Uchiyama, was dispatched by JICA in August 2003. After discussion with officials of the Government of Peru, the Scope of Work for the Study was agreed upon by both sides, and signed on August 18th, 2003.

JICA has organized the Study Team to conduct the Study. The Study Team works in close cooperation with the Peruvian Counterpart Team in accordance with the agreed Scope of Work.

The Inception Report was submitted to the Government of Peru on January 2004 and the contents of the Inception Report were agreed by both sides. The various traffic and transport surveys, data collection and analysis, and other studies for the Study were commenced at the same time.

1.1. STUDY OBJECTIVES

The Study has four objectives as described below.

- 1) Formulation of the Urban Transport Master Plan for the Lima and Callao Metropolitan Area (target year: 2025)
- 2) Formulation of the Short-Term Action Plan (target year: 2010)
- 3) Selection of a project given priority by the Urban Transport Master Plan and the Short-Term Action Plan
- 4) Transfer of technology related to the creation of an urban transport database and model and planning through the Study to the counterparts in Peru.

1.2. TARGET YEAR OF THE STUDY

The target year for the Urban Transport Master Plan (M/P) is 2025 while the target year for the Short-Term Action Plan is 2010.

1.3. THE STUDY AREA

The Study Area comprises the cities of Lima and Callao and their suburbs as shown in Figure 1.3-1.



Figure 1.3-1 the Study Area

1.4. SCOPE OF THE STUDY

The major subjects of the Study are illustrated in in form of the Study Flow. The Study is conducted in the following four stages as described below.

(1) Stage 1 Study

The Stage 1 Study was conducted in the period from mid-January to mid-March, 2004 to clarify the current situation and to identify the problems and tasks. During this period, the Study Team was based in Lima to mainly conduct the following range of work by means of a field survey and interview survey, etc.

- 1) Clarification of the socioeconomic situation and natural conditions in the Study Area
- 2) Gathering of information/data on urban transport plans and studies in the past and analysis of such information/data to identify the problems, limitations, weaknesses, etc.
- 3) Clarification of the development situation of transport infrastructure in the Study Area and identification of the problems.
- 4) Identification of current situation and problems, of the institutional and legal frameworks
- 5) Implementation of a preliminary transport survey (test survey on transport) in preparation for various types of fact-finding surveys on transport
- 6) Rearrangement of the problems and tasks for urban transport to formulate policies and a strategic scenario for the urban transport system to be proposed under the Study.

(2) Stage 2 Study

The Stage 2 Study was conducted in the period from around May to around December 2004 for the purpose of formulating the Urban Transport Master Plan, with the target year

of 2025. During this period, the Study Team was based in Lima and mainly conducted the following range of work.

- 1) Forecasting of the future social and economic indices and establishment of a framework for future urban transport demand
- 2) Implementation of various transport surveys
- 3) Forecasting of the future transport demand
- 4) Formulation and evaluation of the Urban Transport Master Plan
- 5) Implementation of initial environmental examination (IEE)
- 6) Submission of the Progress Report

(3) Stage 3 Study

The Stage 3 Study followed the Stage 2 Study and the Short-Term Action Plan of which the target year was 2010 and it was formulated in the period from around December 2004 to mid-March 2005. During this period, the Study Team was based in Lima and mainly conducted the following range of work.

- 1) Formulation of a public transport mode improvement plan
- 2) Formulation of traffic management methodologies or techniques and a transport system or organization improvement plan
- 3) Formulation of an urgent urban transport improvement plan
- 4) Selection of priority projects
- 5) Submission of the Draft Final Report

(4) Stage 4 Study

The Stage 4 Study aimed at the holding of a seminar in Lima around May 2005 to discuss the objectives of the Study, the contents of the proposals and the construction schedule, etc. During the Stage 4 Study period, the Final Report was prepared and the comments of the Peruvian side to the Draft Final Report, prepared and submitted to the Peruvian side during the Stage 3 Study period, were incorporated. The work to prepare the Final Report was conducted in Japan.

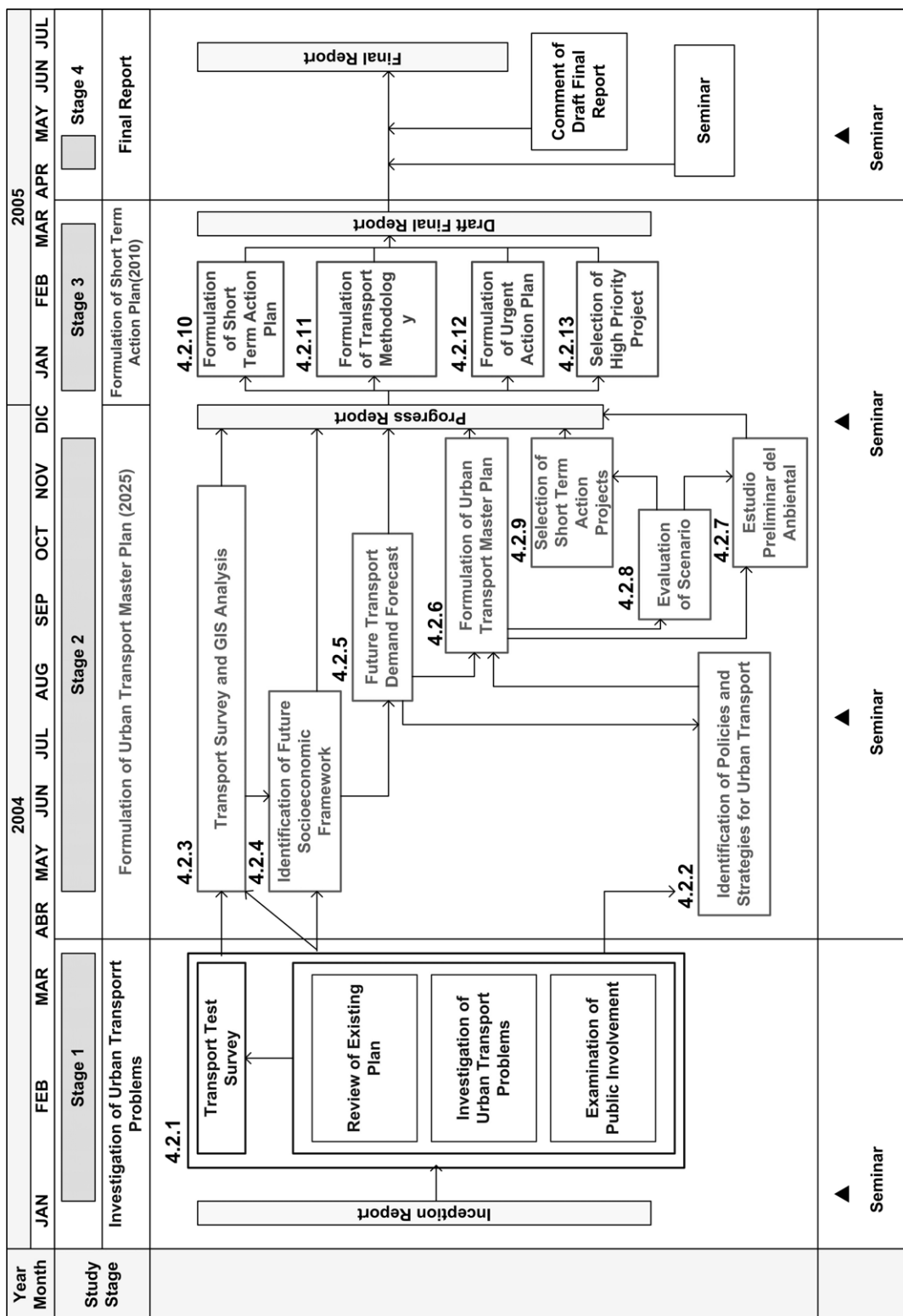


Figure 1.4-1 Flow Chart

1.5. STUDY PROGRESS

The major study activities are shown in Table 1.5-1.

Table 1.5-1 Major activities of the Study

Date	Activities	Participants	Contents
29/1, 2004	Steering Committee Meeting for discussion of Inception Report (IC/R)	CTLC, DMTU, GGTU, IMP, AATE, MEF, PROTRANSPORTE	After Explanation and discussion of the Inception Report (IC/R), both sides agreed on the contents of the I/R.
30/1, 2004	Seminar (First time)	Open (Over 100 persons)	Explanation, questions and answers of Inception Report (IC/R).
10/3, 2004	Steering Committee Meeting for explanation of study progress	CTLC, DMTU, GGTU, IMP, AATE, MEF, PROTRANSPORTE	Explanation and discussion of the existing transport conditions in the Study Area.
11/5, 2004	Steering Committee Meeting for explanation of the Study schedule on Stage-2 of Study	CTLC, DMTU, GGTU, IMP, AATE, MEF, PROTRANSPORTE,	Explanation and discussion of submission terms of the Progress Report (PG/R). Both sides agreed that the PG/R would be submitted at the end of December, 2004.
10/8, 2004	Steering Committee Meeting for explanation of study progress	CTLC, DMTU, GGTU, IMP, AATE, MEF, PROTRANSPORTE, Counterparts members	Explanation and discussion of surveys schedule and tentative survey analysis of PT survey, various traffic surveys, and public transport surveys conducted.
11/8, 2004	Seminar (Second time)	Open (Over 120 persons)	Explanation, questions and answers about tentative surveys analysis of various transport and traffic surveys conducted.
23/11, 2004	Stakeholder Meeting	CTLC, DMTU, GGTU, IMP, AATE, MEF, PROTRANSPORTE, Counterparts and engineers of related Organizations. Professors of Universities, and staffs of Private Consultants	Discussion of transport surveys and results of its analysis. Explanation and discussion of comprehensive urban transport Master Plan.
12/1, 2005	Stakeholder Meeting	CTLC, DMTU, GGTU, Bus Operation Companies (about 50 persons)	Explanation of Urban Transport Master Plan and Bus Operation organization in future.
18/1, 2005	Stakeholder Meeting	CTLC, DMTU, GGTU, Bus Operation Companies (about 30 persons)	Discussion of future Bus Operation System.
24/1, 2005	Stakeholder Meeting	CTLC, DMTU, Citizens of Villa el Salvador	Discussion of future Bus Operation System.
17/2, 2005	Steering Committee Meeting for Explanation and Discussion of the Study	CTLC, DMTU, GGTU, IMP, AATE, MEF, Protransporte	Explanation and Discussion of the PG/R of study
18/2, 2005	Seminar Third Time	Open (over 100 persons)	Explanation and Discussion of the contents of Progress Report
9/3, 2005	Steering Committee Meeting for Explanation and Discussion of the Study	CTLC, DMTU, GGTU, IMP, AATE, MEF, Protransporte	Explanation and Discussion of the DF/R
10/5, 2005	Seminar Fourth Time	Open (over 100 persons)	Explanation and Discussion of the contents of Draft Final Report

1.6. STUDY ORGANIZATIONS

The parties concerned with the implementation of the Study are the Transport Council of Lima and Callao, which is the counterpart to the Study Team, JICA, the Steering Committee organized by the Government of Peru, the Advisory Committee organized by JICA, Peruvian counterparts and the Study Team. A schematic organization chart for the Study is shown in Figure 1.6-1.

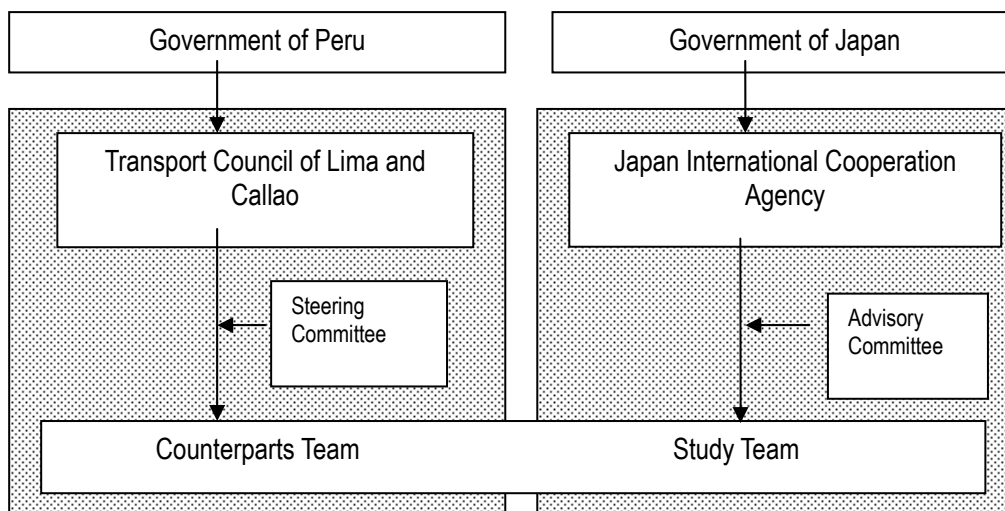


Figure 1.6-1 Organization Chart for the Study

(1) Members of the Steering Committee

- | | | |
|----|-----------------------------------|--|
| 1) | Dr. Jose Luis Villarán Salazar | Metropolitan Planning Institute, Lima.(IMP)
President of the Directive Council |
| 2) | Dr. Patrick Allemant Florindez | Ministry of Transport and Communications (MTC)
Technical Secretariat of the Transport Council of Lima and Callao (CTLC) |
| 3) | Mr. Javier Baraybar G. Delafuente | Metropolitan Municipality of Lima
Municipal Direction of Urban Transport (DMTU) General Director |
| 4) | Mr. Jorge Villareal Ruiz | Provincial Municipality of Callao
General Management of Urban Transport (GGTU) General Director |
| 5) | Mr. Alberto Sanchez Aizcorbe | Autonomous Authority of the Special Project
Electric System of Mass Transport of Lima
Executive President (AATE) |
| 6) | Mr. Julio Pflucker Arenaza | PROTRANSPORTE Executive Director |

(2) Members of the Counterpart Staff

- | | | |
|----|----------------------|--|
| 1) | Mr. Guillermo Tamayo | Metropolitan Planning Institute Lima (IMP) |
| 2) | Mr. Javier Cornejo | Autonomous Authority of the Special Project
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(AATE) |
| 3) | Mr. Rómulo Chinchay | PROTRANSPORTE |
| 4) | Mr. Jose Chanamé | Technical Secretariat of the Transport Council
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| 5) | Mr. John Romero | Metropolitan Municipality of Lima
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6)	Mrs. Susana Maldonado	Provincial Municipality of Callao General Management of Urban Transport (GGTU)
7)	Mr. Miguel Sidia	PROTRANSPORTE
8)	Mr. Manuel Chamorro (Predecessor)	Metropolitan Planning Institute Lima (IMP)

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4)	Mr. Kenji Maeda	Public Transport Planner (Trains)
5)	Mr. Takeshi Yoshida	Bus Operation Organization Planner
6)	Mr. Kimio Kaneko	Traffic Management Planner
7)	Mr. Toshihiro Hotta	Road Planner
8)	Mr. Naoyuki Minami	Transport Facilities Planner
9)	Mr. Yoshiaki Nishikatsu	Road Facilities Planner
10)	Mr. Hisayuki Yamaguchi	Transport Demand Analyst
11)	Mr. Masayuki Ishiya	Transport Surveyor and Analyst
12)	Mr. Takeshi Kagajyo	Transport Surveyor
13)	Mr. Osamu Ohtsu	Economist
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15)	Dr. Takanori Hayashida	Natural Environment Analyst
16)	Mr. Noboru Kawashima	Social Environment Analyst

(4) Members of the JICA Advisory Committee

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2)	Mr. Takuya Hattori	Planning Officer, Road, City and Housing Administration Division, Hokkaido Bureau, Ministry of Land, Infrastructure and Transport
3)	Mr. Izumi Kawaguchi	Manager for Planning, Railway Technology Promotion Center, Railway Technical Research Institute
4)	Mr. Tamotsu Wakai	Deputy Director, Regional Transport Office, Passenger Transport Division, Automotive Bureau, Ministry of Land Infrastructure and Transport

(5) Members of the JICA Tokyo Headquarters

1)	Mr. Akira Nakamura	Director, First Development Study Division, Social Development Study Department
2)	Mr. Yuichi Sugano	Team Director, Transport Team II, Urban and Regional Development Team, Group III, Social Development Department
3)	Mr. Yodo Kakuzen (Predecessor)	Deputy Director, First Development Study Division, Social Development Study Department
4)	Mr. Nobuhiro Kawatani	Transportation Team II, Group III Social Development Department
5)	Mrs. Sawako Hirano (Predecessor)	Transportation Team II, Group III Social Development Department
6)	Mr. Tomoyuki Nakazono (Predecessor)	Transportation Team II, Group III Social Development Department
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(6) Members of the JICA Peru Office

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| 1) Mr. Takao Omote | Resident Representative |
| 2) Mr. Katsuhiro Kakei
(Predecessor) | Resident Representative |
| 3) Mr. Shoji Ozawa | Deputy Resident Representative |
| 4) Mr. Kenji Kaneko
(Predecessor) | Deputy Resident Representative |
| 5) Mr. Rodolfo Soeda | Officer of the Program |

PART I

CURRENT CONDITIONS

CHAPTER 2

Current Socioeconomic Conditions

2. CURRENT SOCIOECONOMIC CONDITIONS

The Metropolitan Area of Lima and Callao, the study area, is located in the center of Peru, facing the Pacific Ocean. It has been historically developed from two differentiated cities: Lima and Callao. Lima is the nation's capital and functions as a political and administrative center, and Callao is the first maritime dock and seaport in the country. Both cities were founded in the 16th century, and since then they have grown and formed a physical and functional unit, of the "conurbation." Today, Lima and Callao have become a continuous "metropolitan area," having a total population of about 8 million¹ with a total administrative area of 2,794 square kilometers. This chapter shows the current socioeconomic conditions of Peru and the metropolitan area of Lima and Callao, including population growth, economic conditions, historical background of the urbanization, and major characteristics of land use in the metropolitan area.

2.1. POPULATION TREND

(1) Population Growth

The official population data is published by the National Institute of Statistics and Information (INEI). According to the census population² published by the INEI, the country increased its population from 7,023,000 habitants in 1940 to 22,639,000 habitants in 1993 (Table 2.1-1). The average annual growth rate was 2.2 percent during the period between 1940 and 1993. The population in the metropolitan area of Lima and Callao increased more significantly; it increased by nearly 10 times, from 662,000 habitants in 1940 to 6,434,000 habitants in 1993. The average annual growth rate was 4.4 percent during the period. The rapid population growth in the metropolitan area was seen particularly during the period between the 1950s and 1960s. The average annual growth rate was 5.2 percent between 1940 and 1961 and 5.5 percent between 1961 and 1972, while the national average was 1.9 percent and 2.8 percent respectively during the same period. Then, the population growth rate in the metropolitan area dropped to 3.9 percent between 1972 and 1981 and to 2.4 percent between 1981 and 1993.

There is no census population data available after 1993³. The current population was estimated by the INEI and prepared in the report entitled "*Perú: Proyecciones de Población por Años Calendario según Departamentos, Provincias y Distritos*" (Peru: Population Projections by Departments, Provinces and Districts). According to this report, the present population of 2004 is 27,547,000 habitants in the country and 8,043,000 habitants in the metropolitan area of Lima and Callao. The average annual population growth rate is 2.0 percent between 1993 and 2004 in the metropolitan area, while the national average is 1.8 percent during the same period. Although the population growth rate in the metropolitan area has dropped since the 1980s, the percentage share in the country increased from 28.4 percent in 1993 to 29.2 percent in 2004. The metropolitan area of Lima and Callao represents nearly 30 percent of the country's total population. The number of population by each district of Lima and Callao is shown in Table 2.4-3.

¹ The recent population of 2004 is based on the estimation made by the INEI.

² The national census of population and housing was implemented 5 times in 1940, 1961, 1972, 1981 and 1993.

³ The INEI will implement the next population census in 2005.

Table 2.1-1 Population Trend in Peru and the Metropolitan Area of Lima and Callao, 1940-2004

Year	Peru	The Metropolitan Area of Lima and Callao*	
	Population (1,000)	Population (1,000)	% Share in Peru
1940	7,023	662	9.4%
1961	10,420	1,902	18.2%
1972	14,122	3,418	24.2%
1981	17,762	4,836	27.3%
1993	22,639	6,434	28.4%
2004**	27,547	8,043	29.2%

Note: * The Metropolitan area of Lima and Callao corresponds to the Province of Lima and the Province of Callao. ** The population of 2004 is the estimation made by the INEI.

Source: (1) INEI, Statistical Year Book, 2002; (2) INEI, Peru: Population Projections by Departments, Provinces and Districts, 2002.

Table 2.1-2 Annual Population Growth Rate in Peru and the Metropolitan Area of Lima-Callao, 1940-2004

Year	Peru	Metropolitan Area of Lima-Callao
1940-1961	1.9%	5.2%
1961-1972	2.8%	5.5%
1972-1981	2.6%	3.9%
1981-1993	2.0%	2.4%
1993-2004	1.8%	2.0%

Source: (1) INEI, Statistical Year Book, 2002;

(2) INEI, Peru: Population Projections by Departments, Provinces and Districts, 2002.

(2) Administrative Structure

The country is geographically divided into twenty-four departments, and each department is composed of administrative autonomous units called provinces. The study area, the Metropolitan area of Lima and Callao, is a part of the Department of Lima⁴, and it is composed of the two autonomous provinces of Lima and Callao⁵. Both provinces are governed by a mayor and a regional government. At the same time, the province is divided into autonomous administrative units called districts. There are forty-three districts in the province of Lima and six districts in the province of Callao (see Table 2.4-3). Each district is an administratively and financially autonomous unit, and it is governed by a mayor and a district government.

The Metropolitan Municipality of Lima (MML) functions as a metropolitan government, covering all the jurisdictions of the 43 districts and of the area of Cercado de Lima. The meaning of this is “walled city of Lima,” which refers to the original part of the city founded in the 16th century. Some of the peripheral districts in the MML were created after the rapid urban expansion during the 1950s and 1960s.

2.2. ECONOMIC ACTIVITIES

(1) Economic Condition

The Peruvian economy experienced a severe recession and uncontrollable inflation in the 1980s. This situation has gradually recovered since the 1990s. Over the last decade, the country’s macro economy has improved and showed relatively high economic growth rates

⁴ There are 10 provinces in the Department of Lima. One of them is the province of Lima, and the other 9 provinces are: Barranca, Cajatambo, Canta, Cañete, Huaral, Huarochiri, Huaura, Oyon and Yauyos.

⁵ Under the Constitution, the province of Callao has a special status; of “Constitutional Province” and presently has the hierarchy of a Region, as each one of the departments in Peru.

compared to other Latin American countries. This section describes the recent economic conditions of the country and the metropolitan area of Lima-Callao.

1) National GDP

The past trend of the country's gross domestic products (GDP) is shown in Table 2.2-1. The national GDP at 1979 constant price increased from 2,518 million soles in 1970 to 3,646 million soles in 1980, and then it decreased to 3,264 million soles in 1990. The average annual growth rate was 3.8 percent in the 1970s, and it turned to a negative growth of -1.1 percent in the 1980s. This is because the country experienced a severe recession and incontrollable inflation in 1985, which caused the subsequent bankruptcy process of companies, increasing the rate of unemployment, and causing a reduction of the inner market. According to the GDP of 1990 by economic sector, 14.2 percent of the national product was generated in the primary sector (agriculture and fishing), 37.4 percent in the secondary sector (mining, construction and manufacturing) and 48.3 percent in the tertiary sector (commercial, real estate, government services and other services). It can be said that quite a large portion of the national products were generated in the tertiary and secondary sectors.

Table 2.2-1 Gross Domestic Product of Peru by Economic Sectors, 1970-1990 (at 1979 Constant Prices)

Year	Primary Sector		Secondary Sector		Tertiary Sector		Total	
	Million Soles	Share (%)	Million Soles	Share (%)	Million Soles	Share (%)	Million Soles	Share (%)
1970	405	16.1	988	39.2	1,123	44.6	2,518	100.0
1980	381	10.4	1,537	42.2	1,727	47.4	3,646	100.0
1990	463	14.2	1,221	37.4	1,578	48.3	3,264	100.0

Source: INEI, Almanac of Lima and Callao, 2001

Efforts of economic recovery have been made since the early 1990s. According to the GDP at 1994 constant price, it increased from 83,760 million soles in 1991 to 120,882 million soles in 2000 and 137,167 million soles in 2004 (Table 2.2-2). In the first half of the 1990s, the country's economy improved significantly with an average annual growth rate of 6.3 percent between 1991 and 1995 (Table 2.2-3). Then, it slowed down to 2.5 percent in the second half because of the large accumulation of external debt and a lack of competitiveness due to the open market under the globalization of world market. More recently, since 2000, the country' experienced a steady growth with an average annual growth rate of 3.2 percent between 2000 and 2004.

In terms of the economic sector, the secondary sector showed the highest annual growth rate of 4.7 percent during the period between 1991 and 2004, while the average GDP growth rate was 3.9 percent during the same period. In general, the Peruvian economy is still weak in terms of competition in the global market, but it has steadily improved in recent years, the secondary sector is a main driving force in the economic growth of the country.

Table 2.2-2 GDP by Economic Sectors, 1991-2004 (at 1994 Prices)

Year	Primary Sector		Secondary Sector		Tertiary Sector		Total	
	Million Soles	%	Million Soles	%	Million Soles	%	Million Soles	%
1991	7,118	8.5	20,552	24.5	56,090	67.0	83,760	100.0
1995	8,816	8.2	27,867	26.0	70,357	65.7	107,039	100.0
2000	11,631	9.6	30,986	25.6	78,265	64.7	120,882	100.0
2004*	12,088	8.8	37,294	27.2	87,786	64.0	137,167	100.0

Note: * The data of 2004 is an estimation made by the Central Reserve Bank of Peru (BCRP)

Source: (1) INEI, Statistical Year Book 2002. (2) Central Reserve Bank of Peru (BCRP), Annual Report

Table 2.2-3 GDP Annual Growth Rate by Economic Sectors, 1991-2004

Year	Primary Sector	Secondary Sector	Tertiary Sector	Total
1991-1995	5.5 %	7.9 %	5.8 %	6.3 %
1995-2000	5.7 %	2.1 %	2.2 %	2.5 %
2000-2004	1.0 %	4.7 %	2.9 %	3.2 %
Average 1991-2004	4.1 %	4.7 %	3.5 %	3.9 %

Source: The JICA Study Team

2) GRDP of the Department of Lima and the Constitutional Province of Callao

The data of gross regional domestic products (GRDP) is only available for the Departments of Lima and Callao, which includes the metropolitan area of Lima and Callao. According to the GRDP at 1974 constant price (Table 2.2-4), the Department of Lima and Callao generated 1,150 million soles in 1970 and 1,658 million soles in 1980. Then, the GRDP dropped to 1,371 million soles in 1990. The average annual growth rates were 3.7 percent in the 1970s, and it dropped to a negative growth of 1.9 percent in the 1980s. If we look at these figures compared to the national average, it can be said that the severe recession of 1985 caused a greater negative effect to the economies of the Department of Lima and the Constitutional Province of Callao.

According to the GRDP by economic sector, the tertiary sector produced 825 million soles in 1990, which occupied 60.2 percent of the total regional products, followed by the secondary sector with 35.3 percent (484 million soles). The primary sector produced only 4.5 percent (62 million soles) of the regional products. Table 2.2-5 shows the percentage share of the GRDP of the Department of Lima and Callao in the national products between 1970 and 1990. The Department of Lima and Callao occupied a significant portion of the national products: i.e., 45.7 percent in 1970, 45.5 percent in 1980 and 42.0 percent in 1990. These figures encapsulate the exceptional importance of the economic activities in the metropolitan area of Lima and Callao.

Table 2.2-4 GRDP of the Department of Lima and Callao by Economic Sectors, 1970-1995 (at 1979 prices)

Year	Primary Sector		Secondary Sector		Tertiary Sector		Total	
	Million Soles	%	Million Soles	%	Million Soles	%	Million Soles	%
1970	61	5.3	450	39.2	639	55.6	1,150	100.0
1980	57	3.4	586	35.3	1,015	61.2	1,658	100.0
1990	62	4.5	484	35.3	825	60.2	1,371	100.0

Source: INEI, Almanac of Lima and Callao, 2001

Table 2.2-5 Share of the GRDP of the Department of Lima and Callao in the National Products, 1970-1990

Year	Peru		Lima-Callao Departments	
	Million Soles		Million Soles	Share in National GDP (%)
1970	2,518		1,150	45.7%
1980	3,646		1,658	45.5%
1990	3,264		1,371	42.0%

Source: INEI, Almanac of Lima and Callao, 2001

The recent GRDP data of the Department of Lima and Callao are not available, but the Ministry of Economy and Finance (MEF) recently estimated the economic growth rate by sector since 2001 (Table 2.2-6). According to the estimation, the annual growth rate of the GRDP was 4.0 percent between 2001 and 2002, 3.9 percent between 2002 and 2003, and 3.2 percent between 2003 and 2004. The secondary sector was estimated to be the highest growth rate with 6.1 percent between 2001 and 2002, 5.0 percent between 2002 and 2003, and 4.7 percent between 2003 and 2004.

Based on these growth rates by economic sector, we estimated the real GRDP at 1994 constant price, between 2001 and 2004 (Table 2.2-7). The real GRDP of the Department of Lima and Callao increased from 54,580 million soles in 2001 to 60,830 million soles in 2004. According to economic sector, the tertiary sector generated 57.6 percent of the regional products in 2004, followed by the secondary sector with 38.0 percent and the primary sector with 4.4 percent. The recent GRDP figure shows that the secondary sector is a driving force of the economic growth in the Department of Lima and in the Province of Callao.

Table 2.2-6 Annual Growth Rate of the GRDP by Economic Sector in the Department of Lima and Callao, 2001-2004

Year	Primary Sector	Secondary Sector	Tertiary Sector	Total
2001-2002	4.1 %	6.1 %	2.8 %	4.0 %
2002-2003	3.6 %	5.0 %	3.1 %	3.9 %
2003-2004	3.1 %	4.7 %	2.2 %	3.2 %

Source: Grupo Maximixe, Study for the Elaboration of Macroeconomic Projections, 2000, prepared for the Ministry of Economy and Finance.

Table 2.2-7 Estimated GRDP by Economic Sector in the Department of Lima and Callao, 2001-2004 at 1994 constant prices)

Year	Primary Sector		Secondary Sector		Tertiary Sector		Total	
	Million Soles	%	Million Soles	%	Million Soles	%	Million Soles	%
2001	2,394	4.4	19,811	36.3	32,355	59.3	54,560	100.0
2002	2,491	4.4	21,015	37.0	33,246	58.6	56,752	100.0
2003	2,581	4.4	22,073	37.4	34,286	58.2	58,940	100.0
2004	2,661	4.4	23,118	38.0	35,050	57.6	60,830	100.0

Note: All the figures are estimations based on the annual growth rate in the previous Table 2.2-6.

Source: The JICA Study Team

3) Characteristics of the Economic Activities in the Metropolitan Area

Major characteristics of economic activities in the metropolitan area of Lima and Callao can be summarized as the following four stages. In the early stage during the 1950s and 1960s, the metropolitan area produced agricultural products and manufactured goods mainly for the inner market of the country. The primary sectors generated quite a large portion of the regional products. In the second phase during the 1970s, the agricultural

products and manufactured goods increased their dependence on imports from foreign countries due to the rapid population growth of the metropolitan area and inadequate industrial technologies. In the third phase during the 1980s, the metropolitan area experienced a severe economic recession, which caused the bankruptcy of many companies and a high rate of unemployment. Thus, the metropolitan economy turned into the center of consumption and trading services, rather than the center of production. The agricultural and mining products generated in other regions of the country were exported and foreign manufactured goods were imported through the metropolitan area. In the recent stage since the 1990s, the metropolitan economy is continuously dominant in the tertiary sector, but it has gradually re-shifted to the secondary sector. In particular, manufacturing and construction activities play an important role in the metropolitan economy.

In the commercial and service sector, there are huge numbers of small-scale enterprises in the metropolitan area, and many of them are informal because of hard to access to the formal market. The large number of informal activity is one of the characteristics in the metropolitan economy. Most of the informal activities are concentrated in the central area (Cercado de Lima) and the suburbs of the metropolitan area. The financial sector is rather weak and lacks competitiveness, because many commercial banks work at high operation costs. These situations have caused massive informal activities, such as ambulant trade, clandestine importation and drug dealers in the city and generally in all the country. These are major characteristics of recent economic activities in the metropolitan area of Lima-Callao.

(2) Poverty and Informal Sector

Poverty is one of the most critical issues in the country. According to data from recent national poverty statistics prepared by the INEI⁶ (Table 2.2-8), the percentage of poor population in the country increased from 42.7 percent in 1997 to 48.4 percent in 2000. These figures indicate that nearly half of the country's population is categorized as the poor. In the metropolitan area of Lima-Callao, the percentage of poor population was lower than the national average, but it increased significantly from 25.4 percent in 1997 to 38.9 percent in 2000. According to these figures, the poor population in the metropolitan area in 2000 is estimated to be 2.9 million habitants.

⁶ There is no clear definition of the meaning of poverty in the statistics prepared by the INEI. According to interviews with INEI officials, the meaning of poverty in the statistic was based on the level of minimum consumption necessary to live. Poor is the household whose consumption expenses are less than 1,200 soles per month.

Table 2.2-8 National Poverty Statistics, 1997-2000

Items	1997	1998	1999	2000
Peru				
Population in thousands of habitants.	24,681	25,104	25,525	25,939
% of Poor Population	42.7%	42.4%	47.5%	48.4%
No. of Poor Population in thousands of habs.	10,535	10,651	12,126	12,552
Metropolitan Area of Lima and Callao				
Population in thousands of habs.	7,087	7,225	7,363	7,501
% of Poor Population	25.4%	24.1%	31.4%	38.9%
No. of Poor Population in thousands of habs.	1,800	1,741	2,312	2,918

Note: (1) The poor population is measured by the level of consumption expense of the household. The INEI, however, does not officially publish the level of expenses to define the poor. According to interviews with INEI officials, poor is the household whose consumption expenses are less than 1,200 soles per month.

(2) The percentage of poor population is based on the National Home Interview Survey implemented by the INEI.

(3) The number of the poor population in the Metropolitan Area of Lima-Callao was estimated by the JICA Study team.

Source: INEI, National Household Survey, 1997, 1998, 1999 and 2000. INEI, Statistic Year Book 2002

The large numbers of poor population in the metropolitan area can be explained in several ways. One of the factors is the large population migration from rural areas in the country to the metropolitan area. Over the last four decades, the metropolitan population increased from 1.9 million in 1961 to 8.0 million in 2004. Most of the massive population growth during the period has been driven by poor migrant families from the Peruvian countryside. They have built their homes in Lima's dusty peripheral desert or on the steep slopes on the hills, and their settlements do not usually have basic infrastructure, such as electricity, piped water and drainage. In the suburbs of the metropolitan area, new settlements have emerged every month, and they are made of scrap wood, cement block or brick. Many of these settlements have no legal titles of the property. Another factor in the increasing number of the poor population is the large number of unemployment, which appeared as a result of recent changes of economic structure that moved from agriculture and the traditional craft industry to the large scale manufacturing and service industry.

The central area and suburbs in the metropolitan area have experienced invasion of the poor population, which causes deterioration of urban environment and increase of delinquency. The invasion of the poor population in the central area (i.e., Cercado de Lima) generates changes in its functions and activities. The large number of informal activities caused the progressive abandonment of formal business activities that moved from the central area to other locations, such as to San Isidro, Miraflores and La Molina. The informal activities accelerated the degradation of the urban environment and loss of values in the central area.

2.3. HISTORICAL BACKGROUND OF THE URBANIZATION

This section summarizes the historical background of urbanization in the metropolitan area of Lima and Callao, from its foundation in the sixteenth century to the present. Historically, the development of the metropolitan area can be described in the following five (5) stages:

Stage I: Foundation of Lima and Callao in the 16th century

Stage II: Development of the enclosed city in the 17th century

Stage III: Slow development in the 18th century

Stage IV: Expansion towards the peripheral areas in the 19th century

Stage V: Formation of the metropolitan area in the 20th century

1) Stage I: Foundation of Lima and Callao in the 16th Century.

Lima was founded in 1535 by the Spanish conquerors in order to consolidate the colonial territory and to be its capital city. It was located at the edge of the Rimac River and about twelve kilometers from its river mouth. Callao, on the other hand, was located in the coast, and it was developed as a strategic trading port connecting through the Pacific Ocean. Callao became a city in 1547, and it was the only worthy natural harbor in the Peruvian shores during the period.

2) Stage II: Development of the Enclosed City in the 17th century.

Lima expanded its surface gradually and occupied about 350 hectares in 1685. The Alameda de los Descalzos was built in 1611 and it expanded the city towards the east along the Rimac River. Various churches were built during this period, and they are currently conserved as historical monuments. The enclosure of the city began in 1684, with walls as a defense against the pirates and corsairs. The construction of the walls halted the physical expansion of the city. In 1687, a harsh earthquake destroyed most of the buildings in the city.

3) Stage III: Slow Development of Lima in the 18th century.

In this period, Lima experienced a slow development within the enclosed city. Important constructions during this period include the Plaza de Toros, the Paseo de Aguas, and the temple of the Nazarenas; these architectural works still exist. The Lima-Callao highway (currently Avenida Colonial) was constructed in 1799 and played a major role in the growth of both cities.

4) Stage IV: Urban Expansion to the Peripheral Area in the 19th century.

During this stage, the city expanded towards the peripheral area, and its surface increased to about 1,000 hectares by 1891. The major infrastructure was constructed during this period, including the Lima-Callao railroad, inaugurated in 1815, the Lima-Chorrillos railroad, inaugurated in 1858, and, the Lima-Oroya-Cerro de Pasco Central Railroad, constructed between 1870 and 1904. These railroads became major axels to stimulate the growth of Lima towards the peripheral areas. The walls of the city were demolished in 1870.

5) Stage V: Formation of Metropolitan Area in the 20th century.

This century characterizes the great urban expansion of the city, which grew from three central areas (Cercado de Lima, La Victoria and Rimac) to the agglomeration of the metropolitan area. Its surface expanded to about 5,600 hectares by 1940. The Avenida Arequipa, between Cercado de Lima and Miraflores, was built in 1917, which led the rapid urban expansion towards the south. The wealthy neighborhoods appeared in the south of the city. Through the Avenidas Brazil and Arequipa, the peripheral settlements of Magdalena Del Mar, Miraflores, Barranco and Chorrillos were developed. These areas were filled up, and formed the consolidated urban areas of the Lima-Callao-Miraflores triangle. The extensive tram network represented an important role in the development.

Since the 1950s the large population migration began, from the rural areas to Lima, and they occupied the lands in the valleys and the hills in the city. These urban expansions to the valleys formed consolidated areas with a ramified structure. From the late 1960s new development axels appeared, such as the Vía Expresa (Paseo de la República) and Avenida Javier Prado. The Vía Expresa changed the physical center of the city from the Cercado de Lima towards San Isidro and Miraflores in the south. Towards the East, intensive residential and commercial developments were provided through Avenida Javier Prado. By 1993, its urban surface expanded to about 66,400 hectares.

2.4. MAJOR CHARACTERISTICS OF LAND USE AND URBANIZATION

2.4.1. GENERAL

As described in the previous section, the metropolitan area of Lima and Callao has expanded to the valleys of the Chillón, Rimac and Lurín Rivers. A rapid urbanization can be seen since the 1950s, resulting in marginal areas without basic infrastructure and urban services. The agricultural land located in the watersheds of the Rimac, Chillón and Lurín Rivers has been rapidly lost and converted into urban ground. Steep hills in the valleys and even barren desert far away from the central area have been gradually occupied by informal settlements. Traffic congestion in the central area is chaotic especially during peak hours. These are typical scenes in the description of the recent situation of the metropolitan area.

In order to overview the major characteristics of the land use and urbanization pattern; the study area can be divided the metropolitan area into five geographical areas: Central Lima, North Lima, South Lima, East Lima and Callao (see Figure 2.4-1). Table 2.4-1 and Table 2.4-2 show the number of population and the annual population growth rate during the period between 1972 and 2004.

Table 2.4-1 Population Trends in the Metropolitan Area of Lima and Callao by Geographical Areas, 1972-2004

Geographical Area	1972	1981	1993	2004
Central Lima (persons)	1,727,049	1,999,319	1,870,886	2,102,908
Share (%)	50.5%	41.3%	29.1%	26.1%
North Lima (persons)	586,225	969,276	1,449,958	1,873,250
Share (%)	17.1%	20.0%	22.5%	23.3%
South Lima (persons)	418,396	693,207	1,110,500	1,468,823
Share (%)	12.2%	14.3%	17.3%	18.3%
East Lima (persons)	354,554	719,678	1,355,414	1,786,665
Share (%)	10.4%	14.9%	21.1%	22.2%
Callao (persons)	332,228	454,313	647,565	811,610
Share (%)	9.7%	9.4%	10.1%	10.1%
Total (persons)	3,418,452	4,835,793	6,434,323	8,043,256
Share (%)	100.0%	100.0%	100.0%	100.0%

Source: The JICA Study Team, based on the population data prepared by the INEI

Table 2.4-2 Annual Population Growth Rate in the Metropolitan Area of Lima and Callao by Geographical Areas, 1972-2004

Geographical Area	1972-1981 Growth rate (%)	1981-1993 Growth rate (%)	1993-2004 Growth rate (%)
Central Lima	1.64	-0.55	1.07
North Lima	5.75	3.41	2.36
South Lima	5.77	4.00	2.57
East Lima	8.18	5.42	2.54
Callao	3.54	3.00	2.07
Total	3.93	2.41	2.05

Source: The JICA Study Team, based on the population data prepared by the INEI

The major characteristics of land use and urbanization in each geographical area can be summarized as follows:

2.4.2. CENTRAL LIMA AREA

Central Lima is composed of 16 districts: Cercado De Lima, La Victoria, Santiago De Surco, Rimac, Surquillo, San Miguel, San Borja, San Luis, Breña, Miraflores, Pueblo Libre, Jesús Maria, Lince, San Isidro, Magdalena del Mar and Barranco. It has a total population of 2,102,908 inhabitants in 2004, which represents 26.1 percent of the total metropolitan population. Generally, it includes high and middle-income residential areas with low densities, such as San Isidro, San Borja and Miraflores. Some districts, however, show relatively high population densities, including La Victoria (271 persons/hectare), Surquillo (295 persons/hectare), Breña (304 persons/hectare) and Lince (245 persons/hectare).

Most of the districts in central Lima show low population growth rates or even a decreasing tendency, except Santiago de Surco and San Borja. The percentage share of the population in the metropolitan area has significantly decreased over the last three decades: from 50.5 percent in 1972 to 41.3 percent in 1981 and to 29.1 percent in 1993, and it dropped to 26.1 percent in 2004. The urban development in central Lima is mainly characterized as having a vertical growth, particularly along the Paseo de la República and Avenida Javier Prado. In these areas, high-rise office towers and apartments have been developed in recent years.

The major business and commercial activities are concentrated in the axis from Cercado de Lima to Miraflores (i.e., along Paseo de la República) and the axis from San Isidro to La Molina (i.e., along Avenida Javier Prado). The historical center of Lima (Cercado de Lima) is one of the tourist attractions with its archeological monuments, and recently the area was designated as a site of UNESCO Cultural Heritage. However, the historical center of Lima has been invaded by massive informal traders and low-income groups, and its environment has been rapidly deteriorated.

2.4.3. NORTH LIMA AREA

North Lima is composed of 8 districts: San Martín De Porres, Comas, Independencia, Puente Piedra, Carabayllo, Ancon, Santa Rosa and Los Olivos. It has a total population of 1,873,250 inhabitants in 2004, which represents 23.3 percent of the total metropolitan population. Generally, it includes residential areas of low and middle-income social classes. Along the Panamericana highway, which is the most important trunk road connecting the metropolitan area with the north and south of the country, there is a concentration of manufacturing industries. Some of the industrial sites were recently transformed into modern shopping centers.

The far north of Carabayllo, Santa Rosa and Puente Piedra show a rapid increase of the population during the 1980s and 1990s, and these areas are mainly occupied by low-income social classes. The agricultural lands along the Chillón River have been transformed to residential uses.

2.4.4. SOUTH LIMA AREA

South Lima is composed of 12 districts: San Juan De Miraflores, Villa María del Triunfo, Villa El Salvador, Chorrillos, Lurin, Punta Hermosa, Cieneguilla, Pucusana, San Bartolo, Punta Negra, Pachacamac and Santa María Del Mar. It has a total population of 1,468,823 in 2004, which represents 18.3 percent of the metropolitan population. Basically, it is the residential area of the middle and low-income classes. In this area, there are still large agriculture lands in the river basin of Lurin, including Cieneguilla, Lurin and Pachacamac. Some of the agricultural lands have been gradually transformed into urban grounds in recent years. In Chorrillos, facing the Pacific Ocean, there is a large-scale ecological zone to protect the natural environment (Pantanos de Villa – Villa's Reservoir -).

The area, such as San Juan De Miraflores, Villa Maria Del Triunfo and Villa El Salvador, showed a rapid population growth during the 1980s. The recent urbanization has expanded towards the south along the Panamericana highway. In the far south, such as Punta Hermosa, Punta Negra, San Bartolo and Santa Maria Del Mar, summer vacation houses have been developed in front of the sea. The east of the Panamericana highway is still undeveloped and occupied by desert.

2.4.5. EAST LIMA AREA

East Lima is formed by 7 districts: San Juan De Lurigancho, El Agustino, Ate Vitarte, Lurigancho, Chaclacayo, La Molina and Santa Anita. It is located on the right and left borders of the Rimac River, along the Central highway. East Lima experienced the most rapid population growth during the period of the 1970s and 1980s. The annual population growth rate was 8.2 percent between 1972 and 1981 and 5.4 percent between 1982 and 1993, which was nearly double of the metropolitan average. Specifically, San Juan De Lurigancho, Ate Vitarte and La Molina had more than 10 percent of annual population growth rate during the period between 1972 and 1981.

East Lima is characterized as a mixture of residential and industrial uses. The industries are mainly located in Ate Vitarte and Lurigancho, along the Central highway. According to the social class, it is diversified: a great percentage of the population lives in marginal settlements in areas such as San Juan de Lurigancho and Ate Vitarte, but La Molina is occupied by middle and high-income classes. There were agricultural lands in Lurigancho along the Rimac River, but they have been rapidly lost and transformed into urban uses.

2.4.6. CALLAO AREA

Callao is formed by 6 districts: Callao, Bellavista, La Perla, Carmen De La Legua, Ventanilla and La Punta Callao play a great importance as the country's transport hub with the seaport and airport terminals. It has a total population of 811,610 habitants in 2004, which represented 10.1 percent of the metropolitan population. The annual population growth rate was relatively stable compared to other areas. 3.5 percent between 1972 and 1981; 3.0 percent between 1981 and 1993; and 2.1 percent between 1993 and 2004. It should be noted that a huge population growth can be seen in Ventanilla; it increased from about 20,000 habitants in 1981 to 95,000 habitants in 1993, and 176,000 habitants in 2004. The increased population is located mainly in marginal settlements and is immigrants from the rural areas in the country. According to social stratification, it corresponds to low and middle classes in general terms. Along the coastal road and Avenida Argentina, there is a concentration of manufacturing industries.

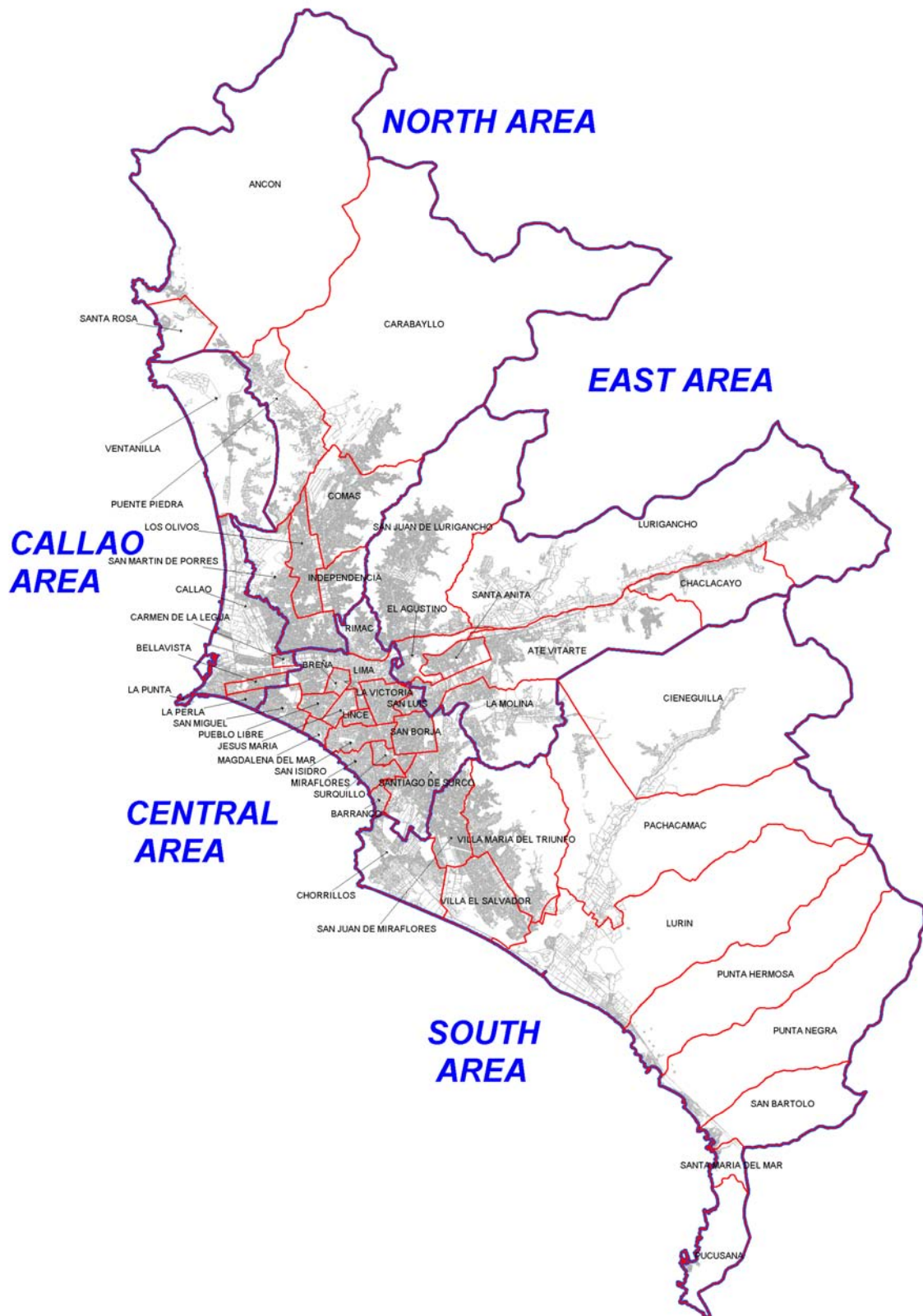


Figure 2.4-1 Map of the Metropolitan Area of Lima-Callao

Table 2.4-3 Populations Trends by District in the Metropolitan Area of Lima and Callao, 1972-2004

DISTRICT	AREA (ha)	Population				Annual Growth Rate		
		1972	1981	1993	2004	1972-1981	1981-1993	1993-2004
LA VICTORIA	874	274,948	284,798	230,063	237,284	0.39	-1.76	0.28
SANTIAGO DE SURCO	3,475	70,953	146,236	203,569	262,985	8.37	2.79	2.36
CERCADO DE LIMA	2,198	366,763	390,447	345,233	350,712	0.70	-1.02	0.14
RÍMAC	1,187	178,638	194,092	192,418	216,953	0.93	-0.07	1.10
SURQUILLO	346	64,330	99,176	89,714	102,274	4.93	-0.83	1.20
SAN MIGUEL	1,072	65,361	104,388	119,148	135,609	5.34	1.11	1.18
SAN BORJA	996	36,776	59,404	101,359	133,341	5.47	4.55	2.52
SAN LUIS	349	22,328	53,141	49,600	62,452	10.11	-0.57	2.12
BREÑA	322	116,151	118,251	91,244	98,193	0.20	-2.14	0.67
MIRAFLORES	962	103,317	108,841	88,344	98,122	0.58	-1.72	0.96
PUEBLO LIBRE	438	80,906	88,359	75,101	83,372	0.98	-1.35	0.95
JESÚS MARÍA	457	87,089	87,511	66,483	70,368	0.05	-2.26	0.52
LINCE	303	85,988	84,646	63,827	74,209	-0.17	-2.33	1.38
SAN ISIDRO	1,110	63,794	72,704	63,894	72,989	1.46	-1.07	1.22
MAGDALENA DEL MAR	361	58,888	58,427	49,655	56,133	-0.09	-1.35	1.12
BARRANCO	333	50,819	48,898	41,234	47,912	-0.43	-1.41	1.37
CENTRAL LIMA	14,783	1,727,049	1,999,319	1,870,886	2,102,908	1.64	-0.55	1.07
SAN MARTÍN DE PORRES	3,691	179,664	310,426	385,759	479,532	6.26	1.83	2.00
COMAS	4,875	183,358	304,548	410,066	502,669	5.80	2.51	1.87
INDEPENDENCIA	1,456	115,788	159,919	186,526	210,682	3.65	1.29	1.11
PUENTE PIEDRA	7,118	19,525	35,689	104,261	177,935	6.93	9.35	4.98
CARABAYLLO	34,688	28,827	55,550	108,049	153,595	7.56	5.70	3.25
ANCÓN	29,864	5,777	8,864	19,968	22,316	4.87	7.00	1.02
SANTA ROSA	2,150	225	518	3,962	16,304	9.71	18.48	13.72
LOS OLIVOS	1,825	53,061	93,762	231,367	310,217	6.53	7.82	2.70
NORTH LIMA	85,667	586,225	969,276	1,449,958	1,873,250	5.75	3.41	2.36
DISTRICT	AREA (ha)	Population				Annual Growth Rate		
		1972	1981	1993	2004	1972-1981	1981-1993	1993-2004
SAN JUAN DE MIRAFLORES	2,398	110,512	174,398	287,353	384,065	5.20	4.25	2.67
VILLA MARÍA DEL TRIUNFO	7,057	106,550	182,981	267,278	341,963	6.19	3.21	2.27
VILLA EL SALVADOR	3,546	80,778	147,679	258,239	344,439	6.93	4.77	2.65
CHORRILLOS	3,894	93,807	149,270	220,066	278,325	5.30	3.29	2.16
LURÍN	18,026	13,239	17,834	34,752	51,943	3.37	5.72	3.72
PUNTA HERMOSA	11,950	940	1,063	3,327	5,476	1.38	9.97	4.63
CIENEGUILLA	24,033	2,616	4,783	9,120	14,572	6.93	5.53	4.35
PUCUSANA	3,166	2,935	4,318	4,293	4,706	4.38	-0.05	0.84
SAN BARTOLO	4,501	1,509	3,065	3,350	3,646	8.19	0.74	0.77
PUNTA NEGRA	13,050	770	582	2,406	4,468	-3.06	12.55	5.79
PACHACAMAC	16,023	4,694	7,133	20,131	34,917	4.76	9.03	5.13
SANTA MARÍA DEL MAR	981	46	101	185	303	9.13	5.17	4.59
SOUTH LIMA	108,625	418,396	693,207	1,110,500	1,468,823	5.77	4.01	2.57
SAN JUAN DE LURIGANCHO	13,125	89,206	272,898	591,213	775,554	13.23	6.65	2.50
EL AGUSTINO	1,254	93,214	135,200	156,204	169,162	4.22	1.21	0.73
ATE VITARTE	7,772	48,822	118,865	270,162	365,176	10.39	7.08	2.78
LURIGANCHO	23,647	53,174	68,531	101,656	129,915	2.86	3.34	2.25
CHACLACAYO	3,950	22,143	33,237	36,502	42,510	4.62	0.78	1.39
LA MOLINA	6,575	6,160	15,422	79,341	142,575	10.73	14.63	5.47
SANTA ANITA	1,069	41,835	75,525	120,336	161,773	6.78	3.96	2.73
EAST LIMA	57,392	354,554	719,678	1,355,414	1,786,665	8.18	5.42	2.54
CALLAO	4,565	205,370	270,626	374,298	424,477	3.11	2.74	1.15
BELLAVISTA	456	41,084	69,181	72,543	87,800	5.96	0.40	1.75
LA PERLA	275	34,554	48,386	59,885	69,526	3.81	1.79	1.37
CARMEN DE LA LEGUA	212	26,935	39,516	38,616	46,524	4.35	-0.19	1.71
VENTANILLA	7,352	17,359	20,186	95,654	175,803	1.69	13.84	5.69
LA PUNTA	75	6,926	6,418	6,569	7,480	-0.84	0.19	1.19
CALLAO	12,935	332,228	454,313	647,565	811,610	3.54	3.00	2.07
TOTAL	279,402	3,418,452	4,835,793	6,434,323	8,043,256	3.93	2.41	2.05

(Source: INEI)

CHAPTER 3

Person Trip Characteristics

3. PERSON TRIP CHARACTERISTICS

3.1. OUTLINE OF TRANSPORT SURVEYS

3.1.1. SURVEY FRAMEWORK

The Study Team conducted various transport surveys for obtaining the characteristics of existing transport situation. The major transport surveys conducted in the Study are listed as shown in Table 3.1-1:

Table 3.1-1 Outline of Transport Surveys

No.	Survey	Objective	Coverage	Method
1	Person Trip Survey	Socio-economic profile and trip information of residents	35,000 sampled households in the Study area (2.0%)	Directly interviewing all members of selected households
2	Cordon Line Survey	Traffic volume and travel information of non-residents	Seven stations at boundaries of the Study area including Jorge Chávez. international airport	Counting traffic during 17 or 24 hours, direct interviews of passengers and drivers, and observation of vehicle occupancy
3	Screen Line Survey	Traffic volume and vehicle occupancy at screen line	13 stations along Rimac river and 7 stations along South Pan-American highway	17 or 24 hour traffic counting and observation of vehicle occupancy
4	Traffic Count Survey	Traffic volume and vehicle occupancy on trunk road	17 stations for 24 hour survey and 92 stations for 4 hour survey in the morning peak	4 or 24 hour traffic counting and observation of vehicle occupancy
5	SP Survey	Stated preference on modal choice	1,285 sampled households along railway line N°1, covering every economic level	Direct interview to selected household members
6	Destination Survey	Characteristics on modal choice at destination place	Approximately 1,200 people sampled at 10 destinations regarding activity such as company, market, and school, etc.	Direct interview to selected people
7	Travel Speed Survey	Travel speed on major road sections	Observation in on and off peak hour on 21 major corridors	Three round trips in time period by route with floating car method
8	Freight Survey	Characteristics of goods and freight flow	7 stations for 24 hour survey, 3 stations for 17 hour survey, and five major transport companies for interviewing	Traffic counting survey and direct interview to drivers. Hearing survey at selected transport companies.
9	Taxi Survey	Characteristics of taxi usage	150 vehicles from authorized, unauthorized and company taxies and 50 moto-taxis.	Recording the movement of operation by using GPS machine
10	Road Inventory Survey	Structure of sections on principal roads	109 points, same stations as traffic count survey	Observation and measurement at typical point in each section
11	Parking Survey	Parking infrastructure and characteristics of parking demand	Existing public and private parking facilities in five central districts, and 80 stations for demand survey	Direct interview with administrators for inventory survey, and counting demand with "number plate matching" methodology

Note: Public transport surveys that will be discussed in another chapter are excluded.

3.1.2. PERSON TRIP SURVEY

The most important survey is the Person Trip (PT) survey. The objective of the PT Survey is to understand the movement of people on a particular day related with their socio economic characteristics.

(1) Coverage

The Study area covers the metropolitan area of the municipalities of both Lima and Callao, including 49 districts. The Study area is initially divided into 427 traffic zones; CENSUS manzanas in every traffic zone are selected in proportion to their population. In total, 35,040 households (2.0 percent) are selected and interviewed. The interview covers all members in the selected households in terms of individual information and trip information of only people 6 years old and above is collected.

(2) Survey Method

In order to determine the households to be interviewed, an “area sampling” is adopted due to the absence of complete household listings. First, the target number of households by zone is determined, then manzanas are selected randomly, and finally interviews are conducted in households in the selected manzanas at a certain interval until the target number is satisfied. Direct interviews are conducted with every one of the household members, and their answers are recorded in the questionnaire by interviewers. If not all the household members are present during the visit; the household is again visited at a later time and date. The manzanas sampled for the Person Trip Survey is shown in Figure 3.1-1.

(3) Survey Items

The information to be collected by the survey is listed and described as follows:

- a) Household Information: covers the socio economic characteristics of household members, household structure, vehicle ownership, income level, location of residence, etc.
- b) Personal Information: covers the socio economic characteristics of household members. These include age, sex, occupation, work and/or study address, etc.
- c) Trip Information: covers the characteristics of trips made by the members of selected households, including origin and destination, trip purpose, travel mode, departure and arrival time, etc.
- d) Information on modal choice: covers the characteristics of perception in terms of modal choice, including reason of mode choice, travel time and travel cost of mode used and alternative, etc.

(4) Survey Schedule

The Person Trip Survey is conducted according to the schedule shown in Table 3.1-2.

Table 3.1-2 Person Trip Survey Schedule

Activity	Schedule
Preparation (training, zoning, sampling, etc.)	25 May – 13 June (3 weeks)
Interview Survey in Field	14 June – 8 August (8 weeks)
Coding	28 June – 15 August (7 weeks)
Encoding	12 July – 15 August (5 weeks)
Error Check and Collection	16 August – 3 October (7 weeks)