

**Plurinational State of Bolivia
Secretariat of Public Works and
Land Use of the Department of
Santa Cruz**

Transport Improvement Master Plan Project for Santa Cruz Metropolitan Area

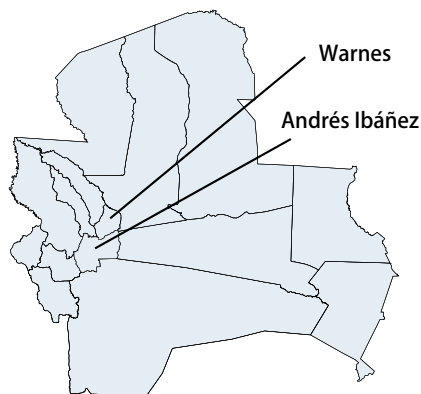
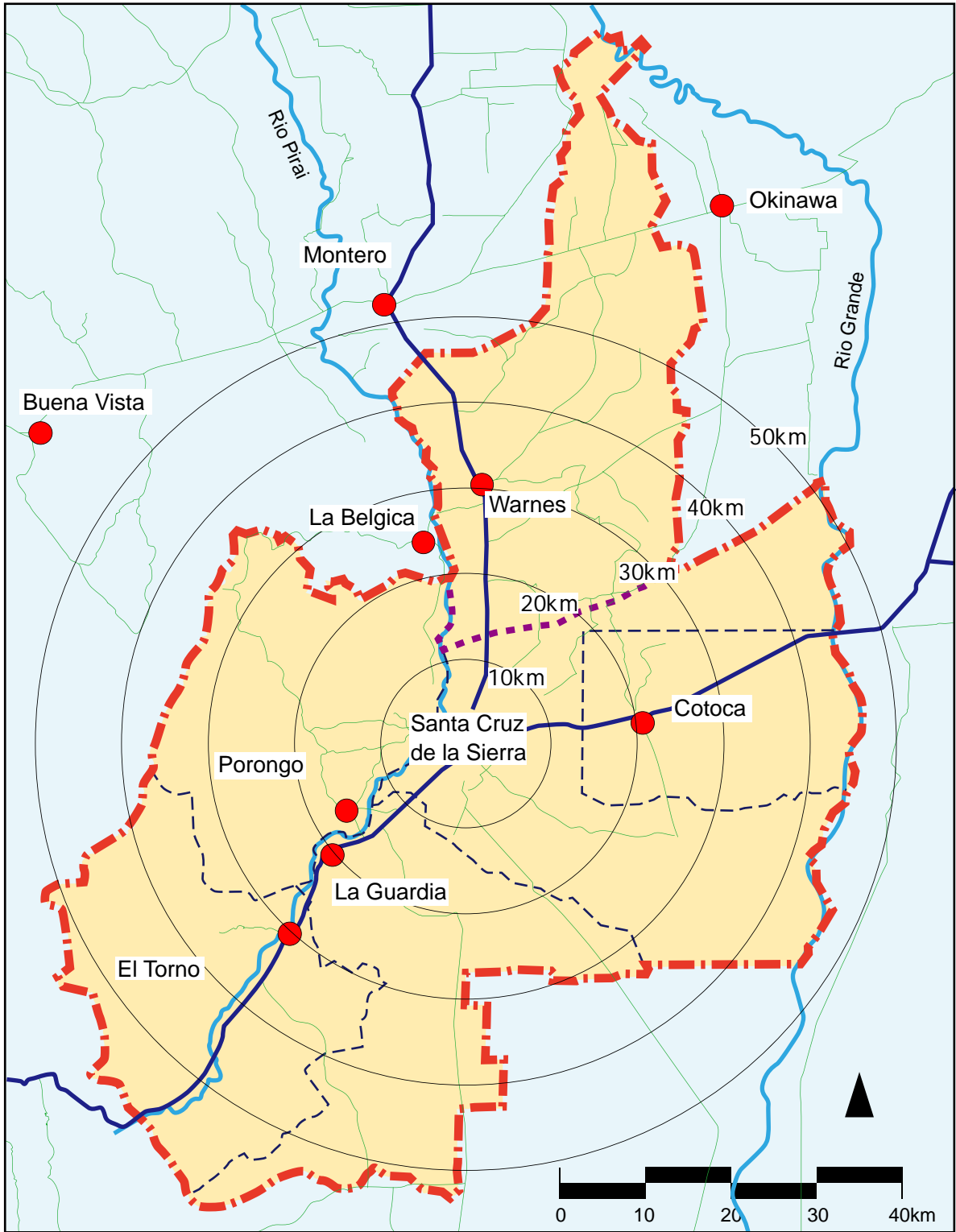
Final Report

December 2017

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

**NIPPON KOEI CO., LTD.
TAMANO CONSULTANTS CO., LTD.
ORIENTAL CONSULTANTS GLOBAL CO., LTD.
NIPPON KOEI LAC CO., LTD.**

EI
JR
17-145



- - - - - Área Metropolitana
- - - - - Provincia
- - - - - Municipal



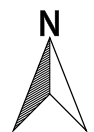
Legend

- Market
- Terminal
- University
- Plaza

Transport Improvement Master Plan Project for Santa Cruz Metropolitan Area

Location Map

0 1 2 3 4 km



**Transport Improvement Master Plan Project for Santa Cruz Metropolitan Area
Final Report**

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ABBREVIATIONS

ABC	Bolivian Highway Administration	FHWA	Federal Highway Administration of the USA
AGT	Automated Guided Transit	GAD	Departmental Autonomous Government (Gobierno Autónomo Departamental)
ANH	National Hydrocarbons Agency	GAM	Municipal Autonomous Government (Gobierno Autónomo Municipal)
BCIE	Central American Bank for Economic Integration	GDP	Gross Domestic Product
BEI	European Investment Bank	GHG	Green House Gas
BIRF	International Bank for Reconstruction and Development	GIS	Graphical Information System
BOD5	Biochemical Oxygen Demand of five days	GPRS	General Packet Radio Services
BRT	Bus Rapid Transit	GPS	Global Positioning System
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes	HBE	Home Based Education
CAD	Computer Aided Design	HBO	Home Based Other
CAF	Construcciones y Auxiliar de Ferrocarriles	HBW	Home Based Work
CBD	Central Business District	HDI	Human Development Index
CCTV	Closed-Circuit Television	HIPC	Heavily Indebted Poor Countries
CDS	Cumulative Distribution Function	HIS	Household Interview Survey
CEA	Centro de Estudios Ambientales (Center of Environmental Studies)	HOV	High Occupancy Vehicles
CFBC	Bi-oceanic Central Rail (Corredor Ferroviario Bioceánico Central)	IBCE	Instituto Boliviano de Comercio Exterior
CIIU	Clasificación Industrial Internacional Uniforme	IC	Integrated Circuit
CLS	Cordon Line Survey	IDB	Inter-American Development Bank
CNES	Centre National d'Etudes Spatiales	IGM	Instituto Geográfico Militar (Military Geographic Institute)
CNL	Cámara Nacional de Industrias	INC	Instituto Nacional de Colonización (National Colonization Institute)
CNI	National Intelligence Centre	INE	Instituto Nacional de Estadística de Bolivia
CO2	Carbon Dioxide	INRA	Instituto Nacional de Reforma Agraria
COD	Chemical Oxygen Demand	IOB	Indian Oversea Bank
COPAGUA S	Corporación de Agua Potable y Alcantarillado	IPBI	Real Estate Property Tax (Impuestos a la Propiedad de Bienes Inmuebles)
COSUDE	Swiss Agency for Development and Cooperation	IPCC	Intergovernmental Panel on Climate Change
COX	Carbon oxides	ISIC	International Standard Industrial Classification
CS	Commuter Trip Survey	ISO	International Organization for Standardization
CUO	Urban Planning Code and Works	IT	Information Technology
D.D.T.	Direction of Traffic and Transport	ITS	Intelligent Transport System
D.S.S	Direction of Road Traffic Sign and Traffic Light	IUCN	International Union for Conservation of Nature
DEI	Sistem of Deteccion Electronica de Infracciones	JICA	Japan International Cooperation Agency
DPSIR	Driving forces, Pressures, States, Impacts, and Responses	KMH	Kilometer per Hour
EAP	Environmental Attribute Punctuation	LAI	Leaf Area Index
EDI	Integrated Development Strategies (Estrategias de Desarrollo Integral)	LDB	Lao Development Bank
EIA	Environmental Impact Assessment	LED	Light Emitting Diode
EIRR	Economic Internal Rate of Return	LRT	Light Rail Transit
EMACRUZ	Municipal Enterprise of Cleaning of Santa Cruz (Empresa Municipal de Aseo de Santa Cruz)	LST	Land Surface Temperature
FAN	Foundation of Friends of Nature (Fundación Amigos de la Naturaleza)	M/P	Master Plan
FAO	Food and Agriculture Organization of the United Nation	MLIT	Ministry of Land, Infrastructure, and Transportation, Japan
		MMAyA	Ministry of Environment and Water (Ministerio de Medio Ambiente y Agua)
		MODIS	Moderate Resolution Imaging

	Spectroradiometer
MONICA	Air Quality Monitoring Network (Red de Monitoreo de Calidad de Aire)
MOPITT	Measurements of Pollution in The Troposphere
MOPSV	The Ministry of Public Works, Services and Housing
MPN	Maximum Probable Number
NASA	National Aeronautics and Space Administration
NDVI	Normalized Difference Vegetation Index
NGO	Non-Governmental Organization
NGV	Natural Gas Vehicle
NHBB	Non-Home Based Business
NHBO	Non-Home Based Other
NMT	Non-Motorized Transport
NO2	Nitrogen dioxide
NPV	Net Present Value
NTU	Nephelometric Turbidity Unit
OD	Origin-Destination
ODA	Official Development Assistance
OMI	Ozone Monitoring Instrument
OTBs	Community based organizations (Organizaciones Territoriales de Base)
OTPR	Technical Office of Regulatory Plan (Oficina Técnica de Plan Regulador)
PASA	Application and Assessment Plan (Plan de Aplicación y Seguimiento Ambiental)
PCB	Polychlorinated biphenyl
PCU	Passenger Car Unit
PD 1995	Santa Cruz de la Sierra Master Plan of 1995
PDD	Department Development Plan (Plan de Desarrollo Departamental)
PDES	Plan of Economic and Social Development under the Integral Development for Living Well
PDM	Municipal Development Plan
PDOT	Plan Deptmental de Ordenamiento Territorial
PDSI	Integral Development Sectoral Plan
PEI	Institutional Strategy Plans (Plan Estratégico Institucional)
PENT	Población en Edad de No Trabajar
PEP	Plans Public Enterprises
PET	Población en Edad de Trabajar
PGDES	General Plan of Economic and Social Development
PGTC	Plans of Community Land Management for Living Well
PILAT	Latin America Industrial Park
PIU	Urban Intervention Plans
PLANAST	National Transport Sector Plan
PLOT	Plan Ordenamiento Territorial
PLUS	Plan de Uso del Suelo
PM10	Particulate matter 10 micrometers or less in diameter

PM2.5	Particulate matter 2.5 micrometers or less in diameter
PMOT	Municipal Territorial Ordering Plan
POA	Plan Operativo Anual (Annual Operation Plan)
POT	Plan de Ocupación de Territorio
POUT	Urban and Territoriaa Ordering Plan
PPM	Prevention and Mitigation Plan (Programa de Prevención y Mitigación)
PRECIS	Providing Regional Climate for Impact Studies
PRODET	Seapartment Transport Program
PROMUT	Municipal Transport Program
PSDI	Sector Plans of Integrated Development for Living Well
PTDI	Land Plans of Integrated Development for Living Well
RC	Reinforced Concrete
RENCA	National Registry of Environmental Consultants
RGDP	Regional Gross Domestic Product
RGGA	Regulation on Environmental Management
RMSC	Region Metropolitan of Santa Cruz
ROW	Right-of-Way
RSA	Road Safety Audit
RUAT	Registro Unico para la Administration Tributaria Municipal
SAGUAPA C	Servicio de Agua Potable y Alcantarillado Sanitario
SDAP	Sistema Departamentalde Areas Protegidas
SEA	Strategic Environmental Assessment
SEARPI	Servicio de Encausamiento de Aguas y Regulación del Río Piraí
SEGIP	General Service of Personal Identification
SEDCAM	Servicios Departamentals de Caminos
SENAMHI	National Service of Meteorology and Hydrology (Servicio Nacional de Meteorología e Hidrología)
SENMA	National Secretariat of Environment (Secretaría Nacional de Medio Ambiente)
SERNAP	National Service of Protected Areas (Servicio Nacional de Áreas Protegidas)
SIB	Sociedad de Ingenieros de Bolivia
SIMCA	Sistema de Información para el Monitoreo y Control de la Calidad de las Aguas
SISMET	Meteorological Data Processing System (Sistema de Procesamiento de Datos Meteorológicos)
SISPLAN	National System of Planning (Sistema Nacional de Planificación)
SIT	Integrated System of Public Transport
SME	Small and medium enterprise
SOPOT	Secretariat of Public Works and Land Use of the Santa Cruz Department
SPIE	Integral State Planning System (Sistema de Planificación Integral del Estado)
SUV	Sport Utility Vehicle
TAVI	Motor Vehicle Property Tax
TAZ	Traffic Analysis Zone

TCOs	Tierra Comunitarias de Origen
TDM	Traffic Demand Management
TDS	Total Dissolved Solid
TOC	Total Organic Carbon
TOD	Transit Oriented Development
TSS	Total Suspended Solid
TWG	Technical Working Group
UBN	Unsatisfied Basic Needs
UCPN	Conservation Unit of Natural Asset
UDAPE	Social and Economic Policy Analysis Unit
UMTS	Universal Mobile Telecommunications System
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNE	Universidad Nacional Ecológica
UNMI	Natural Unit of Integral Management
UPRE	Special Projects Unit
UPSA	Private University of Santa Cruz de la Sierra
UTM	Universal Transverse Mercator
UV	Neighbourhood Unit (Unidad Vecinal)
VCR	Volume Capacity Ratio
VMS	Variable Message Signs
VMT	Vice Minister of Transport
VOC	Vehicle Operating Cost
VOC	Volatile Organic Compounds
WHO	World Health Organization

Chapter 1 Outline of the Project

1.1 Background

The Santa Cruz Metropolitan Area is the second largest urban area and economic center of Bolivia. The population of the area is 1.75 million and increasing in rapid pace as much as 2.4% per year. The recent economic growth rates show a good economic performance of the Department of Santa Cruz.

Due to increase in population and vehicles, the Santa Cruz Metropolitan Area faces various transport issues, such as traffic congestions, insufficient service of public transport and traffic accidents. Also, the limited capacity of urban drainage causes submersion on the road which makes traffic condition worse.

Metropolitan area is low density on the whole. Low-rise buildings are dominant even in the CBD, as urban area is expanding to outskirts where newly developed as residential areas. Urban sprawl is proceeding in the backdrop that land use management does not function well. This fact makes it difficult to create effective transport system.

In this background, the Government of Bolivia requested to the Government of Japan for the formulation of transport master plan for Santa Cruz Metropolitan area.

The “Record of Discussions on Urban Transport Improvement Master Plan Project for Santa Cruz Metropolitan Area in the Plurinational State of Bolivia” was signed December 14th, 2015.

1.2 Project Goal and Outputs

The goal of the Project (Urban Transport Improvement Master Plan Project for Santa Cruz Metropolitan Area in the Plurinational State of Bolivia) is to improve the transport conditions in Santa Cruz Metropolitan Area. The outputs are:

- M/P for Santa Cruz Metropolitan Area
- Technical Transfer to formulate M/P

1.3 Project Components

The Project consists of the following components.

- Traffic surveys including the household interview survey
- Formulation of the Transport Improvement Master Plan (M/P) for the Metropolitan and the Central Area with Strategic Environment Analysis (SEA)
- Analysis and proposal of drainage system in the Central Area
- Proposal on the revision of the land use plan
- Two stakeholder meetings and two seminars
- Technical Transfer of the M/P
- Training in Japan

1.4 The Transport Improvement Master Plan

The Transport Improvement Master Plan (M/P) consists of the two components as:

- 1) Transport Master Plan for Metropolitan Area
- 2) Transport Master Plan for the Central Area

1.4.1 Target Year

The target year of M/P is 2035. The plans for the intermediate years of 2020 and 2025 were prepared as short-term and medium-term plans.

1.4.2 Project Area

The Project area is the Santa Cruz Metropolitan Area consisting of Santa Cruz de la Sierra, Cotoca, Warnes, El Torno, La Guardia, and Porongo. The metropolitan area has a population of 1.75 million in 2012.

The area of the Project Area is calculated from GIS data provided by the Department of Santa Cruz at 6,085 km² as shown in Table 1-1.

Municipality	Area (km ²)
Santa Cruz de la Sierra	1,275
Cotoca	622
Porongo	947
Warnes	1,321
La Guardia	957
El Torno	963
Total	6,085

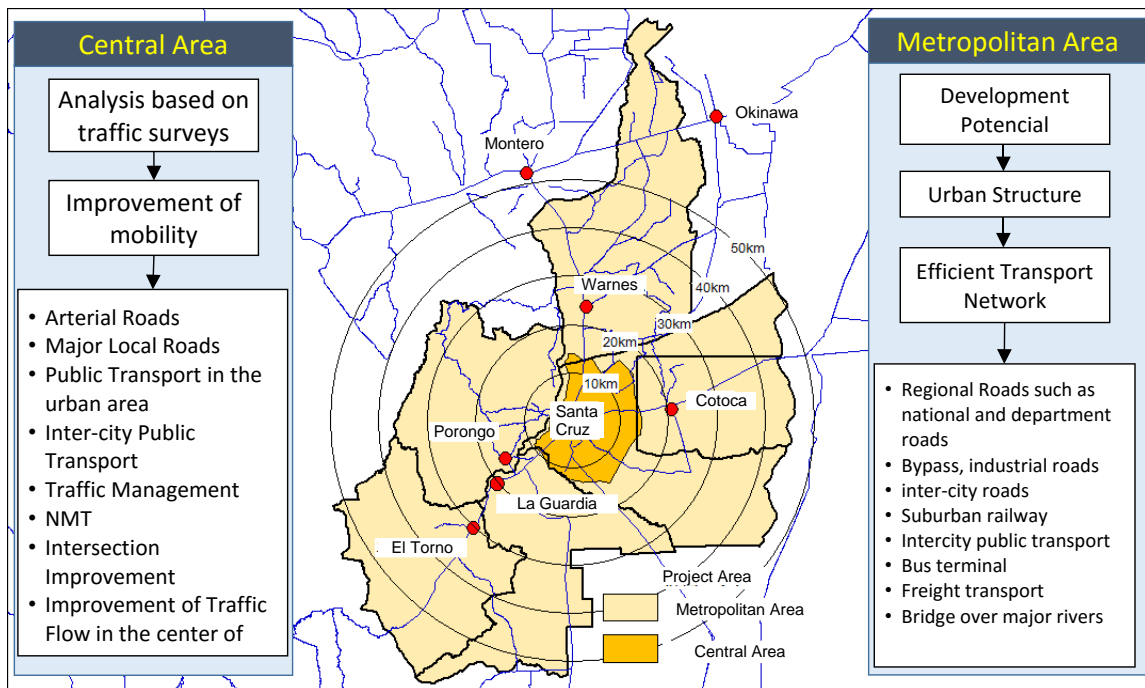
Source: Calculated based on GIS data provided by the Department of Santa Cruz

(1) Transport Master Plan for Metropolitan Area

The area of the Transport Master Plan for Metropolitan Area is as same as the Project Area.

(2) Transport Master Plan for the Central Area

The area of the Transport Master Plan for the Central Area is the urban area of Santa Cruz de la Sierra and its adjoining area where the urbanization is in progress.



Source: JICA Study Team

Figure 1-1 Project Area

1.4.3 Role of the Master Plan

The major role of the Master Plan is:

- To illustrate and describe the future transport system in the Metropolitan Area as the guideline of the decision making for project formulation and implementation (Blueprint)
- To indicate the locations of the future transport facilities as the guideline of development permissions and regulations of buildings (restriction, permission, and approval)
- To show the roadmap to realize the future transport system and identify the necessary programs and projects for the guideline of concrete actions (action plan)

The Master Plan includes not only the list of policies, plans, and programs but also the justifications of them. The results of traffic surveys and the demand forecasts are important references of the justifications.

1.4.4 Structure of the Master Plan

The Master Plan consists of the following contents:

- Diagnosis of the present situation
- Vision, general objectives, specific objectives, and targets
- Regional and Urban structure
- Policy, plans, and projects for the road infrastructure
- Policy, plans, and projects for the public transport system
- Policy, plans, and projects for the traffic management
- Policy, plans, and projects for non-motorized transport

- Socioeconomic framework at traffic zone level
- Demand analysis and the future demand forecast of road traffic and public transport

The definition of the vision, general objectives, specific objectives, targets, policy, and programs and projects are described below.

Table 1-2 Structure of Master Plan

Structure	Definition
Vision	Description of the future picture which is expected to be realized by the improvement of transport system in the Metropolitan Area
General Objectives	Clear description of the future situation
Specific Objectives	Breakdown of the General Objectives
Targets	Realistic and measurable target to achieve the Specific Objectives
Policy (by sector)	Statements to justify the programs and projects
Programs and projects (by sector)	Activities to be implemented during the master plan period

Source: Inception Report

1.5 Project Implementation

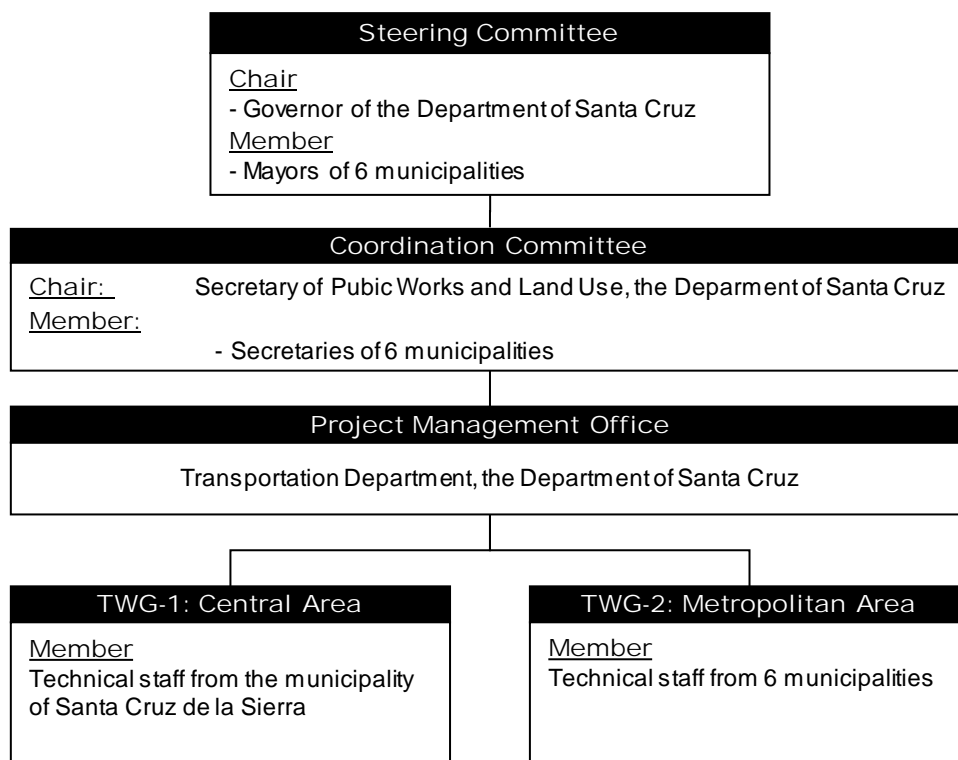
1.5.1 Implementation Structure

The Secretariat of Public Works and Land Use of the Department of Santa Cruz (SOPOT) was responsible for the implementation of the Project. Based on the agreement for the Project, the Steering Committee and the Coordination Committee were established. The Steering Committee, consisting of mayors of the six municipalities and the Governor of the Department of Santa Cruz, was the organization for the final approval of the proposal of the Project. The Coordination Committee, consisting of the SOPOT and the Secretariat of Institutional Coordination of the Department of Santa Cruz, and the secretaries of the six municipalities, was responsible for the coordination and approval of the intermediate reports of the Project.

For the technical works and the capacity development, two technical working groups were established, one was for the central area, and the other was for the metropolitan area.

The Transport Direction under the SOPOT (SOPOT.DT) worked with the JICA Study Team for organizing the workshops, forums, and arrangement of various meetings and data collection. Although SOPOT.DT was not mentioned in the implementation structure in the R/D, it plays an important role as the Project Management Office.

Figure 1-2 shows the implementation organization chart.

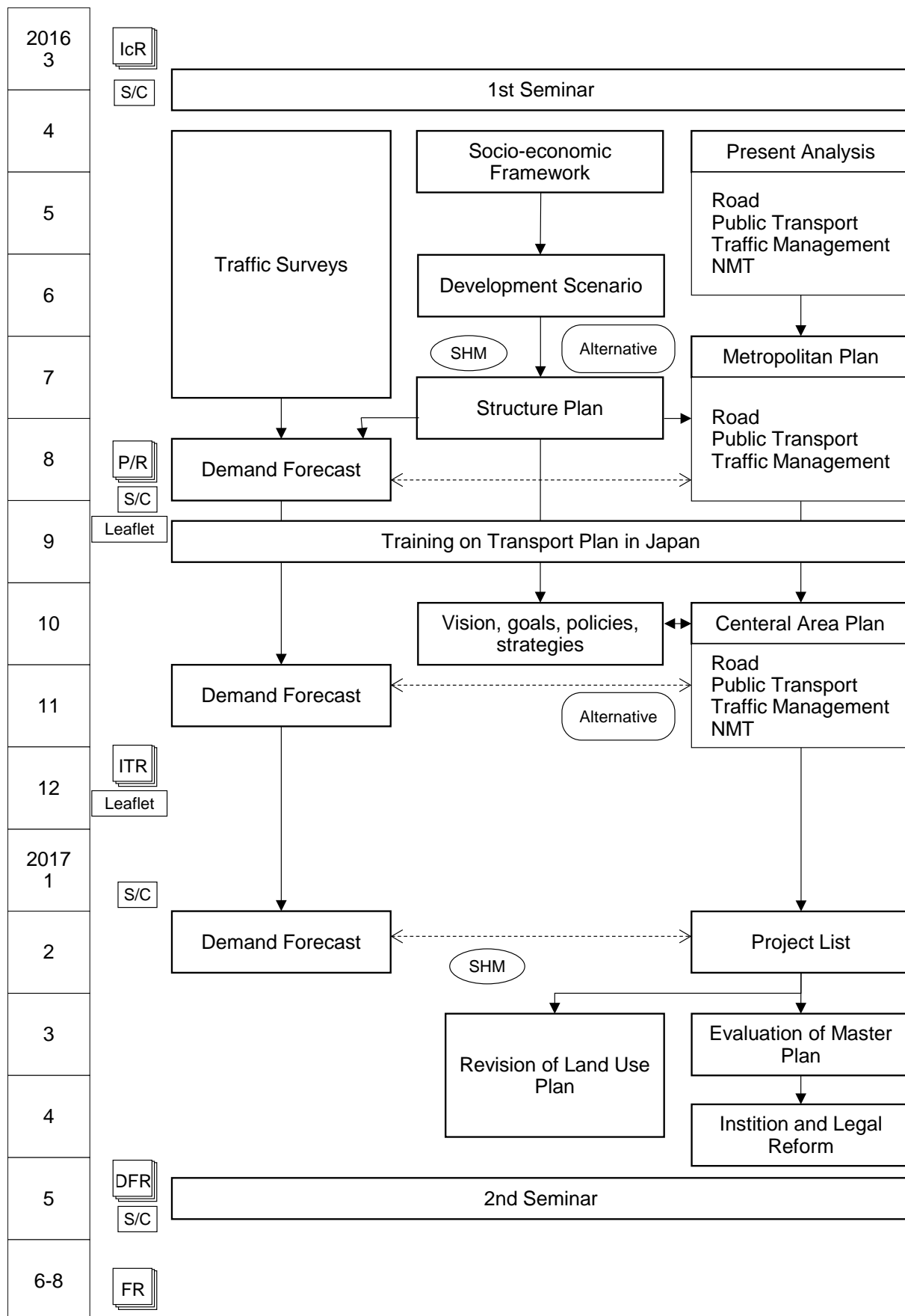


Source: JICA Study Team

Figure 1-2 Implementation Structure of the Project

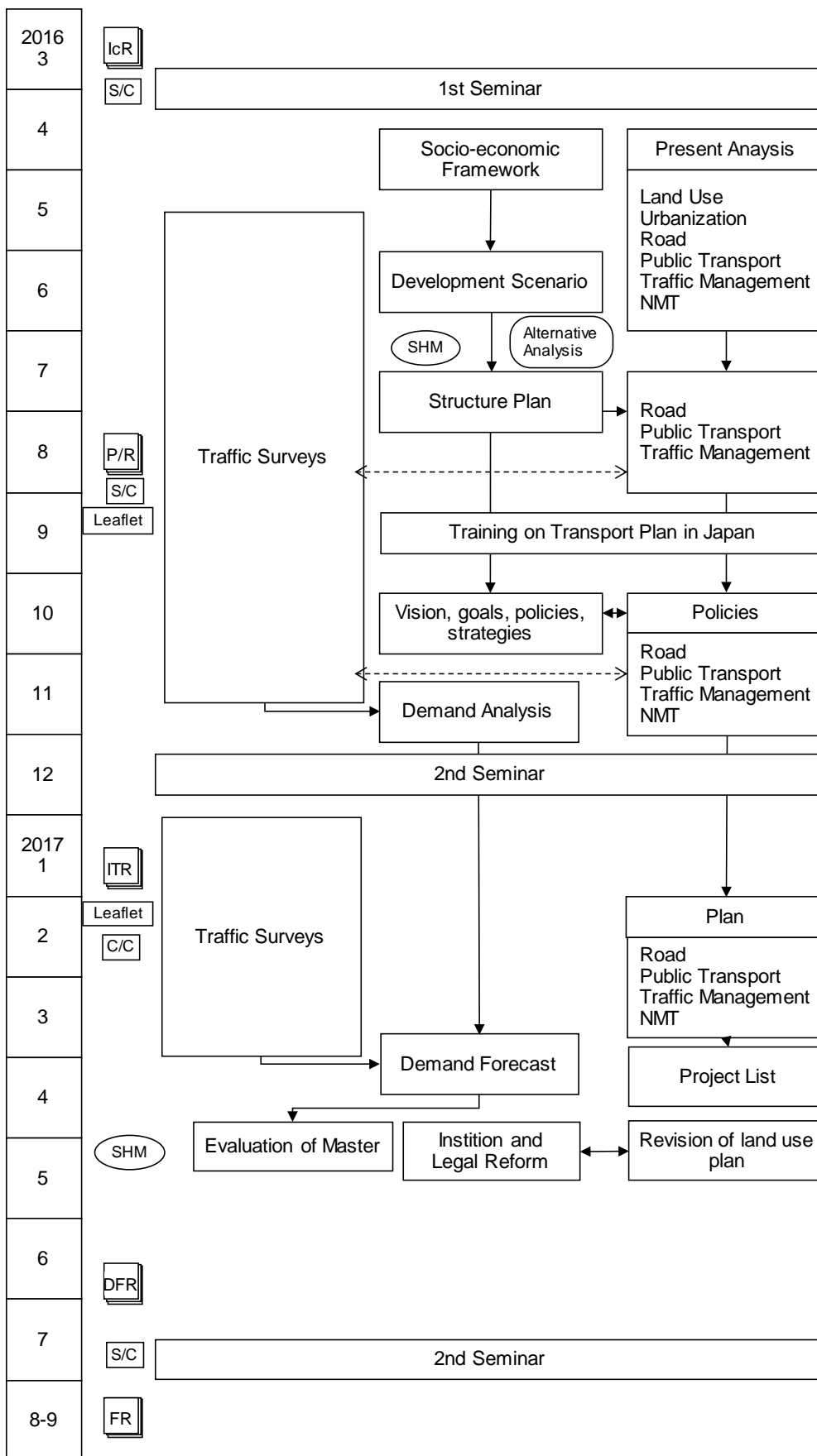
1.5.2 Work Flow

Figure 1-3 shows the original workflow of the Project. Due to the delay of the Traffic Surveys, the schedule of the Project was changed as shown in Figure 1-4.



Source: JICA Study Team

Figure 1-3 Original Work Flow of the Project



Source: JICA Study Team

Figure 1-4 Actual Work Flow of the Project

1.6 Activities of Technical Working Group

1.6.1 Weekly Workshop

As a part of the technical transfer, workshops with the participation of the members of the TWG was conducted every week from April to July except several weeks when other events were taken place. In the workshops, experts of the JICA Study Team made presentations on transport planning. There was no workshop in September due to the training in Japan. From October, the counterpart has taken the initiative for the workshop.

Table 1-3 List of Work Shops in Technical Working Group

Month	Date	Topic	Content
April	1	Introduction of the Project	JICA Study Team explained the outline of the Project such as the goal, objectives, schedule, activities, methodology, and project organization to the member of TWG-2.
	4	Transport problems in Santa Cruz	Members of TWG-1 made following presentations to JICA Study Team. 1) Urban transport project (Accion Vecinal) 2) Public transport system in Santa Cruz de la Sierra (Accion Vecinal) 3) Urban planning in Santa Cruz de la Sierra (Urban Planning)
	7	Urban transport problems (1)	Various problems in urban transport sector were explained using the interview forms that were used in JICA projects.
		Interview items in the Person Trip Survey	The contents of the interview forms of the Person Trip Survey were explained. Participants filled in the interview forms as a trial.
	22	Strategic Environmental Assessment (SEA)	JICA Study Team explained the basic concept, history, process, and legal framework of the SEA in Bolivia. The participants were requested to provide the baseline data of the SEA.
	28	Urban transport problems (2)	Various problems in urban transport sector were explained using the checklist for diagnosing transport problems.
		Person trip survey	The concept of the person trip survey was explained, and participants learned the method of making OD matrices through exercises.
May	6	Present population	The concept of projection method of the population was explained, and estimation of the present population in the metropolitan area was discussed.
	13	Introduction of traffic demand forecast	The necessity and outline of the traffic demand forecast in transport planning were explained.
		Transport infrastructure development in sprawl area	The usefulness of a transport master plan for infrastructure development in urban sprawl area was explained by using the sample of the JICA's transport master plan of Katmandu in Nepal.
	20	Structure of demand forecast and trip generation and attraction model	The JICA Study Team explained: <ul style="list-style-type: none"> The structure of four-stage traffic demand forecast model Detail method of trip generation and attraction model in the four-stage traffic demand forecast.
		Impact of the master plan in the metropolitan area	Introduction of Nairobi urban development plan to show how planning in metropolitan area consisting of municipalities and how
27	Trip distribution model and modal split model in the demand forecast	The JICA Study Team explained:	

Month	Date	Topic	Content
			<ul style="list-style-type: none"> • Detail method of the trip distribution model • Detail method of the modal split model
		Traffic Surveys	<p>The JICA Study Team explained:</p> <ul style="list-style-type: none"> • The schedule, locations, and methodology of traffic count survey with video recording • The methodology of the vehicle occupancy survey
June	3	Implementation plan of the person trip survey	The sampling method, schedule, organization structure, and interview method using tablets were explained. A small exercise was conducted in the TWG to check if the participants understand the concept of the person trip survey.
		Cordon line survey and travel speed survey	The method and survey schedule of the cordon line survey and travel speed survey were explained. The JICA Study Team requested participants to cooperate the conduct of the surveys.
	17	Discussion on urbanization	Participants discussed the problems of decentralization such as the distribution of subsidy, limited power, and inefficient regulations on urban development.
	24	Urban planning and urban renewal in Japan	Based on the request from the TWG members, the methods of development controls in Japan, including incentive methods in urban redevelopment, were explained.
		Traffic assignment and activity diary survey	The methodology of the traffic assignment in demand forecast model and the contents of the activity diary survey were explained.
July	8	Socio-economic Framework	The methodology of the Cohort model for the estimation of the future population was explained. The results of the population projection and GDP growth rates for the metropolitan area were presented.
	15	Urban transport system (1)	<p>The following topics of the urban transport system were explained:</p> <ul style="list-style-type: none"> • Classification • Various types of urban transport systems • Calculation of the capacity • Calculation of the operation speed • Railway accidents on single track lane
		Analysis tools of the natural environment	The methodology of analyzing environmental data using QGIS was introduced.
	22	Urban transport system (2)	Various topics on urban transport systems were explained. Development of the urban transport systems in Lima was shown.
	29	Statistics for the analysis of traffic surveys	The basic concept of the statistics for the analysis of the results of the traffic surveys was explained, especially the calculation of the necessary number of samples and the evaluation of collected data.
August	3	Traffic management	The concept and planning approach to traffic management was explained, and the issues on traffic safety and other traffic management problems were discussed.
October	7	Discussion of the Vision	The vision of the master plan was discussed.
	14	Presentations on experiences of other countries	For the better understanding of the vision, experiences of other countries were presented by participants. The contents are: <ul style="list-style-type: none"> • Urban mobility in Milano, Italia

Month	Date	Topic	Content
			<ul style="list-style-type: none"> • Urban transport systems in Lima and Medellin • Case study of Curitiba • Master plan process in Japan
	21	Making a draft of the Vision	The vision of the master plan was discussed among the participants, and two drafts were presented.
	28	Discussion of the Objectives	Draft objectives were explained by the JICA Study Team, and the contents were discussed.
November	4	Road Network	The road development plans and projects of the Department of Santa Cruz were explained by the Department, followed by the first draft of the road network plan of the Master Plan. The contents of the plan were discussed among the participants.
	11	Progress of the Traffic Surveys	The progress of the traffic surveys was presented.
	16	Road Network	The revised road network plan was presented and discussed. Participants are from municipalities.
	18	Public Transport System	The analysis of the public transport system was presented by the JICA Study Team
	25	Road Network	The revised road network plan was presented and discussed. Participants are from the Department of Santa Cruz.

Source: JICA Study Team

Table 1-4 List of Work Shops in Technical Working Group (2017)

Month	Date	Topic	Content
February	10	Introduction of the Interim Report	JICA Study Team explained the contents of the Interim Report.
March	22	Revision of the land use plan	Participants explained the present situation of the plans of each municipality and discussed how to revise their plan according to the transport master plan.
April	07	Introduction of the land use management of La Guardia	The land use management of La Guardia was explained by the member in La Guardia.
	13	Presentation of the proposed public transport system	JICA Study Team only explained the concept of the public transport plan to the members, and there was no discussion regarding the plan.
	21	Discussion on control method of urban development	The methods to control urban developments in suburban areas were discussed.

Source: JICA Study Team

1.6.2 Workshop on Drainage System

A workshop focusing on the drainage system in Santa Cruz de la Sierra was held on August 2nd, 2016 at the Direction of Drainage of the municipality of Santa Cruz, where 24 engineers participated. The JICA Study Team emphasized that construction of a canal to the Rio Grande will be necessary in future, although participants had an opinion that it would be possible to deal with the drainage problem within the municipality.



1st April, 2016



4th April, 2016



7th April, 2016



22nd April, 2016



6th May, 2016



13th May, 2016



20th May, 2016



24th June, 2016

Source: JICA Study Team



15th July, 2016



22nd July, 2016



29th July, 2016



7th October, 2016



14th October, 2016



21st October, 2016



4th November, 2016



2nd August, 2016

Source: JICA Study Team

1.6.3 Data Collection

(1) Methodology of Data Collection

JICA Study Team requested municipalities to provide necessary data through the members of TWG at the beginning of the Project, and most data were submitted from municipalities. In case that the requested data are missing, JICA Study Team requested during the Project periods through the TWG. The project members of SOPOT assigned to the Project also collected many data which were not provided through the TWG.

The following basic data for the planning of the master plan was collected through the members of the TWG.

1. Plans (PDM, PMOT, PLUS)
2. Organization chart, Number of staff, and Budget
3. Area
4. Boundary map of urban area and rural area
5. Present land use map
6. List and location map of schools with no. of students by school type
7. List and location map of university with no. of students
8. List and location map of tourist attraction
9. Fare system of public transport
10. List of road projects and public transport projects
11. No. of registered vehicles

(2) Data not available

Despite the efforts of the data collection, the following data were not available because some do not exist, some are incomplete, and some are difficult to obtain from relevant authorities.

No	Data item	Remark
1.	Traffic accident statistics	The traffic police own the individual data of traffic accident, but it is necessary to combine all the records to make a summary, which requires many human resources. The statistics of INE was used for the analysis.
2	Frequency of public transport by type by route	The municipalities do not have the statistics. The staff of SOPOT collected the information from operators. The JICA Study Team conducted a bus frequency survey in Santa Cruz de la Sierra, but it does not necessarily cover all routes.
3	Statistics of no. of passengers by type by route	The municipalities do not have the statistics.
4	Length of road by road administrator (paved, unpaved)	The provided data from municipalities are incomplete. The pavement information was updated as a part of the GIS work.

1.6.4 Training of Demand Forecast

The Project used Cube Voyager for the demand forecast modeling. A training course of the demand forecast was conducted using the software.

No	Date	Contents
1	April 12, 2017	A simple model, consisting of a network, public transport routes, and an OD matrix, for the highway assignment (all-or-nothing assignment) and public transport assignment was developed.
2	April 30, 2017	The simple model was updated to take into account of a cost function of the highway network and fare system of public transport system.
3	May 19, 2017	Linking the highway assignment to the transit assignment was explained, and a loop program to iterate the two modules was developed. The outline of the demand forecast model of the Project was explained.
4	November 20–22, 2017	The demand forecast model of the Project was explained in detail.

1.6.5 Coordination Committee

The Coordination Committees were held three times during the Project as shown below.

	Date	Contents	Venue
1	April 8, 2016	Discussion of the Inception Report	The Government House of the Department of Santa Cruz
2	August 24, 2016	Discussion of the Progress Report	The Government House of the Department of Santa Cruz
3	February 17, 2017	Discussion of the Interim Report	The Government House of the Department of Santa Cruz

1.6.6 Seminars

The following seminars were held. Officers of the municipalities and the Department of Santa Cruz, NGOs, professors of educational institutes, representatives of neighborhood communities, and transporters were invited.

	Date	Contents	Venue
1	March 17, 2016	Introduction of the Project	The Government House of the Department of Santa Cruz
2	April 19, 2016	Necessity of the transport master plan	The Center for Environment Education (CEA)
3	December 6, 2016	Preliminary results of the traffic surveys	The Center for Environment Education (CEA)
4	July 28, 2017	Results of the Project	The Center for Environment Education (CEA)

1.7 Preparation of GIS Data

The purpose of using GIS Data in the Project was as follows:

- The analysis of the present situation by showing the geographical distribution of socioeconomic data
- Estimation of socioeconomic data used in the demand forecast by traffic zone
Estimation of the impact of the master plan using the associated geographical information and presentation of the results
- Making land use plan and geographical aggregation of the land use data such as area by land use category

The Department of Santa Cruz, the municipalities, and the Regional Institute of Statistics of the Department of Santa Cruz (ICE) provided the JICA Study Team with various map data in CAD or PDF format through the TWG.

The collected data was compiled into ESRI Shapefile format with the coordination system of UTM 20S/WGS 84. The Road Inventory Survey was carried out using the GIS data with support of the TWG.

The table below shows the compiled GIS data with sources.

Table 1-5 List of Compiled GIS Data

Category	Type	Area	Source
Manzana (Urban block)	Polygon	Santa Cruz de la Sierra	Santa Cruz de la Sierra
		Cotoca	ICE/ Cotoca
		Porongo	Porongo
		La Guardia	La Guardia
		El Torno	El Torno
		Warnes	ICE
UV (Neighborhood Unit)	Polygon	Santa Cruz de la Sierra	ICE
District	Polygon	Santa Cruz de la Sierra	Santa Cruz de la Sierra
		Porongo	Porongo
		La Guardia	La Guardia
		El Torno	El Torno
Urban Area	Polygon	Metropolitan Area	Department of Santa Cruz
Municipal boundary	Polygon	Metropolitan Area	Department of Santa Cruz
River	Polyline	Metropolitan Area	Department of Santa Cruz
Roads	Polyline	Metropolitan Area	Each municipality
Locations of communities	Point	Metropolitan Area	ICE
Locations of schools by community	Point	Metropolitan Area	Each municipality
Urbanizations (housing development areas)	Polygon	Metropolitan Area	Each municipality

Source: JICA Study Team

There are two versions of the data of manzanas: one is a compiled data of all municipalities in the Metropolitan Area for the analysis of the present situation, and the other is the modified data to identify the code numbers of manzanas that were used in the statistics of Census 2012 of the National Institute of Statistics (INE). The latter was used to aggregate the population of the Census 2012 because the population data by UV or district was not provided by municipalities.

The district data of Warnes and Cotoca was not provided. Since municipalities other than Porongo have boundary issues, the district data of La Guardia, El Torno, and Santa Cruz de la Sierra was modified so that the data was used for the traffic demand analysis. The municipal boundary data provided by the Department of Santa Cruz was also modified because some communities were not located in the proper municipality in the data.

Due to the boundary issues, municipal boundary data and district boundary data were not prepared in the Project. Instead, several “zoning” maps were prepared for socio-economic analysis and the demand forecast. They are: 1) Traffic Analysis Zone (TAZ), 2) UV Level Zone, 3) Small Zone, 4) Medium Zone, 5) Large Zone, and 6) Municipal Zone. The purpose of these zones are follows:

Zone	Purpose
Traffic Analysis Zone (TAZ)	Traffic assignment in the demand forecast model
UV Level Zone	To deal with statistics at UV level
Small Zone	Statistical analysis of the traffic surveys
Medium Zone	To analyze socioeconomic and traffic data at district size level. Note that this does not necessarily mean the zone corresponds to district boundary.
Large Zone	To analyze socioeconomic and traffic data at the metropolitan level
Municipal Zone	To aggregate the data at the municipality level. This does not mean the boundary of the zone represents the actual boundary.

Figure 1-5 shows the map of the Medium Zone, while Figure 1-6 shows that of UV Level Zone.

In addition to above, GIS data of environmental theme were collected as the Baseline Survey. See Section 2.7 Environmental Considerations for the data.



Figure 1-5 Map of Medium Zones

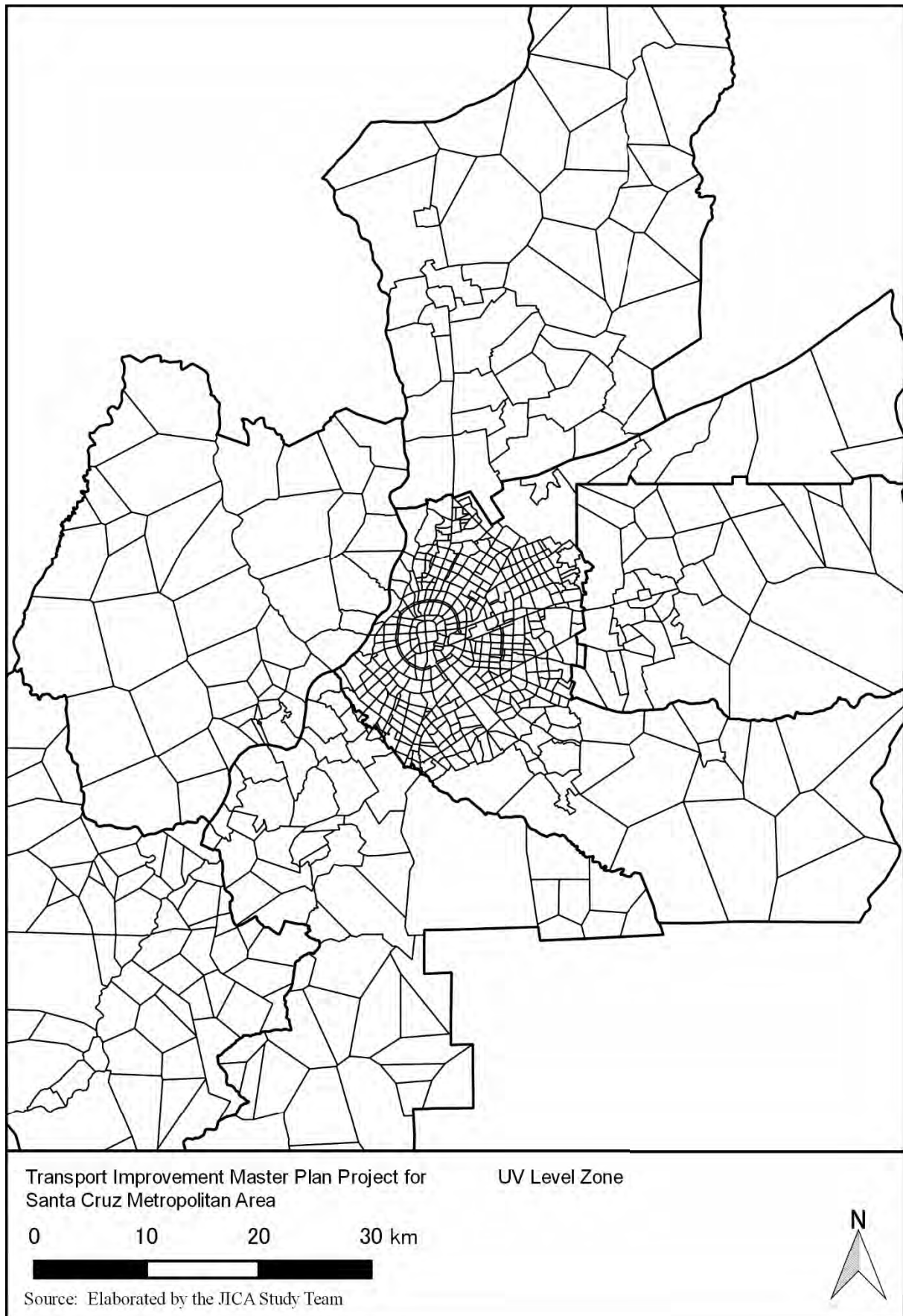


Figure 1-6 Map of UV Level Zones

1.8 Training on Transport Planning in Japan

As a part of the technical transfer, the training on transport planning in Japan was conducted in September 2016. The purpose of the training was to understand about Master Plan, and the importance of Transport Planning coordinated with Urban Planning and Capability Building for implementation of the urban transport policies toward realizing the master plan by the counterpart.

The components of training are:

- To understand the importance of Transport Master Plan
- To understand the role of urban transport systems
- To understand the importance of integrated plan of urban planning and transport planning
- To observe the case of traffic management in Japan

Following table shows the tour program.

Table 1-6 Training Tour Program in Japan

Day	City	Place	Contents
9/5	-	-	Arrival at Narita Airport
9/6	Tokyo	MLIT	Lecture (urban transport planning for metropolitan area)
9/7	Tokyo	JICA Tokyo	Lecture (Transportation systems in Japan)
		-	<ul style="list-style-type: none"> • Test Ride (Metro, AGT, Monorail) • Observation (Urban development of Toyosu and Daiba)
9/8	Tokyo	Shinjuku Expressway Bus Terminal	Observation (Bus terminal)
		Tokyo Government Office	Lecture (Public Transport Development in Tokyo)
		JICA Tokyo	Lecture (Transport Master Plan in Japan)
9/9	Nagoya	JICA Chubu	Lecture (Urban Transport Planning in Nagoya Metropolitan Area)
		Oasis 21	Observation (Bus terminal)
		-	Test Ride (Key Route Bus, Guideway Bus)
9/10	Kyoto	-	<ul style="list-style-type: none"> • Test Ride (Metro, Keifuku Electric Railway) • Observation (Pedestrian space development in Shijo-dori, Bicycle parking development in Oike-dori)
9/12	Tokyo	JICA Tokyo	Lecture (Urban transport planning for suburban area along railway line)
		Tama New Town	<ul style="list-style-type: none"> • Test Ride (Monorail) • Observation (Tama New Town)
9/13	Tokyo	Nippon Koei	Lecture (Urban Transport Planning in Nagoya Metropolitan Area)
		Traffic Control Center	Observation (Traffic Control Center)
		JICA Tokyo	Workshop
9/14	-	-	Departure from Narita

Source: JICA Study Team

The outcomes of the training on transport planning in Japan are:

- The participants have shared the same view about the current problems of the suburban development without control. The points of the view include: (1) the recent urbanizations are threat to the sustainable development, (2) municipalities should take proper actions to prevent the urban sprawl, and (3) the coordination among municipalities are important.
- The participants understood the scale of the structure of urban railway system. This played an important role to understand the public transport plan in the Project.
- The participants observed the technology of transport system such as the smartcard, which enabled quick understand of the proposal of the Master Plan.
- The participants have concluded that it is necessary to have a responsible organization for the urban transport development. Some participants became members of the Secretary of Urban Mobility, Santa Cruz de la Sierra, which was established recently.
- The participants agreed on the necessity of a metropolitan authority to deal with various urban problems.
- The participants continued the discussion on the urban problem after they returned.

1.9 Results of Technical Transfer

The Project focused on the technical transfer of three major areas such as 1) development of mass transit system, 2) comprehensive approach to sustainable development, and 3) update and spread of the master plan to each municipality.

Presently, the TWG members have basic knowledge of urban transport systems including Bus Rapid Transit systems and railway systems. The municipality of Santa Cruz de la Sierra established the Secretary of Urban Mobility during the Project, which is the authority of mass transit systems and implementation of the BRT projects.

The sustainable development had been one of the major issues of the Project, and its importance was reiterated in TWGs. The TWG members understood and the concept and importance of “transit-oriented development”, although more capacity development about the methodology to realize the concept is needed.

Regarding the necessary capacity to update the Master Plan, the technical transfer of the Strategic Environmental Assessment (SEA) was conducted to responsible persons in each municipality and the Department of Santa Cruz regardless he or she is a TWG member. The concept and contents of the traffic surveys were explained many times, and the TWG members understand the meaning of the results. Some TWG members understood the basic concept of the demand forecast through intensive technical transfer workshops.

Chapter 2 Present Situation

2.1 Current Socio-economic Conditions

The Santa Cruz Metropolitan Area is considered one of the major “axis” cities of Bolivia together with the metropolitan areas of La Paz and Cochabamba.¹ One of the main reasons is due to the demographic boom of the municipality of Santa Cruz de la Sierra which is considered nowadays as the economic and industrial center of the country.

2.1.1 Population

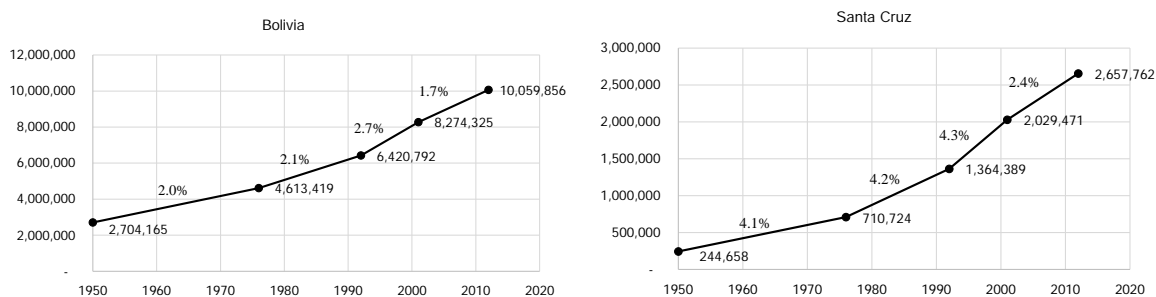
(1) Nationwide population

The National Statistics Institute (INE) of Bolivia publishes the official population data. The last three censuses which were conducted by this institution are the housing and population censuses of years 1992, 2001 and 2012. According to the last census conducted in 2012, Bolivia has a total population of 10,059,856 inhabitants. Table 2.1-1 presents the official population growth in Bolivia since 1831 to 2012 registered by INE². The reduction of the population between 1854 and 1882 is attributed to the territorial losses against Brazil and Chile in 1866 and 1880. The average annual growth rate between 1950 and 2001 exceeds 2%, a trend that is diminished from 2001 to 2012, where rate decreases to 1.7%. Figure 2.1-1 presents the trend of population growth from 1950 to 2012.

Table 2.1-1 Bolivia and Santa Cruz Population

Year	Bolivia	Santa Cruz
1831	1,088,768	43,775
1835	1,060,777	54,381
1845	1,378,896	75,627
1854	2,326,126	255,599
1882	1,172,156	97,185
1900	1,766,451	209,592
1950	2,704,165	244,658
1976	4,613,419	710,724
1992	6,420,792	1,364,389
2001	8,274,325	2,029,471
2012	10,059,856	2,657,762

Source: INE



Source: Elaborated by the JICA Study Team based on INE’s information

Figure 2.1-1 Population of Bolivia (left) and population of Santa Cruz (right)

Table 2.1-2 presents the structure of the population by gender. The table shows that the male population is slightly smaller than the female, which means that for every 100 females there

¹ New Face of Bolivia: Social Transformation and Metropolization by PNUD (2016)

² 2012 Population and Housing Census of Bolivia: Population Characteristics by INE (2015)

are less than 100 males.

Table 2.1-2 Sex ratio of Bolivia by census

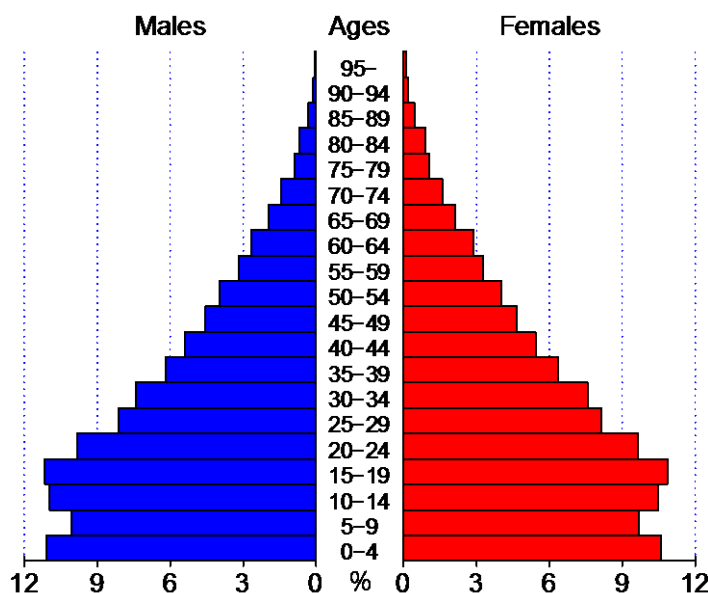
Census	Population (inhabitants)			Sex Ratio
	Total	Male	Female	
1950	2,704,165	1,326,099	1,378,066	96.2%
1976	4,613,419	2,275,928	2,337,491	97.4%
1992	6,420,792	3,171,265	3,249,527	97.6%
2001	8,274,325	4,123,850	4,150,475	99.4%
2012	10,059,856	5,019,447	5,040,409	99.6%

Source: INE

Bolivia has a considerable young population.

The percentage of the population under 15 years was as high as 40% in the census of 1950, 1976 and 1992 but decreased in the censuses of 2001 and 2012.

Figure 2.1-2 shows the population pyramid structured by age and gender according to the results of the 2012 census. The population under the age of 15 represents a percentage of 31.4% of the total population, while the population over 65 years of age represents only 6.0%.



Source: INE (2012 Census)

Figure 2.1-2 Population pyramid of Bolivia (2012)

(2) Department of Santa Cruz

The Department of Santa Cruz has a population of 2,657,762 inhabitants where 1,311,573 are female and 1,346,189 are male (Census 2012). As shown in Figure 2.1-1, the average annual growth rate of the population of the Department of Santa Cruz is greater than Bolivia, exceeding 4% from 1950 to 2001. This rate decreased in the period 2001-2012 to 2.4%; however, it is still higher than that recorded for the nation.

Unlike the national trend, the sex ratio is 103%, i.e., within this department for every 100 females; there are 103 males.

The population structure by age and gender according to the census results of 2012 for Santa Cruz is very similar to the national trend. The population under the age of 15 represents a percentage of 32.3% of the total population, while the population over 65 years of age

represents only 4.2%.

Table 2.1-3 shows a comparison of the trend of population density between departments by INE. The Department of Santa Cruz recorded a population density of 0.7 inhabitants per km² in 1950, one of the lowest of the whole nation, which remains one of the lowest in the country despite the growth shown in 2012 (7.2 inhabitants per km²).

Table 2.1-3 Departmental Population Density by Census

Department	1950	1976	1992	2001	2012
BOLIVIA	2.5	4.3	5.9	7.7	9.3
Chuquisaca	5.1	7.0	8.8	10.3	11.3
La Paz	6.6	11.2	14.6	18.0	20.9
Cochabamba	8.1	13.0	20.0	26.2	31.7
Oruro	3.9	6.2	6.8	7.9	9.9
Potosí	4.7	6.1	6.0	6.6	7.7
Tarija	2.7	5.0	7.7	10.4	12.9
Santa Cruz	0.7	1.9	3.7	5.5	7.2
Beni	0.3	0.8	1.3	1.7	2.0
Pando	0.3	0.5	0.6	0.8	1.7

Source: INE

(3) Santa Cruz Metropolitan Area

Table 2.1-4 presents the population growth in the Santa Cruz Metropolitan Area. The metropolitan area increased from 823,000 inhabitants in 1992 to 1.75 million in 2012 which means a growth of 113% in 20 years, the highest of all metropolitan areas in Bolivia. The average annual growth rate was at 6.5% for the period 1992-2001 and 3.1% for the period 2001-2012.

During the period 1992-2001, the Municipality of Santa Cruz de la Sierra recorded a growth of 6.6%, which decreased to 2.6% during the period to 2001-2012 while the municipalities of La Guardia and Warnes had a considerable population growth 11.3% and 10.3% respectively.

Table 2.1-4 Population of Santa Cruz Metropolitan Area by census

Municipality	1992	2001	2012
Santa Cruz de la Sierra	709,584	1,131,778	1,454,539
Cotoca	21,252	36,425	45,519
Porongo	8,272	11,085	15,317
La Guardia	22,250	39,552	89,284
El Torno	23,320	37,961	49,652
Warnes	38,285	45,318	96,406
TOTAL	822,963	1,302,119	1,750,717

Source: INE

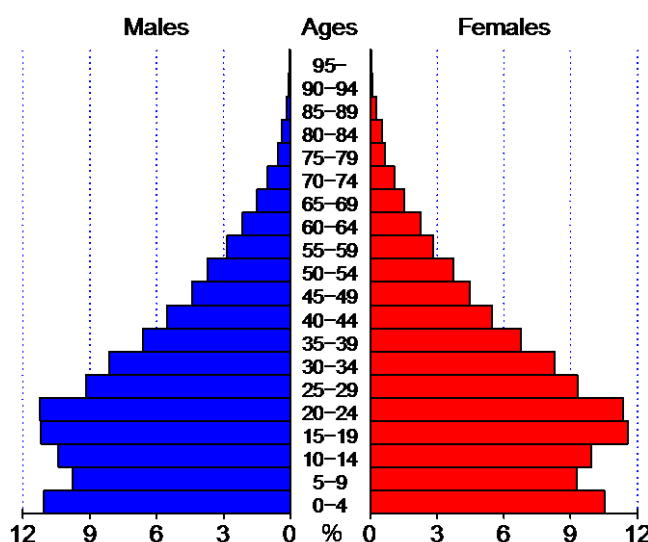
Table 2.1-5 shows the percentage of distribution of population by the municipality within the metropolitan area. Santa Cruz de la Sierra accounts for 83.1% of the population, so it follows that the overall growth of the metropolitan area is closely linked to population growth in this central city. This municipality with 1,454,539 inhabitants is the most populated of all the country, surpassing the 2nd most populous city of El Alto in La Paz (848,452 inhabitants) by more than 40%.

Table 2.1-5 Distribution of population and housing (Census 2012)

Municipality	Female	Male	Total	Distribution of Population (%)	Occupied housing	Distribution of housing (%)
Santa Cruz de la Sierra	732,878	721,661	1,454,539	83,1%	362,877	83.7%
Cotoca	22,015	23,504	45,519	2,6%	10,241	2.4%
Porongo	7,160	8,157	15,317	0,9%	3,622	0.8%
La Guardia	44,360	44,924	89,284	5,1%	21,314	4.9%
El Torno	24,366	25,286	49,652	2,8%	12,235	2.8%
Warnes	47,407	48,999	96,406	5,5%	23,218	5.4%
Total	878,186	872,531	1,750,717	100%	433,507	100%

Source: INE

Figure 2.1-3 presents the population structure by age and gender according to 2012 census results for the metropolitan area. This structure is very similar to the national trend. The population under the age of 15 represents a percentage of 30.5% of the total population, while the population over 65 years of age represents only 3.95%.



Source: INE (2012 Census)

Figure 2.1-3 Population pyramid of the Metropolitan Area (2012)

(4) Population Distribution

Demographic data by administrative area is only available at the municipal level in the Census of 2012, because of frequent changes in boundaries of the Neighborhood Units (UV) and lack of the boundary data of communities in suburban areas. Even the borders of municipalities in Census 2012 are different from those defined by the Department of Santa Cruz. The population data by city block (manzana) can be obtained from the Census webpage of INE, although it is necessary to click each manzana in the webpage to see the population data and the manzana code. All manzana data of the Metropolitan Area were checked on the webpage, and all the data were inputted to the GIS database. The population data by manzana was aggregated to the small zones and the large zones.

Figure 2.1-4 illustrates the population density and population by large zone, while Figure 2.1-5 illustrates the population density by small zone. Figure 2.1-6 is the same figure of Figure 2.1-5 with the different scale focusing on the center of the Metropolitan Area. As can be seen, the population is concentrated in the center of the Metropolitan Area, and the population density is high within the 4th Ring Road, District 7, and Plan 3000. There are highly populated areas where the population density is more than 100 inhabitants/ha. The population density in the center of the Metropolitan Area is not high, and that in the suburban area is very low.

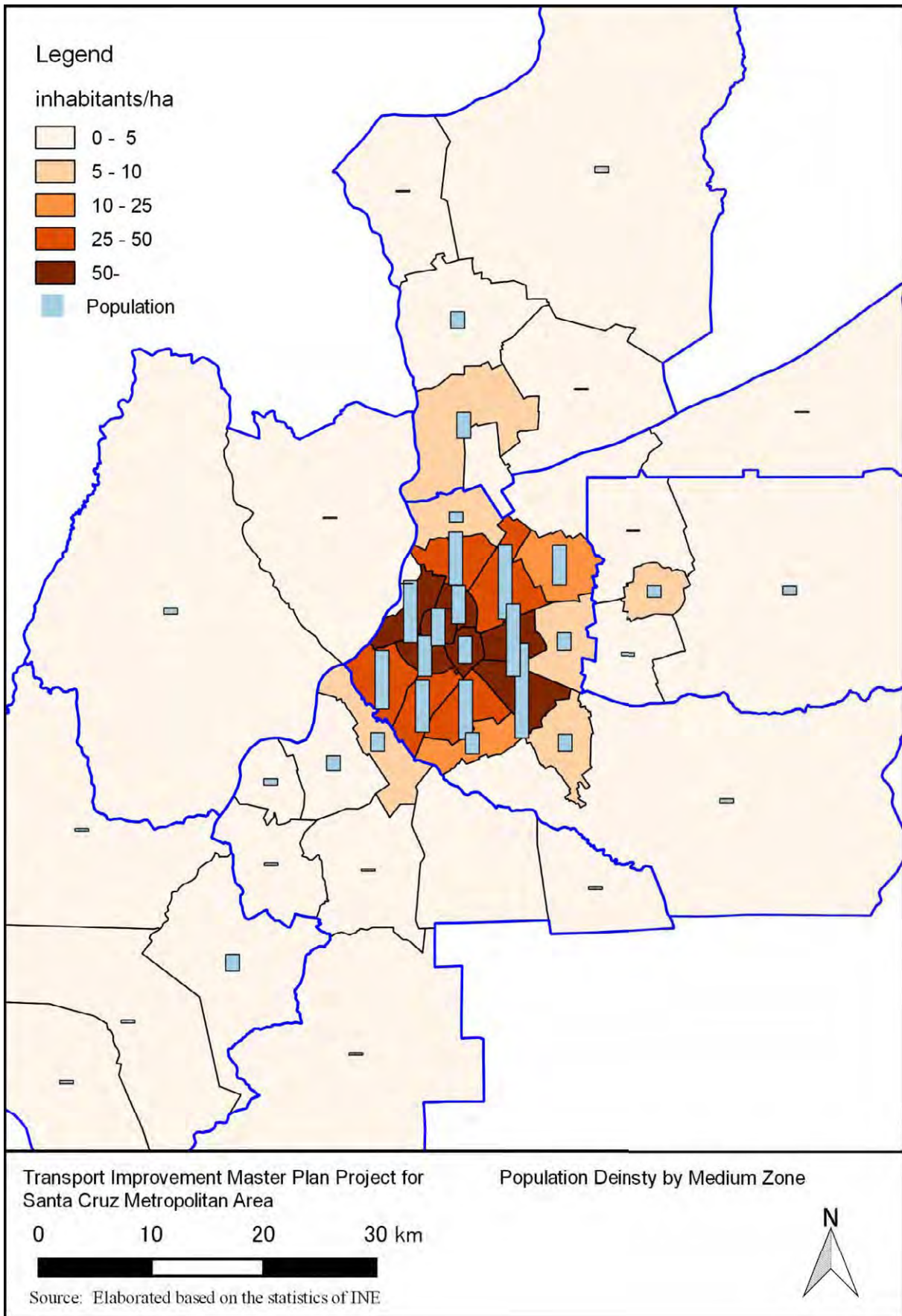


Figure 2.1-4 Population Density by Medium Zone (2012 Census)

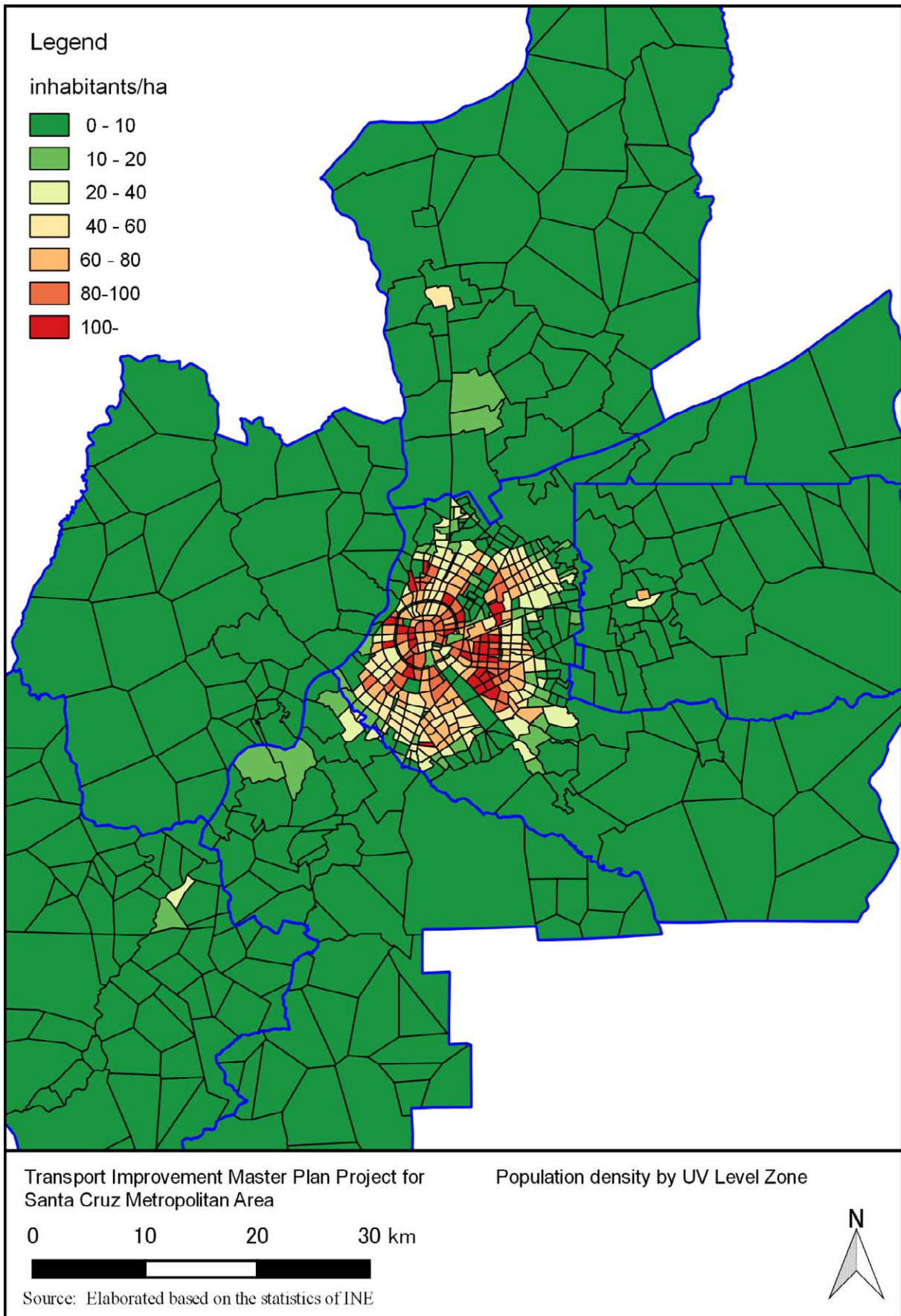


Figure 2.1-5 Population Density by UV Zone (2012 Census)

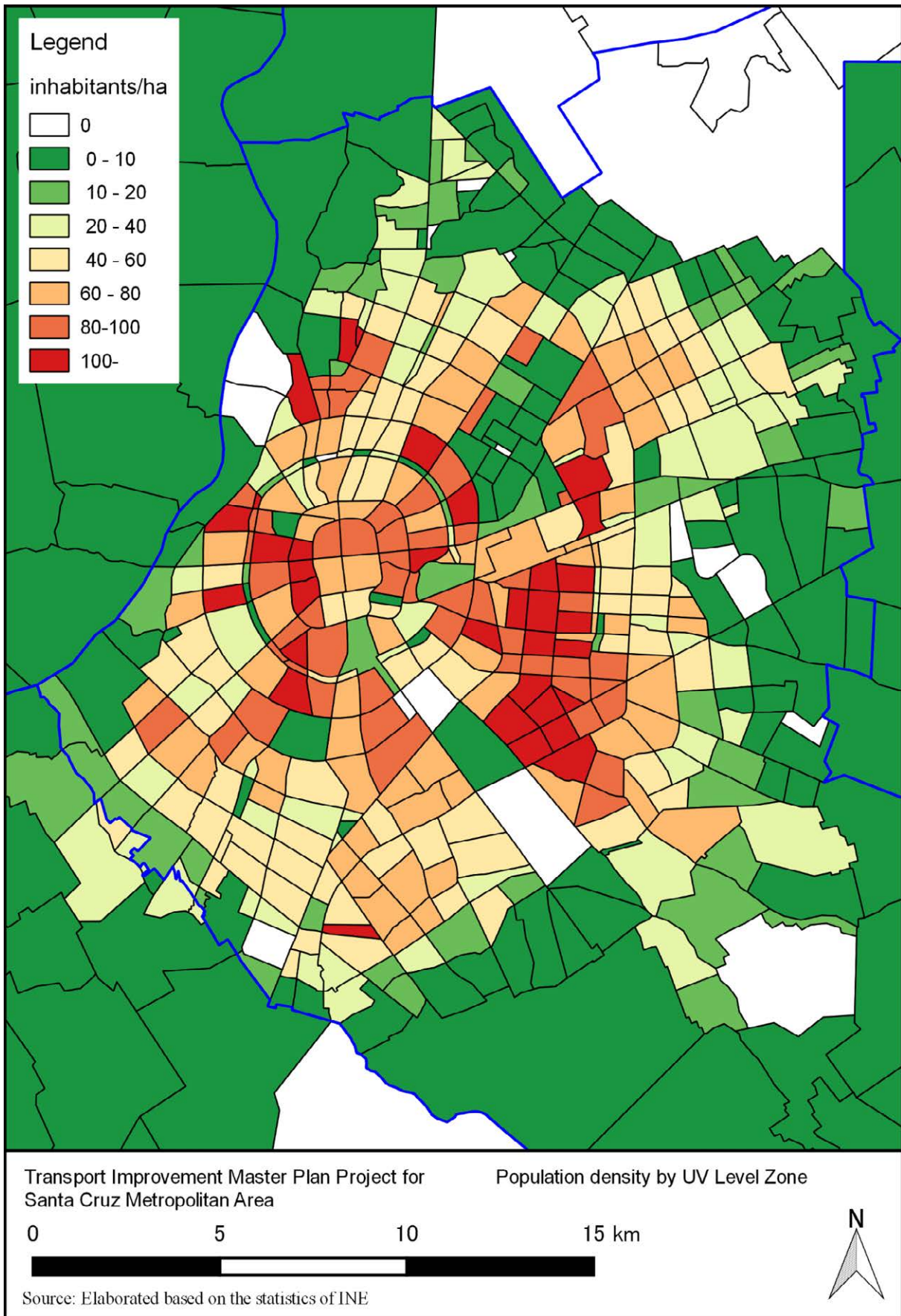


Figure 2.1-6 Population Density by UV level Zone in the Central Area (Census 2012)

2.1.2 Economy

(1) General aspects

The Bolivian economy consists mainly of the exploitation of natural resources and export of raw materials and various types of goods.

As for minerals, major productions are tin (ranked 5th of global production³), silver (ranked 6th), zinc (ranked 7th), lead (ranked 8th), gold in the east side (24th) and copper in the west side (ranked 43). Regarding the exploitation of hydrocarbons, Bolivia has the second largest reserves of natural gas in South America (48 trillion cubic feet).

On the other hand, agricultural production has become more important in recent decades mainly in the east that produces soy, sugar cane and sunflower. In the West, domestic consumer products such as potatoes, barley and export products such as quinoa, bean, cocoa, and coffee are produced.

The main trading partners of Bolivia are Brazil (exportation amount of US\$ 2,447 million), Argentina (US\$ 1,473 million), United States (US\$ 1,054 million), Colombia (US\$ 552 million), China (US\$ 466 million), Japan (US\$ 407 million) and Peru (US \$ 313 million)⁴.

Finally, for livestock production breeding cattle and pigs are major at the east side, while in the West, breeding camelids such as alpaca are important for the textile industry.

The following table summarizes the main economic activities in Bolivia by sector.

Table 2.1-6 Economic sectors of Bolivia

PRIMARY SECTOR	SECONDARY SECTOR	TERTIARY SECTOR
<ul style="list-style-type: none"> • Agricultural sector <ul style="list-style-type: none"> - Traditional subsistence agriculture in the Altiplano (potato, corn, rice, wheat) - Commercial agriculture in lowland areas (soybean, cotton, sugar cane and coffee) - Agriculture of coca leaf • Mining sector <ul style="list-style-type: none"> - Tin, Silver, Zinc, lead, etc. • Hydrocarbons Sector <ul style="list-style-type: none"> - Oil and Natural Gas • Electricity 	<ul style="list-style-type: none"> • Manufacturing Sector <ul style="list-style-type: none"> - Major export markets are Brazil, Argentina, USA, Colombia, China, Japan, and Peru. 	<ul style="list-style-type: none"> • Construction Sector • Tourism Sector <ul style="list-style-type: none"> - Salar de Uyuni - Touristic cities: La Paz, Santa Cruz y Cochabamba • Transportation and telecommunication • Finance Sector <ul style="list-style-type: none"> - 12 private banks - 13 main real estate companies - 24 saving cooperatives - Etc.

Source: Guideline of Bolivia prepared by the Economic and Commercial Office of Spain in La Paz (2007)

(2) Economic Conditions

1) National Economy

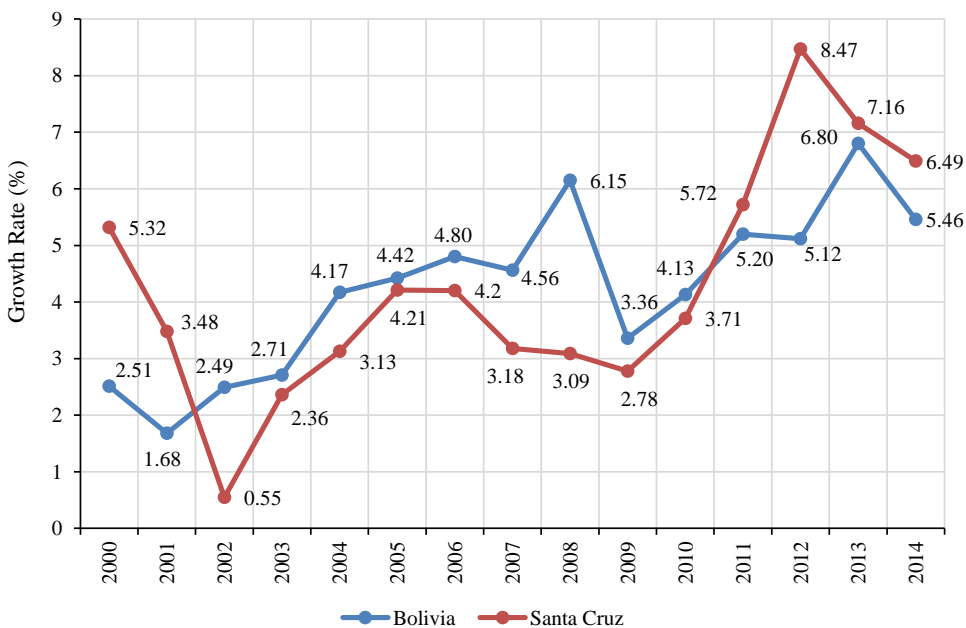
Bolivia is a lower middle-income country⁵ Although the economy of Bolivia has shown a considerable growth (Figure 2.1-7) with a GDP growth rate of 4.85%, the GDP per capita is still the lowest in South America with US\$ 3,124 in 2014 (Figure 2.1-8). The national

³ WORLD-MINING-DATA Volume 31, Minerals Production (Vienna 2016)

⁴ Biweekly Electronic Bulletin No. 530 - Bolivia, August 1, 2016 (Bolivian Institute of Foreign Trade)

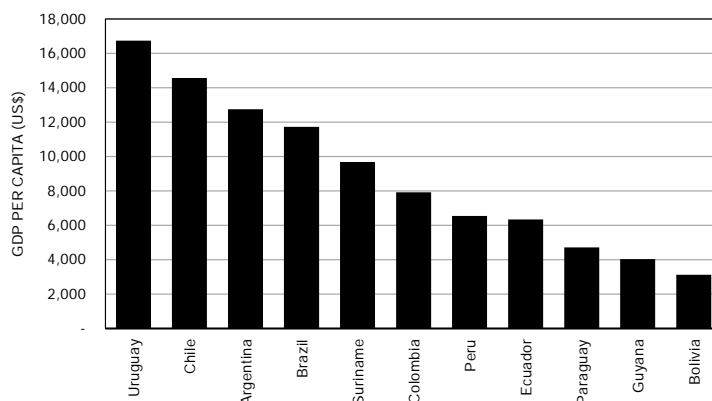
⁵ World Bank: Lower middle-income economies are those with a GNI per capita between \$1,026 and \$4,035

minimum wage in Bolivia is Bs. 1,805 (US\$ 259) according to INE (2016).



Source: INE

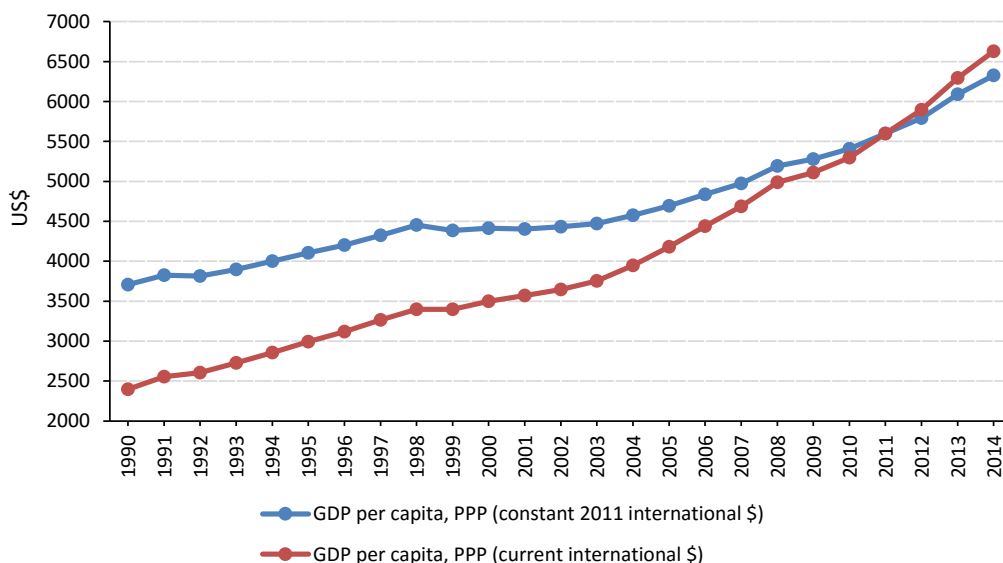
Figure 2.1-7 GDP growth rate of Bolivia and Department of Santa Cruz



Source: World Development Indicators Database of the World Bank (Updated on 22/06/2016)

Figure 2.1-8 GDP per capita in the year 2014 (US\$ actual prices)

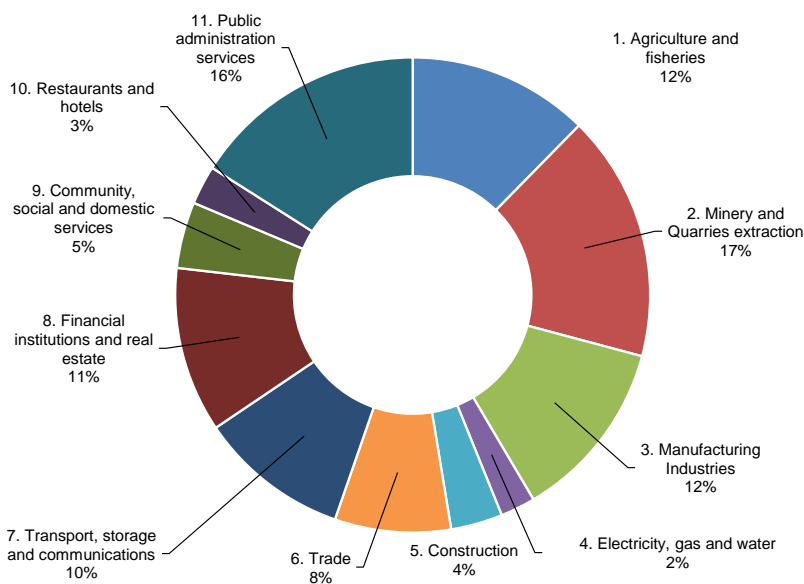
The following figure shows the trend of growth of the Bolivian economy comparing GDP per capita based on purchasing power parity (PPP). The GDP per capita, PPP at current international US\$ rose from US\$ 2,386 in 1990 to US\$ 6,630 in 2014.



Source: World Development Indicators Database of the World Bank

Figure 2.1-9 Trend of GDP per capita of Bolivia

Figure 2.1-10 presents GDP by economic activity in Bolivia. Among the 11 groups of economic activity, GDP in the mining sector including the exploitation of crude oil, natural gas, and minerals is the highest and is valued at Bs. 30.2 billion. At second place there are public administration services valued at Bs. 28.8 billion followed by agriculture and fisheries and manufacturing industries, valued both in Bs. 22 billion.



Source: INE

Figure 2.1-10 Distribution of Bolivia's GDP by economic activity (2014)

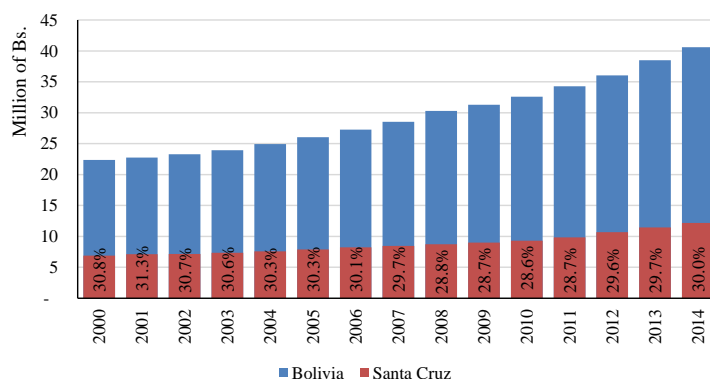
2) Department of Santa Cruz

Table 2.1-7 presents the departmental share of national GDP from 2010 to 2014. The Department of Santa Cruz contributes most to the national GDP during this period, followed by La Paz and Tarija. This contribution is relatively constant during this period (Figure 2.1-11) and amounted to 30.02% in 2014. As presented in Figure 2.1-11, the growth rate of GDP is slightly higher than that of the country, reaching a value of 6.49% in 2014.

Table 2.1-7 Departmental Share of National GDP (%)

	2010	2011	2012	2013	2014
Chuquisaca	4.77%	4.72%	4.87%	5.06%	5.17%
La Paz	23.82%	24.02%	23.91%	23.65%	23.65%
Cochabamba	16.14%	15.99%	15.78%	15.59%	15.51%
Oruro	5.58%	5.51%	5.14%	5.03%	4.89%
Potosí	6.37%	6.32%	5.59%	5.53%	5.47%
Tarija	10.33%	10.44%	10.89%	11.33%	11.28%
Santa Cruz	28.57%	28.71%	29.63%	29.73%	30.02%
Beni	3.46%	3.35%	3.27%	3.20%	3.14%
Pando	0.96%	0.94%	0.91%	0.88%	0.87%

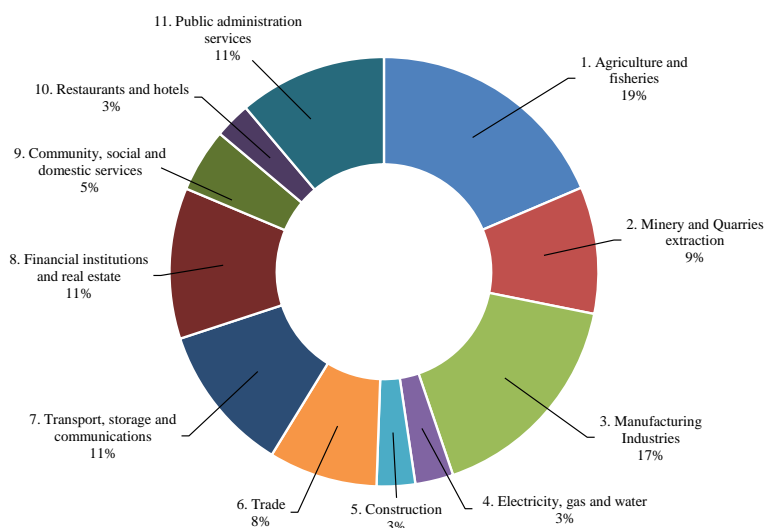
Source: INE (Constant prices for 1990)



Source: INE (Constant prices for 1990)

Figure 2.1-11 Departmental Share of National GDP (2014)

Figure 2.1-12 shows the perceptual distribution of GDP excluding the taxes for each economic activity in the Department of Santa Cruz (2014). Agriculture and fisheries (19%) along with manufacturing industries (13%) are the main activities of its economy. Taxes on import duties, VAT, and other taxes amounted 26% of GDP (at market prices) in 2014.



Source: INE

Figure 2.1-12 Santa Cruz: Share of GDP by economic activity (2014)

As for exports, in July 2015, the main products exported from Department of Santa Cruz were: natural gas (35%), soybean meal (22%), soybean crude oil (10%), crude oil (9%) and crude forms of gold (3%).

Table 2.1-8 List of export products of Santa Cruz

Products	US\$	%
Natural gas	478,494,512	35.5%
Soybean meal	296,673,881	22.0%
Soybean crude oil	134,860,116	10.0%
Crude oil	120,966,493	9.0%
Crude forms of gold	40,630,028	3.0%
Copper ores and concentrates	28,339,548	2.1%
Undenatured ethyl alcohol	23,282,683	1.7%
Fuel	23,245,455	1.7%
Chia seeds	22,565,179	1.7%
Graham soybean meal	14,736,430	1.1%
Other products	164,442,658	12.2%
Total (353 products)	1,348,236,984	

Source: IBCE - Boletín Electrónico Bimensual N° 448 (21/09/2015)

In the period from January to July 2015, the main countries of destination for the exports from Department of Santa Cruz were: Colombia with US\$ 313 million, Brazil (US\$ 308 million), Argentina (US\$ 192 million), Peru (US\$ 131 million) and China (US\$ 106 million).

3) Santa Cruz Metropolitan Area

Santa Cruz de la Sierra is the economic center of the metropolitan area. This city is characterized by a productive vocation of its agro-industrial environment and its status as an important link with Mercosur. In recent years, the business sector has developed strongly because of the corporate field development which attracted many transnational companies who settled in this city. This economic development of the Santa Cruz Metropolitan Area attracted migrants from all over the country, not only from other departments but in rural areas of the same department. This led to the development of two parallel economies where the corporate and business dynamics coexists with informal activities with low productivity.

According to the 2012 census database and estimations of UNDP Bolivia, Santa Cruz de la Sierra contributed 22% to the national GDP, followed by La Paz and El Alto who contributed with 13% and 7% respectively.

The following table presents the estimations made by UNDP Bolivia which shows that the composition of the GDP of the city of Santa Cruz de la Sierra is mainly composed by the contribution of the hydrocarbon sector with 16.4%, followed by the manufacturing sector particularly linked to agribusiness with 13.6%. These corporate and business sectors coexist with the sectors of trade, transport, and services whose economic organization does not have the same strength as the previous one and is mostly characterized by informality and small scale. On the other hand, compared to the other cities, the percentage of public administration is relatively low.

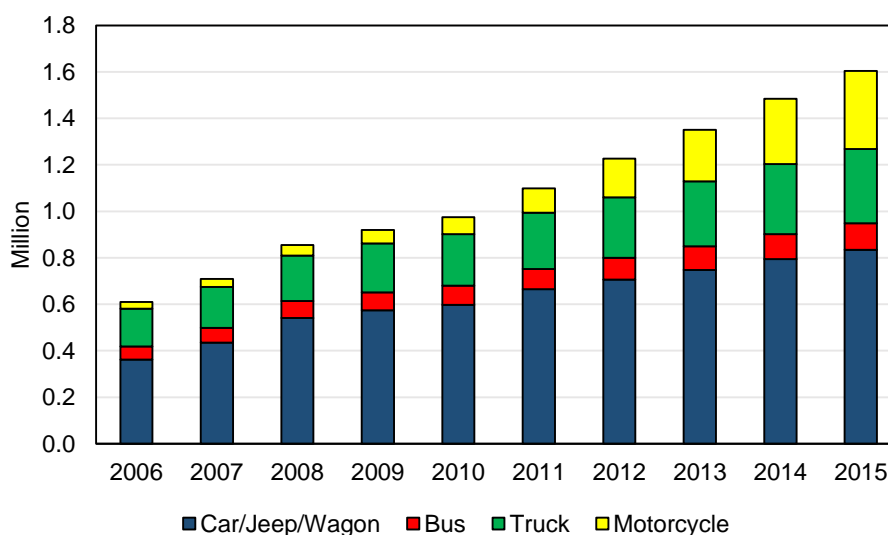
Table 2.1-9 Estimation of GDP by economic activity of the main cities of Bolivia (%)

Economic Activity	La Paz	El Alto	Cochabamba	Santa Cruz de la Sierra
Agricultural trade	0.5	1.1	3.7	2.8
Mining and Hydrocarbons	2.8	5.0	3.1	16.4
Manufacture	12.1	26.9	15.0	13.6
Electricity, Gas and Water	0.3	2.0	1.8	5.0
Construction	2.5	4.4	5.0	3.3
Commerce	6.9	13.5	11.6	10.8
Hotels and restaurants	2.4	2.7	3.6	3.6
Transport and Storage	5.9	11.2	13.3	10.1
Communications	3.2	0.9	2.8	1.4
Financial services	12.5	3.9	3.6	7.5
Business services	3.2	1.8	3.6	5.0
Homeownership	13.0	2.1	4.6	3.5
Public administration	29.5	20.6	13.9	11.7
Social, personal and domestic services	5.1	3.9	6.6	5.3

Source: Made by UNDP (2016) based on INE's 2012 Census database

(3) Car Ownership

The number of registered vehicles in Bolivia is increasing and has reached 1.6 million in 2015 as shown in the table below. The rapid increase in the number of motorcycles from 2011 contributed to the overall increase. In 2015, motorcycles accounted for 21% of the total number of registered vehicles in Bolivia, while cars (car/jeep/wagon) account for 52%. In 2013, they were 16.4% and 55.4%, respectively. The number of registered vehicles excluding motorcycles per 1000 inhabitants in Bolivia is calculated at 117. The number of registered vehicles in the Santa Cruz Metropolitan Area was 335,000 in 2013, while that of Bolivia was 1.35 million⁶. In 2013, motorcycles and cars accounted for 12.9% and 62.3%, respectively, in the metropolitan area. The car ownership in the Metropolitan Area and Bolivia in 2013 is calculated at 155 and 107 per 1000 inhabitants, respectively.



Source: Elaborated based on the statistics of INE

Figure 2.1-13 No. of registered vehicles in Bolivia by vehicle type

⁶ The statistics of 2014 and 2015 at municipality level is not available.

2.1.3 Socioeconomic profile of the residents of the metropolitan area

(1) Demographic and housing characteristics

Table 2.1-5

shows the distribution of population and housing inside the metropolitan area. 83% of the population live in Santa Cruz de la Sierra, which is consistent with the percentage of household’s distribution which registered 83.7% in 2012. The next municipalities that concentrate most distribution of housing are La Guardia and Warnes with 4.9% and 5.4% respectively.

The average family size of Santa Cruz de la Sierra was four members per household (Census 2012). As for gender statistics, the percentage of female (50.2%) within the metropolitan area is slightly higher than male (49.8%), as highlighted in the section regarding population.

Table 2.1-10 shows the percentage distribution of type of housing within the metropolitan area. An average of 74% lives in their own home, hut or pahuichis which are rustic houses with a pitched roof that are very common in this region.

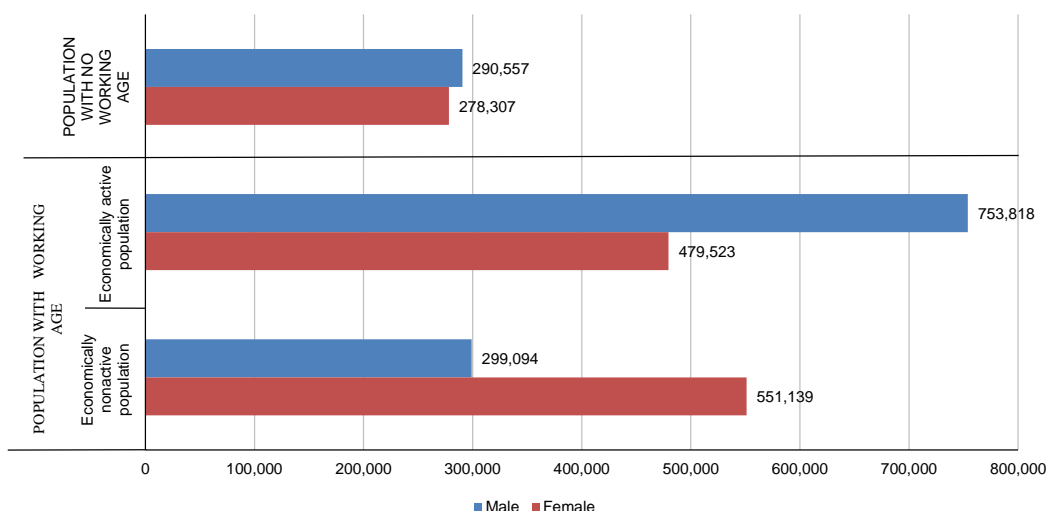
Table 2.1-10 Type of Housing in the Santa Cruz Metropolitan Area (%)

Municipality	House, hut, or Pahuichi	Apartment	Rooms or single bedrooms	Improvised houses	Places which are not intended to be for housing
Santa Cruz de la Sierra	73.0	5.2	20.4	0.7	0.7
Cotoca	83.0	1.0	14.5	0.9	0.6
Porongo	89.6	1.1	7.3	1.4	0.7
La Guardia	81.3	2.0	15.3	1.0	0.4
El Torno	79.1	1.7	18.2	0.7	0.3
Warnes	80.2	1.4	16.4	1.3	0.5
Average	74.3	4.6	19.6	0.7	0.7

Source: INE (Census 2012)

(2) Occupational characteristics of the population

Figure 2.1-14 presents the number of population with ten years or more by employment status by gender within the Department of Santa Cruz. The people of non-working age accounts for 21% of the total population, while economically active people and economically account for 46% and 32%, respectively.



Source: INE (Census 2012)

Figure 2.1-14 Distribution of Population by Occupational Condition and Gender in Santa Cruz

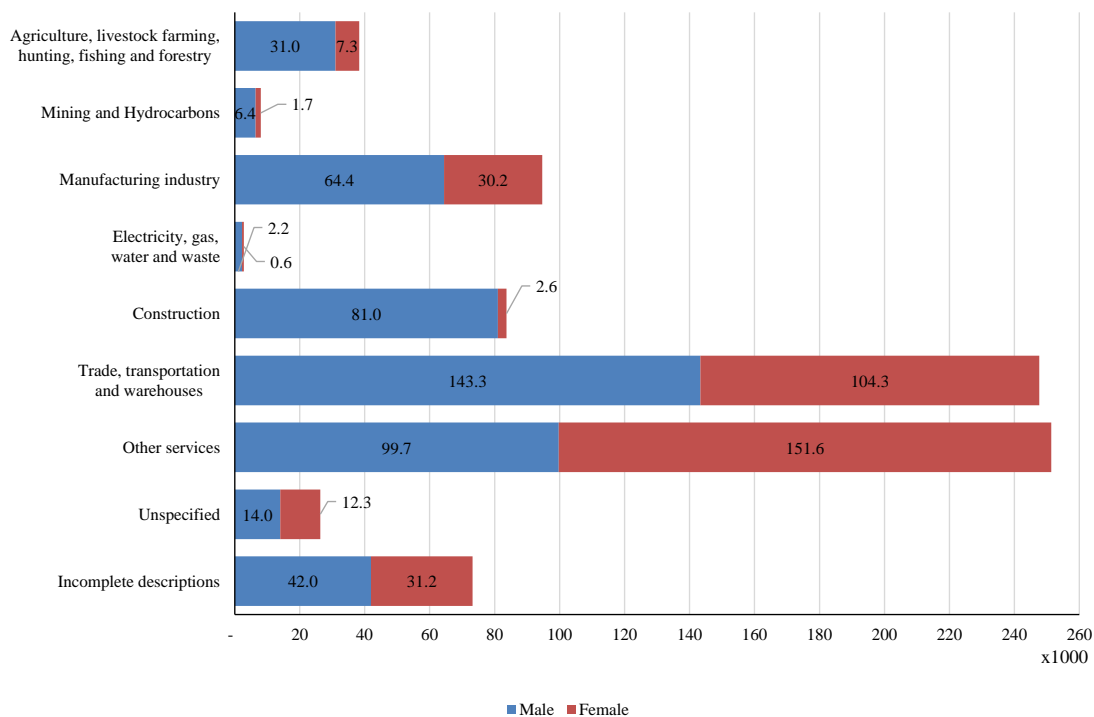
The following table presents the global participation rate by gender and the populations' participation by economic sectors in each of the municipalities. The occupational participation is high in the tertiary economic sector consisting of services (construction, tourism, transport and communications, banking, etc.). The participation rate of women in the metropolitan area exceeds 45%.

Table 2.1-11 Rate of participation and employment by sectors within the Metropolitan Area

Municipality	Global Participation Rate (%)			Economic Sector (%)		
	Total	Male	Female	Primary	Secondary	Tertiary
BOLIVIA	59.5	69.7	49.5	31.2	9.7	59.0
SANTA CRUZ	59.2	71.6	46.5	18.3	11.3	70.4
Santa Cruz de la Sierra	60.5	70.9	50.4	3.8	13.1	83.1
Cotoca	57.3	72.3	41.1	17.4	22.7	59.9
Porongo	62.1	75.5	46.6	42.8	5.6	51.6
La Guardia	59.2	72.1	46.3	14.6	10.0	75.4
El Torno	62.1	76.0	47.7	33.1	8.2	58.7
Warnes	56.7	71.8	41.3	14.4	13.8	71.8

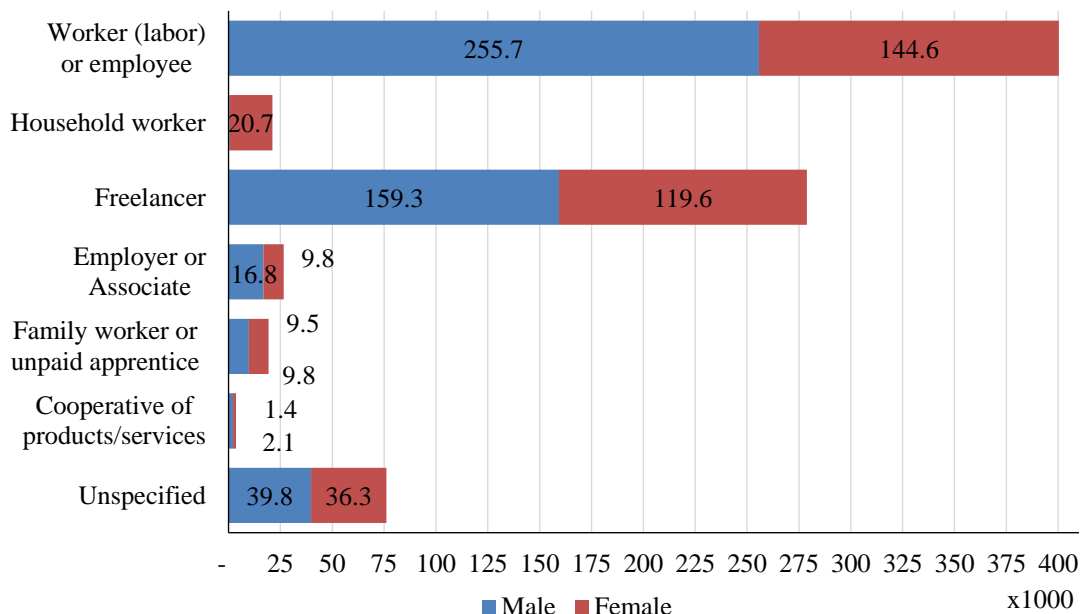
Note: Occupational characteristics of the employed population with 10 years or older
 Source: INE (Census 2012)

Figure 2.1-15 presents the economically active population of the metropolitan area by economic activity differentiated by gender. Figure 2.1-16 presents the population by gender and occupational category, where the category of construction workers (labors) or employee predominate with 48.5%, followed by self-employed people with 33.8%.



Source: INE (Census 2012)

Figure 2.1-15 Economically active population by economic activity



Source: INE (Census 2012)

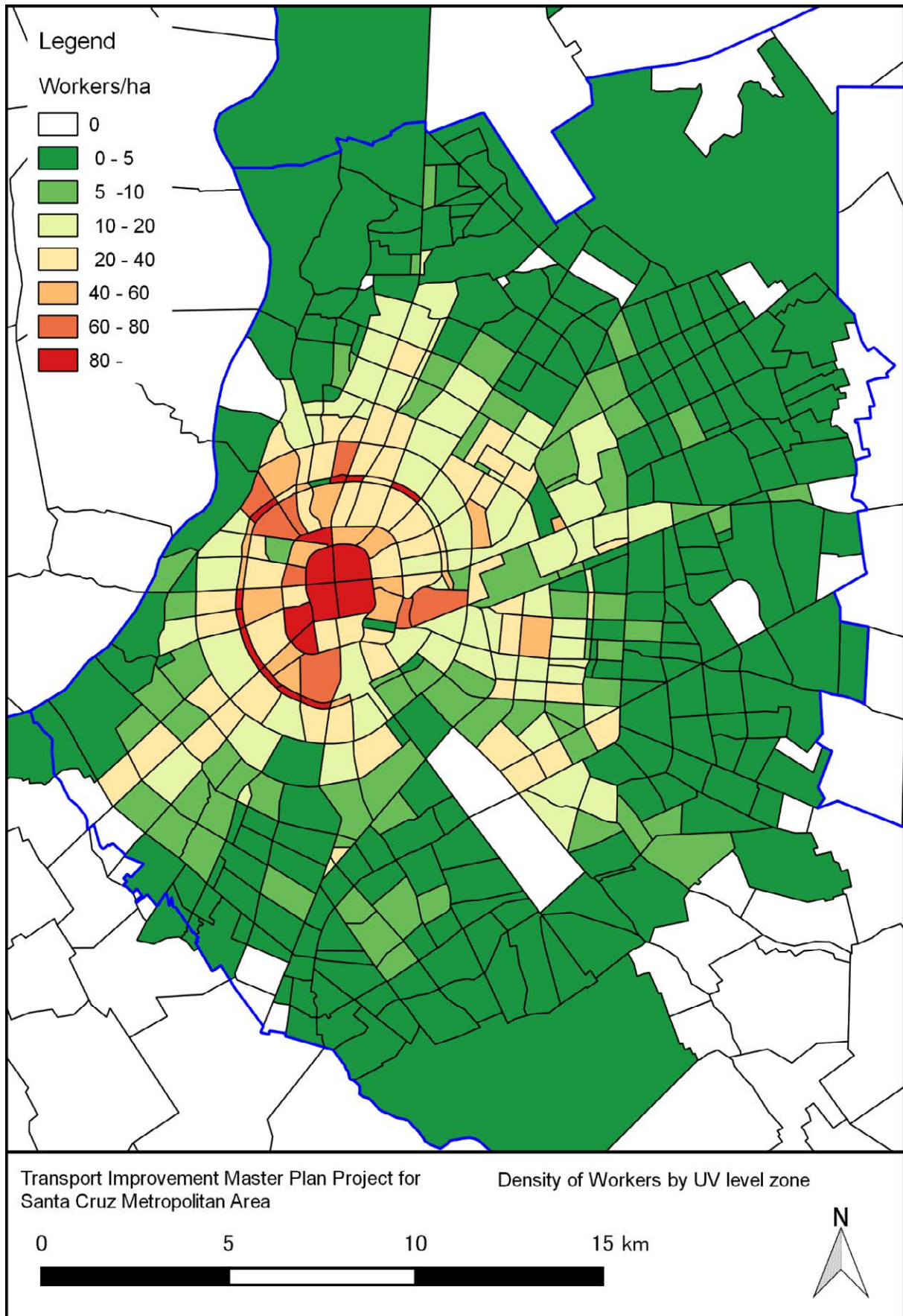
Figure 2.1-16 Economically active population by occupational category

(3) Workers at Place of Employment

The economically active population in the statistics of INE is based on the home location of workers, while the number of workers by place of employment is not available in the statistics of INE. On the other hand, the Regional Institute of Statistics of the Department of Santa Cruz (ICE) estimated the number of workers by place of employment. The number of workers whose place of employment is Santa Cruz de la Sierra is estimated at 290,000. This number is smaller than the economically active population in Santa Cruz de la Sierra by INE, which is 693,643. ICE estimated the number based on a survey of buildings, which means workers of informal sector such as the street vendors are not included, while the statistics of INE includes all sectors

Figure 2.1-17 illustrates the density of the number of workers by place of employment at small zone in the central area. As can be seen, workers’ density is high inside 1st Ring Road and city blocks along the 3rd Ring Road, while it is not high inside the Industrial Park although many factories are located in the Industrial Park. The workers’ density is as low as less than ten workers per hectare in the most parts outside the 4th Ring Road.

The data of the number of workers at the place of employment is also available for Warnes. Although ICE conducted the survey in Cotoca, the data was incomplete. The number by employment sector of these municipalities is shown in Table 2.1-12. The data of Porongo, La Guardia, and El Torno is not available because ICE has not surveyed these municipalities.



Source: Elaborated based on the statistics of ICE

Figure 2.1-17 Density of Workers by UV level Zone in the Central Area (2012 Census)

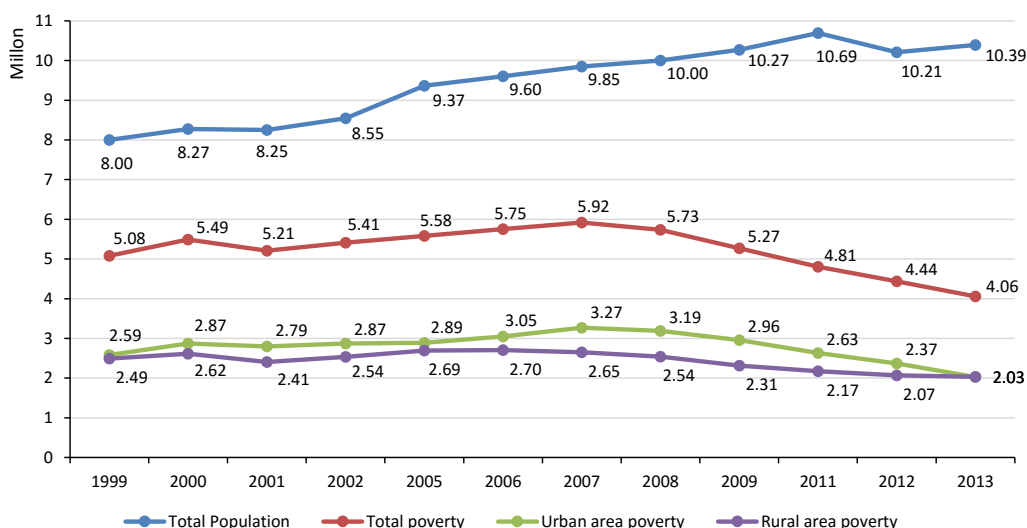
Table 2.1-12 No of Workers at place of employment

Sector	SCZ	Warnes
Agriculture, hunting and forestry	1,777	168
Fishing	3	0
Mining and quarrying	2,625	15
Manufacturing industry	46,719	1,974
Electricity, gas, steam and air conditioning	1,124	8
Water supply, sewage disposal, waste management and decontamination	1,573	28
Construction	6,453	101
Wholesale and retail; repair of motor vehicles and motorcycles	165,957	3,277
Transport and storage	6,818	82
Activities accommodation and meals	42,559	839
Information and communication	21,203	1,678
Financial intermediation and insurance	12,049	63
Real estate	3,991	57
Professional and technical services	23,510	67
Activities of administrative and support services	16,329	119
Public administration, defense and social security schemes compulsory	2,066	27
Education services	14,415	70
Health and welfare	17,415	160
Arts, entertainment and recreational activities	3,183	89
Other service activities	4,966	45
Activities of private households as employers; undifferentiated	8,180	0
Service extraterritorial organizations and bodies	5	0
Others	681	14
Total	403,601	8,881

Source: Elaborated based on the database of ICE

(4) Poverty

Figure 2.1-18 presents the national trend of poverty along the period 1999-2013. The population whose monthly income is less than the poverty line, which is defined as the minimum income through economic surveys, is defined as the population living in poverty. The percentage of the poor population was 60% until 2007, which decreased significantly in 2013 to 39%. As for spatial distribution, the urban area poverty slightly exceeded the rural area poverty until 2012; however, the difference became practically zero in 2013.



Source: INE

Figure 2.1-18 Evolution of poverty in Bolivia (millions of inhabitants)

People whose income is less than the necessary expenditure for the minimum food is defined as the people living in extreme poverty. It is estimated that in 2013 the 18.8% of the

population lives in extreme poverty.

Table 2.1-13 summarizes the estimated poverty by unsatisfied basic needs (UBN) method based on census data of 2012. According to this method, the percentage of poor population of the country was 44.9%, while the percentage of the Department of Santa Cruz was lower at 35.5%.

Table 2.1-13 Population rate for Unsatisfied Basic Needs (UBN-2012)

Department	Percentage of non-poor people			Percentage of poor people			
	Total	Sufficient	Threshold	Total	Moderate	Indigent	Marginal
BOLIVIA	55.1	25.2	29.9	44.9	35.3	9.2	0.4
Chuquisaca	45.4	21.9	23.5	54.5	38.2	15.6	0.7
La Paz	53.7	26.5	27.2	46.3	35.3	10.6	0.4
Cochabamba	54.6	25.9	28.7	45.4	35.2	9.7	0.5
Oruro	53.1	25.5	27.6	47.0	34.4	12.1	0.5
Potosí	40.3	17.1	23.2	59.8	40.9	17.8	1.1
Tarija	65.4	27.9	37.5	34.6	31.3	3.2	0.1
Santa Cruz	64.5	28.1	36.4	35.5	31.7	3.7	0.1
Beni	43.5	16.0	27.5	56.4	45.9	9.5	1.0
Pando	41.1	14.4	26.7	58.8	47.0	11.2	0.6

Source: INE –Social and Economic Policy Analysis Unit (UDAPE)

(5) Education

Table 2.1-14 shows the rate of literacy and school attendance. The literacy rate is very high because virtually all the municipalities are above 95% for both genders. The school attendance rate of the population aged 6 to 19 years is also high and exceeds 85%.

Table 2.1-14 Literacy rate and school attendance rate

Nation / Department / Municipality	Literacy rate of the population aged 15 or more			School attendance rate of the population aged 6 to 19 years		
	Total	Male	Female	Total	Male	Female
BOLIVIA	94.9	97.6	92.3	87.2	87.1	87.4
SANTA CRUZ	97.4	98.5	96.3	85.6	84.9	86.2
Santa Cruz de la Sierra	98.6	99.3	97.8	86.7	86.5	86.8
Cotoca	96.2	97.7	94.6	85.0	83.9	86.2
Porongo	95.8	96.5	95.0	85.9	85.9	86.0
La Guardia	97.1	98.3	95.9	86.4	85.6	87.2
El Torno	93.5	96.2	90.7	85.5	84.4	86.5
Warnes	96.9	98.3	95.5	85.1	84.3	86.0

Source: INE (Census 2012)

(6) Health

According to the census of 2012, life expectancy in Bolivia was 70.7 years (67.8 years for male and 73.6 years for female). Moreover, the infant mortality rate amounted to 31.9% (34.2% for men and 29.4% for women) with a total fertility rate of 3.1%.

UNDP Bolivia conducted a study in 2014 where the residents of each municipality were consulted regarding the level of satisfaction of the quality of health services offered by their municipality and the delay in getting an appointment at the health center. The responses of the residents of the metropolitan area of Santa Cruz were favorable in terms of service quality as 50.9% responded that they were very satisfied with the service and only 13.7% said they were not very satisfied. On the other hand, in terms of waiting times for a medical appointment, 41.7% said they were not very satisfied.

According to the ranking of the Human Development Index (HDI) 2014 in “Human Development Report 2015, UNDP”, Bolivia was ranked at 119 out of 188 countries and is

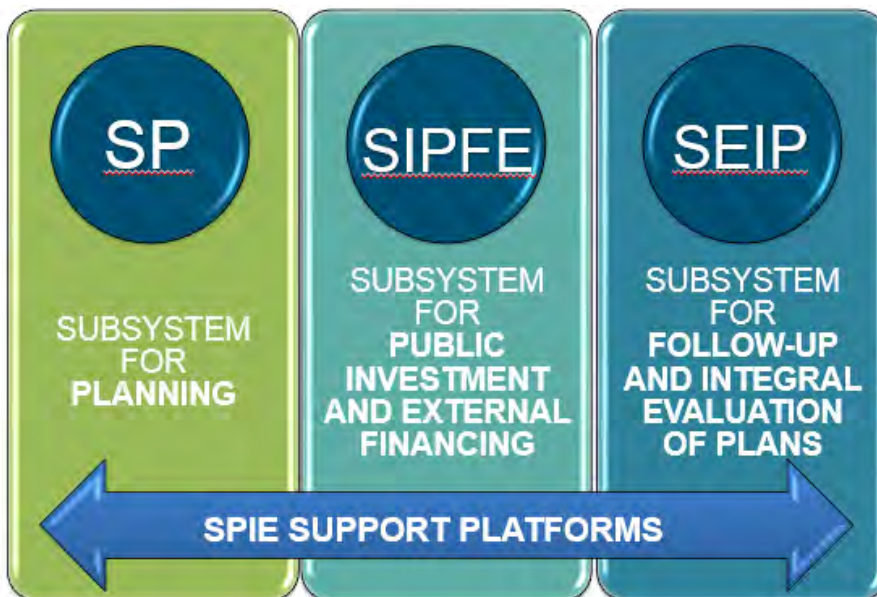
considered a country of medium human development. Bolivia got an HDI of 0.662, based on a life expectancy of 68.3 years, an educational expectancy 13.2 years, an average of schooling 8.2 years and a GDP per capita of \$ 5,760, adjusted for parity international purchasing power. However, the position of Bolivia was still below the other South American countries.

2.2 Transport Policies, legal framework, and institution

2.2.1 Integrated Plans

The Government of Bolivia enacted a new law (Law No 777) on January 21st, 2016 for the system of integrated plans which applies to national, department, and municipal level. The name of the law is “Law of Integrated Planning System of State - SPIE”. SPIE is very similar to the previous planning system (National System of Planning - SISPLAN).

SPIE has following subsystem; i) Planning, ii) Public investment and external financing for integral development and iii) Monitoring and integral evaluation of plans.



Source: Estado Plurinacional de Bolivia

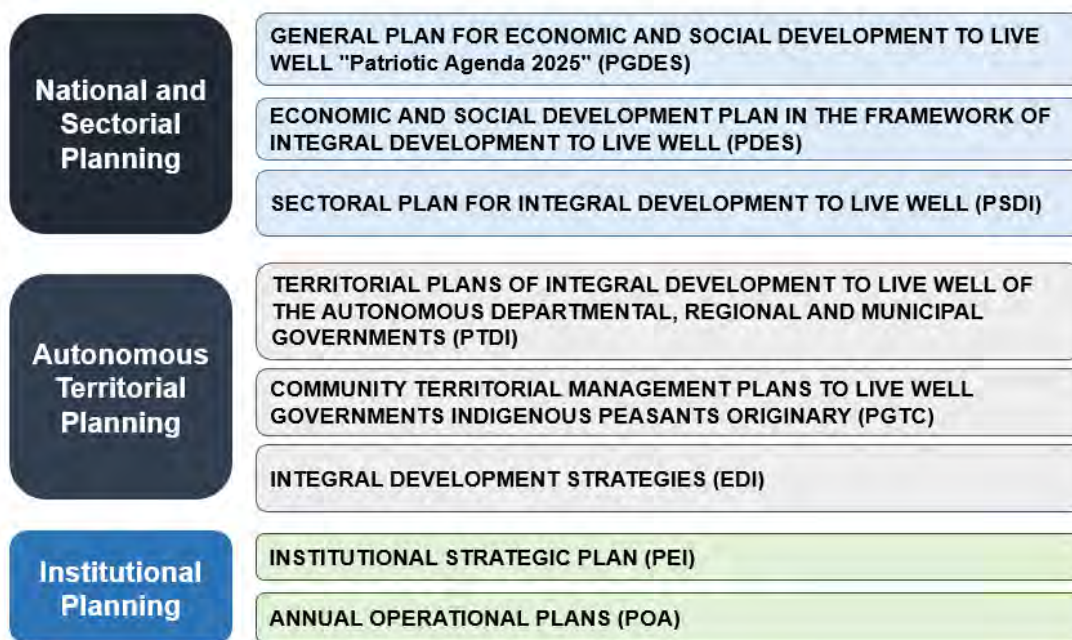
Figure 2.2-1 SPIE Subsystems

The planning system consists of long-term, medium-term and short-term plans. General Plan of Economic and Social Development (PGDES) is the long-term plan for 25 years. In SPIE, there are following medium-term plans for five years.

- Plan of Economic and Social Development under the Integral Development for Living Well (PDES)
- Sector Plans of Integrated Development for Living Well (PSDI)
- Land Plans of Integrated Development for Living Well (PTDI)
- Plans of Community Land Management for Living Well (PGTC)
- Institutional Strategy Plans (PEI)
- Plans of Public Enterprises
- Integrated Development Strategies (EDI)

The short-term plan is Annual Operation Plan (POA), which is effective for one or two years.

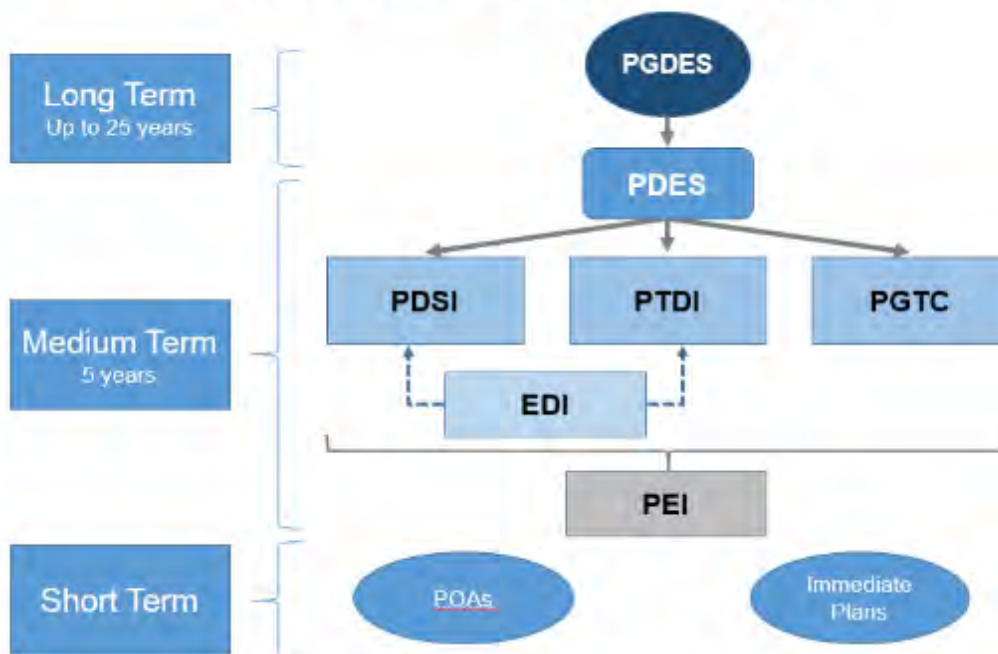
LONG, MEDIUM AND SHORT TERM PLANS



Source: Government of Bolivia, translated by JICA Study Team

Figure 2.2-2 SPIE Subsystems

TERM OF PLANS AND HIERARCHY



Source: Government of Bolivia, translated by JICA Study Team

Figure 2.2-3 Terms of Plan and Hierarchy of SPIE

At municipality level, PTDI, PEI, PEP for five years and POA for annual are necessary to apply budget allocation from the central government. Without approval of PTDI and POA, municipalities cannot receive the annual budget from the central government.

The corresponding plans in SISPLAN are shown in Table 2.2-1.

Table 2.2-1 Name of plans under SISPLAN and SPIE

SISPLAN (National System of Planning)		SPIE (Integrated Planning System of State)
PGDES	General Plan of Economic and Social Development	PDES
PDD	Department Development Plan	PTDI (Department)
PDM	Municipal Development Plan	PTDI (Municipal)
PEI	Institutional Strategic Plan	PEI
POA	Annual Operation Plan	POA

Source: Law No 777 (Law of Integrated Planning System of the State – SPIE)

2.2.2 National Level

(1) Economic and Social Development Plan (PDES)

The Economic and Social Development Plan (PDES) is the national level five-year development plan for various sectors including the transport sector in Bolivia. The recent PDES is for the period of 2016-2020, considering the Patriot Agenda 2025. The plan consists of goal, results, and actions for 2016-2020.

The goal of the transport sector in the PDES is:

100% of the Bolivians are integrated through transport systems in its different modalities.

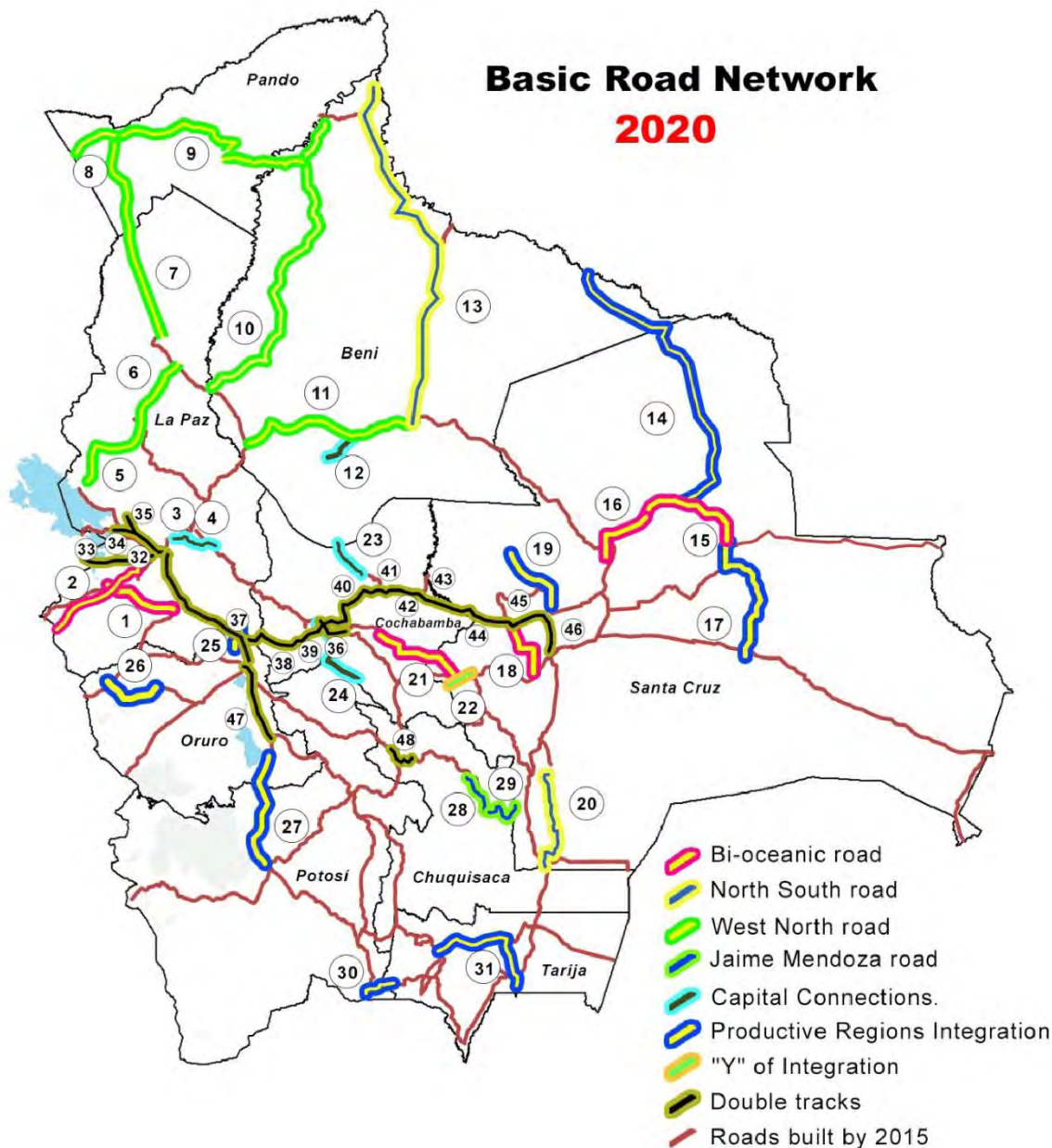
The results are described as follows:

Roads
The construction of 4,806 km of road sections includes: <ol style="list-style-type: none"> 1. Double tracks 2. Bi-Oceanic corridor 3. North-South corridor 4. West-North corridor 5. Jaime Mendoza corridor 6. Capital of Department Connections 7. Integration of productive regions and the “Y” of integration 8. Bridges and accesses
Railway
<ol style="list-style-type: none"> 9. Progress has been made to build the Bi-oceanic Central Rail (CFBC) integrating Brazil - Bolivia - Peru, linking the port of Santos (Brazil) with the Port of Ilo (Peru). 10. The railway for urban transport in Cochabamba and Santa Cruz has been built, to articulate the rail network. 11. Progress has been made in the construction of the railway Motacucito - Mutún - Puerto Busch, which will contribute to the development of the steel industry in the country through the implementation of the Mutún industrial project. 12. The railway section Montero - Bulo Bulo has built, which will contribute to the interconnection of CFBC.
Water Transport
<ol style="list-style-type: none"> 13. Waterways have been rehabilitated in rivers such as Ichilo-Mamore and Beni, and also the Canal Tamengo Phase I has been drained. 14. Three new ports in its first phase have built.

<p>15. Free taxes zones in international waters through agreements have developed.</p> <p>16. The cargo terminal at Puerto Busch has launched.</p>
<p>Aerial ropeway</p>
<p>17. Six new cable car lines in the cities of La Paz and El Alto and new lines of aerial ropeway in other cities have built.</p> <p>18. Construction of aerial ropeway in other cities: Oruro, Potosi, and Sucre have begun.</p>
<p>Air transport</p>
<p>19. Six international airports have built, expanded and equipped: 3 under construction and 3 in expansion and equipment.</p> <p>20. Twelve national and touristic airports in the country have built, expanded and equipped: 5 built and equipped, 7 expanded and equipped, and 1 airport in the pre-investment study.</p> <p>21. The HUB intercontinental airport of Viru Viru - Santa Cruz has implemented.</p>

The construction of urban train in Santa Cruz is included in the PDES.

Figure 2.2-4 shows the Basic Road Network in 2020. The double track project (two parallel roadways with two lanes for each direction) will connect Santa Cruz and La Paz. The section of Warnes – Santa Cruz (28.8km) is a part of the double track project. Road construction of El Torno – Buena Vista (82km) is included in the basic road network in 2020.



Source: PDES

Figure 2.2-4 Basic Road Network in 2020

The project of Bi-Oceanic Central Rail (CFBC) is include in PDES, although the completion of the project is beyond 2020. The PDES describes that the urban railway project in Cochabamba and Santa Cruz will be built by 2020.

(2) Development Plan of Transport Sector

The latest development plan for transport sector was made in 2009. The policy of the transport sector in the plan is:

The transport sector as significant economic, social and sustainable development component should form internal backbone and integrate the country externally, improving and developing the national multimodal system (land, air, and water), also, should provide and ensure adequate transport services universal accessibility, where the Bolivian state exercises its

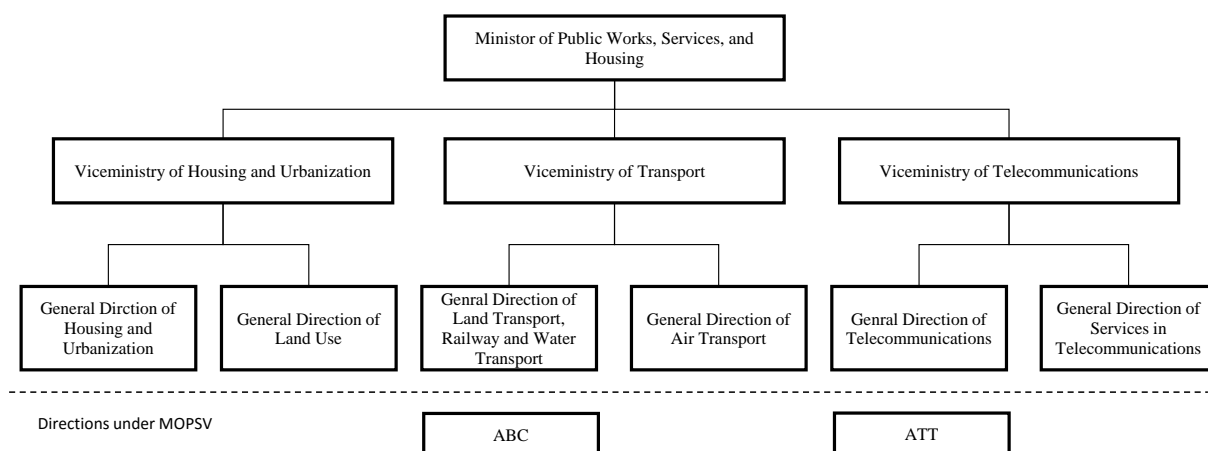
sovereignty over ownership, management, and control of strategic services provided by companies in the sector

The vision in 2020 is described as:

By 2020, the Bolivian people have access to production centers and markets for their economic, social and sustainable integrated development, with universal transport services that meet the user through a consolidated sector, with strengthened institutions, articulated and roles clearly defined, supporting the productive matrix through a multimodal transport system that allows internal and external integration backbone.

(3) Institutional Framework

The Ministry of Public Works, Services and Housing (MOPSV), through the Vice-minister of Transport (VMT), is responsible for the national administration in the transport sector.



Source: <http://www.oopp.gob.bo/>

Figure 2.2-5 Organization Char of MOPSV

(4) General Law of Transport (Law N165)

The General Law of Transport (Law N165) was enacted on August 16, 2011, in which five years transport plans at national, government, and municipal level were stipulated as follows:

- PLANAST (National Transport Sector Plan)
- PRODET (Department Transport Program)
- PROMUT (Municipal Transport Program)

PLANAST is a 10 years plan at the national level, while PRODET and PROMUT are short-term plans for 5 years. These plans have not been formulated. So far, there is no guideline to make these plans.

The law stipulates the jurisdiction of each government level as:

- Autonomous governments of the department have exclusive powers on inter-municipal and inter-provincial transport systems in terms of planning, development, and control including tariff.
- Autonomous governments of the municipality have exclusive powers on transport systems within their jurisdiction in terms of planning, development, and control including

tariff. Each municipality is responsible for registration of vehicles.

(5) Urban Train Project

Presently, the central government takes the initiatives in the implementation of two railway projects: one is an urban train project in Santa Cruz de la Sierra, and the other is an inter-urban train project between Montero and Santa Cruz de la Sierra. Recently, MOPSV has conducted the tender for the project as a turn-key contract, but it has failed because no participant satisfied the conditions in July. MOPSV has not shown the consequent actions of the failed tender. The components of the project are shown in the table below.

Table 2.2-2 Major Characteristics of the Urban Train and Inter-urban Train

	Urban train	Inter-urban train
Length (km)	(km)	(km)
	2 nd Ring Road	12.0
	Radial Mutualista	2.3
	Radial la Guardia	2.2
	Radial la Santos Dumont	2.7
	Radial Av. 3 pasos	8.4
	Radial Busch	2.4
	Total	30.0
		Montero-Warnes 24.0
		Warnes-Ciudad Satélite 11.0
		Ciudad Satélite-Bimodal 27.5
		Total 62.5
Design speed	80km/h	160km/h
Operation speed	60km/h	Urban zone: 60km/h Rural zone: 120km/h
No. of trains in operation	12	3
Capacity	250	350
Stations	20 primary stations + 12 secondary stations	4 primary stations + 3 secondary stations
Structure	Single track at grade (elevated if necessary)	At grade (elevated if necessary)

Source: Documento de solicitud de propuesta contratación llave en mano (gestión de financiamiento) (MOPSV/VMT/CD N°010/2016)

There is no feasibility study for the project, and Environmental Impact Assessment (EIA) for the project has not been conducted yet. Presently, there is no guideline and technical standards for railway development in Bolivia.

2.2.3 Metropolitan

Bolivia is administratively divided into nine departments. Each department is divided into provinces, and each province is divided into municipalities. In the Constitution of Bolivia, there are four types of autonomies such as departmental autonomy, regional autonomy, municipal autonomy, and native ingenious rural autonomy.

In Law 031, “The Framework of Autonomous and Decentralization of Andrés Ibáñez”, which was enacted on July 19, 2010, the conditions of the region metropolitan are described such as:

Article 25: The metropolitan regions are created by law as the area of planning and management by major conurbations of five hundred thousand (500,000) inhabitants.

Article 26: In each of the metropolitan areas, a Metropolitan Council be formed as the highest organization of coordination for metropolitan administration, composed of representatives of the departmental government, of each of the relevant municipal and the central governments.

The Department of Santa Cruz enacted “Ley Departamental N 110” on November 12, 2015, to promote the creation of the Region Metropolitan. The Article 4 of the law describes as:

“The creation of the Metropolitan Region Santa Cruz is declared as a department need, which should be implemented in a manner that it conforms consensus and coordination to the central level of the State and the autonomous governments of the municipalities.”

The municipalities in the Region Metropolitan of Santa Cruz (RMSC) are Santa Cruz de la Sierra, Santa Cruz de la Sierra, Cotoca, Porongo, El Torno, La Guardia, Warnes and Okinawa Uno as described in the Article 5 of the law. Okinawa Uno, which is a member of the RMSC, is not included in the Metropolitan Area of the Project.

2.2.4 Department Level

(1) Department Plan

The latest plan for the transport sector in the Department of Santa Cruz is “the Development Plan of the Department of Santa Cruz 2025”. The plan has a structure of Vision, Strategic Areas, Objectives, Policies, Strategies, Programs, Sub-programs, and projects. The plan of the transport sector is arranged in the Objective 2 under a Strategic Area which describes “Santa Cruz of integrated, productive, industrial and services”. The Objective 2 describes as:

Objective 2: Strengthen infrastructure networks to strengthen economic and territorial integration of Santa Cruz

The policies, strategies, programs, and sub-programs under the Objective 2 are shown in the table below.

Policy	Strategy
Strengthening permanent modal and multimodal territorial connection	Integration of roads, rails, rivers, and the air of the Department in a transport network oriented to generate social and producer surpluses
Programs	Sub-programs
Departmental infrastructure integration	Road infrastructure Achievement Indicators: Provincial road network is paved at 30% by 2020 and at least 50% by 2025
Objective: physically integrate the department to reduce time, costs, and improve the conditions of transport of people and goods in and from Santa Cruz	Railway infrastructure Achievement Indicators: the rail network is increased to 50% by 2020. The eastern network is connected to the western network until 2025 (motacu-PUERTO BUSCH)
Indicators of achievement: the whole territory inhabited department is accessible by at least one mode of transport permanently in both economically and socially profitable until 2025	Airport infrastructure Achievement Indicators: There is at least one subregion Airport, located strategically in intermediate cities in the Department
	Fluvial infrastructure Achievement Indicators: In the department, it has the necessary infrastructure to operate by the water transport of Paraguay-Parana (PUERTO BUSCH, CANAL TAMENGO)

(2) Department Law of Land Transport

The Department Law of Land Transport (Department Law N96) was enacted on May 18, 2015, in which the role and responsibility of the Department of Santa Cruz in the transport sector are clarified. The Secretary of Public Works and Land Use is the major authority on the transport sector, having the responsibilities such as planning, design, implementation, registration, permission, and so on.

The law stipulates that the Executive Organ of Department of Santa Cruz, the Secretary of Public Works and Land Use, will make the transport plan of the inter-municipal and inter-province transport for both passengers and cargos in the Economic and Social Departmental Development Plan.

The law clarifies that operators should obtain authorization from the authority by registering with necessary documents including routes. The authorization is valid for 25 years.

Transport tariff is approved by the authority, and operators should apply the approved tariff for the services. Operators should not change their routes which are approved by the authority.

The authority has the authorization to inspect operators.

2.2.5 Municipality Level

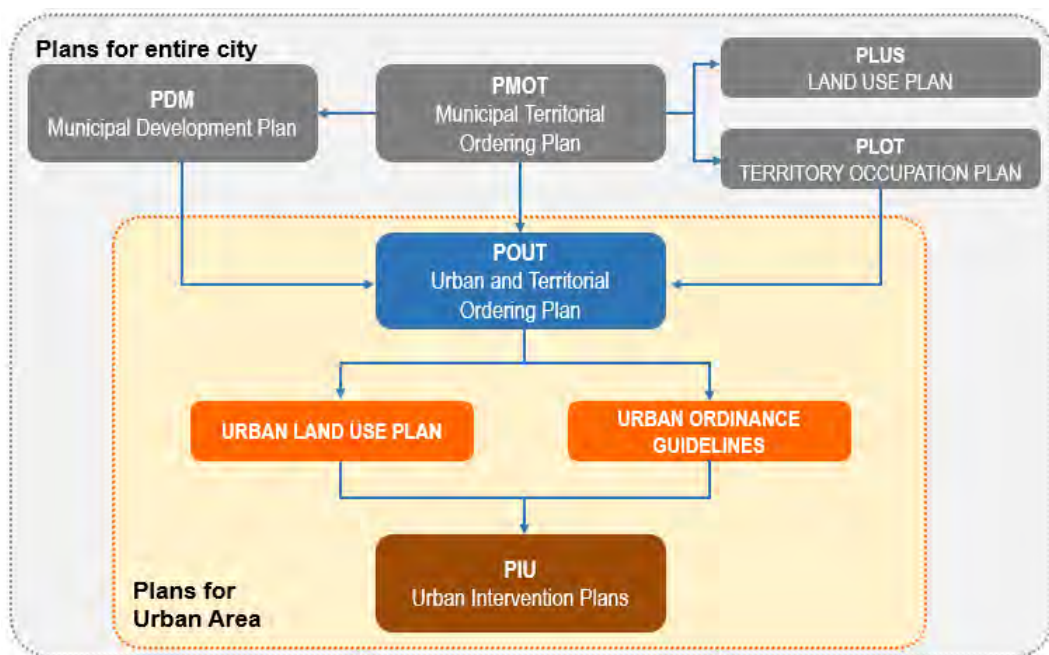
(1) Decentralization

Due to the decentralization policy, each municipality has a wide power on transport and urban development sector within its jurisdiction under the conditions stipulated in the relevant laws such as Framework Law of Andrés Ibáñez Decentralization and Autonomous No 031. From this, each municipality needs to enact laws and regulations, and to make guidelines, although they are similar each other.

Land use plan for whole municipal territory was decentralized in 2010 by the Law No. 031 Framework of Autonomies and decentralization “Andrés Ibáñez”. Before enforcement of this law, municipality’s responsibility was limited to the Urban Area to provide public services for the citizen in the area, while outside of the Urban Area was managed by the departmental government.

(2) Planning System

Municipal Development Plan (PDM) changed to Territorial Plans of Integral Development (PTDI). The following figure shows the relationship of plans between Measures of Planning and Territorial Ordering at the Municipal Level in SISPLAN. Planning system at municipality level has not modified to new SPIE system. Plans prepared by municipalities are not completed in some municipalities. Definition of land use categories is determined by each municipality. Accordingly, the planning system seems still complicated.



Source: Government of Bolivia, rearranged and translated by JICA Study Team

Figure 2.2-6 Relationship between Measures of Planning and Territorial Ordering at the Municipal Level in SISPLAN

(3) Laws and Regulations

Traffic and transport laws in each municipality are under the jurisdiction of both national laws and municipal traffic regulations. Municipalities establish ordinances and regulations related to transport and traffic management.

The Mayor promulgates ordinances and regulations, which the City Council is responsible for making. The City Council also legislates resolutions, but these resolutions are subordinate to the ordinances and laws.

(4) Transport Plans

Santa Cruz de la Sierra developed transport plans in the past. In 1978, the Study of Traffic and Transport was elaborated by an Italian firm. The study proposed the implementation of the Traffic and Transport Office, Road Education System, and the Centralized Organization of Public Transport. Pedestrian zones and integration of bicycle with microbus were also proposed.

The next transport plan was the Plan of Circulation and Transport, which was elaborated by a French company – BCEOM in 1996. The plan included the introduction of traffic signals, reorganization of operators, rationalization of public transport routes, and the introduction of large capacity vehicles for the public transport system. The part of the proposal was approved by the municipality in the Municipal Order 018/98 in 1998.

The Integrated System of Public Transport (SIT) was formulated in 2006, in which modification of public transport routes was proposed based on the demand analysis. The basic concept of the SIT was to formulate the public transport system as a radial and circular network with an integrated fare system. The proposal has not been implemented.



Source: SIT

Figure 2.2-7 Basic Road Network in 2020 in SIT

There is no transport plan in other municipalities in the Metropolitan Area.

(5) Institution

In most municipalities, the responsibility for urban planning, road infrastructure, traffic, and public transport is divided into different secretaries. The responsibility of the municipalities on public transport and traffic management is under one section which is named as traffic and transport. So far, it is not clear which section is in charge of the planning of a comprehensive transport plan.

During the period of the Project, the Municipality of Santa Cruz de la Sierra changed the organization of the municipality by creating the Secretary of Urban Mobility.

Table 2.2-3 Responsible Directions and Secretaries on Transport Sector in Municipalities

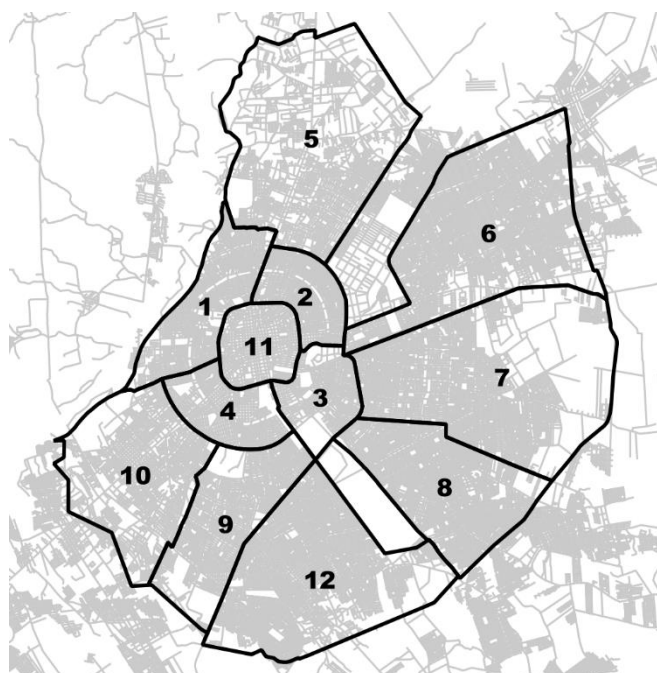
Municipality	Urban Planning	Road Infrastructure	Public transport	Traffic management
Santa Cruz de la Sierra	S. Planning	D. Road Infrastructure S. Public Works	D. Traffic and Transport S. Urban Mobility	D. Road traffic sign and traffic light S. Urban Mobility D. Traffic and Transport S. Urban Mobility
Cotoca	D. Regulation, S. Engineering	D. Public Works, S. Engineering	D. Transport, S. Engineering	D. Transport, S. Engineering
Porongo	S. Land Use	D. Road Infrastructure, S. Public Works	S. Land Use	-
El Torno	D. Urban Planning, S. Planning	D. Public Works, S. Planning	D. Public Works, S. Planning	D. Public Works, S. Planning
La Guardia	D. Regulation, S. Planning and Territorial Development	S. Public Works	D. Regulation, S. Planning and Territorial Development	D. Regulation, S. Planning and Territorial Development
Warnes	D. Cadaster and Land Use S. Administration and Finance	D. Infrastructure and Projects/ D. Road Maintenance S. Engineering	D. Traffic and Transport S. Planning and Coordination	D. Traffic and Transport S. Planning and Coordination

* S. = Secretary of, D. = Direction of

Source: Elaborated by JICA Study Team based on the organization charts provided in the TWG.

(6) Districts

Each municipality is divided into districts. The figure below shows the districts in Santa Cruz de la Sierra.



Source: The municipality of Santa Cruz de la Sierra

Figure 2.2-8 Districts in Santa Cruz de la Sierra

2.3 Urban Planning and Land Use Situation


2.3.1 Urban Expansion


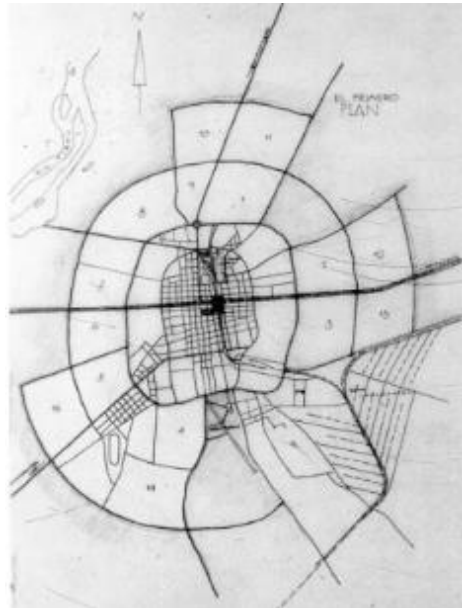
(1) Brief History of Urban Planning of Santa Cruz de la Sierra



Santa Cruz de la Sierra since its founding went through three stages of development that can be seen by looking at its layout because the urbanization process was very late in relation to the generality of Latin American cities including La Paz and Cochabamba.

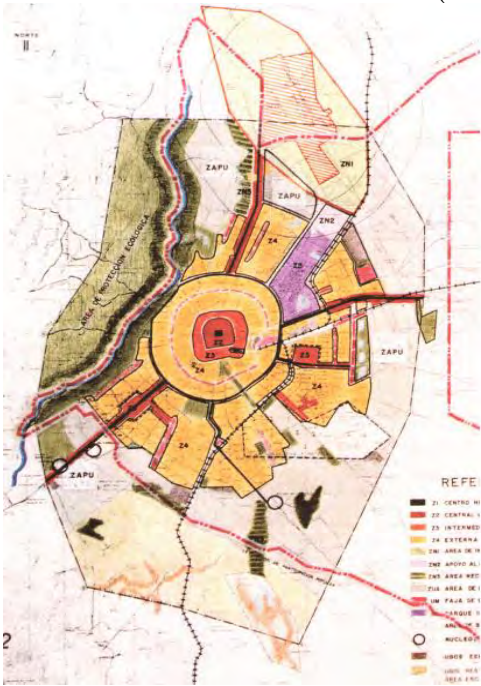
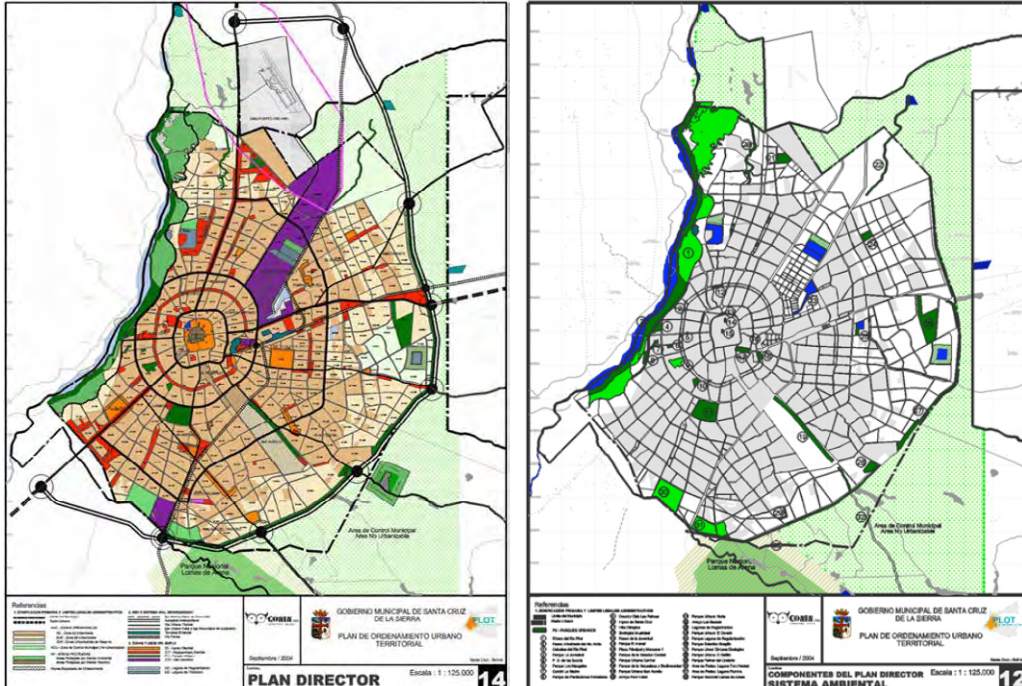
- 1) The first stage is characterized the Republican colonial city last until 1950 with a quadrangular frame compact structure.
- 2) The second stage between 1950 and 1985 which corresponding to the start of urbanization is characterized by a radio-concentric road pattern of a sectoral structure formed by urbanized areas until the 4th Ring Road and expanding urban areas which follows a linear road structure.
- 3) The third stage from 1986 to today is characterized by the polarization of the structure leading to the formation of the fragmented archipelago type.

Subscribed below is a brief historical event relate to urban planning after the first stage of urban development in Santa Cruz de la Sierra, which extracted from PLOT 2005 of the Municipality of Santa Cruz de la Sierra and other documents, to familiarize the master plan area.

Year	Event
1928	<p>Plano de Santa Cruz 1928</p>  <p>Santa Cruz de la Sierra has a clearly defined urban planning tradition that begins with the first scheme of the foundation grid system.</p>
1932-1935	<p>The Chaco War Bolivia lost a large part of Gran Chaco region in the Chaco War which defeated by Paraguay.</p>
1942	<p>Bohan National Development Plan (Melvin Bohan) In 1942, the Plan Bohan, by the central government defined Santa Cruz turning into a supply center for agricultural products for the Andean region, which conceptually called “the march towards the East”.</p>

1947	<p>Ivanissevich Plan - 1947</p>  <p>It was designed for the first time with sewage and storm drainage, electric power grid and paving. The forecast population growth was surpassed in less than 10 years. And very little of project proposed was implemented.</p>
1952	<p>The National Revolution</p>
1953	<p>Law No 3464 Land Reform (Decreto Ley 3464 de Reforma Agraria)</p>
1954	<p>Opening the road from the city center to the hinterland.</p>
1955	<p>05/01/1955 The railway line between Corumba and Santa Cruz inaugurated.</p>
1956	<p>28/01/1956 Founding meeting of the restarted architects (8 members). 07/08/1956 The first Organic Statute of Architects Center of Santa Cruz was approved.</p>
1957	<p>05/09/1957 The Departmental Federation of Professional of Santa Cruz was founded. 19/12/1957 The railway line between Yacuiba and Santa Cruz inaugurated.</p>
1958	<p>Techint Plan</p>  <p>The design was radial-concentric structure following the ideas of the “garden city” of Anglo-Saxon origin. The Plan proposed the 1st Ring Road with subdivision between the center area and expansion area and formation of <i>urbanization</i> with “cul-de-sac” type streets and centralized social space and equipment. Based on the Plan, the drinking water is constructed from 1961, the sanitary and storm drainage network from 1962 and pavement from 1966. Until 1978 networks sanitary and storm sewers, telephones, electricity and paving were built up to the 2nd Ring, including plazas, medians of avenues, boulevards and parks. The Techint Plan was made for a population of 180,000 inhabitants.</p>
1959	<p>The College of Architects of Bolivia was formally established on September 28, 1959</p>
1964	<p>Law of the Republic in 1964 the National Council of Engineering is created. State agency regulated practical professional.</p>
1967	<p>The Council and Technical Office of Regulatory Plan (OTPR) was created.</p>

<p>1970</p>	<p>Master Plan 1970</p>  <p>The Techint Plan was modified and completed the design to 4th ring with 4,600 hectares.</p> <p>The Plan introduced the Tertiary Equipment Belt (3rd Internal and External Ring), Industrial Park and the new railway station.</p> <p>The Industrial Park proposed in Techint Plan in the southeast part was relocated to northeast with 960 ha.</p>
<p>1978</p>	<p>Expanded Master Plan 1978 (Plan Director Ampliado de 1978)</p>  <p>The urban area expanded outside the 4th Ring Road with 14,000 hectares, based on a main road frame extending the radials and incorporating transverse avenues parallel to the ring roads. Mixed land use and first traffic and transport plan was proposed in this plan.</p> <p>At the end of the 70's, the urban planning department started control of the urban development, because of the enormous illegal ground owning and constructing by the poor migrants.</p>
<p>1982-</p>	<p>Latin American debt crisis started from Mexico caused migration wave to Santa Cruz.</p>
<p>1984</p>	<p>Law of Municipality Organizations</p>
<p>1986</p>	<p>New Preservation Plan 1986 A detailed survey of the Historic Center was developed with a proposal to preserve property listed. In 1991 the Plan and Rules were incorporated into the Code of Planning and Works.</p>
<p>1990</p>	<p>Gas discovered in the Department of Santa Cruz</p>
<p>1992</p>	<p>Law No. 1373, Law of Professional Practical Architect, November 13, 1992 Code of Planning and Works of Santa Cruz de la Sierra</p>
<p>1993</p>	<p>Law No 1449: Professional Engineer exercise is regulated on February 15, 1993, recognizing the legal validity of the SIB, so the CNI records are added to the SIB, as the registration authority engineers</p>
<p>1993 - 1997</p>	<p>The second wave of political transformations into a neoliberal model was made, and all public companies were capitalized which opened the way to global external economies to produce an enormous effect on the region of Santa Cruz.</p>

<p>1995</p>	<p>The Santa Cruz Master Plan 1995 (Plan Director 1995)</p>  <p>This plan was developed based on aerial photography December 1993. The model adopted articulates:</p> <ul style="list-style-type: none"> a) Areas subject to restructuring. b) Areas subject to consolidation. c) Areas of suburban character. d) Identification of emerging centers. <p>The objectives are:</p> <ul style="list-style-type: none"> a) The search for greater social or equity access of low-income population to goods and services necessary for a dignified life. b) The pursuit of economic efficiency in all approach. c) Ecological Sustainability: preserving the environment and its resources <p>The City Council recommended “Improving urban land use” and not extend the developable area. As a result, the model considers only the occupation of land located within the buildable area and the possibility of developing self-reliant isolated developments of the current urban structure.</p>
<p>1996</p>	<p>Ley N° 1715 del Servicio Nacional de Reforma Agraria (INRA Law)</p>
<p>1999</p>	<p>Law No. 2028 on Municipalities</p>
<p>2000</p>	<p>Regulation for Law of Practical Architect.</p>
<p>2002</p>	<p>The 03/04/2002 with S.D. 26582 Regulation for Practical Professional Engineer</p>
<p>2005</p>	<p>PLOT.O.M. 078/2005</p>  <p>PLAN DIRECTOR Escala 1 : 125.000 14</p> <p>COMPONENTES DEL PLAN DIRECTOR SISTEMA AMBIENTAL Escala 1 : 125.000 12</p>
<p>2006</p>	<p>First Indigenous President Morales’s new administration started. Ley N° 3545 Modificación de la Ley N° 1715 Reconducción de la Reforma Agraria</p>

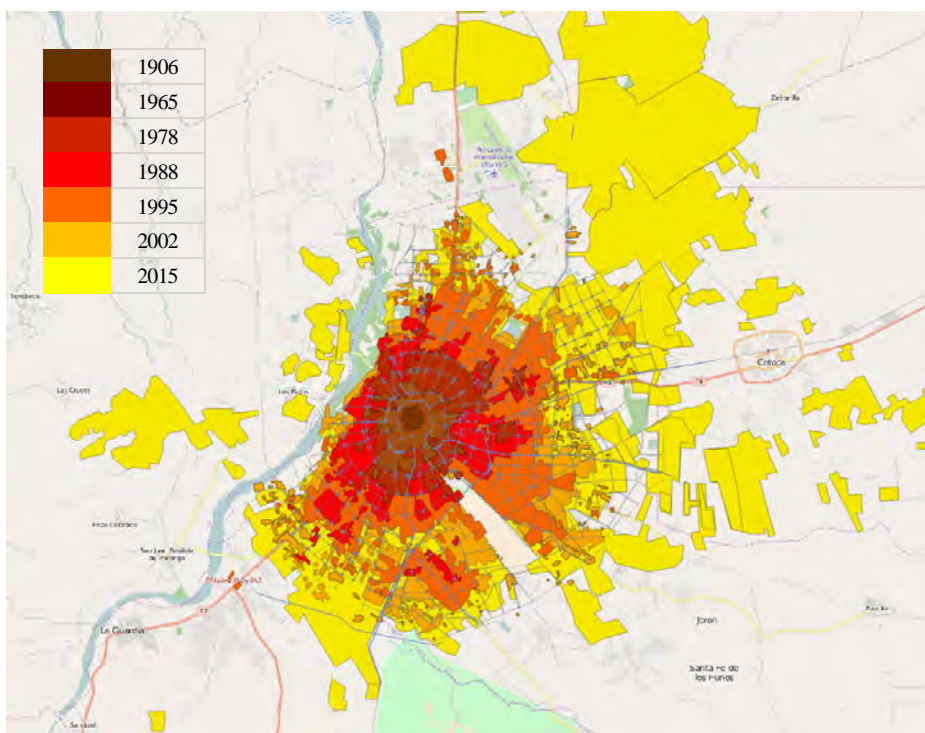
2009	Bolivian Constitution of 2009 The 2009 Constitution defines Bolivia as a unitary plurinational and secular state, formally known as the Plurinational State of Bolivia which stipulate for a mixed economy of state, private and communal ownership, restriction of private land ownership to a maximum of 5,000 hectares.
2014	Law No. 482 on Local Government Autonomous is sanctioned. The New Code of Planning and Works approved in June.
2016	Law No.777 on Integral State Planning System - SPIE

(2) Historical Situation of Urban Land Use Expansion

The 1969 population was only 115,185, settled on 1,355 hectares, which gives us a real density of 84 h / ha. By 1976, the city had more than doubled its population to 254,000 inhabitants, and urbanized area expanded to 4,615 ha. Up to 1993, the area of urban sprawl reached 10,910 ha with 697,278 inhabitants which resulting density of 64 h/ha.

In 2005, there are 325 *urbanizations* outside the fourth ring, of which, 139 are covered by the Director Plan 1995 with an area of 13,433 hectares and the remaining 186 *urbanizations* covering an area of 16,593 hectares are outside the limits set by the Director Plan 1995.

Figure 2.3-1 shows the progress of urban expansion of Santa Cruz de la Sierra. The color in 2015 includes the urbanizations that have not been populated yet.



Source: TOMO I, PLOT of the Municipality of Santa Cruz de la Sierra, JICA Study Team

Figure 2.3-1 Urban Land Use Expansion from Santa Cruz de la Sierra to outside

(3) Population Density

As shown in Figure 2.1-5 and Figure 2.1-6, higher population density area can be seen in eastern part and areas along 2nd and 3rd Ring Road. However, most of the area was lower density under 90 h/ha.

(4) Issues of Urban Expansion

1) Unplanned Scattered Urban Expansion without appropriate Road Network:

Many *urbanization* projects in Santa Cruz Metropolitan area were implemented. Most of the roads in *urbanization* were planned and constructed by developers in their project areas with less concern on network connectivity of road together with other *urbanization* projects or existing road. This caused scattering mosaic pattern of the urbanized area and agricultural area. This situation has been hampering efficient and effective economic activities in Santa Cruz metropolitan area.

Coordination mechanism among local governments has been weak to solve scattering infrastructure.

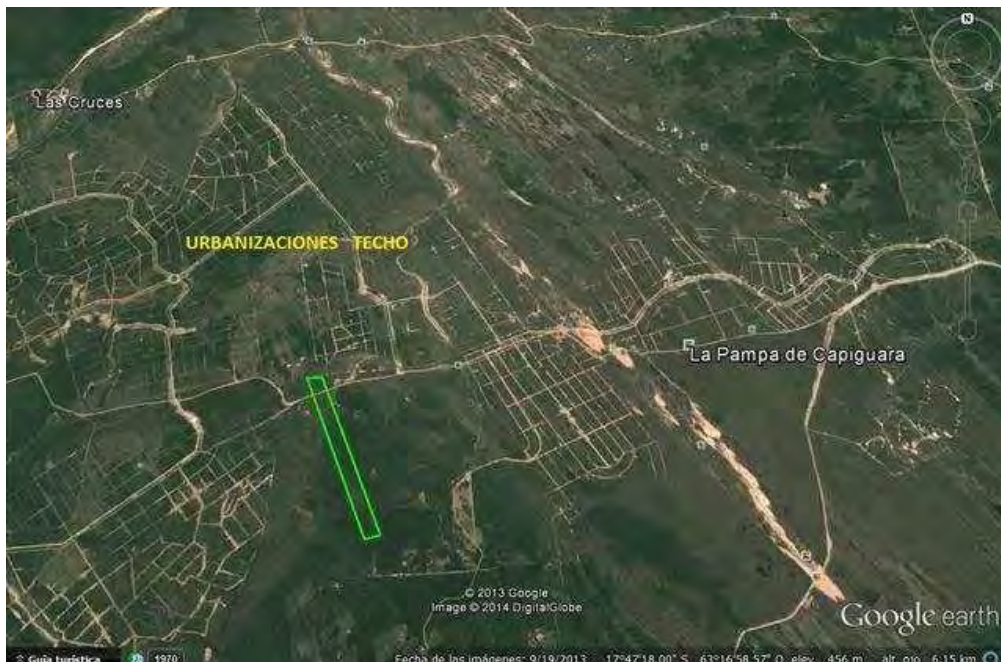


Source: <http://www.santacruzdelacolina.com/>, <http://www.fexpocasa.com>

Figure 2.3-2 Sample Image of Middle to High-Class Urbanization

2) Environmental Concern

Some *urbanization* projects in Porongo are concerned environmental pollution for groundwater which used for water supply. Porongo Municipality stopped those projects.



Source: Google Earth

Figure 2.3-3 Urbanization Construction Work on Groundwater Reservoir

3) Huge New Town Development Plan:

La Fuente is one of the biggest developers in this region. La Fuente planned and is developing so-called “New Santa Cruz City” which has 5,778ha area and 450 thousand planned population with assistance from Korean Land & Housing Corporation.



Source: Executive Summary of New Santa Cruz City Master Plan

Figure 2.3-4 Land Use Plan of New Santa Cruz City

Also, a huge urbanization project can be observed in Colpa Belgica Municipality located west of Warnes. Currently, there are 11 new urbanizations which have been implemented by private developers. The total jurisdictional area of this municipality is 29,000 ha, and the total area of urbanizations is 12,000 ha. The largest urbanization is “La Nueva Gran Ciudad del Urubo” which has been developed by Grupo La Fuente. 2,700 ha have developed as Phase 1, and 5,300 will be developed as Phase 2. While the development is progressed, there are problems on the road networks. Access roads to the city of Colpa Belgica are unpaved and in very poor condition. The only access from Warnes is a bridge that crosses the Pirai River and is in very poor condition.

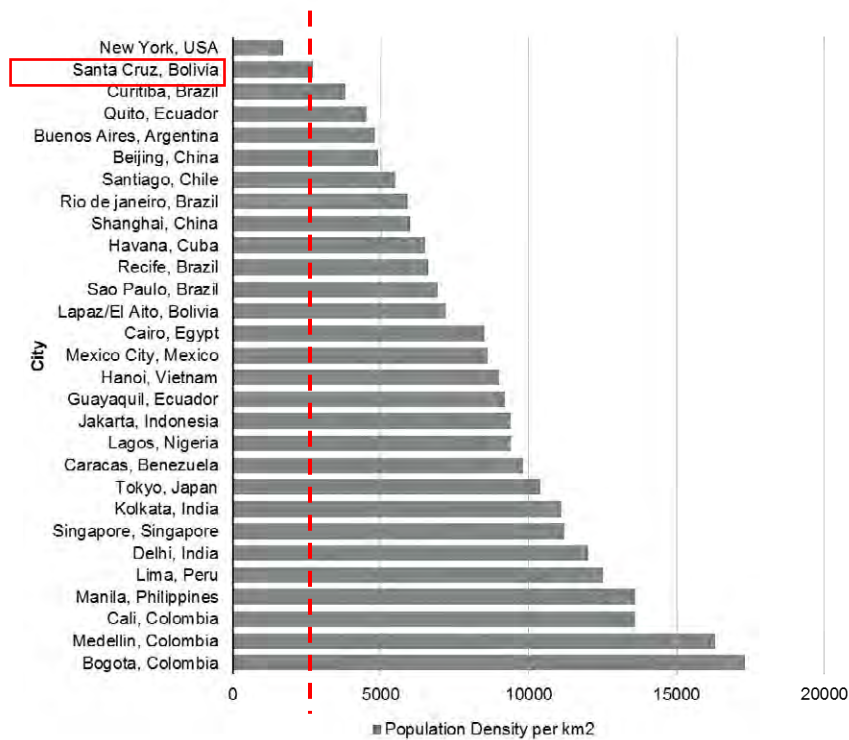


Source: Google Earth

Figure 2.3-5 Spreading Urbanization in La Belgica Municipality

4) Low Population Density

Some high-rise building can be observed in the city of Santa Cruz de la Sierra. However, the average population density of UV which under 150 inhabitants/ha is still low in city center area. Average population density of Santa Cruz de la Sierra was 27 inhabitants/ha for whole municipality area, 72 h/ha for Urban Area in 2012. Compared with other Latin American cities and major cities around the world, the population density is still low.



Source: Demographia World Urban Areas 13th Annual Edition: 2017:04

Figure 2.3-6 Comparison of Urban Population Density

Low-density development cost more than high-density development for infrastructure installation to provide public services such as road, electricity, water, sewerage and public transport service. This means that Municipalities need more budget for their public services to satisfy their citizens.

5) Lack of Appropriate Development Control Mechanism

There are many issues to be solved for appropriate urban development management such as; i) Lack of cadastral data and information sharing among related governmental agencies such as municipalities, departmental government, INRA, Military Geographic Institute (IGM), Property Right Office (*Derecho Rearles*) and so forth, ii) Lack of appropriate procedure of EIA License and deterrent mechanism to control *urbanization* development without EIA License, iii) lack of coordination and information sharing between municipalities and other agencies regarding land ownership change and land subdivision in Rural Area (outside of Urban Area).

Restructuring of development control mechanism must be necessary to manage the urban growth of Santa Cruz Metropolitan area. Details are described following section.

6) Municipality Boundary Problem and Land Use Management:

Municipality boundary has been a serious problem between the municipalities. A municipality approved an *urbanization* project which located in the gray zone to the neighbor municipality. Confusion on provision of public services occurred

The approval process of revision of Urban Area at the central government cannot be receipt without resolution of municipality boundary problem. Without approval of the Urban Area, a municipality cannot get the approval of their revised PLOT and other land use plans from the central government. This means that municipalities who have boundary problem cannot implement development control based on revised land use plan. Municipalities have to use old and outdated master plan.

2.3.2 Land Reform and Land Ownership

The rapid expansion of *urbanizations* is related to the Land Reform policy of Bolivia. This section reviews the brief history of the land reform.

(1) Outline of Land Reform in Bolivia

1) First land reform challenge (1952-1993):

Existing situation of expansion of urbanization is rooted deeply in the land reform policy of Bolivia. Bolivia has faced many *coups* in the history. The Bolivia Revolution in 1952 was a truly revolutionary event to change social system in Bolivia.

The Land Reform Law was adopted in 1953 after the Revolution. Before this law, the land ownership in Bolivia was characterized by large extensions of land held by few with tenure and labor which like feudalism. With the Bolivian Revolution of 1952 and the Land Reform law of 1953, the Bolivian government began to redistribute the large landholdings to the mass of peasants. A general objective of land reform was to restructure the social, political, and economic relationship between landlords and tenants.

The low land around Santa Cruz de la Sierra was developed new frontier for agricultural land.

Land reform was carried out quickly, and unpaid personal and farm labor obligation to landlords were ended almost immediately. In addition, in some areas, peasants took immediate possession of land by means of invasion.⁷

In the period following the Agrarian Reform Law of 1953, until 1993, approximately 58 million hectares of land of Bolivia's total surface of 110 million hectares were distributed among more than 759.000 beneficiaries. In the Department of Santa Cruz, 22 million hectares of agrarian land was redistributed to landless peasants.

However, this is not the case. Additional agrarian statistics from INRA show that the distribution of land has been enormously inequitable between different types of land holdings. Of the total amount of redistributed land in Bolivia between 1953 and 1993, 40.16 percent has fallen into the hands of agro-enterprises. During the same period, only 8.46 percent of the land was redistributed to small agrarian holdings. The most remarkable about these numbers is that in Bolivia agro-enterprises only accounted for 2.24 percent of the total of beneficiaries between 1953 and 1993. In other words, a huge amount of land became concentrated in the hands of a very small group of businessmen. In Santa Cruz, the situation concerning agrarian land redistribution was not much different. In this eastern department, the percentage of land distributed to the agro-business sector was even higher, namely 52.60 percent.⁸

2) Agrarian reform from Ley INRA 1996 to 2006:

Previously a safety-valve for this growing pressure on the land was the process of planned "colonization", whereby rural families were settled on productive land in the valleys and lowlands by the National Colonization Institute (INC). However, this office was closed in 1992 amid government corruption scandals. Subsequent colonization has lacked proper planning and has taken place spontaneously. Many highland peasants now migrate to urban centers in Bolivia, increasing already overcrowded peripheral settlements.

During the 1990s, in response to the situation of gross inequality in land ownership and landlessness of many peasant and indigenous communities, social movements – particularly lowland indigenous groups - had pushed for a new process of land reform. This was finally initiated in 1996 with the passing of the "*Ley 1715 del Servicio Nacional de Reforma Agraria* (so-called INRA law)" which established the National Land Reform Institute (*Instituto Nacional de Reforma Agraria – INRA*). The idea was to create a more equitable distribution of land in the country through a process of "*saneamiento*", or land-titling.⁹

Table 2.3-1 Status of regularization in Bolivia in 2006

Status	Surface in ha		Surface in %		
Regularized	Titled	11,384,775.55	30,243,867.32	10.66%	28.33%
	Before titling	18,859,091.77		17.67%	
In process	15,915,920.23		14.91%		
Without regularization	60,591,935.87		56.76%		
Total surface to be regularized	106,751,723.43		100.00%		

Source: Juan Carlos Rojas Calizaya INRA 2006

⁷ Clark, RJ, "Problems and Conflicts over Land Ownership in Bolivia", Inter-American economic Affairs

⁸ INRA Estadísticas Agrarias 1953-2002, p49 and p68.

⁹ Bolivia Information Forum 2012, "Land and land reform in Bolivia: where are we now?"

Table 2.3-2 Status of regularization in Santa Cruz in 2006

Status	Surface in ha		Surface in %		
Regularized	Titled	4,101,161.14	10,765,247.22	11.15%	29.24%
	Before titling	6,664,086.08		18.10%	
In process			1,347,480.58	3.66%	
Without regularization			24,695,464.21	67.10%	
Total surface to be regularized			36,808,222.01	100.00%	

Source: Juan Carlos Rojas Calizaya INRA 2006

3) Third land reform challenge of Evo Morales 2006:

Evo Morales, Bolivia's first indigenous president, elected in 2005, is making good on his pledge to give land to the country's indigenous majority. The Government promulgated “*Ley No 3545 de 2006 de Reconducción Comunitaria de la Reforma Agraria*”, defining, in specific terms agrarian policy as one of structural transformation in agriculture, bringing about a rapid and massive redistribution of land and providing the beneficiaries with legal security. The main reasons for the Morales’ administration to reform Ley INRA, was the extremely slow execution of the regularization process between 1996 and 2006.

Table 2.3-3 shows that these measures have indeed significantly sped up the process between 2006 and 2008, and the government seized 16,000 hectares; some of it appropriated from a large estate deemed unproductive or illegally owned and redistributing it to the poor.

Table 2.3-3 Status of regularization in Bolivia in 2006

Status	Earlier administrations 1996-2006				Morales administration 2006- 2008				
	En 1000ha		En %		En 1000ha		En %		
Regularized	Titled	11,384	30,243	10.7	28.4	27,795	37,734	26.1	35.4
	Before titling	18,859		17.7		9,939		9.3	
In process	15,916		14.9		13,383		12.5		
Without regularization	60,592		56.7		55,633		52.1		
Total surface to be regularized	106,751		100.0		106,751		100.0		

Source: Juan Carlos Rojas Calizaya INRA 2006

The remarkable speed with which Morales’ administration has regularized and titled agrarian land in Bolivia appears from Table 2.3-4. It is notable how much Morales has focused on the titling of landholdings such as TCOs, communal properties, and *tirras fiscales* within two years than previous administration in ten years. The amount of *tirras fiscales* during 2006-2008 was quite large compared to the amount between 1996-2006. It is not clearly mentioned a breakdown; however, it can be conjectured that *urbanization* area might be included in this amount.

Table 2.3-4 Titled land per type of land holding 1996-2008

Type of holding	Earlier administrations 1996-2006	Morales administration 2006-2008	Total 1996-2008
TCOs	5,762,057	6,856,408	12,618,466
Small holding	707,714	586,629	1,294,344
Residential Plot	145	130	276
Medium-sized	309,247	350,997	660,244
Agro-enterprise	921,165	539,710	1,460,876
Communal Properties	1,523,125	2,351,120	3,874,246
<i>Tierras Fiscales</i>	109,914	7,695,716	7,805,630
Total	9,333,371	18,380,713	27,714,085

Source: Vice-ministry for land 2008

Before the Morales period, landowners and agri-business owners in Santa Cruz were strongly protested land reform policy. However, strong pressure from Morales administration to seize

unused land or low productivity farmland might change the landowners' mind to had better sell their land to land buyers with a certain amount of cash. This situation might cause rapid expansion of *urbanization* in Santa Cruz.

Land purchase activities in the rural area (outside of Urban Area) are tricky. Land brokers pay a certain amount of money to the landowner to transfer the land title to the broker, and they allow the previous landowners to continue their life or farming activities on the land for years until the land could earn development potential or land value to sell. Land use registration of the land has not changed to urban land use until the land gets development potential. Land brokers are continuing to purchase rural land for future urban development.

(2) Issues of Land Reform

1) Ambiguous difference between land redistribution and *urbanization*

Land redistribution to the mass of peasants has been the one of the important Bolivian government's policy since the 1952 Revolution. We could admit that *urbanization* activities might be a kind of land redistribution activities to the landless peoples.

It is difficult to restrict *urbanization* or land redistribution activities in rural areas in Santa Cruz metropolitan area because of the central government policy.

2) Lack of Unified Cadastral Database causing Conflicts on land ownership

The 1953 law was not followed up with vigorous programs to clarify and enforce its provisions, and thus the confusion persists. Conflicts between peasants and former landlords, and among peasants themselves, are common.

3) Weakness on law enforcement

The State is the only entity with the power to maintain order and to define and enforce rights, duties, and obligations involved in exploiting the land. The revolution and massive land redistribution called for an immediate redefinition and institutionalization of property rights. The situation also demanded new legal institutions and topographic services to implement the reform law as quickly and as orderly as possible to minimize conflicts over land. The new government, unfortunately, did not have the resources to carry out these functions immediately after the Revolution of 1952.¹⁰

2.3.3 Decentralization

Bolivia has had perhaps the most radical and extensive decentralization of all Latin American nations. Decentralization is an important challenge in political institutions to improve the efficiency of the delivery of public services and to promote people's initiative at the local level. However, this decentralization process causes several problems on urban management.

(1) Outline of Decentralization in Bolivia

1) The first phase of decentralization:

Bolivia was a highly centralized nation until 1994. Before the Decentralization in Bolivia, Department was thought as the basic local government administration under the control of the

¹⁰ Clark, RJ, "Problems and Conflicts over Land Ownership in Bolivia", Inter-American economic Affairs

central government. The administration of Sanchez de Lozada tried to reduce Departmental power which makes pressure to the Central Government.¹¹ And this system was leaned toward the federalism to divide this nation by ethnicity or social hierarchy, and was linked with a cause of the birth of the Morales administration¹².

The first phase of decentralization in Bolivia started during the administration of Sanchez de Lozada. Municipalities became a full-fledged local government with elected authorities, local taxes, central government transfers and expenditure responsibilities to realize his policy “Plan de Todos”. “Law No 1551 of Popular Participation” was enacted in 1994 and its core of the law consists of four points:

i) Resource Allocation: Funds devolved to municipalities doubled to 20 percent of all national tax revenue. More importantly, allocation amongst municipalities switched from unsystematic, highly political criteria to a strict per capita basis.

ii) Responsibility for Public Services: Ownership of local infrastructure in education, health, irrigation, roads, sports, and culture was given to municipalities, with the concomitant responsibility to maintain, equip and administer these facilities, and invest in new ones.

iii) Oversight Committees (Comités de Vigilancia) were established to provide an alternative channel for representing popular demand in the policy-making process. Composed of representatives from local and grassroots groups, these bodies propose projects and oversee municipal expenditure. Their ability to have disbursements of Popular Participation funds suspended if they find funds are being misused or stolen can paralyze local government and gives them real power.

iv) Municipalization: Previous municipalities were expanded to include suburbs and surrounding rural areas, and 198 new municipalities (out of some 315 in all) were created.

This law No. 1551 was followed by “the Law No 1654 of Decentralized Administration (1995)” and “the Law No 2028 of Municipalities (1999)”, which further defined the municipal mandate and located it in a broader governmental architecture.

2) The second phase of decentralization:

The second phase of decentralization in Bolivia started during Morales administration to reform its marginalized situation of indigenous people and communities together with land Reform policy. “The law No 31 of Autonomy and Decentralization” was promulgated in 2010. The purpose of this law is to regulate the autonomy regime by mandate of Article 271 of the Constitution 2009, the transfer and delegation of powers, the financial regime, and the coordination between the central level and the decentralized and autonomous territorial entities.

(2) Consequence of Decentralization in Santa Cruz Metropolitan Area

These are some consequences of decentralization in Santa Cruz Metropolitan area:

1) Overlapping demarcation among governmental agencies:

This often causes confusions. Problems are not solved at either level, and people lose faith in both their local authorities and the central government. For example, Environmental Impact

¹¹ Grindle, Merilee, *Audacious Reforms: Institutional invention and democracy in Latin America*, Baltimore, The Johns Hopkins Univ Press, 2000.

¹² Funaki, Ritsuko, *Decentralization reform of Bolivia*,

Assessment process, the government of the municipality has authority to approve development project; however, the central government also have authority for the bigger project.

While central governments may use decentralization to turn over important responsibilities to local units, they do not necessarily give them the required control of corresponding financial resources. Even when local governments can charge local taxes and levy fees, these monies are often difficult to collect. Even if a municipality could collect, the budget is often insufficient to fund the tasks assigned to local authorities especially in small municipalities.

2) Lack of reeducation opportunity for local government staff:

During series of TWG (Technical Working Group), counterparts from municipalities could be observed generally serious and faithful to do their assigned work as public servants. However, unfortunately, they do not have enough knowledge and experience to implement better work because of lack of continuing learning opportunity at university or other counties.

Each municipality tried to solve their difficult issues and to improve the situation in their municipality. Kind of TWG arrangement is efficient to strengthen staffs' ability.

3) Power of democratically elected local authorities:

Mayors of municipalities have strong power for decision making in many cases. This power causes some conflicts between neighboring municipalities and lost coordination opportunities during planning and implementation of metropolitan infrastructure projects.

A kind of coordination mechanism among Mayors in Santa Cruz metropolitan area to solve the conflict with neighboring municipalities.

4) Budget and plan approval from central government:

Budget approval is frequently delayed, and the procedure requires many conditions. This approval process causes delay and confusion of implementation of municipality's plan, and increase the influence of central government power.

2.3.4 Revenue System at Local Level

(1) Revenue from Central Government to Local Level

Law No. 1654 on Administrative Decentralization was approved in 1995 to decentralize governmental power to the municipality level. Before this decentralization law, the government budgetary allocation was 75% for the central government, 10% for departmental corporations, 10% for municipalities and 5% for universities. At that time, municipalities were only 24 around the capital of departments. After Law No. 1654, the budget was distributed 45% for the central government, 30% for departmental governments, 20% municipalities and 5% for universities (Medina C. & Galindo 1997).

Table 2.3-5 The Changing Allocation of National Budget

	% of National Total	
	Before (1993)	After (1995)
Central Government	75%	45%
Department Corporation	10%	30%
Municipalities	10%	20%
Universities	5%	5%
Total	100%	100%

Source: Medina C. & Galindo 1997

Other additional budget allocations are; 1) the implementation of the Forestry Law (Law No. 1700), which allocated 25% of forestry regalia to municipalities, 2) the law related to the National Dialogue (Law No. 2035), 3) additional resources from debt relief to municipal governments in three areas: infrastructure, health, and education and finally most influenceable one 4) the Law regarding Hydrocarbon revenues (Law No. 3058), allocates 50% of patent resources to municipalities (FamBolivia, 2011).

For example, the own revenue of the municipality of Warnes in 2015 was 36%, 32% from Central Government, 14% from Hydrocarbon royalties, 17% from UPRE (Special Projects Unit) and 1% from HIPC.

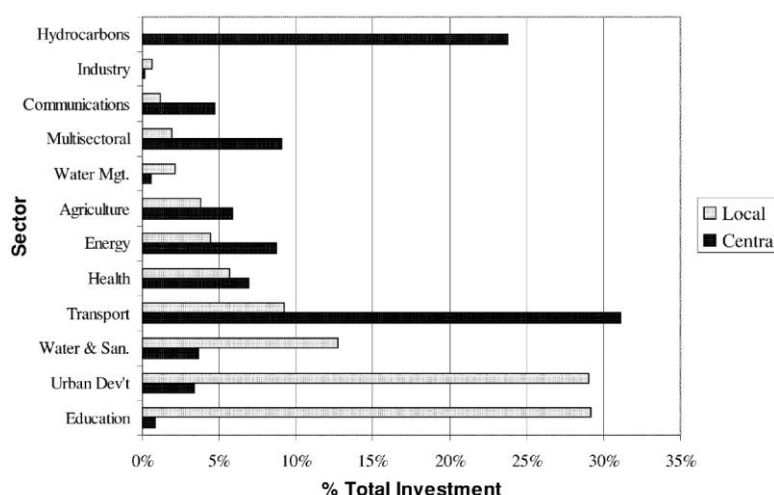
The extent of the change is perhaps best appreciated by examining the changes in resource flows it catalyzed. Table 2.3-6 shows that before decentralization 308 Bolivian municipalities divided amongst them a mere 14% of all devolved funds, while the three main cities took 86%. After decentralization, their shares reversed to 73% and 27% respectively. The per capita criterion resulted in a massive shift of resources in favor of smaller, poorer districts.

Table 2.3-6 The Changing Allocation of Public Funds

City	Central-to-Local Revenue Sharing (Bs'000)			% of National Total	
	1993	1995	% Change	1993	1995
La Pas	114,292	61,976	-46%	51%	10%
Santa Cruz	51,278	63,076	23%	23%	10%
Cochabamba	25,856	38,442	49%	12%	6%
3 Cities Sub-total	191,427	163,494	-15%	86%	27%
Rest of Bolivia	32,099	444,786	1286%	14%	73%
Total	223,525	608,280	172%	100%	100%

Source: Faguet 2003

Figure 2.3-7 shows central and local government investment by sector for the periods 1991-3 and 1994-6. The differences are large. In the years leading up to reform, central government invested most in transport, hydrocarbons, multi-sectoral and energy, which together accounted for 73% of public investment during 1991-3. After decentralization local governments invest most heavily in education, urban development, and water & sanitation, together accounting for 79% of the municipal investment. (Faguet 2003)



Source: Faguet 2003

Figure 2.3-7 Central and Local Government Investment

It looks like equal treatment for revenue of local government. It is not adequate amount for

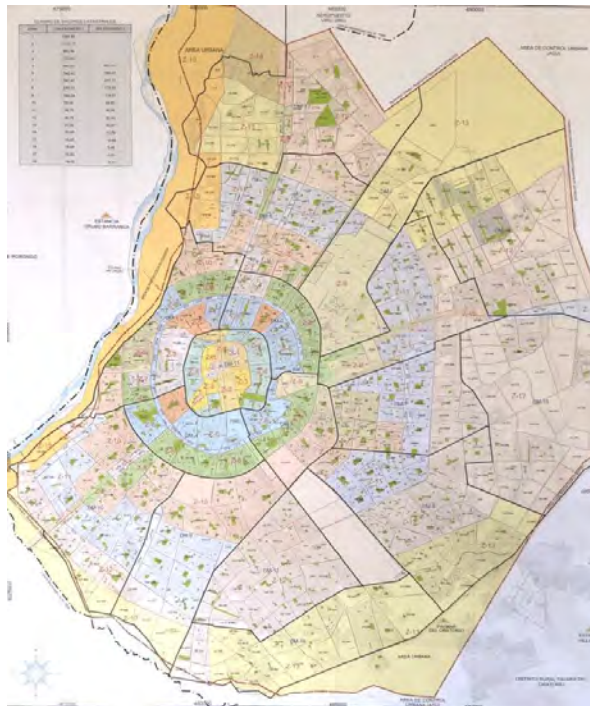
smaller local authorities, and consequently, this situation causes the inducement to increase their population if they do not have enough revenue resource in their territory.

(2) Taxation System in Municipality Level

Transfers from the National Treasury, municipalities receive direct transfers, loans or donations from central or regional governments, from bilateral or multilateral programs, and raise their own revenues. Municipal revenues are based on municipal services, taxes on local property and means of transport, licenses, etc. Local revenues are nonetheless relatively insignificant. (IOB Study 2012)

1) Real Estate Property Tax (IPBI): Tax valuation established in each municipal jurisdiction pursuant to cadastral and technical tax standards issued by the municipal executive. Valuation mechanism was established, and value can be calculated both land and building. Land value can be calculated based on tax zone, plot area, pavement of front road and infrastructure services. Building value can be calculated by type of structure, interior finishing, floor use and total floor area.

The following figure shows zoning of tax valuation. The valuation unit prices shall be revised based on land use and market price trend to collect property tax appropriately.



Source: The Municipality of Santa Cruz de la Sierra

Figure 2.3-8 Flat Tax Zone Map

2) Motor Vehicle Property Tax

Tax rate determination is given by the values of the motor vehicle for the corresponding models which determined annually by the Executive.

3) Transaction Tax on Real Estate and Motor Vehicle:

The amount is greater between the resulting value of the appraisal of the property is transferred, established in the last affidavit annual tax on real estate or motor vehicles, or recorded in the minutes. Three (3) percent of the appraised value being transferred shall be levied.

4) Business License Tax:

The business license tax is charged on every business including street vendor which charged based on business size.

5) Municipal Service Fee:

Any document of approval, certificate, and others shall be charged a service fee for the authority including development certificate to the *urbanization* project.

(3) Issues of Revenue at Local Level**1) Population-based actuating revenue allocation from central government:**

Government revenue had been significantly improved because of the rise in oil price since 2011. However, due to the price slump from early 2015, the hydrocarbon royalty distribution to local government was sharply dropped. Such fluctuation has been difficult for local government management.

Moreover, the budget allocation is basically distributed based on population volume. This system motivates some mayors to try to increase their population to have more budget from the central government to provide more public service to their people.

2) Difficulty on updating the cadastral database for real estate property tax collection:

Real estate property tax might be main revenue resource for the municipalities. This property tax shall be linked to market price to gain profit from development investment. It is necessary to update land valuation as a reference to taxation in a timely manner. Unfortunately, this task is difficult for municipalities because of human resources.

3) Difficulty of unpaid measures of tax

About half of the residents do not pay their real estate property tax. Low awareness of residents is a problem to pay taxes to receive the public services.

2.3.5 Development Control**(1) Urban Area Expansion and Land Reform Policy**

The Urban Area in Bolivia means the area where the municipality has to provide public services to the residents. Outside of the Urban Area shall be protected from urban developments and conserved for agricultural areas, natural areas, and water surface areas. However, in the recent decade, many “*urbanizations*” were planned and implemented outside of the urban areas. Sometimes urban area was expanded to cover new *urbanization* projects.

This trend is following the land reform policy of President Morales’s Administration which promising of land redistribution from wealthy *latifundistas* and agribusiness elites to poor farmers and indigenous communities. Actually, this land redistribution is used for not agricultural land but housing plot.

(2) Development Permission & EIA

The development permission shall be given by municipality. Before the development permission, the developer shall have the approval of environmental impact assessment from GAD or central government. However, some *urbanization* started development without EIA

permission from GAD.

Most of the municipalities gave conditions for *urbanization* to secure 30 to 40% of public land for public facilities, such as road, public park, school, health facility and so forth, which given to local government.

The criteria of permission are affected by municipal mayor's policy for land development. Some municipality utilizes *urbanization* to develop their infrastructure by private resource because of their limited budget. The municipality budget allocation from the central government is proportional to the population. For that reason, population growth is a major policy goal for smaller municipalities. This motivation eases to give development permission for *urbanization*.

(3) Land use and land registration

The land registration system is also a serious institutional fault in Bolivia, especially for *urbanization*. There is no linkage between several cadastral databases done by IGM (Military Geographical Institute of Bolivia), INRA (National Institute of Agrarian Reform), *Derechos Reales* (Property Right Office) and municipalities. IGM certifies survey data from property owners, INRA registers agricultural lands, *Derechos Reales* registers property rights, and municipalities value property value for taxation.

(4) Issues of Development Control

1) Lack of inspection and penalty system:

For example, 115 *urbanization* projects were planned in Porongo from 1999 to 2010, but only 30 projects applied for EIA license then approved only 15 projects. No strong power is given to local government to stop on-going *urbanization* projects. The reasons that those developers do not follow the regulations are i) the fine of violation of the law is rather low comparing to project cost which 0.3% of project cost, ii) approval procedure period is long (6 to 12 month).

2) Lack of ethics of law compliance:

Not only development permission process but other law, regulation, obligation to pay taxes and so forth, moral for law compliance is basically low. Many *urbanization* developers started their project before or without approval. Managing development control in such condition is difficult.

3) Lack of independence of local governments

Through the series of interview with municipality technical staffs, some of the developers of *urbanizations* got EIA approval from the central government instead of the local government. It is because of project size. This situation is different from the decentralization policy.

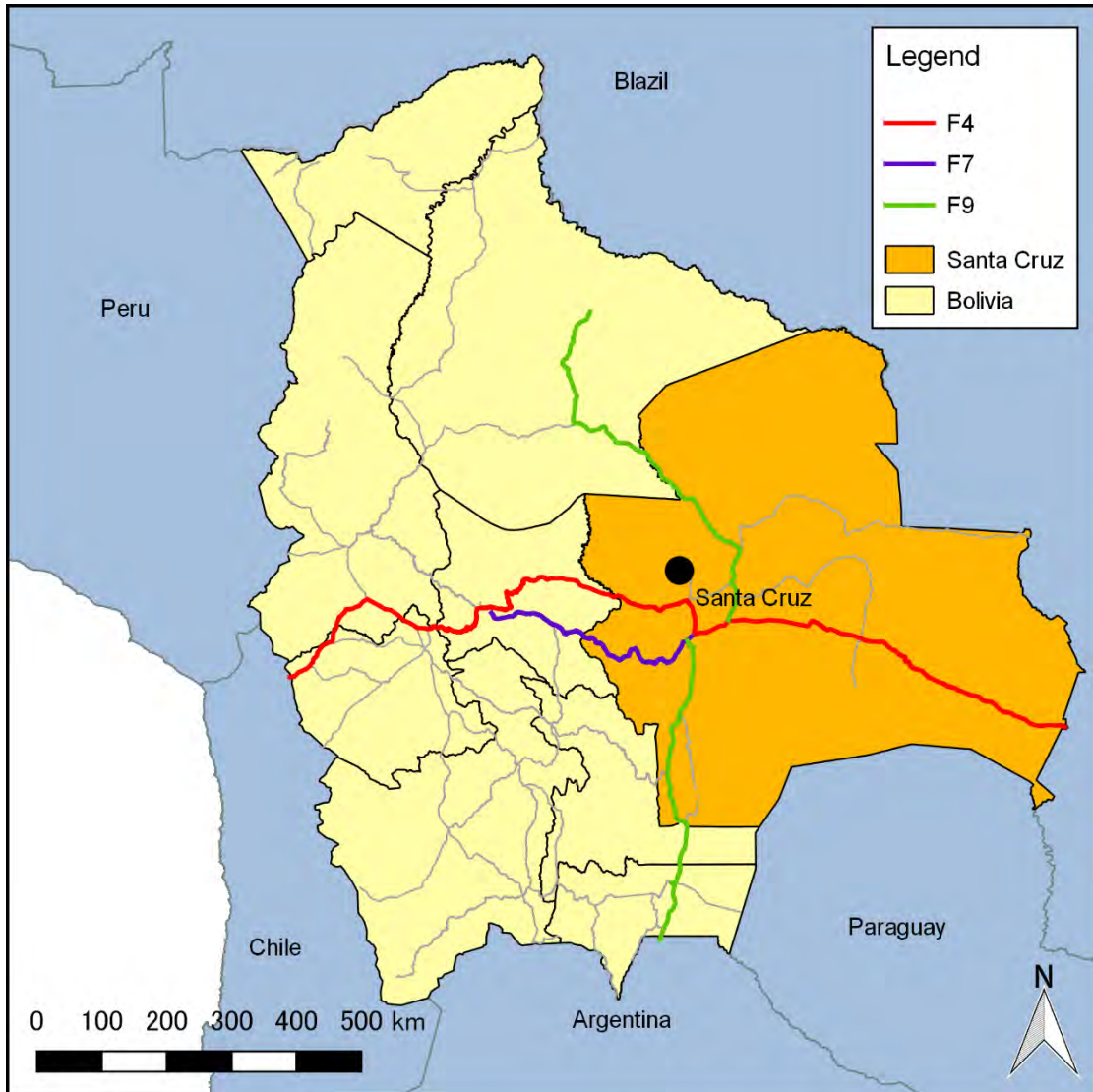
4) Long procedure and lack of data linkage among cadastral databases

Confusion on land-related issues is caused by its long procedure and no information sharing among related organizations. Developers of *urbanization* are utilized these time gaps to implement their development works for creation a fait accompli by selling out plots for the people. Municipalities cannot struggle against people's living rights secured by the Constitution.

2.4 Road Infrastructure

2.4.1 Road Management

The Santa Cruz Metropolitan Area is strategically located in the center of the country, with an arterial network that integrates it directly with bordering countries in the region. With the Fundamental Road 4 (F4) connecting the east with Brazil and west with Chile, and indirectly also connecting with Peru. F9 connects Argentina to the south and the border of Brazil to the north. Department of Santa Cruz has its north and east border with Brazil and on the south with Paraguay.



Source: Elaborated by JICA Study Team

Figure 2.4-1 Inter-connection of Santa Cruz with Other Regions

There are several government agencies that manage road infrastructure in the Metropolitan Area. The powers of each are stated by the Transport Act (Law 165), as shown in Table 2.4-1.

Table 2.4-1 Powers of Road Infrastructure Management

Article 20. (Central level).	Article 21. (Autonomous Departmental Governments).	Article 22. (Autonomous Municipal Governments).	Article 23. (Autonomous Rural Native Indigenous Governments).
a) To develop and approve government policies, including those concerning infrastructure in all modes of transport.	a) To approve departmental transportation policies and interprovincial and intermunicipal infrastructure.	g) To Plan, design, build, maintain and manage neighborhood roads, in coordination with the native indigenous people, where appropriate.	a) Maintenance and management of neighborhood and community roads.
c) To propose regulatory initiatives, execute and implement funding mechanisms for projects in the sector.	e) To plan, design, build, maintain and manage the roads of the Departmental Network.		b) Construction of neighborhood and village roads in concurrence with the central level of the State and the autonomous territorial Agencies, as appropriate.
k) To plan, design, build, maintain and manage roads, railways, and railroad of the Key Network.	f) To classify departmental, neighborhood and community network roads in the department.		
l) To Set up the classification criteria of the departmental, neighborhood and community, and classify the roads of the Fundamental Network.	g) To support the planning of road infrastructure works in the jurisdiction of the rural native indigenous autonomies of the department.		
m) To set up the criteria for classification and classify the railroads of the Fundamental Network and railways in the departments.	h) To build and maintain railways, railroads and other means of the Departmental Network.		
n) To have exclusive Power over road and rail transport at an interdepartmental and international scope of the Fundamental Network.			

Source: Elaborated based on Law No 165

The fundamental road network in the Metropolitan Area is composed of F4, F7, and F9 as shown in Table 2.4-2, which are managed by ABC. The jurisdiction of ABC on these roads is outside of the 4th Ring Road, although the Municipality of Santa Cruz de la Sierra is responsible for the maintenance of the three roads from the 4th Ring Road up to the 8th Ring Road based on an agreement between ABC and the Municipality of Santa Cruz de la Sierra.

Table 2.4-2 Fundamental Network interconnecting Santa Cruz

Route	Itinerary	length (km)
F4*	Hito XVIII (Border with the Republic of Chile) - Tambo Quemado -Pal acama va - Cnracollo - Caihuasi - Cochabaniha - Villa Tunari -Yapacani - Guabirá - Montero - Santa Cruz - Pailón - San José de Chiquitos - Roboré - Puerto Suárez - Arroyo Concepción (Bridge at the border of the Federative Republic of Brazil) - Ramal Guachalla - Mutún - Fortín Vitienes - Fortín Vanguardia - Puerto Buch.	1,657
F7	Cochabamba (plaza de armas) - Paracaya - Epizana -Comarapa - Samaipata - La Guardia - Cruce Route N° F9.	488
F9	Positos Boliviano (International bridge, Border with the Republic of Argentina)- Yacuiba - Villa Montes - Boyuibe - Camiri - Ipatí -Abapó - Cruce Route N° F7 - Santa Cruz - Pailón - Los Troncos - San Ramón - Ascención de Guarayos - San Pablo - Casarabe - Trinidad (plaza de armas).	928

(*) This Road is part of the bi-oceanic highway linking the Pacific and the Atlantic Coasts, connecting Brazil, Bolivia, Peru, and Chile.

Source: Elaborated by JICA Study Team

2.4.2 Road Classification

(1) Classification by Administrative Jurisdiction

The roads can be classified according to the administrative jurisdiction, i.e., the central, department, and municipal government. The Type of Classification by Jurisdiction is shown as follows:

According to the Transport Act (Law 165 of 16.08.11), roads are classified as

- a) Fundamental Road Network
- b) Departmental Road Network
- c) Municipal Road Network.
- d) Neighborhood and Community Road Network.

A competent authority has been determined in each one of them and is characterized by the connection between each of the territorial areas as shown in Table 2.4-3.

Figure 2.4-2 shows the roads in the Metropolitan Area by road administrator.

Table 2.4-3 Transport Road Classification by Jurisdiction - Transportation Act (Law 165)

Legal Framework	Article 193.	Article 194.	Article 195.	Article 196.
Class	Fundamental Road Network	Departmental Road Network	Municipal Road Network	Neighborhood And Community Road Network
Power/ Competency	Central Government	Autonomous Departmental Governments	Autonomous Municipal Governments	Rural Native Indigenous autonomies
Characteristics	a) Link the department capitals together.	a) Integrate the different regions of a department.	a) Neither part of the arterial nor the departmental road network. Within the territorial jurisdiction of a municipality.	a) Neither part of the arterial nor the departmental road network. Within the territorial jurisdiction of the Rural Native Indigenous Autonomies.
	b) Be part of the connection with National (Inter Fundamental) Roads linking the country with bordering countries.	b) Connect the arterial road network directly.		
	c) Connect together two or more roads of the arterial road network.	c) Allow short connections through municipal roads.	b) Feeder roads of either the departmental or arterial road network.	b) Feeder roads of either the departmental or arterial road network.
		d) Link provincial capitals and department capitals.	c) Link rural population, communities and production centers within the jurisdiction of a municipality.	c) Link rural population, communities and production centers.
e) Have connections with multimodal transport systems.				
f) Give access to departmental development poles/centers.				

Source: Elaborated based on Law No 165

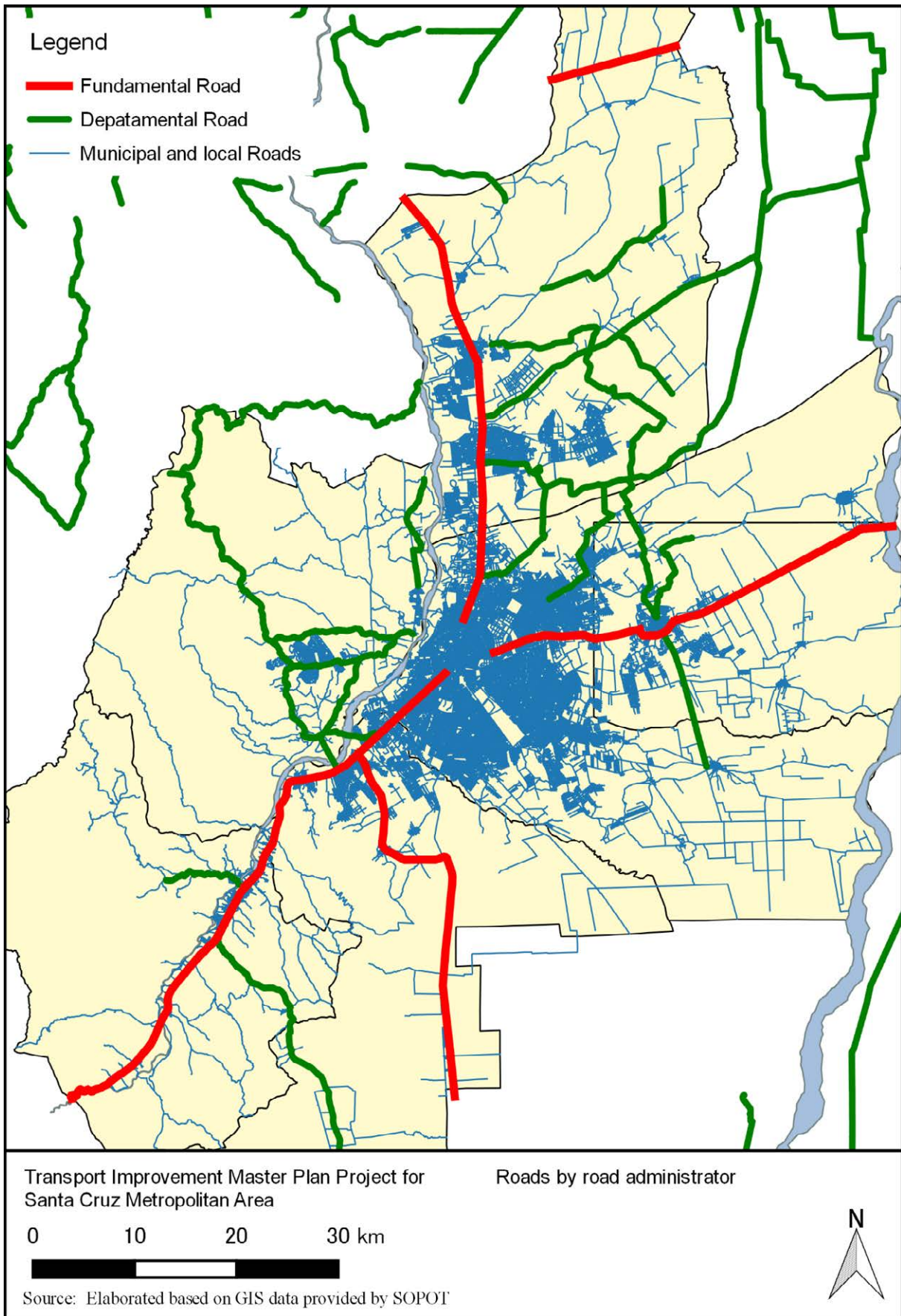


Figure 2.4-2 Road by Administrator

1) Fundamental network in Department of Santa Cruz

The fundamental network in the department is composed of different road surfaces: 52% is paved (2,186 km), 30% is with gravel (1,272 km), and 17% (732 km) are dirt roads. The detail of the distribution is shown as follows.

Table 2.4-4 Fundamental Network in the Metropolitan Area

Road Code	Section		Type of Road	Number of lanes per direction	Length (Km)	Destination
	Start	End				
F4	Fourth Ring	Eighth Ring	Double lane	3*	6.5	Towards Cotoca
	Eighth Ring	Cotoca	Double lane	3	8.3	
	Second Ring of Cotoca		One lane	1	4.5	
F4	Fourth Ring	Eighth Ring	Double lane	4	4	Towards Warnes
	Eighth Ring	Warnes	Double lane	2	25.7	
F7	Fourth Ring	Eighth Ring	Double lane	3	4.2	Towards La Guardia
	Eighth Ring	La Guardia	Double lane	2	12	
	La Guardia	El Torno	One lane	1	22.2	Towards El Torno
F9	Crossing with F7	Crossing with the railway	One lane	1	16.2	South of Santa Cruz Expansion
Total (km)					103.6	

(*) 3 lanes until Camino Montecristo and continues with 2 Eastward

Source: Elaborated based on maps provided by SEDCAM

The Regional Management of Santa Cruz under the ABC manages the fundamental network, although the municipality of Santa Cruz de la Sierra takes the responsibility to manage the Fundamental Roads within the 8th Ring Road. Previously, the municipality managed the roads within the 2nd Ring Road, but it was extended to 4th Ring Road, and now Fundamental Roads within the 8th Ring Road are managed by the municipality.

There are toll gates at the crossing point of the Fundamental Road and the municipal boundaries.

2) Departmental Network

The departmental network consists of roads of 6,340.7 km in total. Since 2006 the paving process began with 5.36 km, and it has already implemented the pavement of 195.34 km, and 25.52 km would be added to the paved network, although it accounts for only 3% of the departmental network.

The Province of Andres Ibañez has a departmental network of 259 km and in Ignacio Warnes Province has that of 352.9 km.

Table 2.4-5 Departmental Network in the Metropolitan Area

No	Province	Road Code	Starting place	Ending place	Type of Road Surface (km)			
					PAV.	Gravel	Dirt	Partial
1	Andrés Ibañez	100	Santa Cruz	Buena Esperanza (Lim. Prov. I. Warnes)	3.50	12.20	10.00	25.70
2		150	El Torno	La Forestal	0.00	9.90	0.00	9.90
3		M-01-10	Cotoca	Orialza	0.00	0.0	16.10	16.10
4		M-01-30	Urubo	Porongo	15.50	0.0	3.30	18.80
5		160	Limoncito	La Cañada	0.36	16.00	14.44	30.80
6	Ignacio Warnes	200	Warnes	La Esperanza	6.50	13.00	9.40	28.90
7		230	CR. RT.4 (PIL)	La Belgica Bridge	5.36	0.00	0.24	5.60
8		235	CR. RT. 4 – Zona Franca	Candelaria	5.00	7.50	0.00	12.50
9		280	CR. RT. 4 – Warnes KM 17	Clara Chuchio	7.00	0.00	0.00	7.00
TOTAL					43.22	58.60	53.48	155.30

Source: Elaborated based on information of SEDCAM

The total length of paved and unpaved roads of the departmental network in the Metropolitan Area is 43.22 km and 112.08 km, respectively.

(2) Classification by Function

The road classification of the municipality of Santa Cruz has been evolved based on different plans. The first one was the Santa Cruz de la Sierra Master Plan of 1995 (PD 1995) that defined a road structure at regional and urban level and a hierarchy according to their function

Table 2.4-6 Road Structure in the Master Plan of 1995 (PD 1995)

Type	Scope	
Regional	Interconnection Northern Highways from the city of Warnes to the Abapó highway.	In the North, East and South backbones of the city.
Urban	Backbone roads entering the city from Northern Highway, Cotoca and old highway to Cochabamba	United by the Fourth Ring Road and the former intercontinental road, now urban avenue.
Internal Road	The hierarchy of roads for a system based on neighborhood units as information cells	The model establishes district interconnection roads.

Source: PD 1995. Elaboration by JICA Study Team

The proposed urban structure in PD 1995 was to form independent centers instead of keeping the radio-concentric city.

Table 2.4-7 Hierarchy of Urban Road System according to the Master Plan of 1995

Typology	Care level	Right of Way	Use	Connectivity
Backbone Distribution Roads	Region / City	50 - 100 m	Heavy traffic is allowed, open drainage channels, high voltage power lines, gas pipelines, and oil pipelines	Road regional structure, linking the city with the region
Primary Distribution roads				
Radials	City / District	35 -50 m	Public and Private vehicular traffic. Mixed land use	Connects the city with the districts.
Rings	District / Unit	35 -50 m	Public and Private vehicular traffic. Mixed land use	Connects radials with the core of the districts
Collector Roads	Neighborhood unit	16 - 35 m	Vehicular and Pedestrian traffic in the neighborhood units	Connecter together
Local Roads	Neighborhood Basic Unit	13 - 16 m	Vehicular and Pedestrian traffic in the basic unit or neighborhood	Connection with the neighborhoods
Pedestrian	Neighborhoods / specific use areas	8 -10 m	Pedestrian traffic, malls	Connects neighborhood sectors in safe areas for pedestrians

Source: Master Plan of 1995, Technical Office of Regulatory Plan, Municipal Government of Santa Cruz de la Sierra. Elaboration by JICA Study Team.

The Urban and Territorial Land use plan (PLOT) of the municipality of Santa Cruz de la Sierra establishes a classification similar to that of PD1995, with some adjustments to road sections

Table 2.4-8 Road hierarchy of the PLOT 2006

Classification	Care Level / Connection	Right Of Way
Backbone Distribution Roads	Region or City / Highways to Warnes, Cotoca, and to La Guardia	Minimum 50 m
Main Distribution Roads	City / District/ U.V. / Rings and Radials	Minimum 33 m
Local Distribution Roads	Connection of distribution roads/ Roads crossing the U.V.	Minimum 16 m
Back Streets/Secondary Streets	Access roads to the plots	Minimum 13 m
Pedestrian Streets	Linking sites with the primary equipment	Minimum 10 m

Source: Elaborated based on the Urban and Territorial land use Plan (PLOT) of the Santa Cruz de la Sierra Municipality

2.4.3 Regulatory Design Standards

Article 125 of the Urban Planning Code and Works (CUO) states that the road system of the city of Santa Cruz de la Sierra considers the urban scale, allowing connectivity of urban steps at the metropolitan level. The CUO 2014 shows three type classifications: urban areas, rural areas, and passages & walkways as shown in Table 2.4-9, Table 2.4-10, and Table 2.4-11.

Table 2.4-9 Classification in Urban Areas

1. Metropolitan or Urban Highway	Level of care or coverage: Tangential or marginal road connecting the three metropolitan areas of development, funneling heavy traffic around the perimeter of urban areas and becoming its limit.
	Right of way or minimum width: 100 m. with a green belt to the side of the highway.
2. Urban Backbone Roads	Level of care or coverage: they connect the city with the three metropolitan axes of development (Santa Cruz - La Guardia, Santa Cruz - Warnes, Santa Cruz - Cotoca) and the 4 th ring as a structural road among them.
	Name of roads: Cristo Redentor Avenue / Northern road to the boundary of the municipal jurisdiction, on the north side. Grigotá Avenue to 2 nd Ring Road and highway to Cochabamba to the limit of the municipal jurisdiction, on the southwest side. Virgen de Cotoca Avenue to 4 th Ring / Cotoca road up to the limit of the municipal jurisdiction, on the east side.
	Road Width: 50 m. At least four lanes in each direction, including high-speed lanes.
3. Perimeter East Avenue.	Level of care or coverage: connector among districts.
	Right of way or minimum width: 50 m. and at least four lanes in each direction, including high-speed lanes.
4. Rural-urban axes.	Level of care or coverage: Formed by radials that due to their importance connect the city to the rural area. They are the future secondary expansion axes of the city.
	Right of way or minimum width: 40 m. profile consistent with the intended design for radials described above.
5. Main Road Network	Level of care or coverage: Corresponds to the traditional ring route, radials and avenues that define the neighborhood units.
	Right-of-way or minimum width: Three lanes in each direction, with 33 m width without drainage channel, and 40 m when it has a channel or according to drainage plan.
	Nodes or intersections: 600 m to 1,000 m
6. Local distributors or collectors.	Level of care or coverage: They are characterized by crossing the neighborhood units, becoming traffic collectors
	Right of way or minimum width: Between 16 m and 22 m. full width with 9 m to 11 m roadway.
7. Secondary Streets	Level of care or coverage: neighborhood level and neighborhood unit.
	Right of way or minimum width: 13 m. in one direction.
8. Walkways or urban Passages.	Level of care or coverage: neighborhood level.
	Right of way or minimum width: existing walkways between 5 to 8 m. wide, pedestrian exclusive use, with widths of between 8 m. and 10 m. and restricted vehicle use.
9. Bikeways.	Level of care or coverage: The entire area of coverage
	Right of way or minimum width: 2.5 m. for two cyclists, considering the space of evasive maneuvers.

Source: Code of Urban Planning and Works (2014), the Municipality of Santa Cruz de la Sierra. Elaborated by JICA Study Team.

Table 2.4-10 Classification in Rural Areas

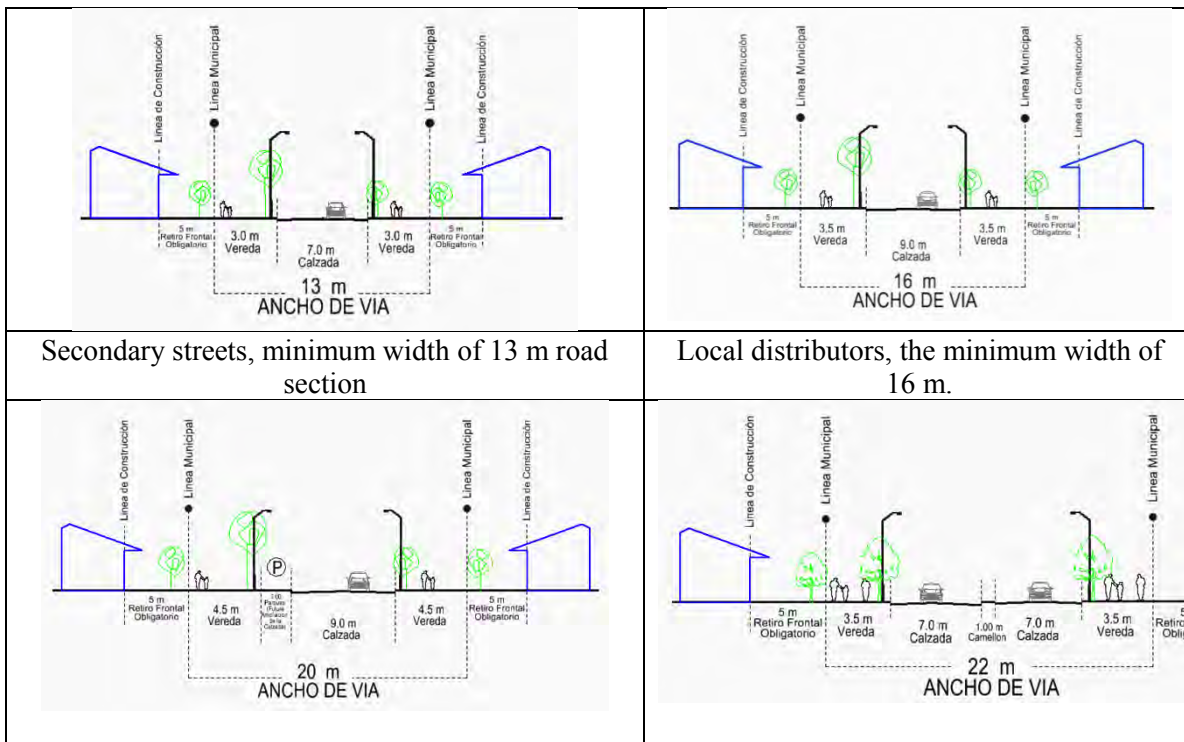
2.1. Metropolitan Axes	2.1.1. Level of care or coverage: Axis formed by the three backbone roads which, outside the metropolitan area, become a part of the Fundamental Roads system.
	2.1.2. Highway names: Road to the North, from the Urban Highway. Cotoca road, from the urban highway, Former highway to Cochabamba.
	2.1.3. Right of way or minimum width: 60 m with separated high-speed lanes. Intersections with urban highway overpasses
2.2. Main rural road network scale: Includes the roads linking the capital with the old canton headlands and these with backbones.	
2.3. Neighborhood roads: They link communities and productive properties within the municipal jurisdiction.	

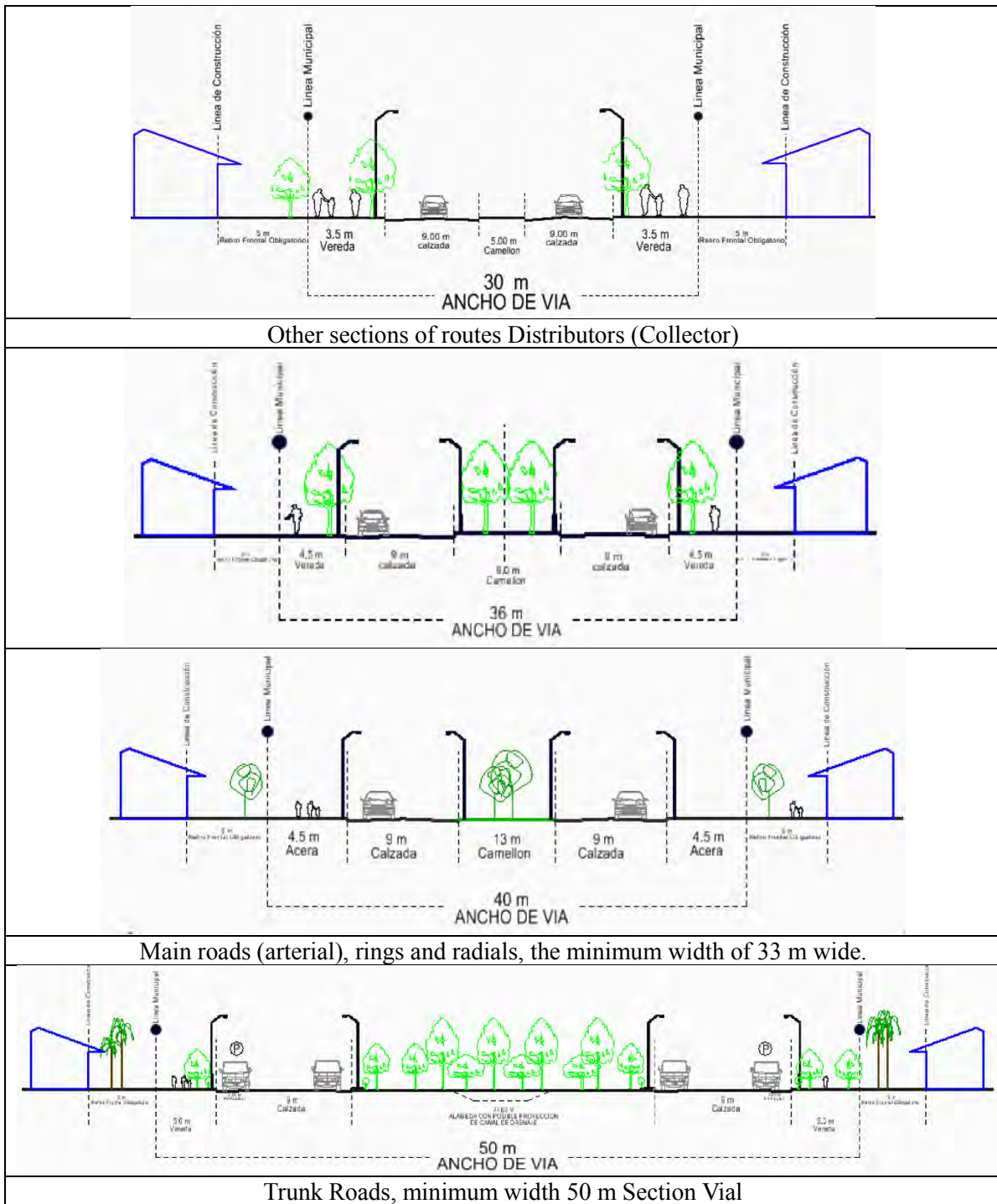
Source: Code of Urban Planning and Works (2014), the Municipality of Santa Cruz de la Sierra. Elaborated by JICA Study Team.

Table 2.4-11 Classification of Urban Passages and Walkways

1. Urban passages or walkways that have a maximum width of 10,00 m. are formed as follows:	· 7 m. Of roadways, Urban Passages
	· 1.5 m. Of sidewalk per each side.
2. Urban passages or walkways having a maximum width of 8,00 m. are formed as follows:	· 6 m. Of roadways.
	1 m. Of Sidewalk per each side.
3. Urban Passages or pre-existing walkways	The width of 5 m to 8 m. They will be for pedestrian use, except for the consolidated vehicular paved roads to the date of the enactment of this Code.
	In pre-existing lots at the front of these passages, vehicular lane with a width of 3.50 m is admitted.

Source: Code of Urban Planning and Works (2014), the Municipality of Santa Cruz de la Sierra. Elaborated by JICA Study Team.





Source: Oficialía Mayor de Planificación, PLOT 2005, Ordenanza 078/05

Figure 2.4-3 Type of Road Sections

2.4.4 Existing Urban Roads Network

(1) Santa Cruz de la Sierra

1) Road Network

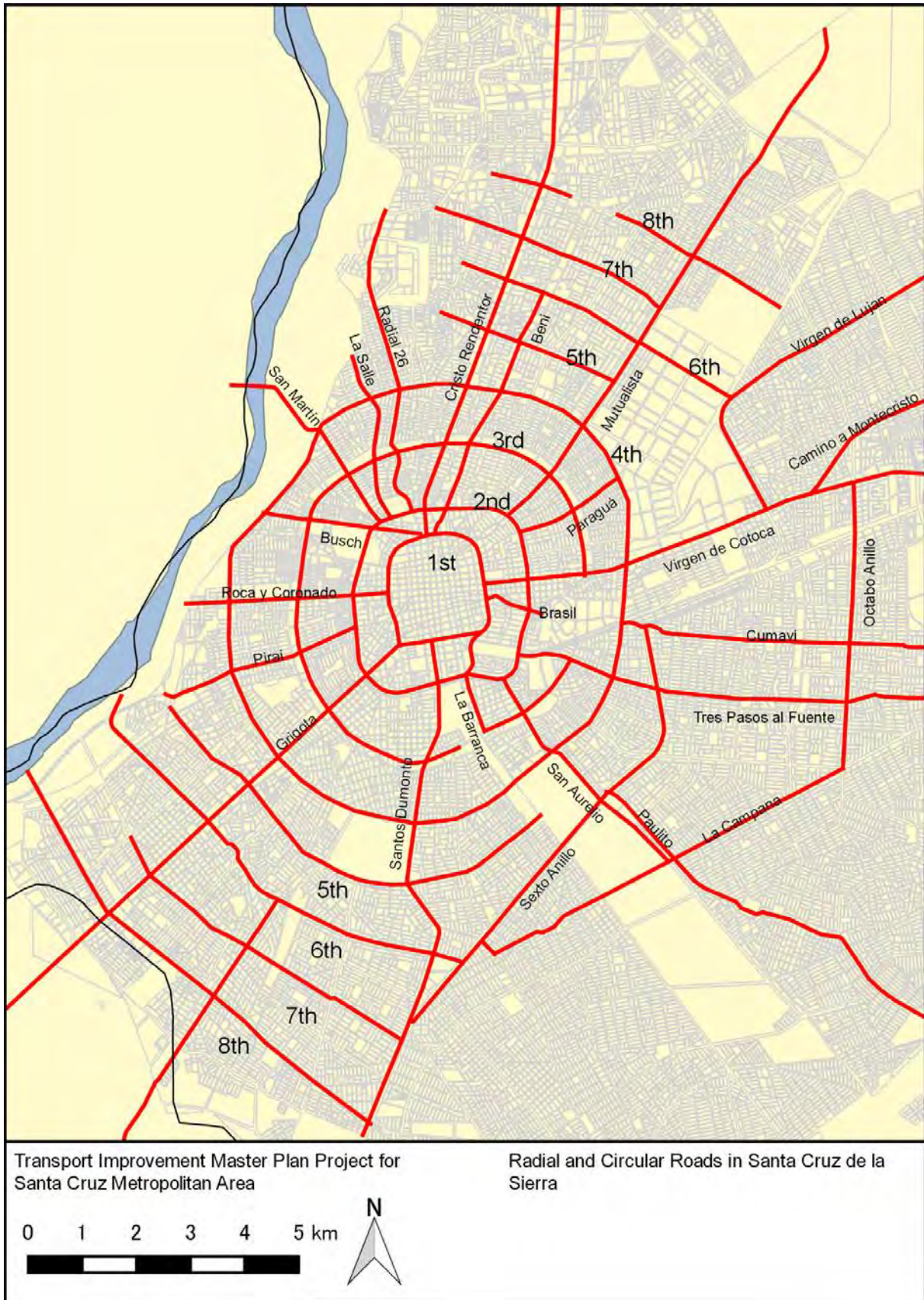
The road network in Santa Cruz de la Sierra is mainly composed of radial and ring roads, starting from the Ring “Zero” that surrounds the Main City Square where the cathedral, City Hall and the House of Government are located. The radial and ring roads within the 4th Ring

Road are in good condition.

The city is composed of inter-district roads that are articulated to the district roads and ring roads that form the concentric shape of the city. However, some ring roads lack sections to form a ring. The 8th Ring Road, which is also called as International Avenue, has been developed gradually. The street opening program for the 8th Ring Road shows a progress of 70%, although the road width is narrower than the plan of about 50 m. Some sections have only 30 or 35 m in width, especially in districts 6, 8, and 12 and there are some sections where the width is only 13 m. The 4th Ring Road carries heavy traffic, playing an important role to distribute traffic to radial roads such as Plan 3000, Cumavi, El Trillo, Cocota, Montecristo, Prolongación Mutualista, Radial 26, among others.

Within the urban area of Santa Cruz, the most important Avenues of the Radial Road Network are: Barranca (1.1 km), Beni (4 km), Grigota (2.3 km), Independencia (2.2 km), La Salle (1.3 km), Mutualista (4.1 km), Radial 26 (4.1 km), Santos Dumont (9.1 km), Virgen Fatima (1.1 km), Centinelas Del Chapo (7.8 km), and San Aurelio (12.9 km) for the north to south directions and vice versa. For east-west, the avenues are Ana Barbara (1.2 km), Brasil (3 km), Bush (3 km), Paraguay (2.2 km), Pirai (2.9 km), Roca y Coronado (3.8 km), Tres Pasos Al Frente (1.9 km), Virgen de Cotoca (2.4 km), Cumavi (7.7 km), and there are other long routes. The G77, which provides another access to the airport, was implemented before the G77 summit was held in Bolivia in 2014.

Santa Cruz has the concentric shape until the 4th Ring Road, but the ring roads from the 5th Ring Road do not form the circular shape because of the disconnection of the routes. Obstacles to form the circular shape are the Pirai River in the west, railway lines in the north and east, sugar cane field in the south, and the residential area. The urban sprawl area starts from the 5th Ring Road.



Source: Elaborated based on maps published in Bolivia

Figure 2.4-4 Radial and Circular Roads in Santa Cruz de la Sierra

2) Existing Plan

Figure 2.4-5 shows the comparison between the planned road network in PLOT 2005 and existing road network. The road length in the table was calculated based on the GIS data. The construction of the ring roads is discontinuous, and approximately 33% of the road ring network is missing. On the other hand, the radial roads have been developed well according to the plan.

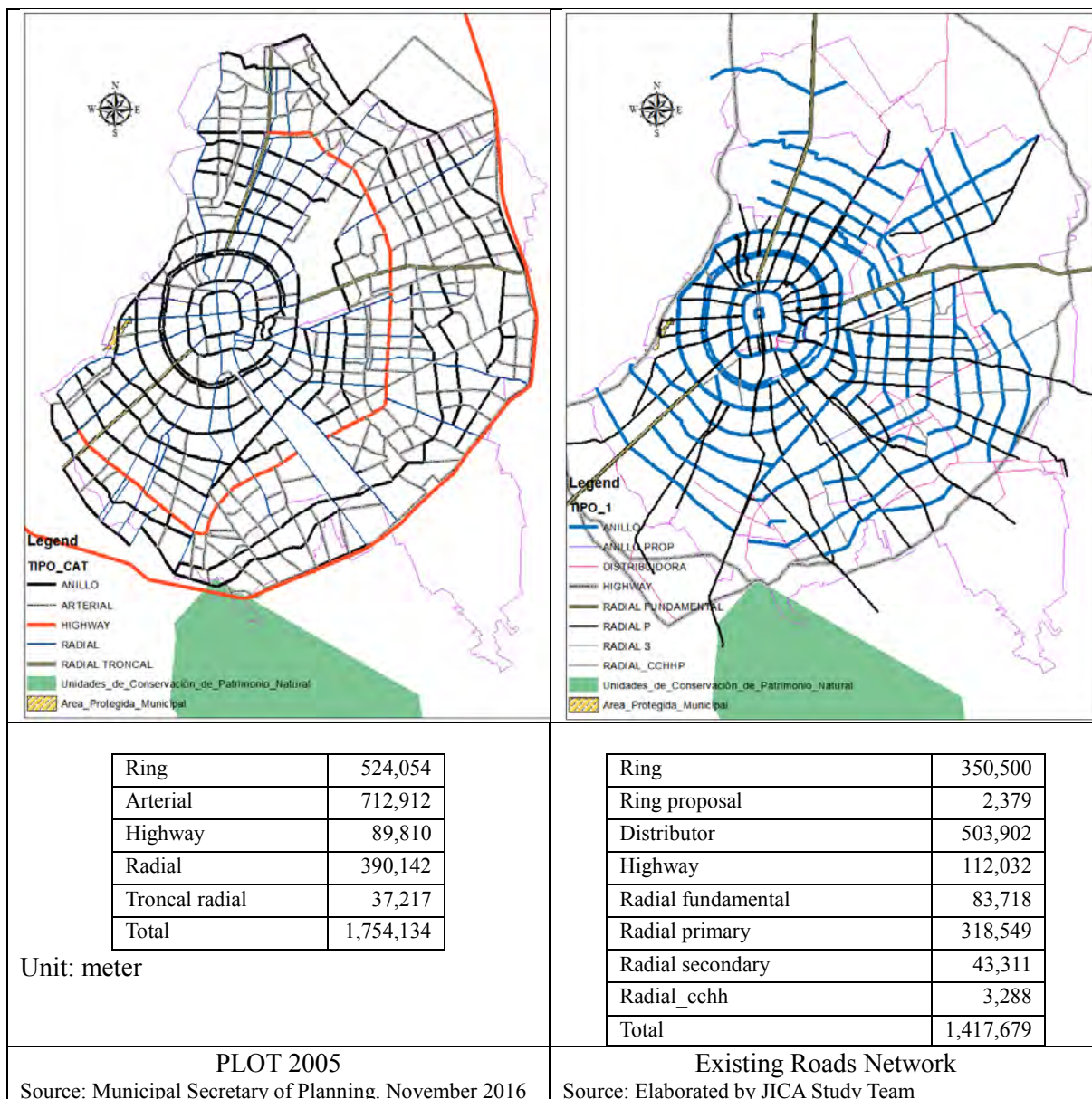


Figure 2.4-5 Planned and Existing Roads Network of Santa Cruz

The distribution roads, consisting of the ring roads, radial roads and collector roads, account for approximately 20% of the total roads, while 79% correspond to local streets and 1% to alleyways.

(2) Cotoca

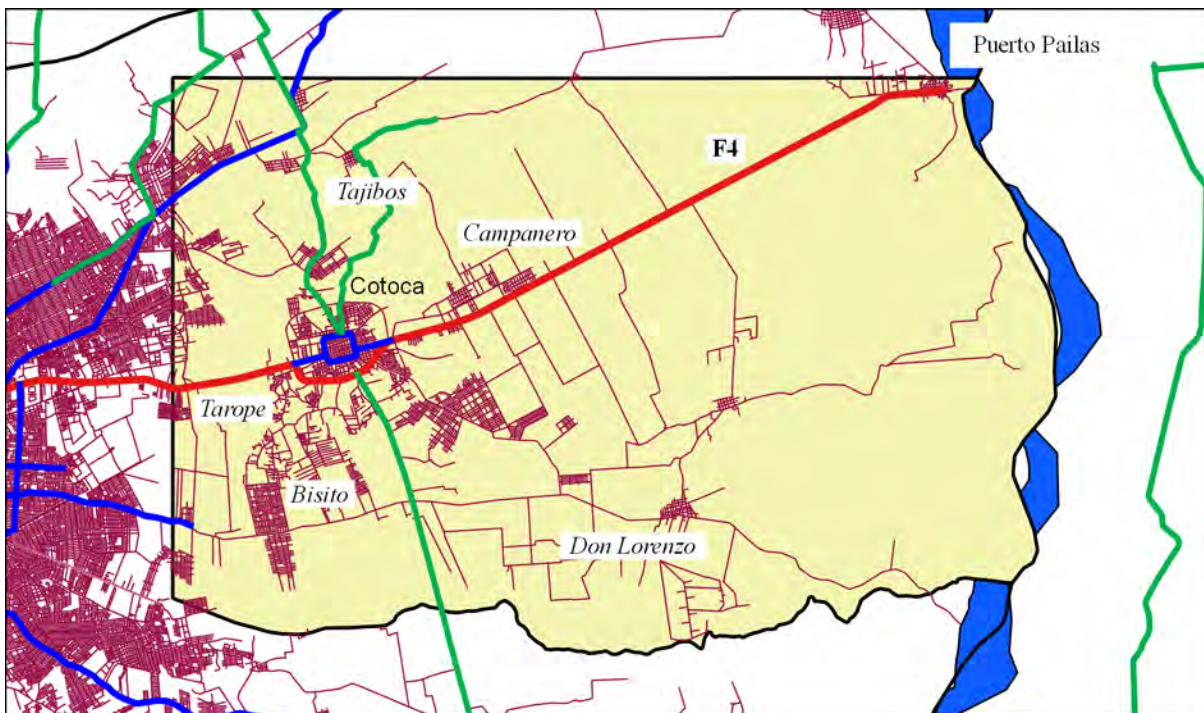
The Fundamental Road 4 (F4), connecting Santa Cruz de la Sierra and Puerto Paylas, runs through east and west in Cotoca. F4 is an important logistic corridor for the Metropolitan Area, being a part of Bi-oceanic Corridor. This road is also named as Virgen de Cotoca.

The highway illumination is poor along Virgen de Cotoca. A frequent traffic accident is one of the problem, especially collision relating trucks. Despite the number of accidents, ABC stopped the implementation of speed reduction measurements.

Cotoca has two ring roads of an average diameter of 1 and 3 km. The roads inside the 1st Ring Road form a grid-network, and there are some diagonal roads outside the 1st Ring Road. The main roads are constructed of reinforced concrete, but most are unpaved or dirt roads. Roads in the center of the city are 2 lane-roads, while the 1st Ring Road and some radial roads are dual-lane roads.

The road network in Cotoca is expanding as the part of urban developments by the private sector. Although Cotoca does not have the future road network plan, the urban developments with the construction of roads have been approved and implemented, which causes a typical urban sprawl problem.

The municipality allocates 4 million bolivianos every year to finance neighborhoods roads and community roads.



Source: JICA Study Team

Figure 2.4-6 Road Network in Cotoca



Source: Photos taken by JICA Study Team

Figure 2.4-7 Photos of Roads in Cotoca

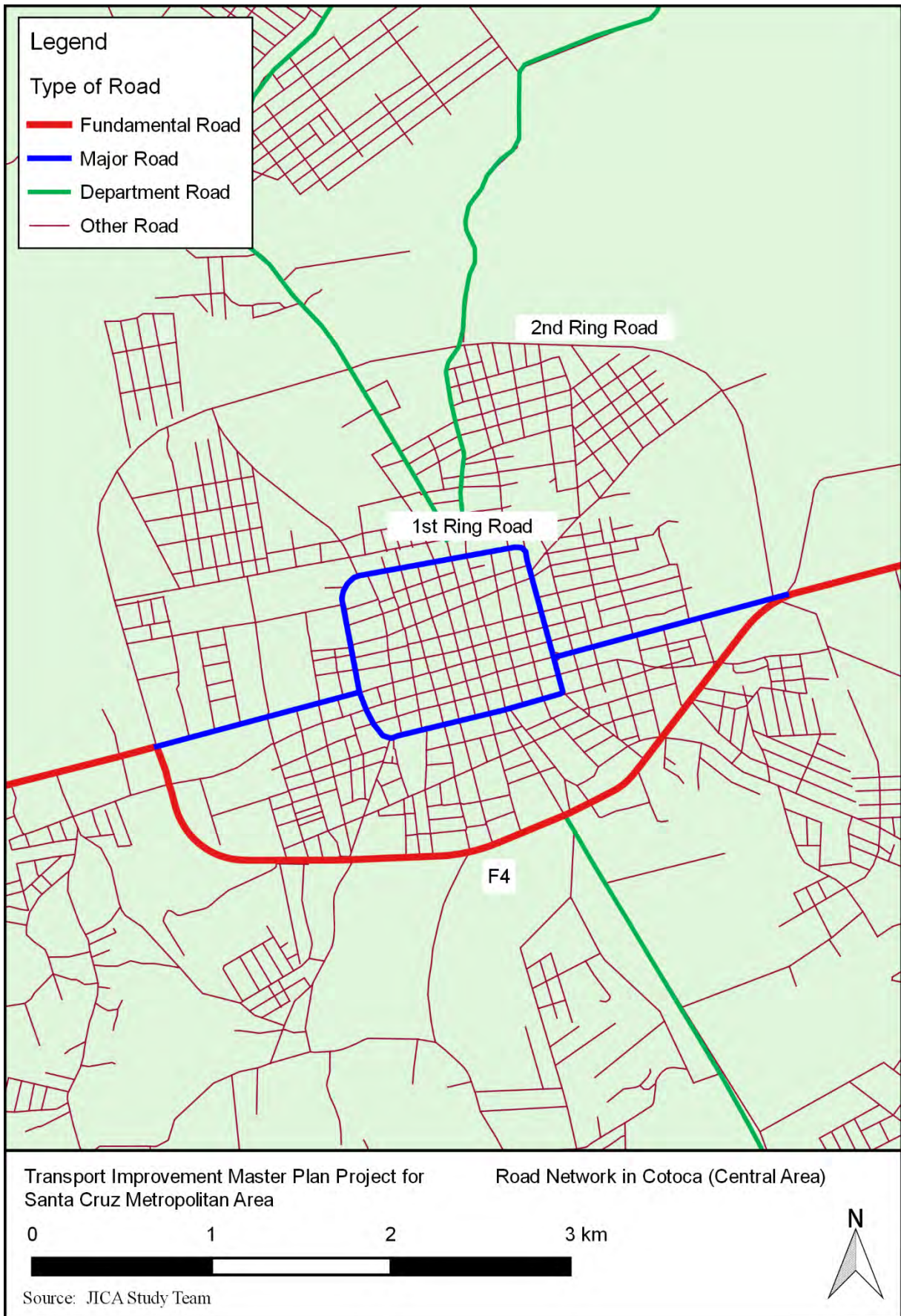


Figure 2.4-8 Road Network in Cotoca (Central Area)

(3) Porongo

Porongo is located on the west side of the Pirai River and connected to the Metropolitan Area only with Foianini Bridge. There are some crossing points of the Pirai River where the depth is shallow enough for high-height vehicles to cross in the dry season, but it is not possible for normal sedan cars.

The historical town of Porongo, which is the center of the municipality, is located in the south of Porongo, while the major urbanized area, which called Urubo, is located near Foianini Bridge. The historical town and Urubo are connected to the departmental road (M-01-30), which was unpaved but was constructed as a paved road by SOPOT in 2016 in a length of 18.8km.

Porongo has many urban development zones which have their own paved roads inside. Some urbanizations assume the construction of a bridge over the Pirai River.

The urbanization of “Colinas del Urubo” has collector rings roads. This project has the best organization and is based on a construction regulation which is “Reglamento de construcción Ordenanza 020-2008-Porongo” (Construction Regulation - Ordinance No. 020-2008-Porongo).

The Ordinance 065-2011 establishes that one housing lot can have 9000 m², while no ordinance establishes the location and management of road construction.

Since 2007, the municipality established the ROW of the primary, secondary, and tertiary roads that were constructed partially until 2016.

The pavement design of the principal roads in Porongo is a concrete pavement with a thickness of 15 cm and a subbase of 18cm of thickness. The lane width is 3.5 m and has an asphalt berm of 1.5 m. This road is currently supporting heavy loaded trucks traffic with construction aggregate material taken from the riverbank. In the past, the quarry work was shared with La Guardia, but since the municipality of La Guardia restricted the quarry works, all the trucks traffic has been derived to Porongo.

In case of residential zones, the pavement has 12cm of thickness and road section is usually from 6 to 7 m. The drainage system of the residential zone is not sufficient to drain all the rainfall water. The Chaupa ravine, located near the historical town of Porongo, is severely affected when heavy rain occurs.



Source: Photos taken by JICA Study Team

Figure 2.4-9 Photos of Roads in Porongo

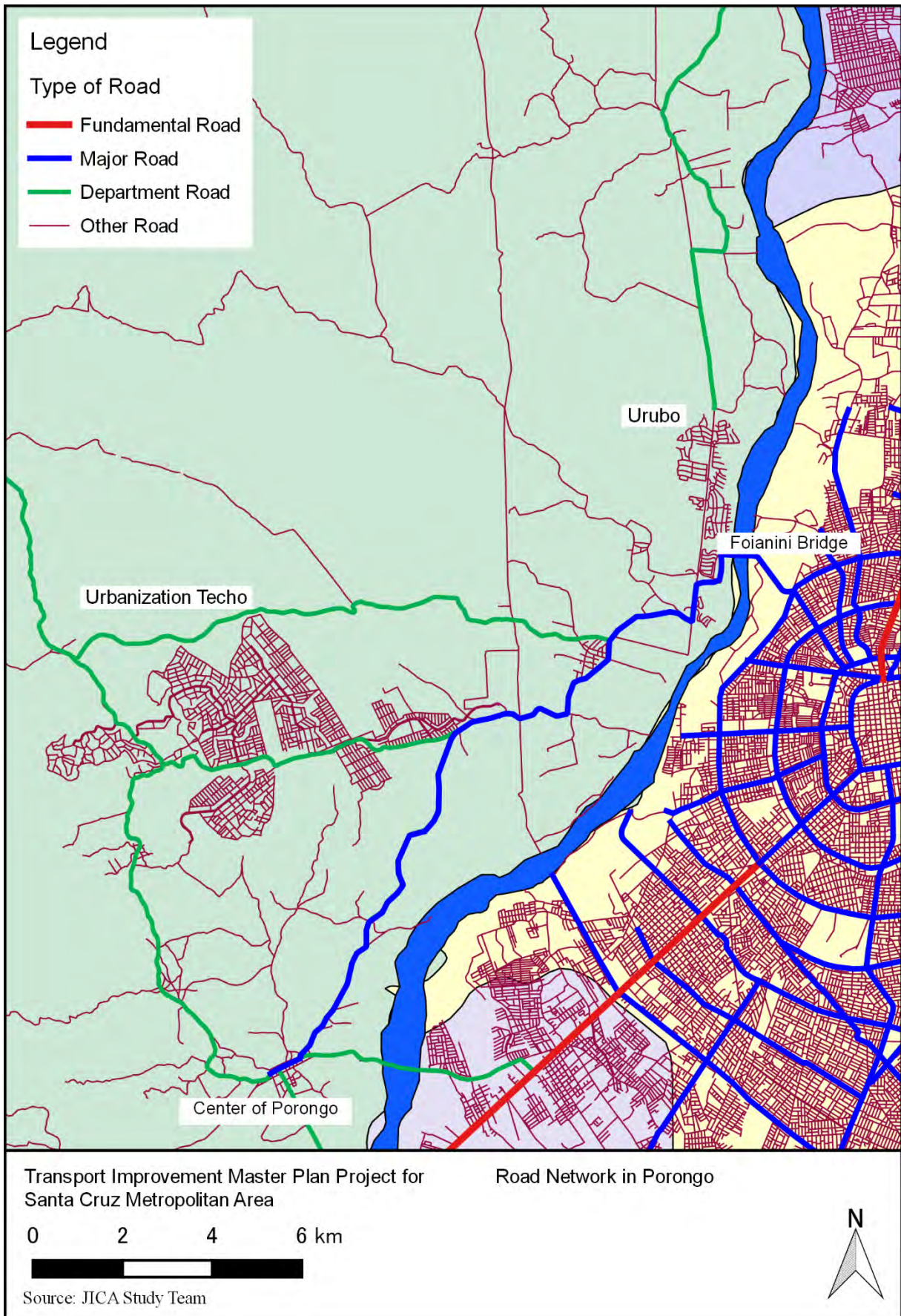


Figure 2.4-10 Road Network in Porongo

(4) La Guardia

La Guardia is connected to Santa Cruz de la Sierra by the Fundamental Road 7 (F7), which connect the Metropolitan Area and Cochabamba through El Torno, and F9, which goes to the boundary of Argentina. F7 branches from F9 at the location of “KM 13”. The road between Santa Cruz de la Sierra and La Guardia (F9 and F7) is called as “Doble Via” because the road has two lanes per direction.

F7 is the arterial road in the center of La Guardia, and there is no ring road or bypass route. Heavy traffic of trucks, including those carrying crushed stones as construction material, is one of the problems in La Guardia because it causes traffic congestion and damage to the pavement.

Due to the rapid expansion of the urbanized area of Santa Cruz de la Sierra toward the south direction, the boundary area of La Guardia with Santa Cruz de la Sierra has been developed in recent years without the development of arterial roads.

<p>Fundamental road to La Guardia, the road is in good condition in some sections</p>	<p>The road, in general, is double carriageway with two lanes per direction, in some sectors because the heavy load is damaged</p>
<p>KM 13: Crossing of F7 and F9</p>	<p>Section of the main road towards La Guardia (F7) in good pavement conditions and signaling</p>
<p>Section of the main road towards La Guardia (F7) in bad pavement conditions and signaling</p>	<p>Existence of passenger transport in the fundamental network</p>

Source: Photos taken by JICA Study Team

Figure 2.4-11 Photos of Roads in La Guardia

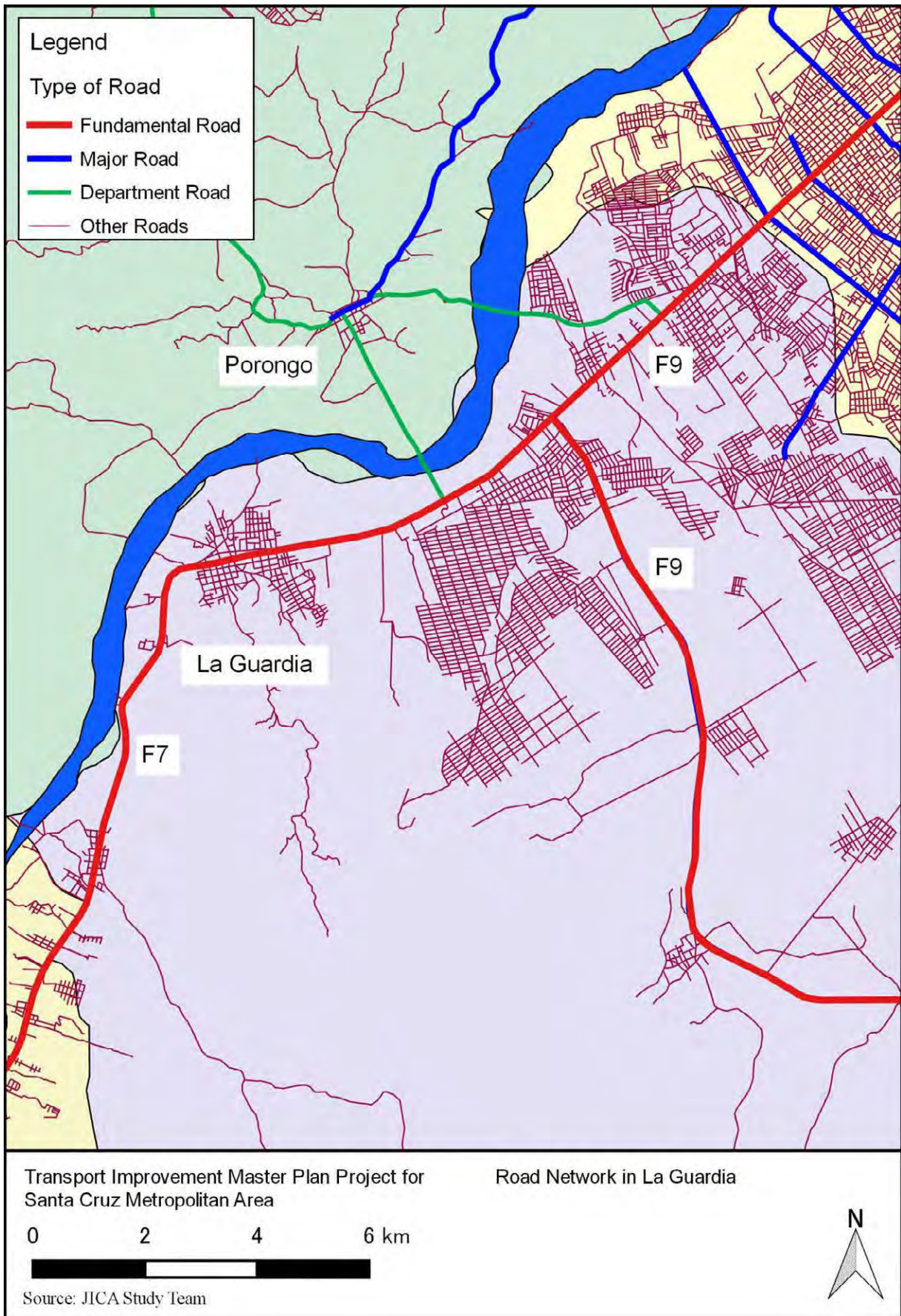


Figure 2.4-12 Road Network in La Guardia

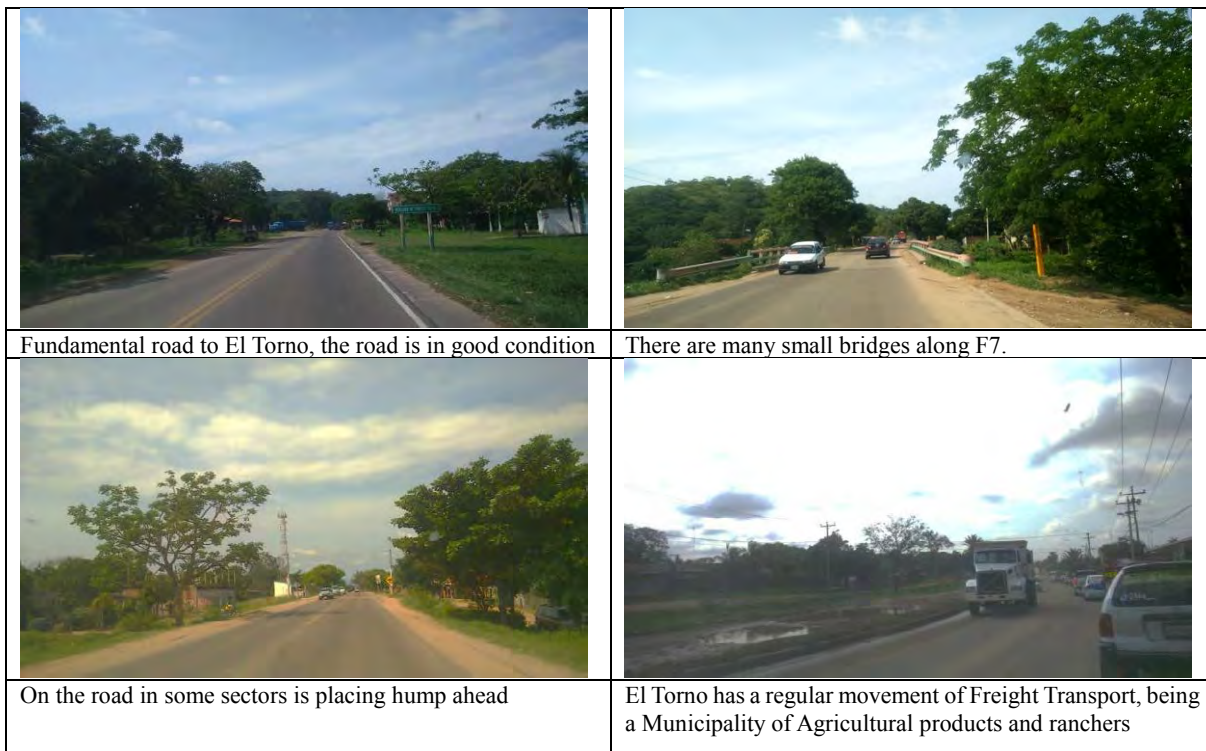
(5) El Torno

El Torno stretches in a linear shape along the Fundamental Road 7 (F7), which is the only arterial road in the municipality. Agricultural and livestock products are the major goods of the freight transport on F7, where 60% is of consumption and supply to nearby communities, and 40% is directed to Santa Cruz, especially on weekends.

The area of El Torno is restricted due to the topography (hilly terrain and the Pirai River), and the urban activities are concentrated along the highway.

F7 has only two lanes (one lane in each direction) in El Torno, except for the center of the municipality where both directions are separated by the median. This causes congestion of the road for a long section between communities in El Torno because private cars and public transport cannot overtake slow speed trucks. The municipality has planned to change the section of these main avenues to 22 m with two lanes.

Traffic safety is also one of the problems along F7 due to the lack of traffic signals, pedestrian crossing, open ditch without proper protection facilities, and street lights. There is no street light between the centers of La Guardia and El Torno, and the risk of traffic accidents on this road in the night time is high.



Source: Photos taken by JICA Study Team

Figure 2.4-13 Photos of Roads in El Torno

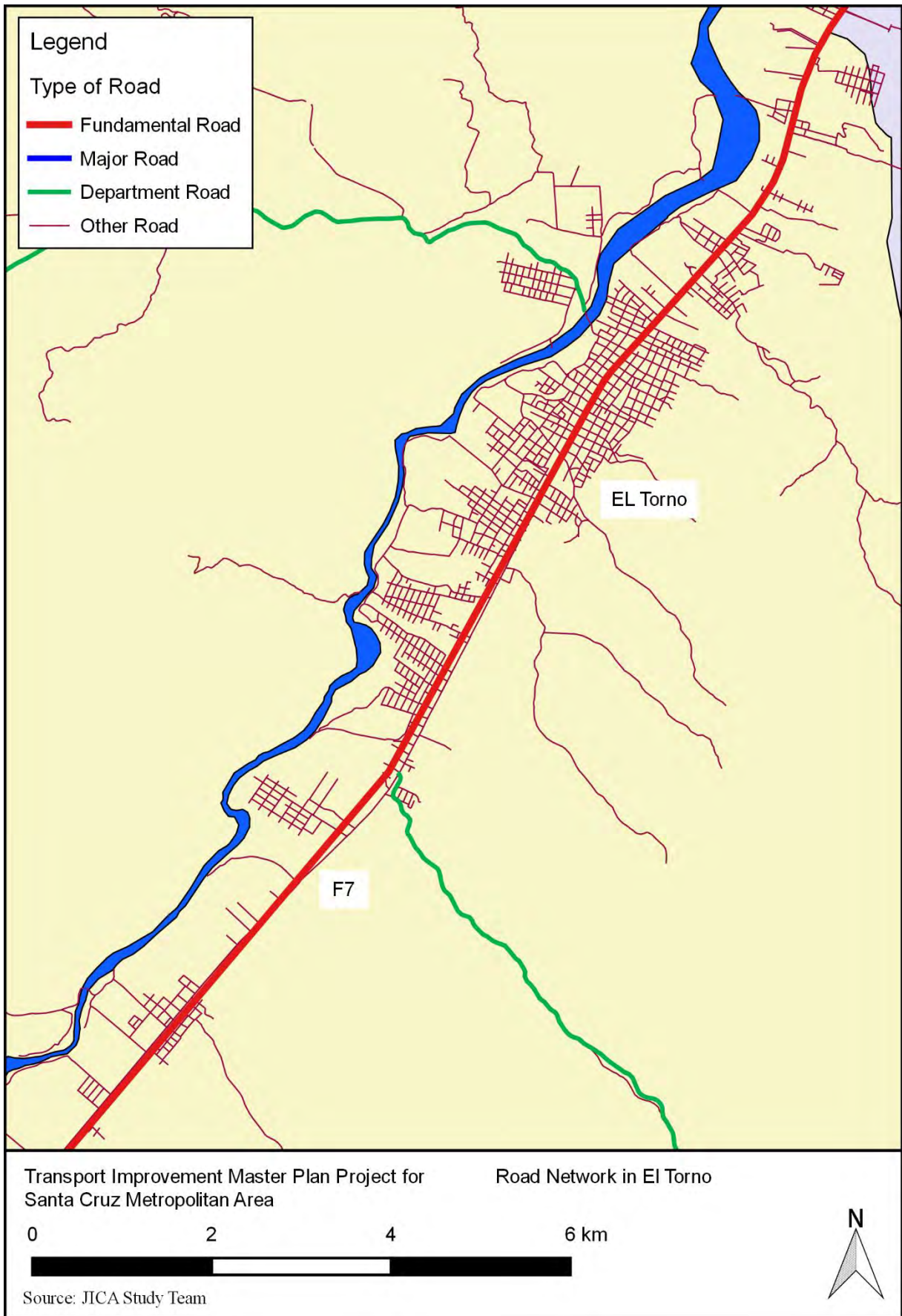


Figure 2.4-14 Road Network in El Torno

(6) Warnes

The Fundamental Road 4 (F4), connecting Montero and Santa Cruz de la Sierra, passes through Warnes in the direction of north and south, along which the historical town of Warnes and the new area of Satele Norte are located. The historical town of Warnes has a ring road as a detour route to avoid heavy vehicles entering the central area. There are few facilities for pedestrian crossing along F4.

Highway illumination on F4 is insufficient because there are some sections where street lights are not installed. The lack of street light raises the risk of traffic accidents on F4.

Av. Principal Satele Norte is the main road of Satele Norte, which is connected to F4 where traffic congestion occurs during peak hours.

The Fundamental Road 10 (F10), connecting Montero and Okinawa Uno, penetrates the north area of Warnes.

Warnes and Okinawa Uno are connected by two department roads between F4 and Okinawa Road, one of the roads branches from F4 at the Industrial Park and the other at Satele Norte.

Real estate companies continue to develop new road network in a large area especially in the east of Satele Norte and Viru Viru International Airport. The urban development by the private sector is so active that the road network, including the future plans, have been determined by the private sectors.

Warnes and La Belgica, which is located in the west of the Pirai River, are connected with a bridge, which should be rebuilt due to the deterioration.

	
<p>Road To Warnes with two lanes per direction, in good condition</p>	<p>Section of the Road to Warnes with three lanes per direction</p>
	
<p>There are large lots of sales of vehicles of all sizes: buses, trucks, and cars</p>	<p>Toll for the admission to Warnes</p>
	
<p>Main road to Warnes, extension work</p>	<p>Main road towards Warnes direction North-South in good condition</p>
	
<p>Along the road there are large flow of trucks, Warnes has major industrial facilities</p>	<p>Urban center, collector road has pedestrian bridge</p>

Source: Photos taken by JICA Study Team

Figure 2.4-15 Photos of Roads in Warnes

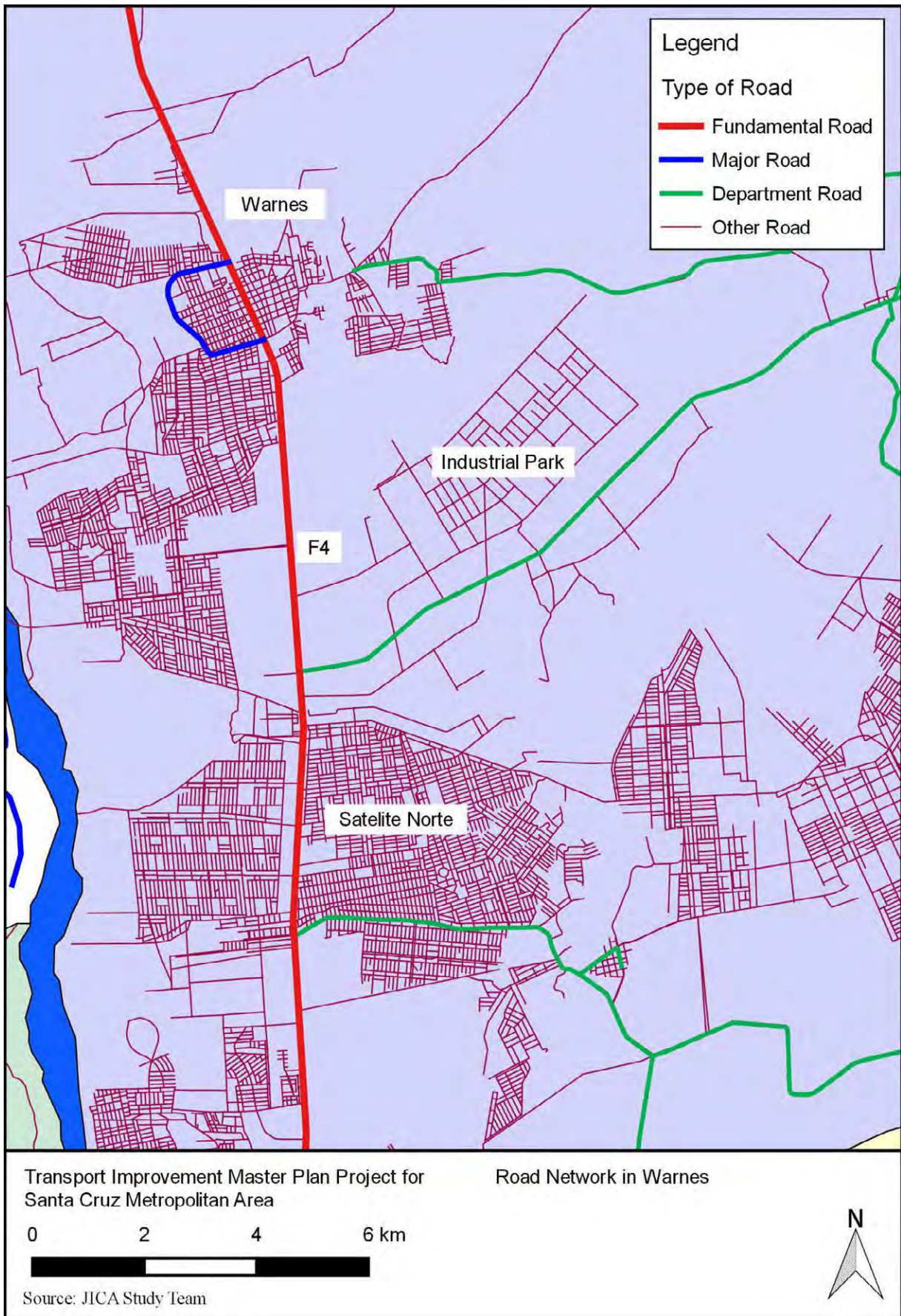


Figure 2.4-16 Road Network in Warnes

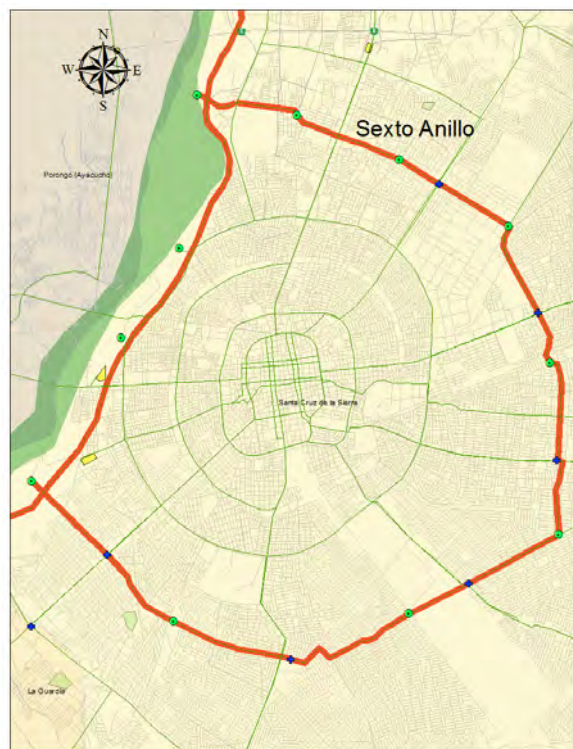
2.4.5 Road Projects

(1) 6th Ring Road Highway

The municipality of Santa Cruz de la Sierra has proposed the development of the project called “Improvement and expansion of the Main Distributor of the 6th Ring Road”. This project foresees that the 6th Ring Road joins the 4th Ring Road through a new road parallel to the Ecological Strip of the Pirai River, which is part of the 4th Ring Road expansion. These works are linked with the intention of integrating the new markets whose construction is being completed. The 4th Ring Road currently concentrates high traffic of vehicles and trucks of high tonnage, which come from the roads of the north, the old route to Cochabamba (southwest) and towards the east part of the department.

It is proposed that the new road section of the 6th Ring Road contains cycle paths, pedestrian bridges, urban and interurban public transport lanes and heavy transport lanes.

The implementation of this project could be divided into two sections: 22 km of roads that include the construction of infrastructure facilities and 12 km of roads that will be built parallel to the 4th Ring Road, in the sector of the ecological cordon of the Pirai River. The first section contemplates the implementation of two paved roads, sidewalks and drainage channels. At present, the 6th Ring Road lacks continuity in 8 km. An expropriation of lands (Pampa de la Isla, Villa 1ro de Mayo, Plan 3000 and El Bajio) is required for the integration of this section. For this purpose, an expropriation law must be created to support the 6th Ring Road expansion project. The second section has led to a great discussion due to its location; however, the works are contemplated as part of the extension of the 4th Ring Road, which does not affect the ecological cordon of the Pirai River. Therefore, the cargo transport will be able to arrive and circulate until the 6th Ring Road.

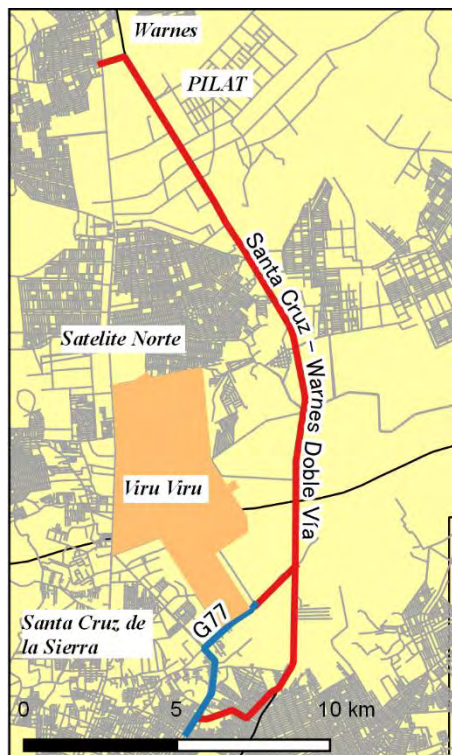


Source: Elaborated based on information from the Municipality of Santa Cruz de la Sierra

Figure 2.4-17 Location Map of the 6th Ring Road of the Metropolitan Area of Santa Cruz

(2) Double-tracks Road between Santa Cruz de la Sierra and Warnes

ABC is constructing a new highway between Santa Cruz de la Sierra and Warnes along the railway line (as of November 2017). This highway connects the industrial zone in Warnes, new urbanizations to the east of Viru Viru International Airport, and the G77 Road with a length of 26 km. The maximum speed is 100 km/h.



Source: ABC

Figure 2.4-18 Location of Double-tracks Road Santa Cruz–Warnes

(3) Bridge Projects

There are four bridge projects in the Metropolitan Area

- **Bicentennial Bridge “Puente Bicentenario”:** This bridge will connect Santa Cruz de la Sierra and Porongo at the intersections of the 4th Ring with “Busch Ave.” and “Radial 21 (prolongation of Av. Centenario Ave.)”. The length of the bridge is 400 m, and the width is 11.4 m with 2 m of pedestrian walkways. Civil works will be executed by the municipality of Santa Cruz within the Ecological Cordon.
- **Bioceanic Bridge “Puente Bioceánico”:** This bridge is located at KM13 of the F9 at “Doble Via La Guardia” near a motocross circuit well known by the near residents. Also, there is a proposal for the construction of a bypass road at the intersection of F9 and the road to Camiri City which currently is in final design phase and will be tendered in November 2017
- **Private Bridge for Urubo Village:** This bridge, planned as a cable-stayed bridge with 11.4 m in width, will connect Urubo Village to the extension of Roca y Coronado Ave. The private sector will invest in the construction.
- **“Radial 26” Bridge:** Located inside the private project of “Gran Ciudad del Urubo” near an oxidation pond.

(4) Bi-oceanic Road

La Guardia - Buena Vista highway is an important project by Department of Santa Cruz, which will be a part of the Bi-oceanic corridor. The project needs a construction of a bridge over the river where the width is as wide as more than 800 m.

(5) La Guardia Ring Road

Construction of a ring road is planned to provide a detour route for heavy trucks around the center of La Guardia, with a length of approximately 3 km.

(6) Radial 17 1/2 of La Guardia -

The municipality has projected an alternative road to the F7 that connects Santa Cruz de la Sierra with La Guardia to avoid the entrance of heavy trucks to the city. This road is called “Radial 17 1/2” and connects with the 4th Ring Road of Santa Cruz. This project has a total length of approximately 19 km. The execution is shared by ABC and the municipality of La

Guardia.

(7) EL Torno Ring Road

This road will be an alternative route for heavy loaded trucks to regulate their entry to the urban area of El Torno. This project is developed along the Pirai River and considers an ecological park component which is a green band along the proposed road. This park will have a minimum width of 100 m and may touch the buffer zone of the Pirai River managed by SEARPI. This project is only in a conceptual outline level but considers a new terminal and the relocation of local markets.

(8) Cotoca Second Ring Road

This project is called “Cotoca Double Lane Project (Doble vía de Cotoca)”. The road will connect the Cotoca 2nd Ring Road and Puerto Paylas. The first phase of the project, which will connect Cotoca and Okinawa, is projected to be implemented during 2017 (2km).

(9) Bicycle Lanes

There is also a project for the construction of bicycle lane on the right side of the road that connects Urubo and Porongo.

2.4.6 Pavement Conditions

The central area of each municipality is paved with bricks or concrete. The streets in the historical town of Porongo were paved in 2016. In Santa Cruz de la Sierra, hexagon tiles made of concrete are used for the pavement of streets inside the 2nd Ring Road.

All streets are paved within the 4th Ring Road in Santa Cruz de la Sierra, while most roads and streets except for arterial roads are unpaved as shown in Figure 2.4-19. The municipality continues the pavement work outside the 4th Ring Road with the policy of paving 15 km per district each year.

The most streets in urbanizations remain unpaved. Heavy rain easily deteriorates the surface condition of the unpaved road.

Table 2.4-12 Paved roads length – Santa Cruz

Pavement	Length (km)	%
Rigid	1,335.6	80.7%
Block	208.0	12.6%
Flexible	111.9	6.8%
Total	1,655.5	100.0%

Source: SMOP – April 2016

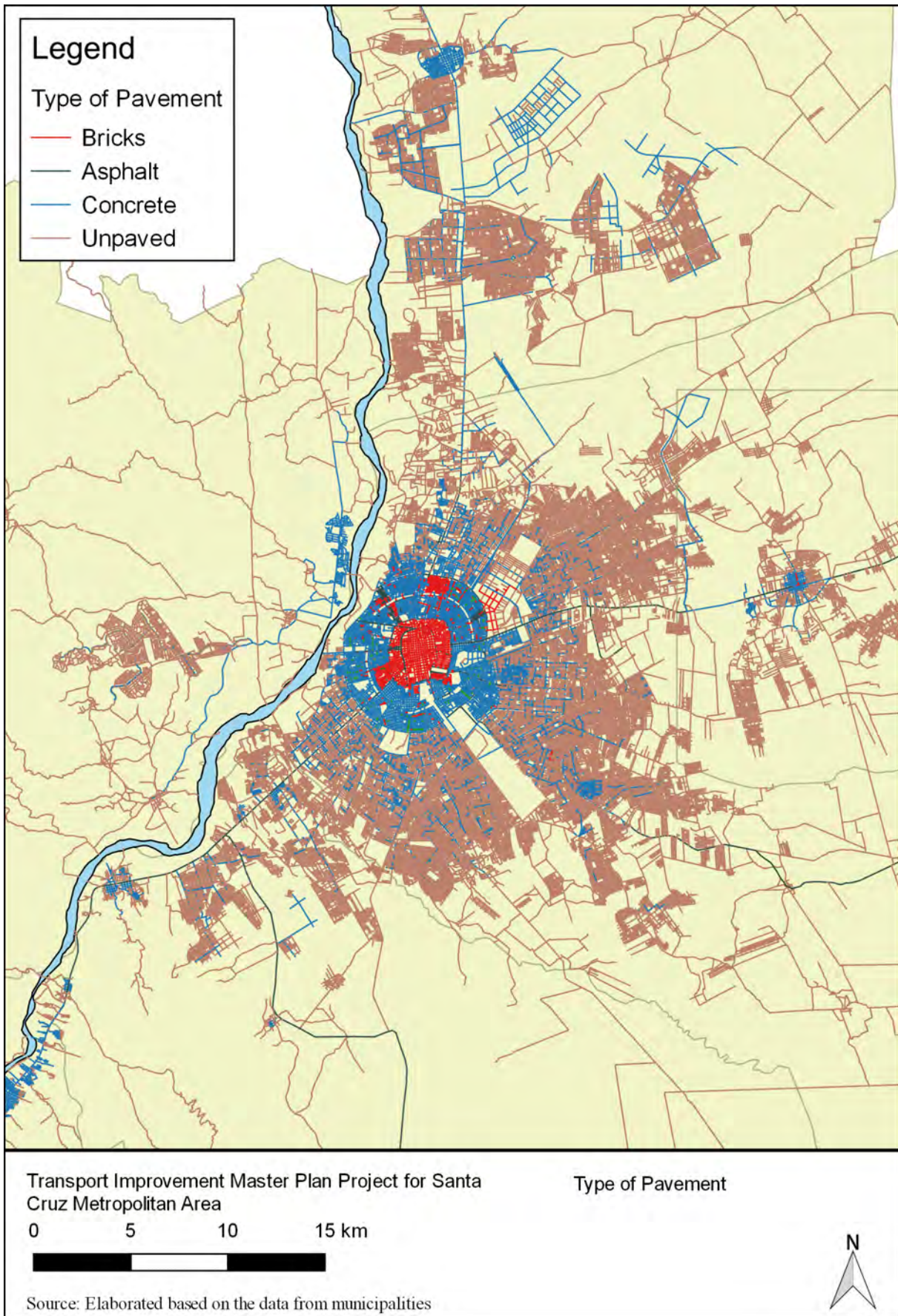


Figure 2.4-19 Type of Pavement in Santa Cruz de la Sierra

2.4.7 Present Problems on Road Infrastructure

(1) Lack of coordination among organizations

The demarcation among road authorities does not necessarily coincide with the function of the roads, especially where the national roads enter the urban areas. Generally, ensuring high mobility is required for intercity highways which are usually under the responsibility of the national or the departmental level while ensuring high accessibility to roadside facilities is required for urban streets which are usually under the responsibility of municipalities. Reducing vehicle speed is one of the major concerns of local communities while ensuring high speed and high capacity is one of the major performance indicators of the authorities of roads. There are some sections where high mobility is required but the speed is restricted by speed bumps, and there are some sections where speed restriction is necessary for pedestrians, but speed bumps were removed.

(2) Unpaved Road

The backlog of the road pavement has been accumulated due to the rapid expansion of the urbanized area. The road condition of unpaved roads is easily deteriorated after heavy rains. This is one of the reasons that the number of public transport services is frequently reduced in the rainy season.

(3) Incomplete Road Network

There are some missing sections along ring roads such as 8th Ring Road. A missing section means that the width of the section is not wide enough for the road, or the section is not paved, or the section is occupied by private properties. The major roads of east-west direction to the north of the north section of the 4th Ring Road are named as 5th, 6th, 7th, and 8th Ring Road. The same rule is applied to the major roads in the south. However, the route of the ring roads between the north and the south in the east side is not clear because of lack of major roads in District 6, 7, and 8.

The crossing point of the Pirai River is limited to the Foianini Bridge.

(4) Insufficient Right-of-way (ROW) Protection

Private houses easily occupy the project sites of new roads soon after the disclosure of the road plan to the public. This is due to the lack of the institutional system to protect the planned area of public infrastructure.

(5) Poor condition of sidewalks

The design of most sidewalks does not consider the use of wheelchairs. Although the sidewalks in the central area are designed with slope, it does not necessarily satisfy the accessibility by wheelchair or bicycle.

(6) Lack of highway illumination

Street lights are installed along major roads and local streets in Santa Cruz de la Sierra, which are relatively in good conditions especially in the central area, while streets are dark without proper illumination in some districts. Most of the street lights are sodium lamps. There are some sections where mercury lamps are used.

On the other hand, the highway illumination of the Fundamental Roads is insufficient in

suburban areas. The lack of street lights raises the risk of traffic accidents because the traffic in the night time is also heavy along the Fundamental Roads.