

**Republic of Nicaragua
Municipality of Managua**

**PROJECT FOR
URBAN DEVELOPMENT MASTER
PLAN FOR MANAGUA CITY
IN REPUBLIC OF NICARAGUA**

**FINAL REPORT
Part - III: Appendix**

August 2017

Japan International Cooperation Agency

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The exchange rate used in the report is

US\$ 100 = NIO 2820

APPENDIX 1 APPROACH FOR MASTER PLAN GOALS (ANNEX TO CHAPTER 8)

(1) Forecasting and Backcasting

Setting the goals for Managua City in 2040 is an important starting point for the formulation of the master plan. In this project, a methodology called backcasting or retrospective assessment method is employed as opposed to a forecasting or perspective assessment method.

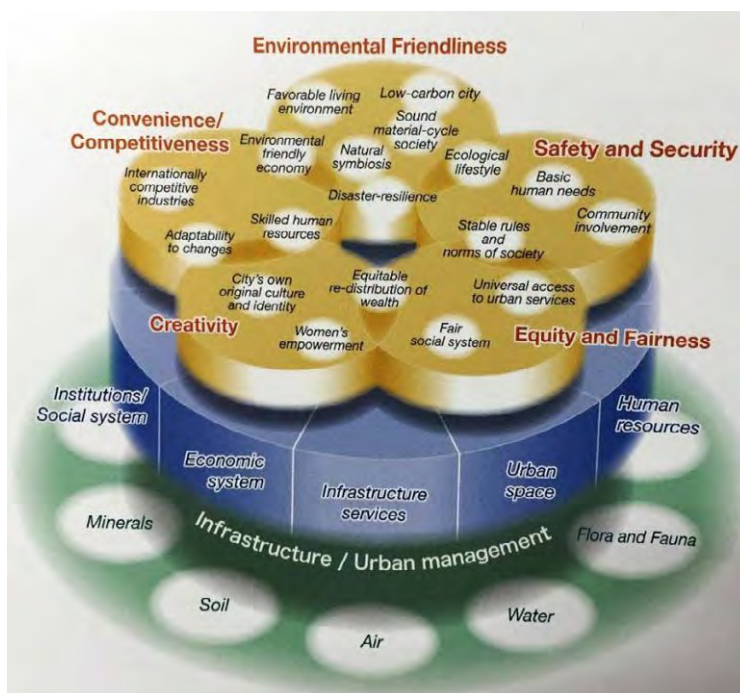
The forecasting method helps to cope with the uncertainty of the future, relying mainly on data from the past and present and analysis of trends. Forecasting utilizes certain assumptions based on the experience, knowledge, and judgment. These estimates are projected into the future using techniques such as mathematical models, regression analysis, and trend projection. Many of the master plans have been formulated chiefly in the forecasting methodology.

Backcasting technique starts with defining a desirable future status and then works backwards in time to identify policies and programs that will connect the future to the present. Backcasting is increasingly used in urban planning and resource management projects such as water and energy. The fundamental question of backcasting asks: "if we want to attain a certain goal, what actions must be taken to get there?"

This project tries to use the backcasting method in an attempt to find the necessary interventions to obtain the desirable future status set as the goals.

(2) Methodology

For the backcasting exercise, a questionnaire sheet was prepared and delivered to the members of the counterpart group. The questionnaire sheet requested each of the respondents to assess the situation of Managua City today (2016) and in the future (2040) in the relative scale of 1 through 5 for each of the established categories of assessment. The categories of assessment were taken from JICA's concepts for sustainable city, which consists of eighteen sub-entries broadly categorized to five major pillars including 1) environmental friendliness; 2) safety and security; 3) equity and fairness; 4) creativity; and 5) convenience/competitiveness, as illustrated in Figure A.1.1.



Source: JICA Study Team

Figure A.1.1 JICA's Five Basic Charters in Concept for Sustainable City

(3) Overall Results

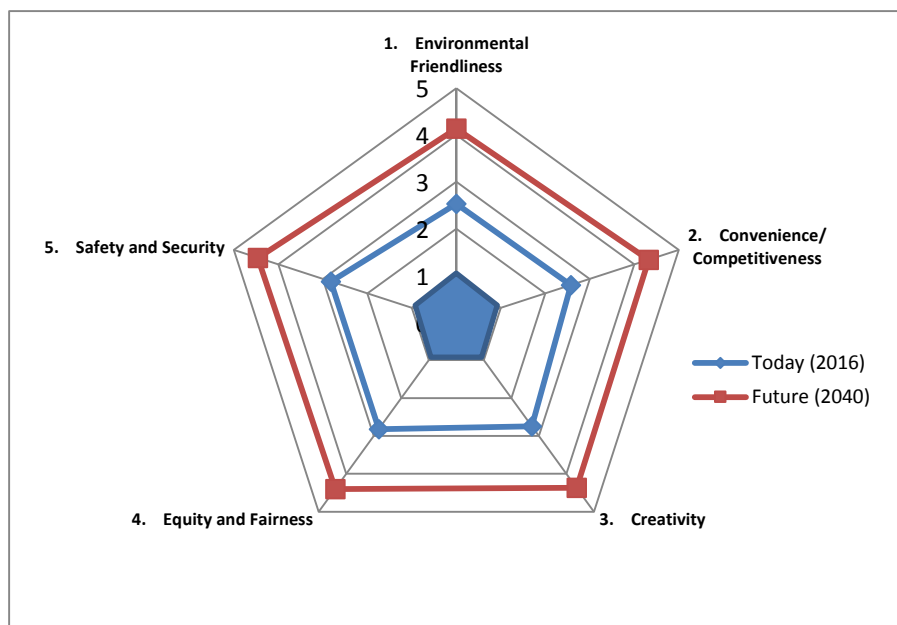
In total, 34 people of the members of the counterpart group responded to the backcasting assessment form. First, the results averaged on the five basic characters in the Concept for Sustainable City are shown in Table A.1.1.

Table A.1.1 Average Rating for Five Major Categories of Sustainable City Goals

Major Categories	Rating (Scale of 5)		Gap
	Today (2016)	Future (2040)	
1. Environmental Friendliness	2.53	4.14	1.61
2. Convenience/Competitiveness	2.57	4.32	1.75
3. Creativity	2.75	4.37	1.62
4. Equity and Fairness	2.82	4.46	1.64
5. Safety and Security	2.88	4.4	1.52

Source: JICA Study Team

It is noted that Convenience and Competitiveness has the largest gap between the future and present ratings of 1.75 and Safety and Security has the smallest gap of 1.52.



Source: JICA Study Team

Figure A.1.2 Radar Chart Showing the Present and Future Ratings and Gaps

(4) Sub-category Output Summary

The following are the results of the quick survey for sub-categories for each of the five categories of the sustainable city.

The sub-categories having relatively large gaps between the should-be future and present of more than 2.00 and 1.70 ratings are as follows:

- Equitable redistribution of wealth <Creativity> (2.18)
- Ecological lifestyle <Environmental Friendliness> (2.09)
- Environmentally friendly economy <Convenience and Competitiveness> (2.03)
- Skilled human resource < Convenience and Competitiveness> (1.79)
- Internationally competitive industries< Convenience and Competitiveness> (1.77)
- Universal access to urban services<Equity and Fairness> (1.77)
- Disaster resilience <Safety and Security>(1.76)
- Basic human needs <Safety and Security> (1.74)
- Sound material cycle <Environmental Friendliness>(1.73)
- Fair social system <Equity and Fairness> (1.70)

Table A.1.2 Ratings for the Eighteen Sub-Categories of Sustainable City Goals

Results of Retrospective Assessment of Managua Today and Should-be Future

1. Environmental Friendliness

	Favorable living environment	Low-carbon city	Sound material cycle	Natural symbiosis	Ecological lifestyle	Average
Today (2016)	3.03	2.79	2.24	2.53	2.06	2.53
Future (2040)	4.35	4.15	3.97	4.06	4.15	4.14
Gap	1.32	1.36	1.73	1.53	2.09	1.61

2. Convenience/ Competitiveness

	Environmentally friendly economy	Internationally competitive industries	Adaptability to changes	Skilled human resources	Average
Timeline					
Today (2016)	2.38	2.47	2.74	2.68	2.57
Future (2040)	4.41	4.24	4.15	4.47	4.32
Gap	2.03	1.77	1.41	1.79	1.75

3. Creativity

	City's own original culture and identity	Equitable re-distribution of wealth	Women empowerment	Average
Timeline				
Today (2016)	2.94	1.97	3.35	2.75
Future (2040)	4.50	4.15	4.47	4.37
Gap	1.56	2.18	1.12	1.62

4. Equity and Fairness

	Fair social system	Universal access to urban services	Stable norms rules / norms of society	Average
Timeline				
Today (2016)	2.74	2.85	2.88	2.82
Future (2040)	4.44	4.62	4.32	4.46
Gap	1.70	1.77	1.44	1.64

5. Safety and Security

	Disaster resilience	Basic human needs	Community involvement	Average
Timeline				
Today	2.68	2.47	3.50	2.88
Future	4.44	4.21	4.56	4.40
Gap	1.76	1.74	1.06	1.52

Sample Size: 34 (counterpart of ALMA)
Sampling Period: April - May 2016

Legend

	Large gap (>2.00)
	Medium gap (>1.70)
	Small gap (<1.4)

Source: JICA Study Team

(5) How to Fill the Gap

The following table summarizes the proposal made by the respondents as the necessary actions for each of the goals that have gaps (future and present).

Table A.1.3 Necessary Actions (Proposals) to Fill the Gap

Category	Necessary Actions (proposal) to Fill the Gap (Present and Future)
Environmental Friendliness	<ol style="list-style-type: none"> 1) Create awareness campaigns and educative campaigns. 2) Promote recycling and reforestation. 3) Efficient public transport to reduce number of vehicles. 4) Promote to expand the green areas. 5) Apply norms and laws to control environmental issues, solid waste treatment, and deforestation.
Convenience/ Competitiveness	<ol style="list-style-type: none"> 1) Hire more educated staff and or promote staff according to capacities. 2) Create policies that promote local industrial development, tax exemption, exporting and importing process, fair tax payment, etc. 3) Create programs for human capacity training. 4) Develop laws for fair minimum wage.
Creativity	<ol style="list-style-type: none"> 1) More ownership of our culture and customs. 2) Support women and give them the opportunity to participate for high job positions. 3) Guarantee and implement strategies to distribute fairly the wealthiest of the country. 4) More gender equity.
Equity and Fairness	<ol style="list-style-type: none"> 1) Apply norms to all economical levels and social class. 2) Better provision of services to all social class levels. 3) Provide a fair opportunity to job positions.
Safety and Security	<ol style="list-style-type: none"> 1) Form and train brigades. 2) Invest and develop infrastructure for refuge areas for the people affected by disaster. 3) Investment in early warning systems for natural disaster. 4) Apply construction supervision and norms to prevent infrastructure demolition.

Source: JICA Study Team

APPENDIX 2 OUTLINE OF TRAFFIC SURVEY

2.1 Household Interview Survey

2.1.1 Survey Objective

This survey aims to collect information on the socio-economic characteristics of the population in Managua. In addition, information on the travel characteristics of residents of Managua is also collected.

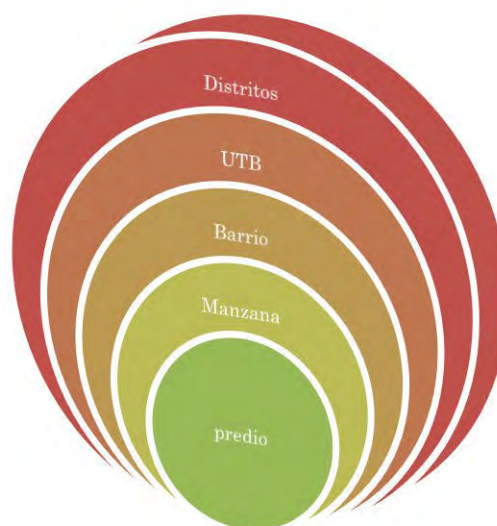
2.1.2 Survey Methodology

(1) Sample choosing

Sample size was decided based on the population in Managua city and Ciudad Sandino city. ALMA announced the population in the Managua city is 1,559,948 people in 2015 and INIFOM announced the population in the Ciudad Sandino is 109,644 people in 2015. Average household members in Nicaragua are 4.6 people according to INIDE's statistics in 2005. Based on those numbers necessary sample size was decided as 10,000 households. The sample size is matched with 3% of population in Managua city and Ciudad Sandino city of five years old and above.

To selecting the households to be interviewed, JICA study team utilized SISCAT code to identify each property. SISCAT code is a cadastral mapping code developed by ALMA Dirección de Catastro. Every properties have a municipality code and a SISCAT code. SISCAT is consisted of Eighteen (18) digit code; department number, district number, UTB number, neighbourhood number, block number, and parcel number. Based on SISCAT code, target households are chosen randomly. Predio is the minimum unit of the address coding system. It represents boundary of property and includes around one to three households.

While, Ciudad Sandino does not have address coding system, but has map of properties in the city. JICA study team randomly selected from the map and numbering surveyed predios.



Source: JICA study team

Figure A.2.1 SISCAT Code System

(2) Survey methodology

Survey form was adopted tablet-type device instead of paper. Tablet type device has several advantages. Firstly it can reduce the labor of coding process, secondly it prevents surveyors from misanswer. Interviewer cannot skip to the next question without inputting answer. There are some questions aimed only specific people. For example trip information collected people above five years old. If interviewee was under five years old, the device automatically skips the questions. In the device, map and questionnaire are installed. Coding staffs accumulated all of collected data and check the error. In the case of unexpected event such as run out the battery, JICA study team prepared paper type survey form for supplement item.

Role of supervisor is assigning surveyor to designated household based on the map. Interview. Average interview time is 20 to 30 minutes per household. If some members were absented at the interview, surveyors made appointment and conducted revisit.



Source: JICA study team

Figure A.2.2 Tablet Type Device

(3) Training, Pilot survey

To test the tablet-type device and accustom surveyors to the devices, two times training sessions and pilot survey were conducted. 1st training session was held on 6th and 7th June. The objective is explaining questionnaire and survey manual to the supervisors and surveyors. A pilot survey was conducted on 8th and 9th June. Target samples are 50 households out of Managua city and Ciudad Sandino city. After polot survey, 2nd training session was held on 23rd and 24th June, with participation of the JICA study team. The objective is feedback of result of pilot survey from JICA study team and explaining revision of software.



Source: JICA study team

Figure A.2.3 Training Session



Source: JICA study team

Figure A.2.4 Training Session

(4) Survey form

Surveyors manipulated tablet type device. All of questions are input in one software. JICA study team prepared paper type survey form just in case as shown in Figure A.2.5.

Interview items are:

- Household Information
- Members information (for all household members of 5 years old and above)
- Trip information (for all household members of 5 years old and above)
- Urban planning, environmental aspects, disaster prevention (for all household members of 5 years old and above)

Except “Trip information” , all of questions are answered by one interviewee from a household.

<p>P9 Type of House</p> <ol style="list-style-type: none"> 1 Independent House 2 Housing in condominium 3 Apartment building 4 Quinta House 5 Dwelling House (solar, alley) 6 Room 7 Other What? _____ 	<p>P8 House ownership</p> <ol style="list-style-type: none"> 1 Own 2 government owned house for rental 3 Private-owned house for rental 4 Group owned house 5 Iend 5 Rent one of a room 7 Other What? _____ 	<p>P10 If you answer yes in 4,5 or 6 of P8, Respond:</p> <p>Land ownership</p> <ol style="list-style-type: none"> 1 Self owned 2 Private-owned 3 government-owned 4 group owned 5 Solvency for disposal and revision 6 Uncertain ownership 																																																																																																																																							
<p>P11 The size of living area of the house in m2</p> <div style="border: 1px solid black; width: 80px; height: 30px; margin: 10px auto;"></div>	<p>P12 Excluding bathroom; kitchen, passages, and garage, how many bedrooms occupies this home for 1 household?</p> <div style="border: 1px solid black; width: 60px; height: 30px; margin: 10px auto;"></div>	<p>P13 What kind of service you can access in their house</p> <ol style="list-style-type: none"> 1 Electricity 2 Piped water supply 3 Sewage Facility 4 TV Cable 5 Telephone 6 Solid Waste collection 7 Internet 																																																																																																																																							
<p>P14 The water in your home comes from:</p> <ol style="list-style-type: none"> 1 Public network within the housing 2 Public network outside the house but inside the building 3 Pylon of public use 4 Truck/tanker or other similar 5 Well 6 Rio, ditch, spring or similar Other What? _____ 	<p>P15 No. of years living in the present house</p> <div style="border: 1px solid black; width: 60px; height: 30px; margin: 10px auto;"></div>																																																																																																																																								
<p>P16 Where did you live in before living in this place?</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; padding: 2px;">Managua</td> <td style="width: 85%; padding: 2px;">Address</td> </tr> <tr> <td style="padding: 2px;">Other</td> <td style="padding: 2px;">city/department</td> </tr> </table>			Managua	Address	Other	city/department																																																																																																																																			
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<p>P17 What are the current main environmental concerns or issues of Managua regarding the urban development?</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 60%;"></th> <th style="width: 5%;"></th> <th style="width: 5%;">Less</th> <th style="width: 5%;"></th> <th style="width: 5%;">Major</th> <th style="width: 5%;"></th> </tr> </thead> <tbody> <tr><td>Noise/vibration</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Vehicular emission</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Air pollution</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Water pollution</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Vegetation/Deforestation</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>hazard to Fauna</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Soil Erosion</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Bush Fire</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>damage to Historical/cultural and/or monumental prope</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Urban floods/drainage</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>limited Safe Water Resources</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Others (please specify _____)</td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>					Less		Major		Noise/vibration	1	2	3	4	5	Vehicular emission	1	2	3	4	5	Air pollution	1	2	3	4	5	Water pollution	1	2	3	4	5	Vegetation/Deforestation	1	2	3	4	5	hazard to Fauna	1	2	3	4	5	Soil Erosion	1	2	3	4	5	Bush Fire	1	2	3	4	5	damage to Historical/cultural and/or monumental prope	1	2	3	4	5	Urban floods/drainage	1	2	3	4	5	limited Safe Water Resources	1	2	3	4	5	Others (please specify _____)						<p>P18 What are the current main socio-economical concerns regarding the urban development of Managua?</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 60%;"></th> <th style="width: 5%;"></th> <th style="width: 5%;">Less</th> <th style="width: 5%;"></th> <th style="width: 5%;">Major</th> <th style="width: 5%;"></th> </tr> </thead> <tbody> <tr><td>Poverty</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Availability of Social Services</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Employment Opportunities</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Infrastructure Improvement</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Education</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Safety and security</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Regional Conflicts</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>Others (please specify _____)</td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>					Less		Major		Poverty	1	2	3	4	5	Availability of Social Services	1	2	3	4	5	Employment Opportunities	1	2	3	4	5	Infrastructure Improvement	1	2	3	4	5	Education	1	2	3	4	5	Safety and security	1	2	3	4	5	Regional Conflicts	1	2	3	4	5	Others (please specify _____)					
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<p>P19 Information disclosure and public involvement program regarding the PDUM is to be initiated soon. Which procedures you prefer to express your concerns and/or opinions (multiple answers)?</p> <ol style="list-style-type: none"> 1 Stakeholder meeting (e.g., periodical town and/or community meeting) 2 MP website 3 Call center (e.g., set-up of MP hot number) 4 Direct visit and talk to ALMA 5 Others (please specify _____) 			<p>P20 Do you support on-going Managua Urban Development MP study?</p> <ol style="list-style-type: none"> 1 Support (Unconditionally) 2 Support (Conditionally, please specify conditions to support) 3 No 4 I don't know the project 																																																																																																																																						

02

Source: JICA study team

Figure A.2.6 Household Interview Survey Form (Household Information)

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Part 4. PERSONAL INFORMATION												
Number of person	P21 Member of the family	P22 Relation with the Head of the household	P23 Gender	P24 Age	P25a Disability Do you have any Disability? (total or partial)		P26 Occupation What is your Occupation Today?	P27 Sector What activity is Dedicated business, Company, or Body in which You work?	P28 Occupation and Activity In 2010		P29 License Do you have. Vehicle License?	P29a [.....] Do You Mobilized the day Yesterday?
	C2 First and Last Name	Relationship	Sex		Disability	Need Help	Occupation	Sector	Occupation	Sector	1. Yes 2. No	1. Yes 2. No
01		1										
02												
03												
04												
05												
06												
07												
08												
09												
10												

Relationship:

1. Head
2. Spouse (spouse, cohabitee, companion)
3. Son
4. Son-in-law/daughter-in-law
5. Grand son /Grand daughter
6. Parent
7. Father or mother-in-law
8. Another relative
9. Domestic worker
10. Sibling
11. Another person not relative

Sex:

1. Male
2. Female

Disability

1. Yes
2. No (→ P26)

Need Help

1. Need help to travel
2. Do not need

Occupation

1. Manager, Chief, Pattern, Director
2. Independent Professional
3. Employee
4. Independent Technical
5. Worker, Pin
6. Seller, Trader
7. Independent worker non-specialist
8. Police / FF.AA.
9. Driver
10. Guard
11. Student worker
12. Primary student/ Secondary (→ P29)
13. University student (→ P28)
14. Student of technical career
15. Housewife (→ P28)
16. Worker from home
17. Unoccupied/Retired (→ P28)
- Another What? _____ (→ P28)

Sector

- 1 Agriculture
- 2 Fishing
- 3 Mining
- 4 Manufacturing
- 5 Electricity
- 6 Construction
- 7 Trade, Restaurant, Hotel
- 8 Transport, Communication, Storage
- 9 Finance, Insurance
- 10 Education
- 11 Health and Social Service
- 12 Governmental services
- 13 Private Services Rendered to Companies
- 14 Domestic Service
- 15 Other Community Service Activities, Social and Personal
- Another What? _____

03

Source: JICA study team

Figure A.2.7 Household Interview Survey Form (Personal Information)

Part 4. PERSONAL INFORMATION (continued)							
Number of person	P30 Directions						
	P30A where is located the work place?						
	District	Address:	Reference		Traffic Zone		
c2	1. Main Work Place						
01				→			
02				→			
03				→			
04				→			
05				→			
06				→			
07				→			
08				→			
09				→			
10				→			
11				→			
12				→			
	2. Secondary Work Place						
01				→			
02				→			
03				→			
04				→			
05				→			
06				→			
07				→			
08				→			
C2	P30B where is located the place of school?						
	District	Address:	Reference		Traffic Zone		
01				→			
02				→			
03				→			
04				→			
05				→			
06				→			

A-12


Source: JICA study team

Figure A.2.8 Household Interview Survey Form (Personal Information)

Part 5. TRIP INFORMATION (FOR 5 YEARS OR MORE)			
Home No.	No. of Person	Total trip	Reference Date
What trips did you make on (day of the week) ? (Apply individually)			
Trip N°	No. of Trip		
P31 origin of the trip		P31 origin of the trip	
District	Address	Place of reference	Traffic zone
P32 place of origin		P32 place of origin	
1 House	5 School/College	7 Restaurant	Other what? _____
2 Office	6 Store	8 Doctor clinic	
3 Industrial	7 Recreational Center		
4 Banco			
P33 Departure Time	Time	Minute	AM/PM
P34 the trip destination		P34 the trip destination	
District	Address	Place of reference	Traffic zone
P35 Place of destination		P35 Place of destination	
1 House	5 School/College	7 Restaurant	Other what? _____
2 Office	6 Store	8 Doctor clinic	
3 Industrial	7 Recreational Center		
4 Banco			
P36 Arrival Time	Time	Minute	AM/PM
P37 Purpose	The Trip		
1 To work	7 To bring a family member	8 Procedures	9 Leisure
2 To study	10 Back home	11 Another particular	6 Health treatment
3 By work			
4 Shopping			
5 Eat			
6 Health treatment			
P38 Means of transport			
Mode	Time (Minutes)	Cost	Transhipment
1			
2			
3			
4			
5			
6			
7			
Major mode			
1 Walk	9 Intercity bus		
2 Bicycle	10 microbus		
3 Motorcycle	11 School or Company vehicle		
4 Mototaxi -> P39a	12 Small truck		
5 Bicycle taxi	13 Truck		
6 Taxi	Other what? _____		
7 Car -> P39a			
8 Bus urbano			
P39a Did you drive the vehicle you transported on? 1. Si 2. No			
P39b How many people traveled with you? _____			
P40 Where do you park?			
Place	1 Street 2 Parking lot 3 No		
Payment	1 Paid 2 Free		
Fare C\$	Per: 1)Hour 2)Day 3)Month 4)total		

Source: JICA study team

Figure A.2.9 Household Interview Survey Form (Trip Information)

<p>P45 How often is your house flooded?</p> <ol style="list-style-type: none"> 1 Twice a year 2 every year 3 every 2 years 4 every 10 years 5 More than 10 years 6 never 	<p>P46 When your present house have the most serious flooding in the past, how deep is the water level and how long it lasts?</p> <p>The most serious flood: (YY/MMDD: _____)</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;"></td> <td style="width: 35%; text-align: center;">a. house</td> <td style="width: 35%; text-align: center;">b. road in front of the house</td> </tr> <tr> <td style="border-right: 1px solid black; vertical-align: top; padding: 5px;"> <p><i>water level</i></p> <ol style="list-style-type: none"> 1. hasta lo talones 2. Up to the shin 3. up to knees 4. up to waist 5. more than waist </td> <td style="border-right: 1px solid black; vertical-align: top; padding: 5px;"> <table border="1" style="width: 100%; height: 40px;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> </table> </td> <td style="vertical-align: top; padding: 5px;"> <table border="1" style="width: 100%; height: 40px;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> </table> </td> </tr> <tr> <td style="border-right: 1px solid black; vertical-align: top; padding: 5px;"> <p><i>Duración de la inundación</i></p> <ol style="list-style-type: none"> 1. less than half day 2. half day- one day 3. from one to three days 4. from three to five days 5. more than 5 days </td> <td style="border-right: 1px solid black; vertical-align: top; padding: 5px;"> <table border="1" style="width: 100%; height: 40px;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> </table> </td> <td style="vertical-align: top; padding: 5px;"> <table border="1" style="width: 100%; height: 40px;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> </table> </td> </tr> </table>		a. house	b. road in front of the house	<p><i>water level</i></p> <ol style="list-style-type: none"> 1. hasta lo talones 2. Up to the shin 3. up to knees 4. up to waist 5. more than waist 	<table border="1" style="width: 100%; height: 40px;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> </table>			<table border="1" style="width: 100%; height: 40px;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> </table>			<p><i>Duración de la inundación</i></p> <ol style="list-style-type: none"> 1. less than half day 2. half day- one day 3. from one to three days 4. from three to five days 5. more than 5 days 	<table border="1" style="width: 100%; height: 40px;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> </table>			<table border="1" style="width: 100%; height: 40px;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> </table>		
	a. house	b. road in front of the house																
<p><i>water level</i></p> <ol style="list-style-type: none"> 1. hasta lo talones 2. Up to the shin 3. up to knees 4. up to waist 5. more than waist 	<table border="1" style="width: 100%; height: 40px;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> </table>			<table border="1" style="width: 100%; height: 40px;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> </table>														
<p><i>Duración de la inundación</i></p> <ol style="list-style-type: none"> 1. less than half day 2. half day- one day 3. from one to three days 4. from three to five days 5. more than 5 days 	<table border="1" style="width: 100%; height: 40px;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> </table>			<table border="1" style="width: 100%; height: 40px;"> <tr><td style="width: 50%;"></td><td style="width: 50%;"></td></tr> </table>														
<p>P48 Can you receive any warnings on floods if disaster happen?</p> <ol style="list-style-type: none"> 1. Si 2. No → P49 <p>P48 If yes in P47, what is the main source of the information?</p> <ol style="list-style-type: none"> 1. Radio/ TV 2. Neighbors 3. Community leader 4. Governmental office 5. Others (Please specify _____) 	<p>P49 Have you ever had experience in the evacuation due to flood?</p> <ol style="list-style-type: none"> 1 Yes → P49a 2 No → P49b <p>P49a If yes in P49, where did you evacuate?</p> <ol style="list-style-type: none"> 1 Lugares religiosos (templo, iglesia, mezquita, etc.) 2 Escuela 3 Casa de familiares 4 Casa de vecinos 5 Otros (Especificar _____) <p>P49b If no in P49, why didn't you evacuate?</p> <ol style="list-style-type: none"> 1 No place to go 2 Risk of looting household items 3 Too late to evacuate 4 No issuance of warning 5 Small depth of inundation 6 Flood is an ordinary event 7 Others (Please specify _____) 																	
<p>P50 Do you prepare anything for natural disasters?</p> <ol style="list-style-type: none"> 1 Yes 2 No → P52 <p>P51 If Yes in P46, what do you prepare ?</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">1 Emergency Food</td> <td style="width: 10%; text-align: center;">1 yes</td> <td style="width: 10%; text-align: center;">2 No</td> </tr> <tr> <td>2 Emergency Goods (e.g. Candle, radio with battery)</td> <td style="text-align: center;">1 yes</td> <td style="text-align: center;">2 No</td> </tr> <tr> <td>3 Other</td> <td style="text-align: center;">1 yes</td> <td style="text-align: center;">2 No</td> </tr> </table>	1 Emergency Food	1 yes	2 No	2 Emergency Goods (e.g. Candle, radio with battery)	1 yes	2 No	3 Other	1 yes	2 No	<p>P52 What is the most serious issue in your community or living environment?</p> <ol style="list-style-type: none"> 1 Lack of basic infrastructure (water supply, electricity and sewage) 2 Lack of safety 3 Occurrence of disaster (flood, land slide) 4 Environmental Pollution/sanitation 5 Bad or narrow roads 8 Limited access to public transportation 7 Other <p>P53 What kind of facility do you want near your house?</p> <ol style="list-style-type: none"> 1 Bus stops 2 Office or working palce 3 School 4 Hospital or clinic 5 Market or shops 6 Park or green area 7 Others 8 none 								
1 Emergency Food	1 yes	2 No																
2 Emergency Goods (e.g. Candle, radio with battery)	1 yes	2 No																
3 Other	1 yes	2 No																
<p>P54 How many stories your house has?</p> <ol style="list-style-type: none"> 1 Detached house 2 2-stories building 3 3-stories building 4 higher than 4-stories building 5 Others <p>P56 Which floor the most favorable to live?</p> <ol style="list-style-type: none"> 1 1st or 2nd floor 2 up to 4th floor 3 higher than 5th floor 4 any floor that the building applies earthquake measure <p>P57 In case the apartment has strong earthquake resistant, which floor do you want to live?</p> <ol style="list-style-type: none"> 1 I prefer to live either 1st or 2nd floor 2 I want to live 3rd or 4th floor 3 I want to live higher than 5th floor 4 I do not mind any floor 5 I do not want to live a such building 	<p>P55 Do you want to live the apartment like the picture?</p> <ol style="list-style-type: none"> 1 Yes, but I prefer to live either 1st or 2nd floor 2 Yes, I want to live 3rd or 4th floor 3 Yes, higher than 5th floor 4 Yes, any floor it's ok 5 No, I do not want to live a such building <div style="text-align: center; margin: 10px 0;">  </div> <p>P58 Where do you prefer to live?</p> <ol style="list-style-type: none"> 1 Urban Area in Managua 2 Sub Urban Area in Managua 3 Rural Area in Managua 4 Outside Managua 																	
<p>P59 Which floor the most favorable to work?</p> <ol style="list-style-type: none"> 1 1st or 2nd floor 2 up to 4th floor 3 higher than 5th floor 4 any floor that the building applies earthquake measure 	<p>P60 Where do you prefer to work?</p> <ol style="list-style-type: none"> 1 Urban Area in Managua 2 Sub Urban Area in Managua 3 Rural Area in Managua 4 Outside Managua 																	
<p>P61 Have you access to Home Page of ALMA?</p> <ol style="list-style-type: none"> 1 Yes 2 No, because I did not have necessity 3 No, because I did not know the Home Page of ALMA 4 No, because I did not have computer or smartphone 	<p>P62 What kind of information is needed on the Home Page of ALMA?</p> <ol style="list-style-type: none"> 1 Land Use 2 Hazard Area 3 Evacuation Place or/and Route 4 Construction/Development Regulation 5 Public Transportation routes (bus routs) 6 Other 																	

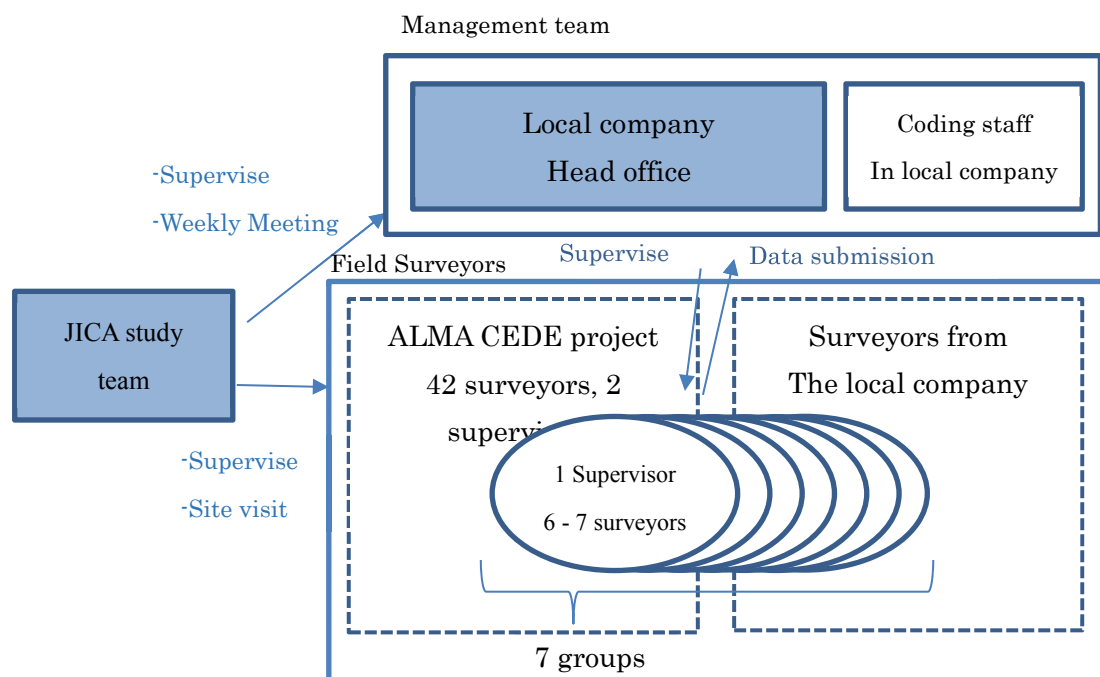
Source: JICA study team

Figure A.2.11 Household Interview Survey Form (Disaster Prevention and Urban Planning)

2.1.3 Survey Organization

ALMA Direccion General de Infraestructura provided the corresponding human resource of fortyfour surveyors, who have much experience in a social economic survey. The participants have five years of experience in surveying opinion, nutrition, health, education, state of infrastructures, land use, among others. However it is the first time that they conducted an interview of person trip. Basically, almost all the traffic survey components in this project was organized by local company in Nicaragua. Regarding a part of supervising work, JICA study team conducted in cooperation with ALMA as one of the capacity building.

As for survey organization, surveyors from ALMA and local company are mixed in the same team. There are seven survey groups and all of surveyors in same group work together at the site interview. Each group is composed of 6 to 7 interviewers and 1 supervisor. JICA study team discussed with concerned personnel through TWG meeting to explain of survey contents and decide methodology and



survey forms.

Source: JICA study team

Figure A.2.12 Survey Organization

2.1.4 Survey Schedule

Survey period was continued until end of October. Average Survey pace is around three households per day per surveyor. To conduct the interview smoothly, meeting with district office was held to ask community leaders' support. Community leaders accompanied with surveyors and visit to target households. It contributes to decreasing rejection of the interview.

Table A.2.1 Schedule of Household Interview Survey

Activity	March	April	May	June	July	August	September	October
Procurement	18th							
Contract Date			4th					
Survey form								
Survey methodology								
Sample choosing								
Training session				6th,7th				
Pilot Survey				8th,9th				
Necessary revision					8th,9th			
Actual Survey					28th			15th
District 1								
District 2								
District 3								
District 4								
District 5								
District 6								
District 7								
Ciudad Sandino							22, 23, 24th	6th - 11st
Meeting with district office								
Reporting								

Source: JICA study team

2.1.5 Survey Results

Total sample size is 10,000 households. Number of samples per district is shown in following table. As a result of the interview, number of people who surveyed is 41,108 people. Average number of household member is 4.11 people.

Table A.2.2 Sample Size by District

Location	Sample size (Household)
Distrrito 1	1325
Distrrito 2	1159
Distrrito 3	1358
Distrrito 4	1042
Distrrito 5	1551
Distrrito 6	1418
Distrrito 7	1244
Cudad Sandino	903

Source: JICA study team

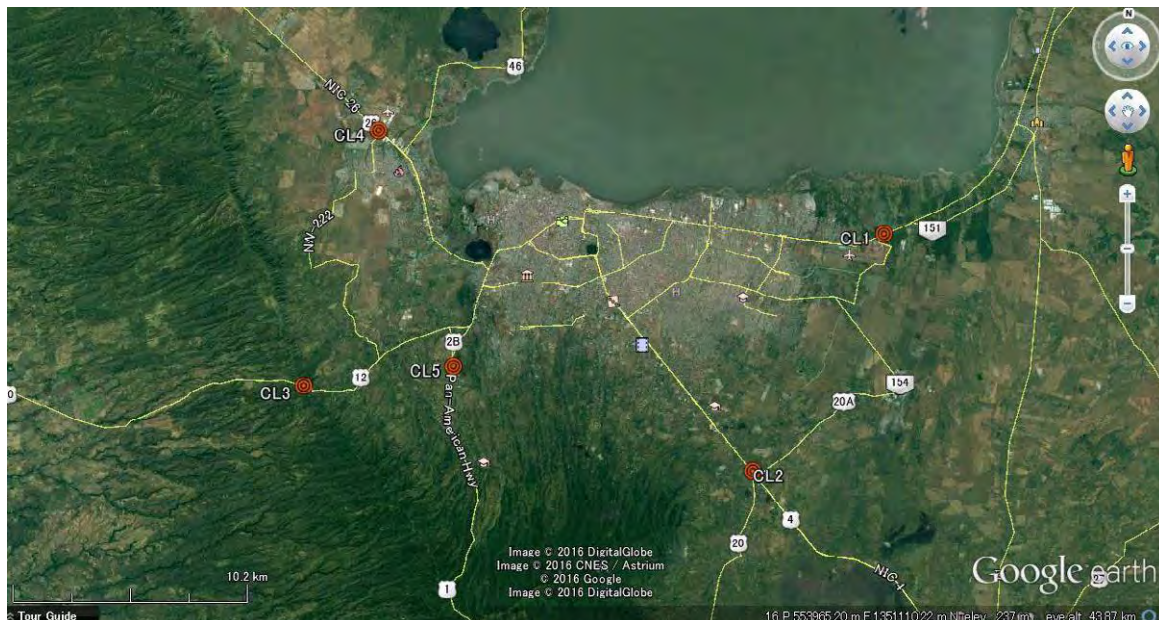
2.2 Cordon Line Survey

2.2.1 Survey Objective

This survey aims to collect traffic information on the boundary of the Municipality of Managua. Based on the results of this survey, the characteristics of trips made by the residents outside the Study Area (Managua) become clear. The results is used to supplement the person trip survey regarding non-residents' trips made in the Study Area as well as to analyze the traffic characteristics in the peripheral areas.

2.2.2 Survey Stations

The Cordon Line Survey consists traffic count survey and interview survey. These surveys were carried out at five (5) locations where all arterials crossing the study area boundary as shown in the figure below.



Source: JICA study team

Figure A.2.13 Survey Location for Cordon Line Survey

Table A.2.2 Survey Location for Cordon Line Survey

No.	Location Name	Location	Direction
1	Aeropuerto	Pan-Americana Road (12.150515°, -86.154852°)	Tipitapa-Managua Managua-Tipitapa
2	Gaspar García Laviana	Masaya Highway (12.057092°, -86.203281°)	Masaya-Managua Managua-Masaya
3	Santa Ana I	Old Road to León (12.082617°, -86.380974°)	León-Managua Managua-León
4	Los Brasiles	New Road to León	León-Managua

		(12.182123°,-86.354714°)	Managua-León
5	Urbanization El Sosiego	Pan-Americana Road (12.091895°,-86.324345°)	El Crucero-Managua
			Managua- El Crucero

Source: JICA study team

2.2.3 Survey Methodology

ALMA Direccion General de Proyecto also dispatched eight (8) surveyors who have an experience of traffic counting for cordon line survey, screen line survey, passenger interview survey and truck movement survey.

(1) Sample choosing

Total number of sample size of interview survey was set 2,000. Interviewers continued the interview during survey hour even if sampling number reached the target number. Sample size of each survey location was set approximately 2% of whole traffic volume based on traffic survey data conducted in “National Transport Master Plan in Nicaragua” (JICA, 2015). To start the roadside interview survey, JICA study team asked cooperation to national police to flag down the vehicles.

Table A.2.3 Sample Size of Interview Survey for Each Survey Location

	CL1	CL2	CL3	CL4	CL5
Car, Taxi,	240	700	60	200	120
Van, Mini Bus, Bus	160	300	40	100	80
Truck	200	500	50	150	100
Total	400	1,000	100	300	200

Source: JICA study team



Source: JICA study team

Figure A.2.14 Roadside Interview

(2) Survey time and vehicle classifications

The traffic count survey was carried out for 24 hours, and the interview survey was carried out for 14 hours (6:00- 20:00). The traffic count survey was recorded by each 15 minutes and subtotaled hourly. Vehicles were classified into eleven types for the vehicles except truck and seven types for trucks as shown in following table.

Table A.2.4 Vehicle Classifications for Cordon Line Survey

Vehicle classifications of traffic count survey for Cordon Line Survey			
Vehicles except truck (11 types)		Trucks (7 types)	
- Bicycle	- Van	- Light cargo truck	- Articulated lorry 4 axle or below
- Caponera	- Taxi	- 2-axle truck	- Articulated lorry 5 axle or more
- Mototaxi	- Microbus	- 3-axle truck	
- Motorcycle	- Bus	- Heavy cargo truck 4 axle or below	
- Car	- Others	- Heavy cargo truck 5 axle or more	
- Pickup			

Source: JICA study team

Regarding the roadside interview, vehicles except buses and trucks were flagged down and conducted interview. The interview items for vehicles except truck are: 1) resident or non-resident in Managua City, 2) origin and destination, 3) vehicle type, and 4) no. of passengers. The interview items for truck drivers are: 1) origin and destination, 2) commodity, and 3) tons loaded, 4) commodity type, and 5) route from origin to destination.

2.2.4 Survey Schedule

Each survey date of Traffic Count Survey and Roadside Survey are shown in Table A.1.6.

Table A.2.5 Survey Date

Location	Traffic Count	Roadside Interview
CL1 (Pan-American Highway)	7 th June	7 th June
CL2 (Carretera a Masaya)	21 st June	21 st June
CL3 (New Road to Leon)	7 th June	7 th June
CL4 (Old Road to Leon)	7 th June	7 th June
CL5 (Road to El Crucero)	21 st June	21 st June

Source: JICA study team

2.2.5 Survey Results

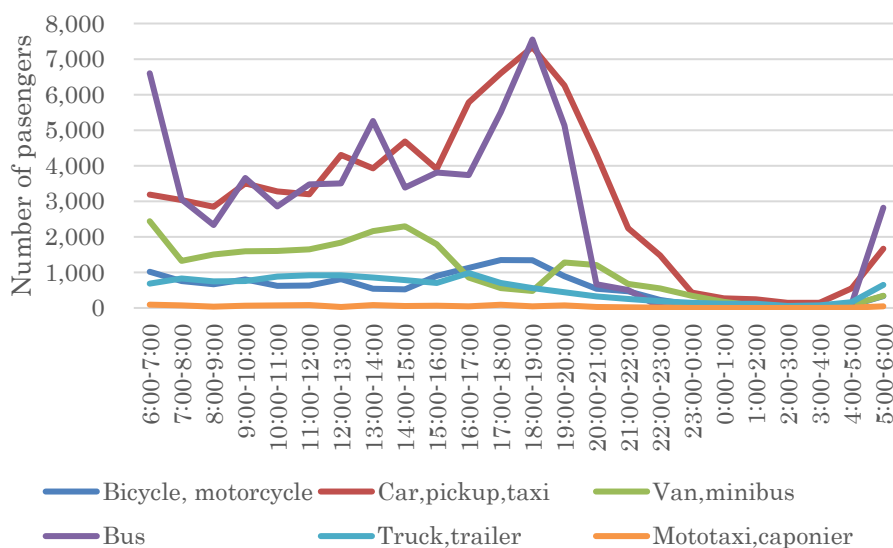
Following tables show the results of cordonline survey.

Table A.2.6 Traffic Volume in Cordon Line

	MOTOR CYCLE	CAR	PICK UP	VAN	MOTOT AXI	TAXI	MICRO BUS(mi nibus)	Autobus	TRUCK	CAPON EIR	Others	BICYCLE	Total
CL1 (Pan-American Highway)	3,560 (14.6)	6,130 (25.2)	5,553 (22.8)	642 (2.6)	18 (0.1)	1,078 (4.4)	643 (2.6)	1,709 (7.0)	4,721 (19.4)	14 (0.1)	62 (0.3)	182 (0.7)	24,312 (100.0)
CL2 (Carretera a Masaya)	8,517 (16.8)	23,047 (45.5)	9,450 (18.7)	1,035 (2.0)	871 (1.7)	495 (1.0)	2,156 (4.3)	1,374 (2.7)	3,305 (6.5)	15 (0.0)	2 (0.0)	386 (0.8)	50,653 (100.0)
CL3 (New Road to Leon)	1,421 (21.8)	1,249 (19.2)	1,475 (22.6)	280 (4.3)	96 (1.5)	520 (8.0)	135 (2.1)	294 (4.5)	1,002 (15.4)	4 (0.1)	13 (0.2)	24 (0.4)	6,513 (100.0)
CL4 (Old Road to Leon)	3,413 (16.2)	6,910 (32.8)	4,512 (21.4)	1,064 (5.1)	210 (1.0)	344 (1.6)	762 (3.6)	598 (2.8)	2,806 (13.3)	5 (0.0)	49 (0.2)	394 (1.9)	21,067 (100.0)
CL5 (Road to El Crucero)	3,476 (18.8)	5,566 (30.0)	3,884 (21.0)	436 (2.4)	183 (1.0)	542 (2.9)	1,637 (8.8)	1,236 (6.7)	1,512 (8.2)	2 (0.0)	6 (0.0)	50 (0.3)	18,530 (100.0)
Outbound total	10,703 (18.1)	20,802 (35.2)	13,061 (22.1)	1,278 (2.2)	576 (1.0)	1,447 (2.4)	2,394 (4.1)	2,087 (3.5)	6,134 (10.4)	5 (0.0)	57 (0.1)	557 (0.9)	59,101 (100.0)
Inbound total	9,684 (15.6)	22,100 (35.7)	11,813 (19.1)	2,179 (3.5)	802 (1.3)	1,532 (2.5)	2,939 (4.7)	3,124 (5.0)	7,212 (11.6)	35 (0.1)	75 (0.1)	479 (0.8)	61,974 (100.0)

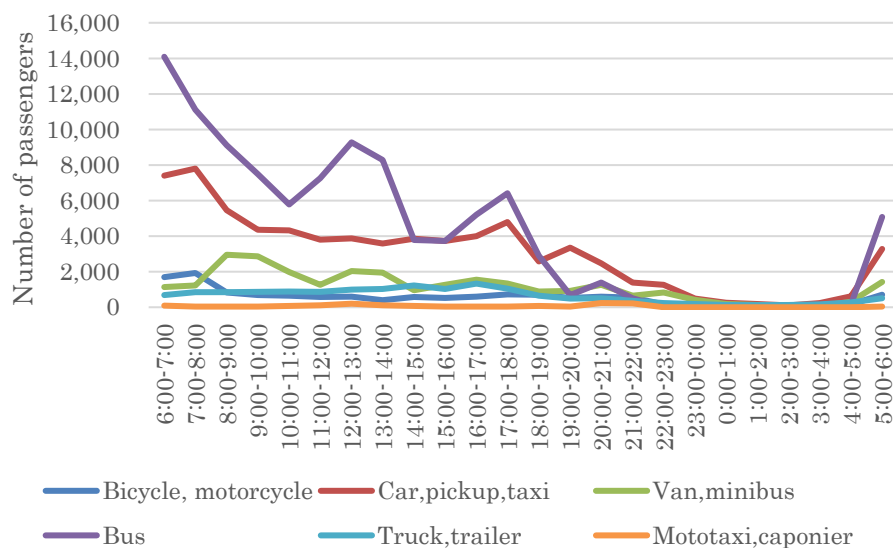
(xx) shows percentage of the composition in the total traffic volume

Following figures show number of passengers passed cordonline by vehicle type



Source: JICA study team

Figure A.2.15 Time Number of Passengers (Outbound)



Source: JICA study team

Figure A.2.16 Time Number of Passengers (Inbound)

Following table is a result of truck driver interview.

Table A.2.7 Type of Cargo at Cordonline

	Food	Lubricants	Cement	Other raw materials	Manufacturing Good	Steel	Others
CL1 (Pan-American Highway)	13,267	279	2,121	4,350	1,496	7,690	18,663
	28%	1%	4%	9%	3%	16%	39%
CL2 (Carretera a	17,555	1,928	2,683	2,948	3,727	16,963	15,976

Masaya)	28%	3%	4%	5%	6%	27%	26%
CL3 (New Road to Leon)	705	306	256	390	276	931	1,648
	16%	7%	6%	9%	6%	21%	37%
CL4 (Old Road to Leon)	885	115	396	236	32	296	1,472
	26%	3%	12%	7%	1%	9%	43%
CL5 (Road to El Crucero)	362	112	465	2,802	1,428	1,829	4,943
	3%	1%	4%	23%	12%	15%	41%

Source: JICA study team

2.3 Airport Cordon Line Survey

2.3.1 Survey Objective

This survey is to supplement the Cordon Line Survey for the passenger arriving and departing through air route since the airport is considered to be one of the cordonline stations. The movement of cargo vehicles, which is difficult to be got by the person-trip survey, is also taken by this survey.

2.3.2 Survey Stations

The survey was conducted at Augusto C. Sandino International Airport. Survey location in the airport is on gate of domestic flight and international flight.



Source: JICA study team

Figure A.2.17 Survey Location for Airport Cordon Line Survey

2.3.3 Survey Methodology

The interview was conducted arrival passengers and departing passengers. Target of sampling number is more than 1,000 (500 for domestic flight and 500 for international flight). The interview items were 1) origin and destination, 2) access mode to the airport, 3) purpose of visit to Managua, and 4) resident or visitor.

2.3.4 Survey Schedule

The survey was conducted on 17th and 18th June 2016.

2.4 Screen Line Survey

2.4.1 Survey Objective

This survey aims to count traffic volume at several stations allocated along a predetermined screenline. The result is used not only to analyze traffic characteristics but to calibrate the results of the person-trip survey.

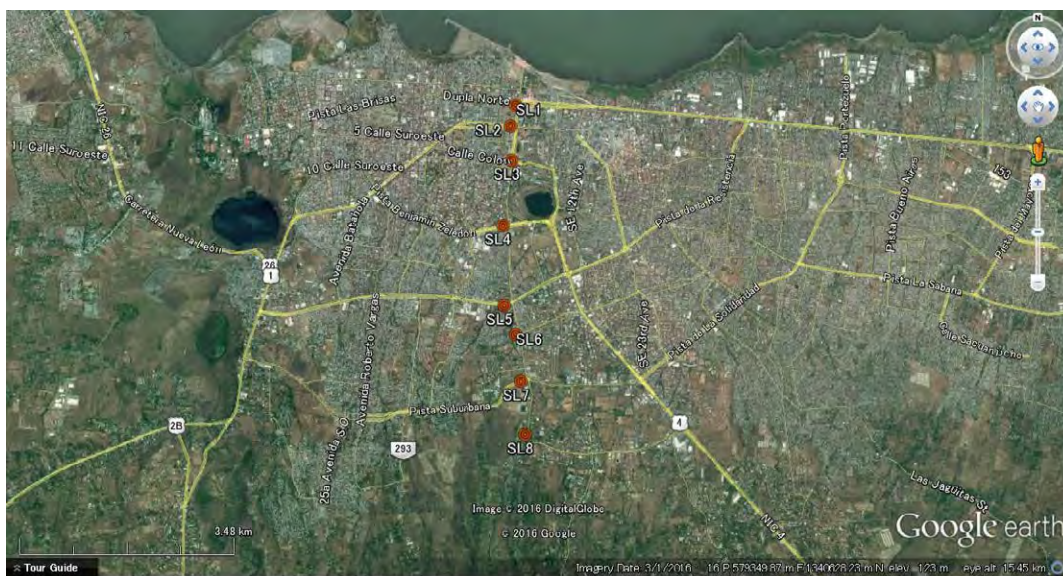
2.4.2 Survey Stations, Schedule

The Screen Line Survey was carried out at eight locations along with Avenida Bolívar as shown in the figure below.

Table A.2.8 Survey Location for Screen Line Survey

No.	Name	Location	Time	Survey Date
1	Xolotlán Promenade - Pan-American Highway	Access to Xolotlán Promenade and Salvador Allende Pier	6:00-20:00 (14 hours)	9 th June
2	North Highway Intersection	Dupla Norte, Cine González traffic light	6:00 - 6:00 (24 hours)	9 th June
		Dupla Sur, Chancellory traffic light.	6:00 - 6:00 (24 hours)	9 th June
3	Traffic light intersection "Asamblea Nacional"	Intersection Bolívar Av. with 3 Calle Suroeste	6:00 - 6:00 (24 hours)	9 th June
4	Hugo Chavez Roundabout	Intersection Bolívar Av. with Calle Colón	6:00-20:00 (14 hours)	9 th June
5	Traffic light intersection "Hospital Militar"	Intersection Bolívar Av. with Pista Benjamín Zeledón	6:00 - 6:00 (24 hours)	9 th June
6	Traffic light intersection "ENEL"	Intersection Bolívar Av. con Pista Juan Pablo II	6:00 - 6:00 (24 hours)	9 th June
7	Rigoberto López Pérez Intersection	Intersection: end of Bolívar Av., beginning of Pista de La Unan, with beginning of Miguel Obando Av.	6:00-20:00 (14 hours)	9 th June
8	Universitaria Roundabout	Intersection Pista de La Unan with Pista Suburbana	6:00 - 6:00 (24 hours)	9 th June

Source: JICA study team



Source: JICA study team

Figure A.2.18 Survey Location for Screen Line Survey

2.4.3 Survey Methodology

Survey hour for vehicle count survey is for 24 hours from 06:00 at 5 locations, 14hours from 6:00 at 3 locations and the number of vehicle by vehicle type and by direction are recorded by each 15 minutes and subtotaled hourly. Vehicles are classified into 15 types.

ALMA Direccion General de Proyecto also dispatched eight (8) surveyors who have an experience of traffic counting for cordon line survey, screen line survey, passenger interview survey and truck movement survey.

Table A.2.9 Vehicle Classifications for Screen Line Survey

Vehicle classifications of traffic count survey for Screen Line Survey			
- Bicycle	- Car	- Microbus	- Truck
- Caponera	- Pickup	- Urban bus	- Truck trailer
- Mototaxi	- Van	- Intercity bus	- Others
- Motorcycle	- Taxi	- School/company bus	

Source: JICA study team

Passenger occupancy survey is observing number of passenger per vehicle from roadside. Classified occupancy rates were observed for minibuses, and buses (Inner-city bus, Intercity bus, and School bus). The survey hour was for 14 hours (6:00- 20:00).

2.4.4 Survey Results

Following tables show the results of Screen Line Survey.

Table A.2.10 Traffic Volume in Screen Line Survey

	BICYCLE	CAPONEIR	MOTOTAXI	MOTORCYCLE	CAR	PICKUP	VAN	TAXI	MICROBUS	BUS			TRUCK	OTHERS	TOTAL
										Urban Bus	Intercity	School/company bus			
SL1(Xolotan Promenade - Pan-American Highway)	25 (0.5)	0 (0.0)	557 (11.7)	960 (20.2)	1,437 (30.2)	480 (10.1)	145 (3.1)	539 (11.3)	97 (2.0)	448 (9.4)	2 (0.0)	11 (0.2)	52 (1.1)	1 (0.0)	4,754
SL2(North Highway Intersection)	79 (0.3)	4 (0.0)	6 (0.0)	7,112 (22.6)	7,694 (24.5)	5,742 (18.3)	1,292 (4.1)	4,122 (13.1)	839 (2.7)	715 (2.3)	126 (0.4)	138 (0.4)	3,527 (11.2)	18 (0.1)	31,414
SL3(Traffic light intersection "Asamblea Nacional")	157 (0.8)	5 (0.0)	9 (0.0)	3,771 (19.6)	5,028 (26.2)	3,901 (20.3)	739 (3.8)	3,467 (18.0)	545 (2.8)	581 (3.0)	220 (1.1)	37 (0.2)	746 (3.9)	8 (0.0)	19,214
SL4(Hugo Chavez Roundabout)	163 (0.5)	6 (0.0)	7 (0.0)	6,157 (18.5)	8,741 (26.2)	5,524 (16.6)	1,168 (3.5)	8,668 (26.0)	618 (1.9)	1,259 (3.8)	132 (0.4)	59 (0.2)	773 (2.4)	40 (0.1)	33,315
SL5(Traffic light intersection "Hospital Militar")	97 (0.3)	3 (0.0)	1 (0.0)	5,681 (17.4)	10,718 (32.8)	6,395 (19.6)	1,664 (5.1)	6,182 (18.9)	824 (2.5)	569 (1.7)	64 (0.2)	84 (0.3)	346 (1.0)	27 (0.1)	32,655
SL6(Traffic light intersection "ENEL")	108 (0.2)	4 (0.0)	3 (0.0)	8,360 (16.2)	15,025 (29.2)	7,734 (15.0)	993 (1.9)	9,944 (19.3)	3,187 (6.2)	3,456 (6.7)	422 (0.8)	364 (0.7)	1,914 (3.8)	15 (0.0)	51,529
SL7(Rigoberto Lopez Perez Intersection)	58 (0.6)	43 (0.4)	635 (6.3)	2,113 (20.9)	2,930 (28.9)	1,542 (15.2)	382 (3.8)	1,624 (16.0)	390 (3.9)	9 (0.1)	5 (0.0)	11 (0.1)	385 (3.8)	2 (0.0)	10,129
SL8(Universitaria Roundabout)	177 (0.4)	2 (0.0)	10 (0.0)	8,143 (19.8)	11,178 (27.2)	7,997 (19.4)	5,082 (12.4)	3,586 (8.7)	1,635 (4.0)	50 (0.1)	55 (0.1)	134 (0.3)	3,075 (7.5)	10 (0.0)	41,134

(xx) shows percentage of vehicle composition. Source: JICA study team

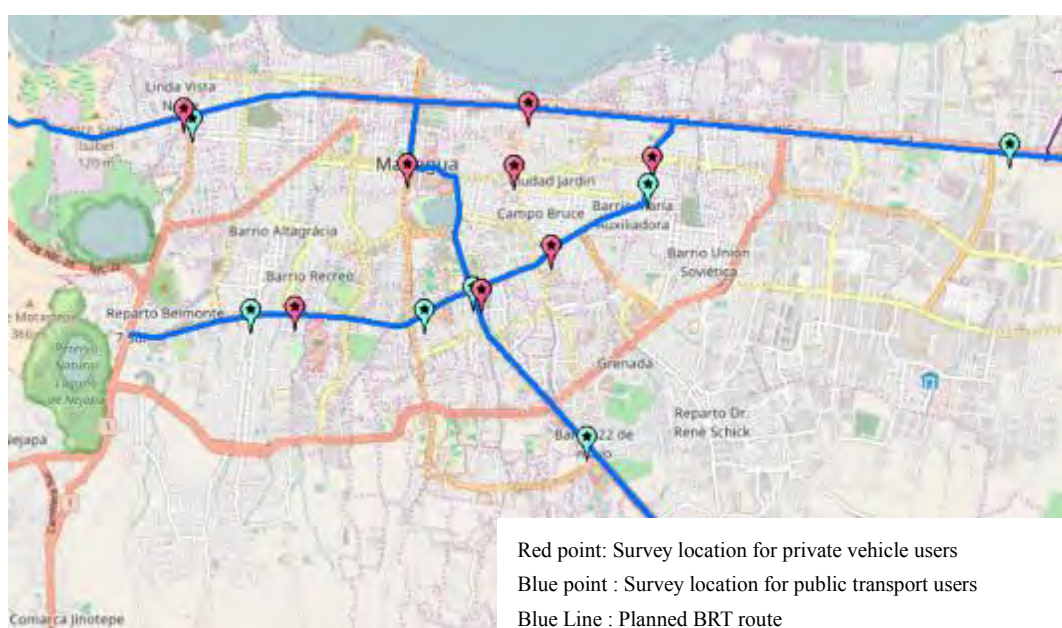
2.5 Passenger Interview Survey

2.5.1 Survey Objective

This survey is to collect information of passenger’s willingness to change their transportation mode to mass transit system. The survey includes Stated Preference Survey.

2.5.2 Survey Stations

Survey location was along with planned BRT routes shown in Figure A.2.19. Planned BRT routes are shown in the “Plan de acción – Managua Sostenible” prepared by Inter-American Development Bank (IDB).



Source: JICA study team

Figure A.2.19 Survey Location for Passenger Interview Survey

Table A.2.11 Survey Location for Passenger Interview Survey

Proposed BRT line	Location
Centro Histórico Carretera a Masaya	Estación del Catorce - Bus stop (12.058937°, -86.204427°)
	Movistar - Bus stop (12.108008°, -86.250077°)
	Roadside near Laguna de Tiscapa (12.135244°, -86.274209°)
	Metrocentro – Parking lot, bus stops (12.128091°, -86.265141°)
	Oriental Market (12.147666°, -86.257686°)
Trayectoria Juan Pablo II	Roadside near Auxiliadora (12.139277°, -86.253631°)

	Zumen - Bus stop (12.125217°, -86.297326°)
	UCA - Bus stop (12.125746°, -86.272632°)
Tipitapa-Ciudad Sandino	Linda Vista - Bus stop (12.152569°, -86.305385°)
	Roadside near centro cultural Managua (12.154343°, -86.272358°)
	La subasuta - Bus stop (12.147817°, -86.191096°)

Source: JICA study team

2.5.3 Survey Methodology

Sample size was 1,000. Interviewer ask some questions related to the public transport and mass transit system to bus passenger directly. Interview items are 1) personal attributes, 2) trip information, 3) opinion on public transport, 4) Willingness-to-pay for modern type mass transit system.

2.5.4 Survey Schedule

Survey date of Passenger Interview Survey is shown in Table A.2.12.

Table A.2.12 Survey Schedule

Date	Time	Location
19 Sep	PM(1pm-7pm)	No.1 Bus stop (Linda Vista)
		No.2 Bus stop (La subasta)
20 Sep	AM(5am-1pm)	No.3 Bus stop (Zumen)
		No.4 Bus stop (Movistar)
	PM(1pm-7pm)	No.5 Gasolinera(Rot. Hugo chavez)
		No.1 Gasolinera(Linda Vista)
21 Sep	AM(5am-1pm)	No.6 Bus stop (Costa Rica)
		No.6 Gasolinera (Costa Rica)
	PM(1pm-7pm)	No.7 Gasolinera (Oriental market)
22 Sep	AM(5am-1pm)	No.8 Bus stop (UCA)
		No.8 Gasolinera (UCA)
	PM(1pm-7pm)	No.9 Parking (Metro centro)
		No.9 Bus stop (Metro centro)

Source: JICA study team

2.6 Travel Speed Survey

2.6.1 Survey Objective

This survey is to collect travel speed information of a sedan car in morning peak hours and afternoon peak hours along major roads for both directions. The objective is to find the place where is the bottle-necks of the road network in the peak hour,

2.6.2 Survey Stations

Survey location for Travel Speed Survey is shown in Figure A.2.20.



Source: JICA study team

Figure A.2.20 Survey Location for Travel Speed Survey

2.6.3 Survey Methodology

Travel Speed survey is undertaken on 16 arterial roads by the floating car method with GPS. The survey was conducted for a weekday on each route.

Travel time was recorded for every section of the survey roads by running a sedan car with a GPS device for each direction. The car speed was kept in normal so that the surveyed speed can represent the average speed of sedan cars in traffic flow. Four cars run in the city three times per one route and there are three times shift. As shown figure 4.4.3 in main report peak hour is appeared on 7:00 – 8:00 in the morning and 17:00 – 18:00 in the evening. Morning shift and Night shift cover those periods. Traffic volume is relatively lower in the 12:00 to 13:00, this period was included in the off-peak shift.

12:00 is Morning shift is from 7:00 to 10:00. Off peak shift is from 11:00 to 14:00. Night shift is from 16:00 to 19:00.

2.6.4 Survey Schedule

The survey was conducted in weekdays from end of May to mid June.

2.7 Truck Movement Survey

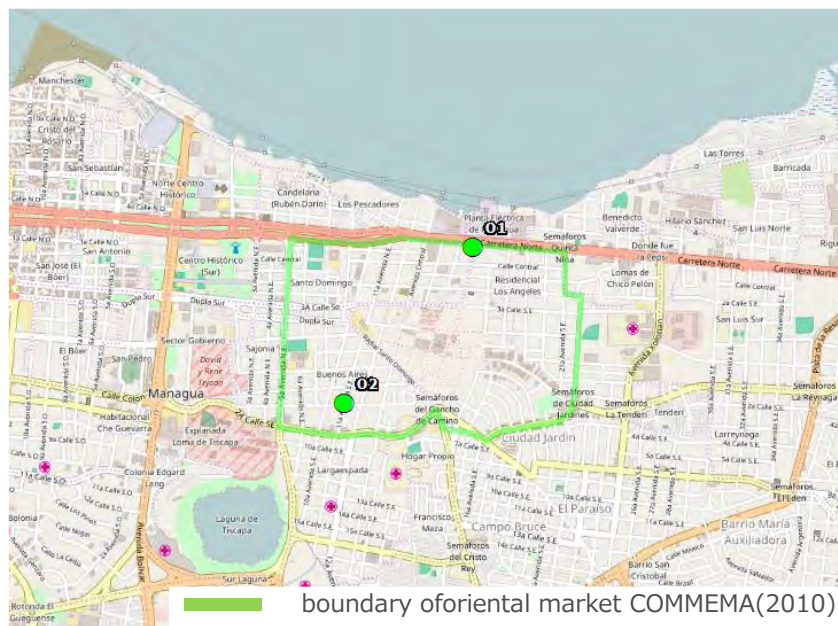
2.7.1 Survey Objective

The purpose of this survey is to estimate origin-destination matrices of trucks and analysis of truck movement. This survey is consisted of three sub components; truck count survey, truck interview survey, and truck company interview survey.

2.7.2 Survey Stations

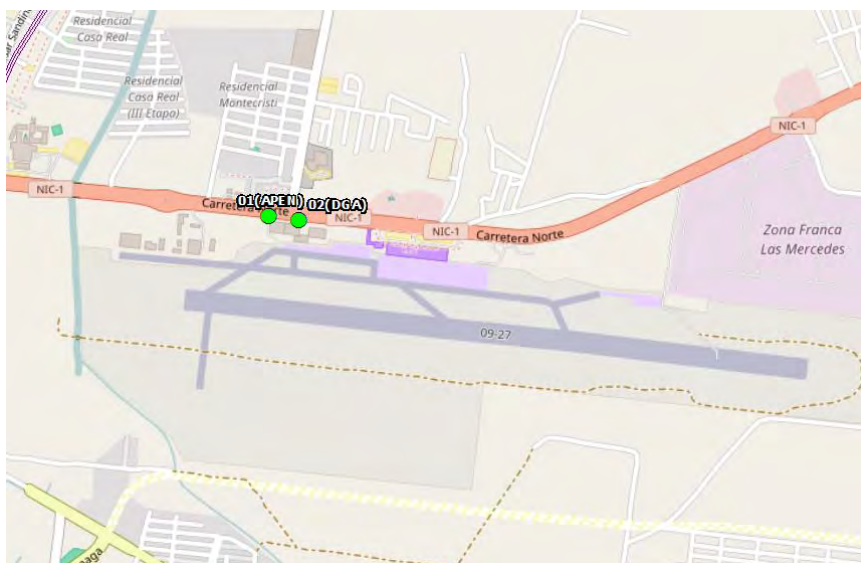
Truck Movement Survey consists Truck Count Survey, Truck Interview Survey and Truck Company Interview Survey.

- 1) Truck Count Survey and Truck Interview Survey were conducted at the airport and market, and same place as Cordon Line Survey. The reason of choosing market and airport is because these two locations gather many logistics and cargo movement. JICA study team requested the permission from COMMEMA and custom department of airport for conducting the survey properly.
- 2) Truck Company Interview Survey was conducted at 50 major transport companies in Managua city. JICA study team interviewed to the candidate companies which is provided by ALMA and MTI. ALMA owns truck company list mainly focusing on intra municipal movement.



Source: JICA study team

Figure A.2.21 Survey Location for Truck Movement Survey (Oriental Market)



Source: JICA study team

Figure A.2.22 Survey Location for Truck Movement Survey (Airport)

2.7.3 Survey Methodology

Survey methodology is consisted of three components.

1) Truck Count Survey

The number of trucks by vehicle types and by directions is counted every fifteen minutes at the survey location. Trucks are classified into seven (7) types.

2) Truck Interview Survey

The number of trucks by locations is counted by vehicle type. This survey is to interview truck driver at the entrance or roadside of survey location to collect information about origin and destination of drivers and freight detail. Trucks are flagged down for interview, and drivers are asked some questions in the survey. Since the survey forces drivers to stop on the road, cooperation of police is essential. The interview items are: 1) origin and destination, 2) commodity, and 3) tons loaded, 4) commodity type, and 5) route from origin to destination.

3) Truck Company Interview

MTI manages the logistic company of intermunicipal movements. JICA study team choosed target companies from both of the list. The interview items of truck company interview survey are 1) company profile and 2) truck movements. Interview was conducted at office of each company or office of JICA study team

2.7.4 Survey Schedule

Truck Count Survey and Truck Interview Survey was conducted along with Cordon Line Survey except oriental market and airport.

The survey date for Truck Count Survey and Truck Interview Survey is below.

Table A.2.13 Survey Date

Location	Traffic Count and Truck Interview Survey
CL1 (Pan-American Highway)	7 th June
CL2 (Carretera a Masaya)	21 st June
CL3 (New Road to Leon)	7 th June
CL4 (Old Road to Leon)	7 th June
CL5 (Road to El Crucero)	21 st June
Oriental Market	3 rd June
Airport	16 th June

Source: JICA study team

2.7.5 Survey Results

The results are summarized as following.

- Trucks from outside Managua city go to market mainly such as Oriental market, Huembus market, Mayoreo market and Israel market. Oriental market accounts 7% of trucks' destination

coming from outside Managua city. Industrial zone also attracts many trucks such as Linda Vista and Zona Franca.

- Main origin and destination outside Managua city are Masaya, Leon and El Corinto. El Corinto is an international port in Nicaragua.

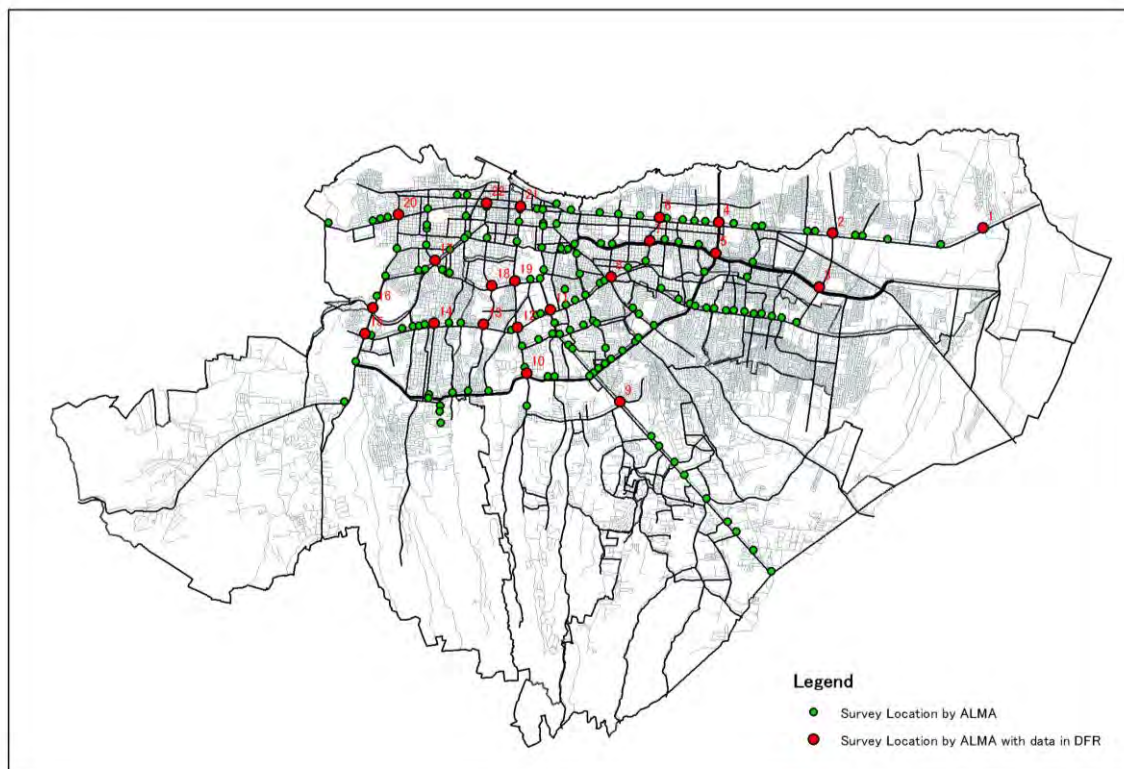
2.8 Intersection Count Survey

2.8.1 Survey Objective

This survey aims to count the traffic volume of major intersections of Managua in order to know the traffic characteristics in relation to the capacity, signal allocation and design of intersections. The result of this survey is used to evaluate the performance of existing intersections as well as to plan improvement of traffic for the future.

2.8.2 Survey Stations

Survey location was shown in Figure A.2.23.



Source: JICA study team

Figure A.2.23 Location of Intersection Counting by ALMA

2.8.3 Survey Methodology

ALMA surveyed traffic volume at intersection by direction for around 170 intersections every year. Based on the traffic survey data, ALMA grasped current traffic situation and planning future road investment plan.

2.8.4 Survey Results

The result of main intersection count survey was summarised in Table A.2.14.

Table A.2.14 Traffic Volume at Each Intersection in 2014

Location	From North	From South	From East	From West	Survey Date(2014)
Aeropuerto	-	3,695	9,536	11,555	8-Jan(Tue)
Mercado Mayoreo/Miguel Gutierrez	-	8,728	10,763	7,848	27-Feb(Thu)
Portezuelo	8,479	12,793	-	7,836	23-Jan(Thu)
La subasta	1,992	7,571	22,925	17,177	15-Jan(Wed)
Rotonda Larreynaga	12,076	13,381	18,194	11,665	3-Mar(Mon)
Plásticos Robelo	3,081	-	17,172	14,867	5-Feb(Wed)
Puente Larreynaga	5,483	7,091	9,395	6,916	6-Jul(Fri)
El Dorado	-	10,128	12,545	16,991	27-Nov(Thu)
Rotonda Ruben Dario/Metrocentro	12,103	13,356	16,288	17,263	24-apr(Thu)
Rotonda Jean Paul Genie	26,581	28,190	-	16,064	3-june(Tue)
Rotonda Universitaria	11,159	6627	16,272	14,829	3-Apr(Thu)
7 sur	13,529	14,244	10,950	229	19-Sep(Fri)
Salida san judas	-	8,701	13,803	13,755	17-Dec(Wed)
Rotonda el periodista	14,407	12,424	20,988	18,407	12-Dec(Fri)
Enel	10,921	15,533	15,230	18,229	5-Dec(Fri)
Petronic/Pista intermedia-Av Bolivar	11,656	11,403	17,057	17,130	7-Oct(Tue)
Rotonda el gueguense	12,151	15,062	19,225	16,439	3-Oct(Fri)
Distrilum	-	1,333	10,117	12,492	25-Jun(Wed)
Ferreteria lang	6,399	6,283	9,564	12,312	1-Sep(Mon)
Cine González	4,838	14,005	11,605	-	15-Jul(Tue)
Ministerio del trabajo	3,359	2,522	13,892	-	17-Jul(Thu)
Linda Vista Norte	5,532	8,680	6,931	13,385	8-Sep(Mon)

Unit: volume

Source: JICA study team

2.9 Database Building

JICA study team handed over the database of traffic surveys. Those survey results are aimed to be updated in the future.

Survey Item (1st Folder Name)	File Name	File Type
00_Index	List_of_Traffic_Survey_Data	xlsx

01 Household Interview Survey	0.Code	xlsx
	1. Hogar	xlsx
	2. Socio	xlsx
	3. Viajes	xlsx
	4. Viajes adicionales	xlsx
	Survey_Forms_english and Spanish	xlsx
	Zone Code&Sample size	xlsx
	Database	accdb
02_Cordon_Line_Survey	Cordon_Line_Survey(OD interview)	xlsx
	Cordon_Line_Survey(Traffic Count)	xlsx
03_Airport_Cordon_Line_Survey	Airport_Cordon_Line_Survey	xlsx
04_Screen_Line_Survey	Screen_Line_Survey(Occupancy)	xlsx
	Screen_Line_Survey(Traffic Count)	xlsx
05_Passenger Interview Survey	Passenger_Interview_Survey	xlsx
06_Travel_Speed_Survey	Analysis result(GIS)	file folder
	Travel Speed Survey	xlsx
	Travel Speed Survey_Methodology	docx
07_Truck Movement Survey	01_Truck Movement_Traffic Volume	file folder
	Truck_Count_Survey Result(Airport)	xlsx
	Truck_Count_Survey Result (Cordonline)	xlsx
	Truck_Count_Survey Result (OrientalMarket)	xlsx
	02_Truck Movement_Roadside Interview	file folder
	Desire Line(OrientalMarket,Airport)	file folder
	Roadside_Cargo_Interview Result(Airport)	xlsx
	Roadside_Cargo_Interview Result (CordonLine)	xlsx
	Roadside_Cargo_Interview Result (OrientalMarket)	xlsx
	03_Truck Movement_Company Interview	file folder
	Location	file folder
	Survey Result	xlsx
	Survey Form	xlsx

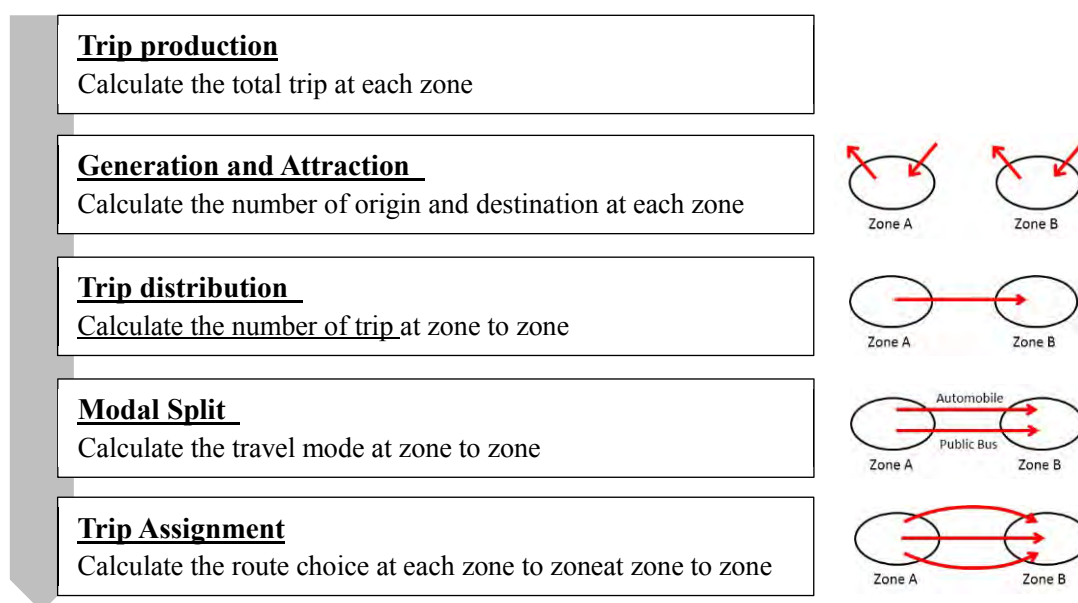
Source: JICA study team

APPENDIX 3 TRAFFIC DEMAND FORECAST

3.1 Methodology

3.1.1 General

Four step method, which is the most basic analysis method, is applied to forecast future demand. Four-step method composed i) trip generation and attraction, ii) trip distribution, iii) modal split, and iv) trip assignment as shown in Figure A.3.1.



Source: JICA Study Team

Figure A.3.1 Outline and Flow of Four Step Method

3.1.2 Zoning

Target zone for traffic demand forecast of this study was classified into 105 small zone, 30 medium zone and 8 large zone. There are 104 small zone, 40 medium zone and 18 large zone include outside target area.

Table A.3.1 Target Zone of Traffic Demand Forecast

	Target Zone		
	Small	Medium	Large
Managua	104	8	2
Outside Managua	1	12	11
Total	105	20	13

Source: JICA Study Team

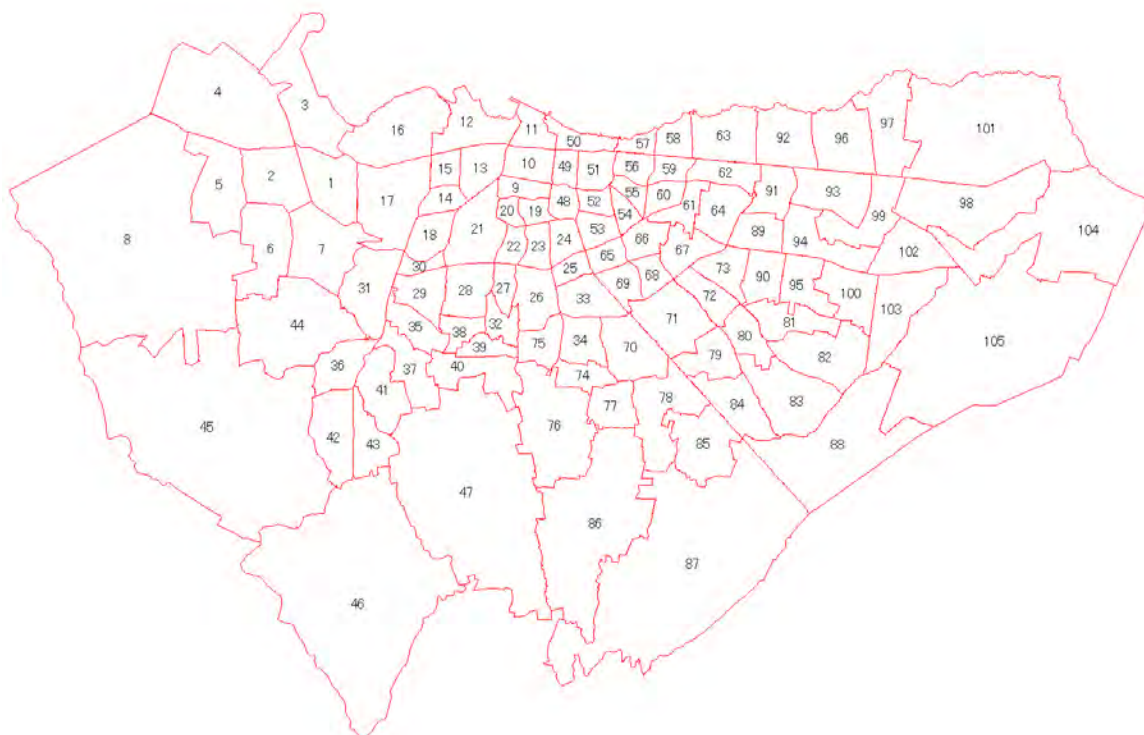
Table A.3.2 Zone Code of Study Area

Large Zone	Midium Zone	Small Zone (Principal Barrio Name)	Zone No.
Managua	District 1	Bolonia (60%)	19
		Bolonia (40%)	20
		Rene Cisneros	22
		Carlos Nunez	23
		Villa Argentina	24
		Edgard Munguia,	25
		Hialeah, Lomas de Monserrat	26
		La Esperanza, Altos de Nejapa	27
		Memorial Sandino, Hialeah 4	32
		Los Robles, Altamira 4	33
		Villa Fontana	34
		Colonia Militar Tiscapa	48
		Sajonia	49
		Candelaria, Carlos Reyna	50
		Santo Domingo	51
		Largaespada	52
		Jorge Domitrov, Serrano	53
		Catorce de Junio (La Luz)	65
		Riguero, El Dorado	66
		Bosques de Altamira	68
		Planes de Altamira	69
		Villa Italianas, Las Cumbres	70
		Bosques del Recreo	74
		Miguel Bonijja (Zogaib)	75
	Sector Norte Comarca Las Viudas	76	
	San Isidro de La Cruz Verde	77	
	El Mirador	78	
	Sector Sur Comarca Silvia Ferrufino	86	
	District 2	Martha Quezada, El Carmen	9
		El Boer	10
		Manchester	11
		Santa Ana	12
		Monsenor Lezcano	13
		Anexo Edgar Lang	14
		El Cortijo, Monsenor Lezcano (west)	15
La Chureca		16	
Linda Vista Sur, Los Arcos		17	
Batahola Sur		18	
District 3	Altagracia	21	
	Heroes y Martires del Bocay	28	
	Frawley	29	
	Belmonte	30	
	Reisel	31	
	San Patricio	35	

	Santa Anita	36
	Sector Noroeste Altos de Ticomo	36
	Villa Nueva, La Zacatera	37
	Luis Alfonso Velasquez 2	38
	Los Trejos	39
	Sierra Maestra, Villa Roma	40
	Los Laureles, William Galeano	41
	El Rosal	42
	El Sociego	43
	Comarca Nejapa	44
	Comarca Chiquilistagua	45
	Comarca Ticomo	47
District 4	Rigoberto Lopez Perez	54
	Ciudad Jordin	55
	Los Angeles	56
	Quinta Nina (Benedicto Valverde)	57
	Las Torrens, Barricada	58
	San Luis Sur	59
	Lrreyanaga	60
	El Eden, Ducuali	61
	Costa Rica	62
	Pedro Joaquin Chamorro	63
	Bello Horizonte	64
District 5	Diez de Junio	67
	Centroamerica	71
	La Fuente (Ariel Darce)	72
	Omar Torruos	73
	Las Colinas (40%)	79
	Rene Shick	80
	Miraglo de Dios, Sol de Libertad	81
	Sector Sur Lomas de Guadalupe	82
	Colinas de Santa Cruz	83
	Las Colinas (60%), Las Cuarezmas	84
	Lomas de Santo Domingo	85
	Coarca Santo Domingo	87
	Sector Oeste Comarca Esquipulas	88
District 6	Villa Progreso	91
	Carlos Sanchez (La Primavera)	92
	Waspan Nur (Alina)	93
	Nueva Esperanza	96
	Anexo Jose Benito Escobar	97
	Sector Zona Franca Industrial	98
	Concepcion de Maria	99
	Casa Real	101
	Villa Israel, Palestina	102
	Sector Norte Comarca San Cristobal	104
District 7	Villa Austria	89
	Premero de Mayo	90
	Villa San Jacinto Libre	94

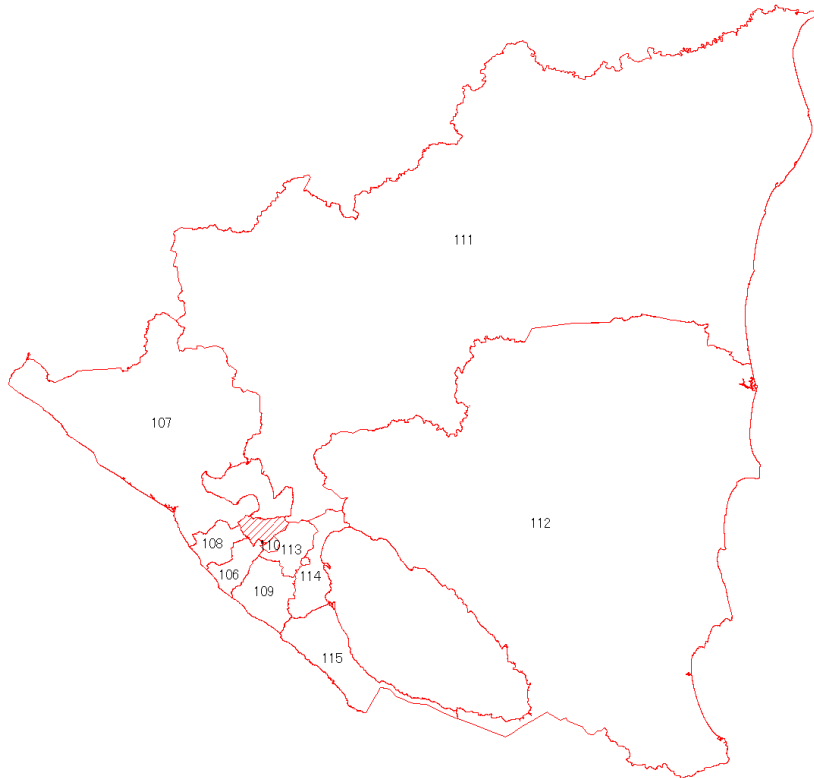
		Villa Venezuela	95
		Villa Liberto	100
		Altos de la Sabana	103
		Sabana Grande	105
Ciudad Sandino		Gruta Xavier	1
		Vista Hermosa, Satelite Asososca	2
		Tangara	3
		Zona 3 Cd Sandino	4
		San Andres, Santa Eduvigis	5
		Bello Amanecer South	6
		Zona 13 Mptastepe	7
		San Miguel, Nueva Vida	8
El Crucero		El Crucero (Monte Tabor)	46
		El Crucero	106
Mateare, Leon, Chinandega			107
Villa El Carmen			108
Carazo			109
Ticuantepe			110
Tipitapa, San Francisco Libre, Matagalpa, Esteli, Madriz, Nueva Segovia, Jinotega, RAAN, America del Norte			111
Boaco, RAAS, Chontales, Rio San Juan			112
Masaya			113
Granada			114
Rivas, America del Sur			115
Other Country			-

Source: JICA Study Team



Source: JICA Study Team

Figure A 3.2 Zone Map Inside of Study Area



Source: JICA Study Team

Figure A 3.3 Zone Map Outside of Study Area

3.1.3 Trip Purpose

Trip purpose was categorized into 4 trip purposes which were categorized into 11 categories of household interview survey. These trip purposes are able to affect the characteristics on analysis method.

Table A.3.3 Category of Trip Purpose

In Person Trip Survey		In Demand Forecasting	
10	To home	1	HOME
1	To Work	2	WORK
2	To School	3	SCHOOL
3	Business	4	OTHERS
4	Shopping		
5	Eat		
6	Health treatment		
7	To bring a family member		
8	Procedures		
9	Leisure		
11	Others		

Source: JICA Study Team

3.1.4 Travel Mode

Travel mode was categorized as shown in Table A.3.4. Analysis accuracy of modal split forecast is improved by gathering the travel mode.

Table A.3.4 Category of Trip Purpose

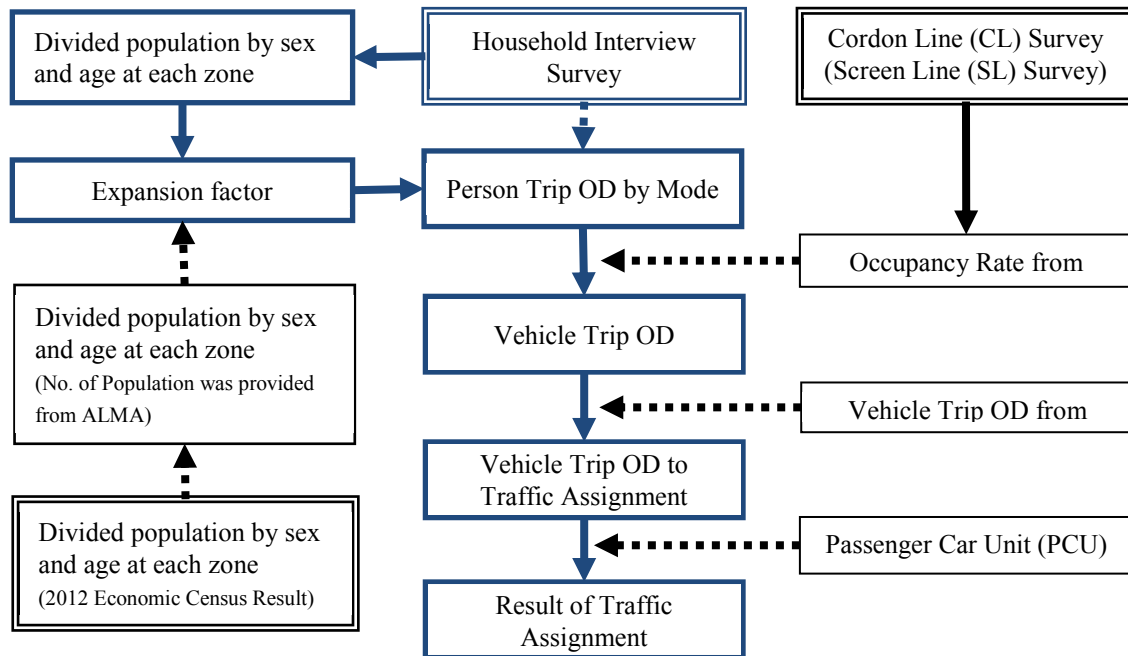
In Person Trip Survey		In Demand Forecasting	
1	Walk	1	WALK
2	Bicycle		
5	Bicycle Taxi		
14	Others		
3	Motorcycle	2	BIKE
4	Mototaxi		
6	Taxi	3	PRIVATE
7	Passenger Car		
8	Urban Bus	4	PUBLIC
9	Intercity Bus		
10	Micro Bus		
11	School or Company Vehicle		
12	Small Truck	5	TRUCK
13	Truck		

Source: JICA Study Team

3.2 Calibration

3.2.1 Traffic Assignment Flow

Traffic assignment flow for calibration of current condition is shown in Figure A 3.4.



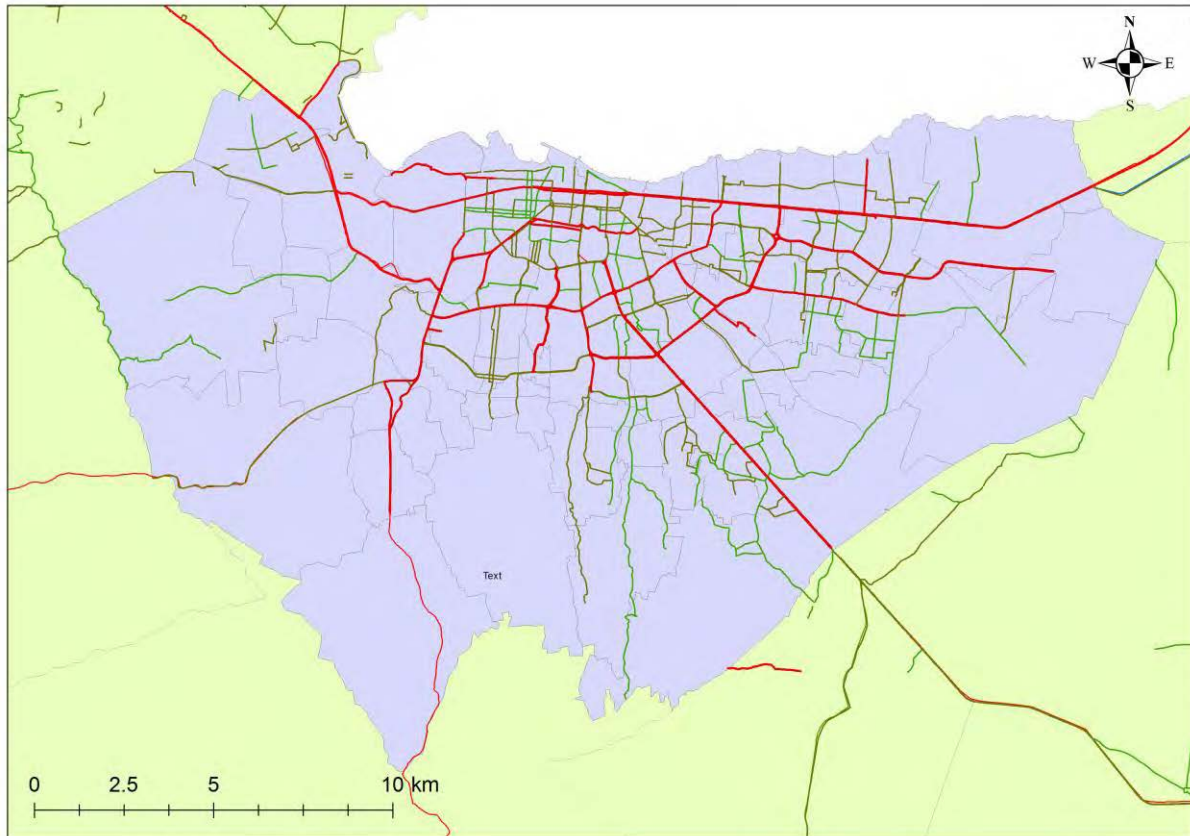
Source: JICA Study Team

Figure A 3.4 Traffic Assginment Flow

- Population which was divided by sex, age and zone was calculated by Household Interview Survey, Economic Census in 2012, and population data provided by ALMA.
- Person trip OD by mode is calculated by expansion factor which was calculated by above divided population.
- Vehicle trip OD was calculated by occupancy rate from Cordon line survey
- Traffic assignment was calculated by vehicle trip OD Passenger Car Unit.

3.2.2 Road Network

Current Road network is shown in Figure A 3.5. Road classification and design speed were classified based GIS data which is prepared by ALMA and the standard which is described in Regulatory Plan. Road rank, No.of lanes, speed, and road capacity is summarized in Table A.3.5.



Source: JICA Study Team

Figure A 3.5 Present road network inside the Study Area

Table A.3.5 Basic Setting of Road Network Data

Rank	No. of Lane	Speed (km/h)	Capacity (PCU)
Primary Distributor	4	60	40,000
	3	55	30,000
	2	50	20,000
Primary Collector	4	50	20,000
	3	45	10,000
	2	40	5,000
Secondary Collector	4	45	8,000
	3	40	5,000
	2	30	3,000
Local Road	2	30	3,000
	1	20	1,000

Source: JICA Study Team

3.2.3 Current OD (2016)

Current OD was prepared in the traffic assignment flow. Occupancy rate was calculated from result of Cordon line survey. Person trip information of household interview survey can collect the study area traffic. Vehicle OD including the outside of study area was coordinated by result of cordon line survey.

Table A.3.6 Occupancy Rate

	Bike	Private	Public	Truck
Total Passenger (person)	445	3,765	10,600	141
Total Vehicle(vehicle)	320	1,755	676	63
Average occupancy rate(person/vehicle)	1.39	2.15	15.68	2.24

Source: JICA Study Team

Passenger Car Unit (PCU) was calculated in this study based on the Cordon Line survey because there was no latest data of this. Calculation result was summarized in Table A.3.7. Private including Bike=0.5, Passenger Car and Taxi =1.0, Public including intercity bus and urban bus = 2.1, and Truck= 1.6.

Table A.3.7 Passenger Car Unit

	Bike	Private	Public	Truck
Passenger Car Unit (PCU)	0.5	1.0	2.1	1.6

Source: JICA Study Team

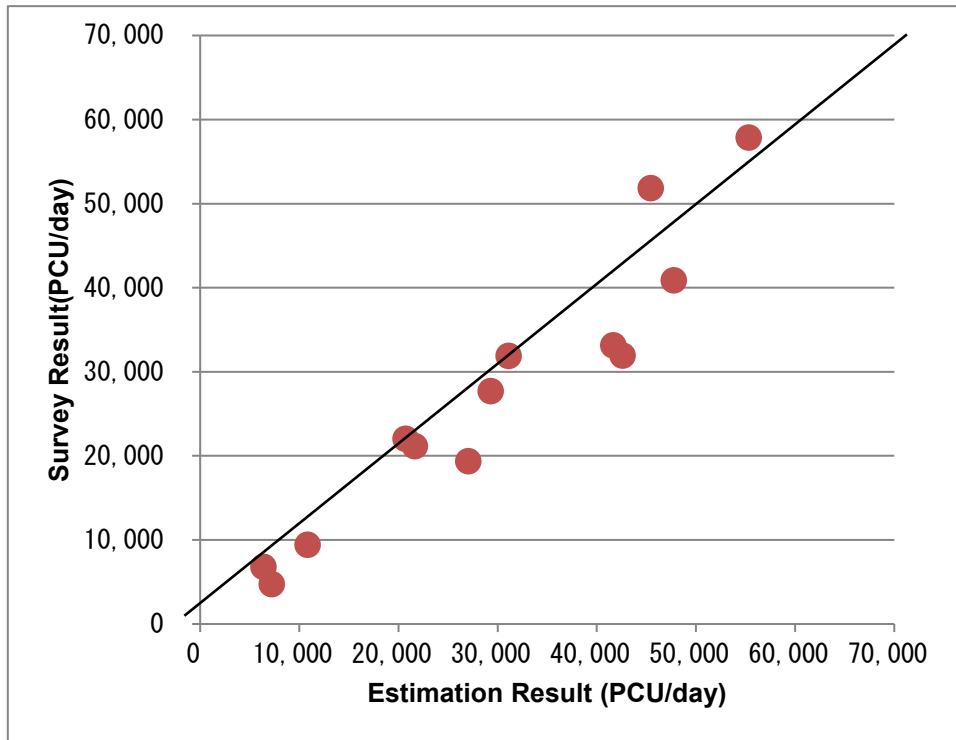
3.2.4 Traffic Assignment in Current Condition

By using above described Current OD in 2016, the volume of vehicle trip is forecasted applying the equilibrium assignment model to the present road network. The result is shown in Figure A 3.6. Comparison with estimation result and survey result is shown in Figure A 3.7. The r-squared by PCU is 0.953 in this correlation, reproducibility is high.



Source: JICA Study Team

Figure A 3.6 Result of Road Network Assignment in Present Situation



Source: JICA Study Team

Figure A 3.7 Comparison with Estimated and Observed

3.3 Trip Production Forecasting

3.3.1 General

Total trip production per day was forecasted based on the household interview survey and future framework. The number of total trip production is the control total number of trip generated and attraction forecasting. Trip rate per person per day was calculated by person trip. Characteristics of trip rate are different among job classification.

3.3.2 Trip Rate

Trip rate per person is summarized in Table A.3.8. Trip rate of car owner is higher than no-car owner's one, especially trip rate of employee. The trip rate of no-car owner is approximately same. Total trip rate is 2.1919.

Table A.3.8 Trip Rate per Person per Day

		Trip Purpose (Trip per Person per Day)					
		HOME	WORK	SCHOOL	OTHERS	Invalid	TOTAL
Car owner	Employee	1.0410	1.2936	0.0107	0.3014	0.0013	2.6480
	Student	1.0432	0.0414	0.6522	0.4734	0.0000	2.2102
	Un-employee	1.1113	0.0454	0.0000	1.0853	0.0000	2.2420
	Invalid	1.0123	0.0089	0.9620	0.0547	0.0014	2.0393
	Total	1.0392	0.6863	0.3490	0.3334	0.0009	2.4087
No-car owner	Employee	0.9870	1.0260	0.0119	0.1423	0.0002	2.1674
	Student	1.0499	0.0423	0.6119	0.4645	0.0007	2.1693
	Un-employee	0.9685	0.0691	0.0270	0.9871	0.0008	2.0524
	Invalid	1.0019	0.0057	0.9733	0.0418	0.0006	2.0232
	Total	1.0068	0.5123	0.3719	0.2434	0.0004	2.1347
Total	Employee	0.9989	1.0850	0.0116	0.1774	0.0004	2.2733
	Student	1.0485	0.0421	0.6200	0.4663	0.0005	2.1775
	Un-employee	0.9985	0.0641	0.0213	1.0077	0.0006	2.0922
	Invalid	1.0038	0.0063	0.9712	0.0442	0.0008	2.0263
	Total	1.0135	0.5486	0.3671	0.2621	0.0005	2.1919

Source: JICA Study Team

3.3.3 Future Framework and Trip Rate

Summary of future framework is shown in Table A.3.9. Future household income is estimated by growth rate of GRDP per capita in Managua. Car ownership rate per household is estimated by the model between household income and number of car owner of household interview survey. Car owner rate per household is to be 29.5% household in 2016 to 56.7% household in 2040.

Table A.3.9 Future Framework

	Unit	2016	2020	2030	2040	Remarks	
a	GDP per Capita (base year = 2015)	US\$	2,106	2,409	3,259	4,553	Nicaragua
b	GDP per Household (base year = 2015)	US\$	2,927	3,488	4,962	7,084	Managua City
	GRDP (Million NIO, base=2015)	NIO	117,239	147,371	235,499	368,107	
	GRDP per Capita (Million NIO, base=2015)	NIO	78,401	93,330	132,896	189,738	
c	Household Size	No.	4.35	4.10	3.80	3.40	
d	Population	No.	1,599,472	1,688,941	1,895,403	2,075,118	Target Area (Managua City and Ciudad Sandino)
e	Number of Households	No.	367,695	411,937	498,790	610,329	d/c
f	Avg. Household Income (monthly)	US\$	450.5	537.3	701.4	908.2	Estimated by growth rate of GRDP
g	Car Ownership Rate per Household	%	29.5	35.3	45.5	56.7	Estimated result $y = -2E-05x^2 + 0.0866x - 5.4066$
h	Number of Private Cars	No.	108,650	145,610	226,940	346,350	e*g
i	Population Age 5 & Above	No.	1,455,107	1,554,365	1,784,019	1,998,492	Target Area
j	Student at Residence Base	No.	396,603	419,945	418,555	400,816	Target Area
k	Worker at Residence Base	No.	755,792	839,292	1,026,019	1,191,630	Target Area
l	Student at Enrollment Base	No.	428,691	453,916	457,452	444,464	Target Area
m	Worker at Workplace Base	No.	884,242	981,933	1,200,394	1,394,150	Target Area
n	Unemployee	No.	49,127	54,554	66,691	77,456	Estimated by jobless rate (6.5%)

Source: JICA Study Team

3.3.4 Future Total Trip Production

Expanding the trip production of the target area was forecasted based on the trip production rate and future framework. Total trips in 2040 will be more than four million trips. It means it will be increased approximately one million trips from 2016 trips.

Table A.3.10 Future Total Trip Production by Trip Purpose

Target Year	Trip Purpose (Person Trip per Day)				
	HOME	WORK	SCHOOL	OTHERS	TOTAL
2016	1,474,644	788,497	549,142	373,165	3,185,449
2020	1,574,909	874,490	557,272	403,031	3,409,701
2030	1,804,452	1,064,918	601,735	447,539	3,918,644
2040	2,018,130	1,233,285	657,443	480,526	4,389,385

Source: JICA Study Team

3.4 Trip Generation and Attrication Forecasting

3.4.1 Method

The trip generation which departs from each zone, and the trip attraction which arrives to each zone was forecasted in this flow. The model parameters were estimated to forecast the trip generation and attraction at each zone by applying linear regression model. The formula of estimation is shown in below. The predictive accuracy of the model is shown by the r-squared.

$$G_i = a_i * X_{1i} + b_i * X_{2i} + \dots$$

$$A_j = a_j * X_{1j} + b_j * X_{2j} + \dots$$

Where, G_i : Trip Generation in Zone i

A_j : Trip Attraction in Zone j

X_{1i}, X_{2j} : Attributes in Zone i, j

a_i, a_j, b_i, b_j : Coefficient

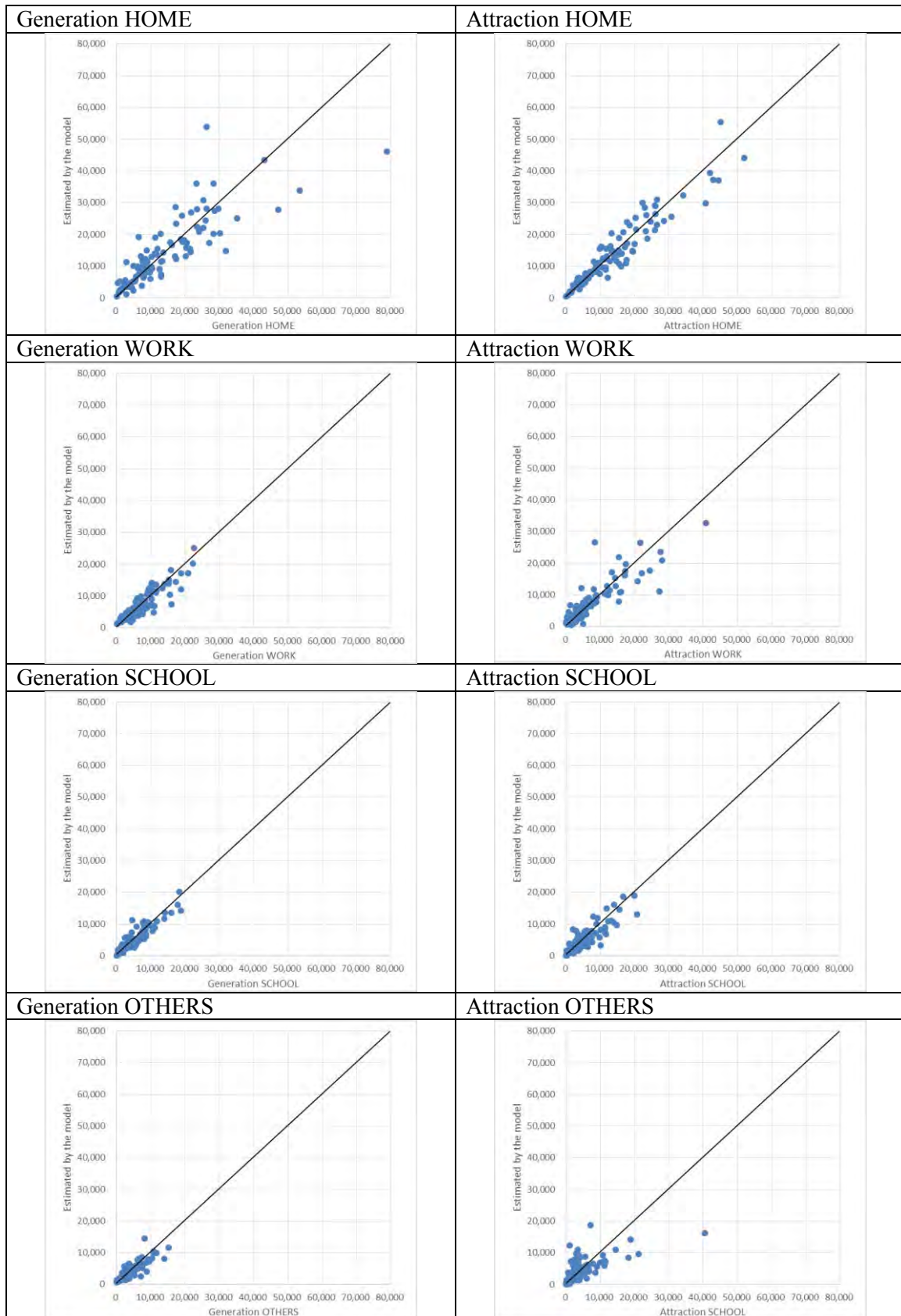
3.4.2 Estimation of Trip Generation and Attraction

Explanatory variables were established by models. It shows the high value because mostly r-squared are more than 0.8. It is necessary to balance generation and attraction before forecast of trip distribution step. Each generation must be paired with a corresponding attraction. Then, the volume of generation and attraction forecasted by each zone and trip purpose was adjusted with the overall trip production forecast result.

Table A.3.11 Trip Generation and Attraction Model Parameters

Model Type	Purpose	Pop. 5 and above	Student at Residence	Worker at Residence	Student at Enrollment	Worker at Workplace	Unemploy ee	Constant	R-squared
Trip Generation	HOME	-	-	-	0.376	1.361	1.047	434	0.8358
	WORK	-	-	0.814	-	-	-	1,199	0.9068
	SCHOOL	-	1.305	-	-	-	-	80	0.9258
	OTHERS	0.244	-	-	-	-	-	649	0.8458
Trip Attraction	HOME	0.971	-	-	-	-	-	470	0.9491
	WORK	-0.185	-	-	-	1.013	-	1,092	0.8750
	SCHOOL	-	-	-	0.550	-	5.832	38	0.8746
	OTHERS	-	-	-	-0.044	0.510	0.819	-465	0.6711

Source: JICA Study Team



Source: JICA Study Team

Figure A 3.8 Model Estimated Result and Observed for Trip Generation and Attraction

3.5 Trip Distribution Forecasting

3.5.1 Method

Generation and attraction volume among each zones are estimated by the distribution forecasting. The gravity model for inter-zonal trips and the trip rate model for intra-zonal trips were applied for trip distribution forecasting, as shown in following formulas. This intra-zonal trip length created the model as 1.0 km by each zone.

$$\text{Inter zonal trip } X_{ij} = K * O_i^\alpha * D_j^\beta / L_{ij}^\gamma$$

$$\text{Intra zonal trip } X_{ij} = R_i * O_i$$

$$R_i = X_{ii} / O_i$$

Where, X_{ij} : Inter zonal trip distribution zone i to j

X_{ii} : Intra zonal trip distribution in zone i

O_i : Trip generation in zone i

D_j : Trip attraction in zone j

L_{ij} : Travel length from zone i to j (km)

R_i : Intra trip rate

K, α, β, γ : Model parameters

3.5.2 Estimation of Trip Distribution

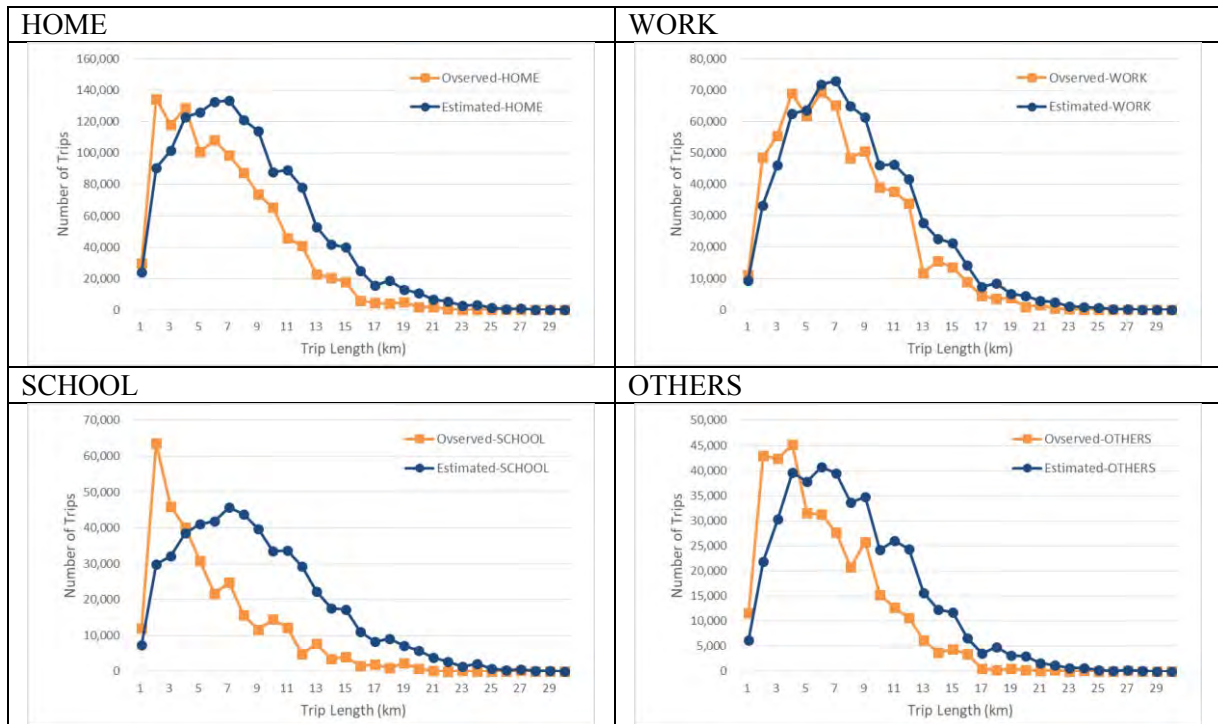
To adjust the total trip generation and attraction volume by each zone, the distribution forecasting by a gravity model is calculated. The parameter for the gravity model is shown in Table A.3.12. After forecasting by this gravity model, a frater balancing method was applied. This is a model of convergence calculation. The total trip generation and attraction volume for each zone is converged according to trip generation and attraction volume of the zone.

The observed and estimated values of the trip length are shown in Figure A 3.9. Trip among zones was forecasted by this model in each zone.

Table A.3.12 Inter Zonal Trip Distribution Model Parameters

Trip Purpose	α	β	γ	K	R-squared
HOME	0.4827	0.6018	-0.5993	0.0118	0.5941
WORK	0.5911	0.4029	-0.3331	0.0253	0.5605
SCHOOL	0.4656	0.2292	-0.5457	0.7704	0.5403
OTHERS	0.4177	0.3535	-0.3394	0.2435	0.4955

Source: JICA Study Team



Source: JICA Study Team

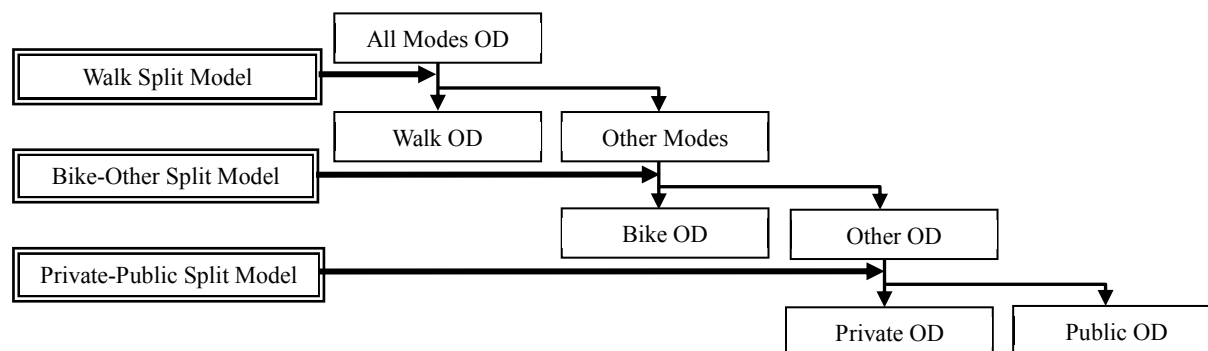
Figure A 3.9 Verification of trip Distribution Models

3.6 Modal Split Forecasting

3.6.1 Method

The trip modal split forecasting model is based on the forecast and analysis of transportation modes choice at the time of particular trip with an individual or a group. Generally, the volume of trips and share for each traffic modes is forecasted. The most commonly applied method to estimate modal split is the logit model.

The modal split models consists three models, “Walk Split Model”, “Bike-Other Split Model” and “Private-Public Split Model” as shown in Figure A 3.10. It is the binary choosing method split into two transportation mode by each step. The split of these models was established as trip purpose using the household interview survey data. The “Walk Split Model” splits a walk and the other traffic. “Bike-Other Model” splits other than a walk into a motorcycle and other traffic. The “Private-Public Split Model” splits other than walk and motorcycle into a private trip (a privately-owned car and a taxi) and a public transportation mode (urban bus and intercity bus).



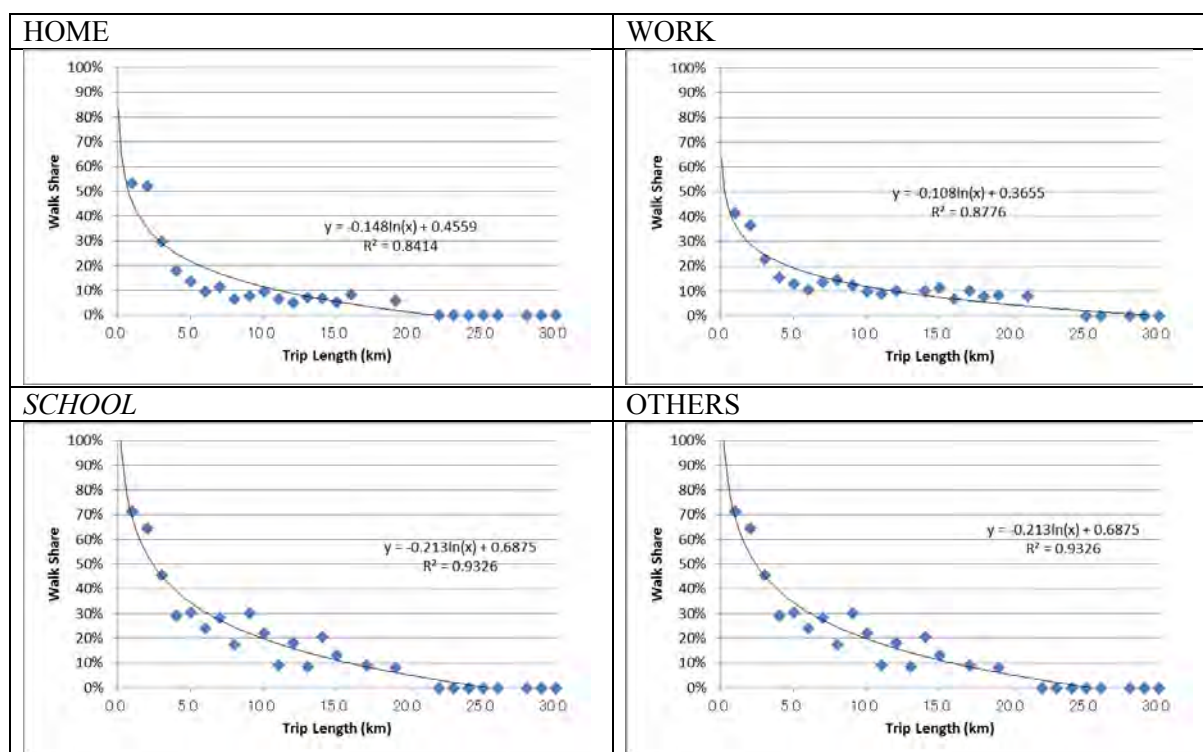
Source: JICA Study Team

Figure A 3.10 Basic Flow of Modal Split Model

3.6.2 Walk Split Model

(1) Inter Zonal Walk Split Model

The diversion curve models are used in a “Walk Split Model”. The independent variable used in this model is the trip distance of the shortest pass on the road network. Although a walk share is mostly based on trip distance, it is also different with the trip purpose or car ownership conditions. The car ownership conditions which were estimated in the future framework are also taken into consideration. A walk share curve is a model for each trip purpose in consideration of a car ownership rate. The model equation taken by the household interview survey is shown in Figure A 3.11.



Source: JICA Study Team

Figure A.3.11 Intra Zonal Walk Split Model

(2) Intra Zonal Walk Split Model

The result of walk share is summarized in Table A.3.13. Walk share of school purpose is high, and car owner and bike owner of work purpose is low.

Table A.3.13 Intra Zonal Walk Share by Trip Purpose and Vehicle Ownership

Trip Purpose	Car Owner	Bike Owner	No-Owner	All
HOME	16.4 %	26.9 %	38.3 %	32.3 %
WORK	7.3 %	12.4 %	28.5 %	21.1 %
SCHOOL	31.4 %	53.0 %	61.9 %	54.9 %
OTHERS	14.8 %	25.8 %	39.4 %	31.5 %

Source: JICA Study Team

3.6.3 Bike-Other Split Model

The logit model is generally applied for modal split model. The logit model means that an individual acts based on the rule of "choosing the preferable alternative out of the alternative group which can be used". The desirability of some alternative is different with the characteristic which the alternative has, or personal social attributes. The parameters of the model must be able to be forecast at the existing situation and the future. Model formula is shown below, and model parameter is summarized in Table A.3.14.

$$p = e^{V_k} / \sum e^{V_k}$$

$$P=1/(1+\exp(\Delta V))$$

Table A.3.14 Bike-Other Split Model Parameters

Trip Purpose	Bike	Other	Constant
HOME	0.5588	0.8187	-
WORK	-3.2508	-0.5136	-
SCHOOL	0.7036	0.8309	-
OTHERS	-118.1305	-62.2430	-46.9592

Source: JICA Study Team

3.6.4 Private Public Split Model

The logit model was also applied for Private-Public split model. Model parameter is summarized in Table A.3.15.

Table A.3.15 Private-Public Split Model Parameters

Trip Purpose	Private	Public	Constant
HOME	1.2099	43.6388	-
WORK	0.9431	30.4407	-
SCHOOL	1.7436	59.7880	-
OTHERS	1.6746	55.7677	-

Source: JICA Study Team

3.7 Traffic Assignment Forecasting

3.7.1 General

The traffic volume which passes through each links in transportation network was forecasted. The traffic assignment forecasting model is calculated the traffic volume among zones by assigning on some routes among the zones. By forecasting the traffic volume of each links, it can be considered as the index which studies the solution of the traffic problem forecast in the future.

Vehicle trip was assigned to the individual road link in process of a trip assignment forecasting. This step is taken to input an OD matrix that indicates the volume of vehicle trip between origin and destination pairs. User equilibrium assignment was used for the estimate method. User equilibrium assignment is formulated as all the trip persons have the information on the road characteristic which chooses the road link, and choose the minimum route for travel time or cost.

The input of a link performance function is necessary for user equilibrium assignment. This function describes the travel time which passes through the link under conditions with various congestions by the ratio of traffic and capacity, etc. The BPR (Bureau of Public Roads) function is the most common and the equation is shown below.

$$V_c = V_o / [1 + \alpha (Vol / C) ^ \beta]$$

Where, V_c : Congested Speed

V_o : Free-Flow Speed

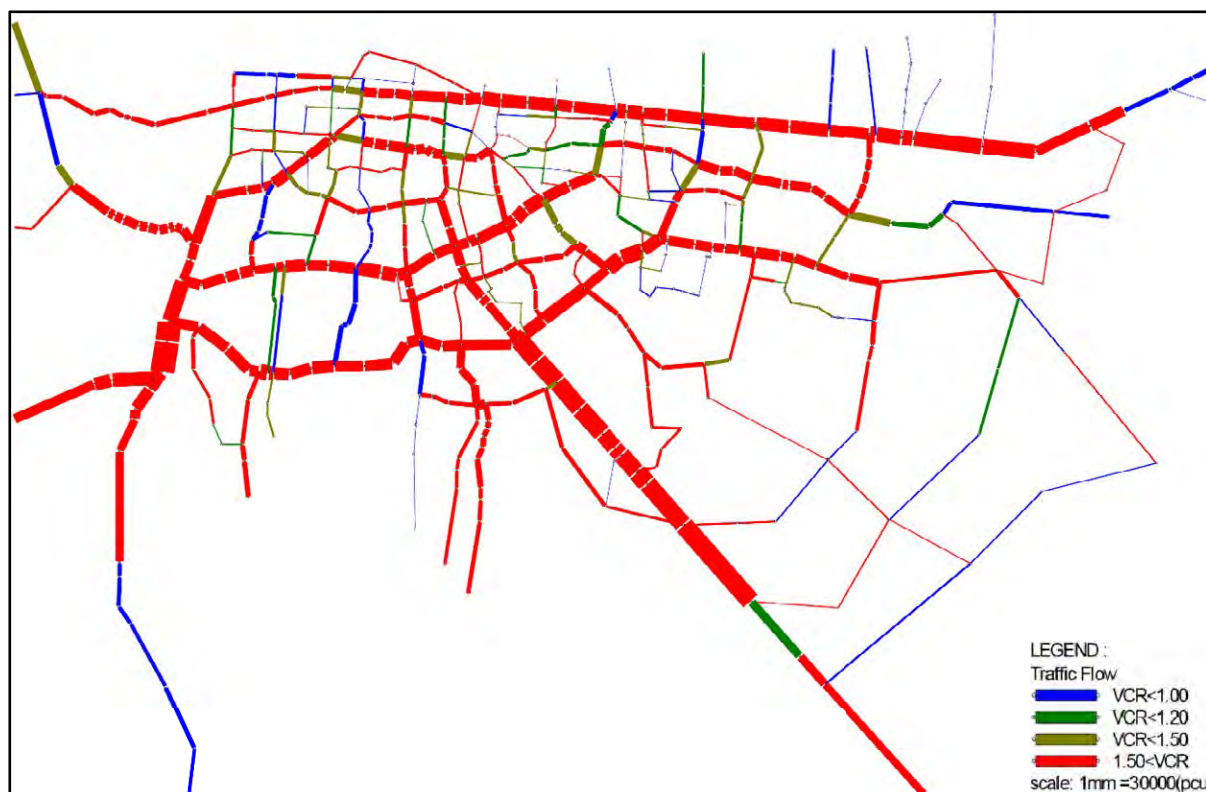
Vol: Traffic Volume (PCU)

C: Ideal Traffic Capacity (PCU)

$$\alpha = 0.48, \beta = 2.82$$

3.7.2 Assessment of Future Traffic Demand at Present Network

The result of future traffic demand was forecasted at present road network as shown in Figure A.3.12.



Source: JICA Study Team

Figure A.3.12 Result of Road Network Assignment in 2040

3.7.3 Assessment of Future Traffic Demand at Future Network

(1) Case Setting

The traffic demand forecast with future road network which was proposed by JICA Study Team was conducted in order to evaluation of the project by comparison with “With Project Case” and “Without Project Case). Case setting is shown in Table A.3.16. This analysis was considered about with/without urban densification and with/without mass transport project, and the case of traffic demand forecast was divided “with road project” and “with road and mass transportation” for understanding effect of implementation of road project only and both cases.

Table A.3.16 Traffic Demand Forecast Cases

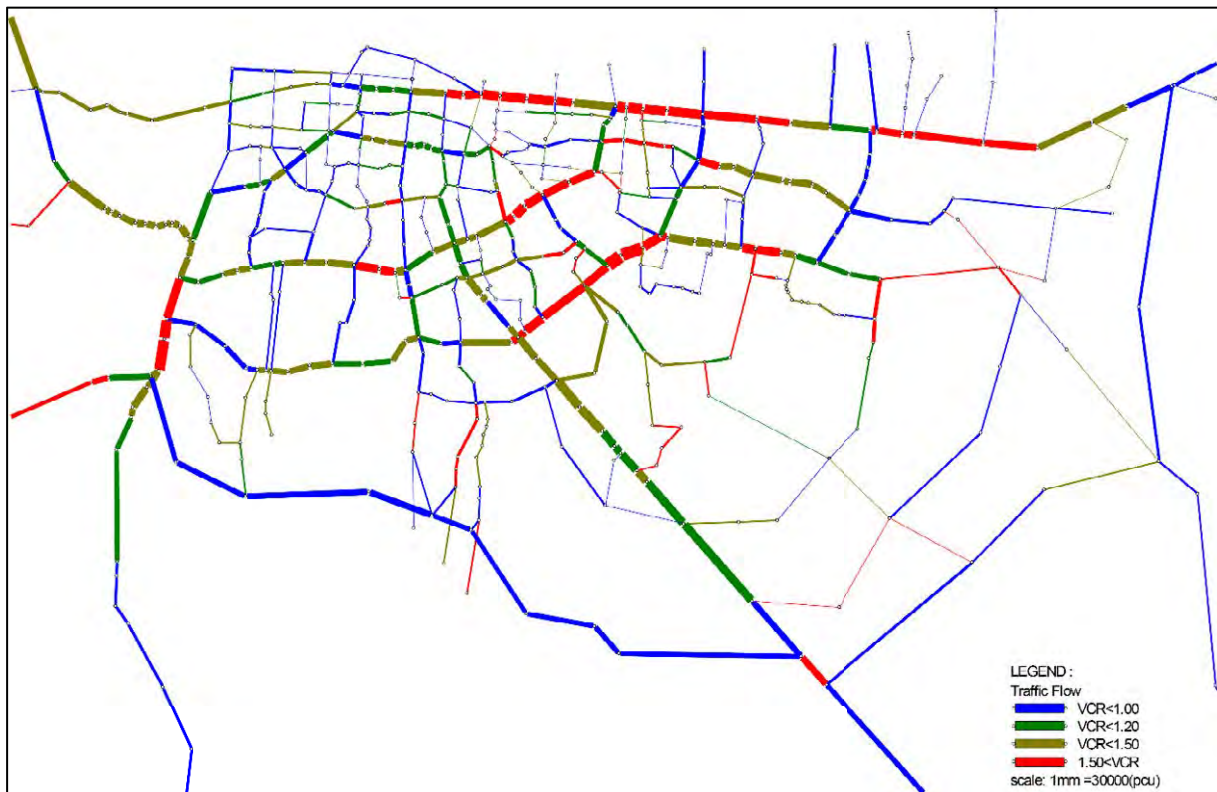
		Densification		Traffic Management	Road		Mass Transportation
		Do Nothing	Optimization		Planned	Proposed	
Case 0 (Existing Case)	2016	-	-	-	-	-	-
Case 1	2020	☑	-	-	☑	-	-
Case 2		-	☑	☑	☑	☑	-
Case 3		-	☑	☑	☑	☑	-
Case 4	2030	☑	-	-	☑	-	-
Case 5		-	☑	☑	☑	-	-
Case 6		-	☑	☑	☑	☑	-
Case 7		-	☑	☑	☑	☑	☑
Case 8	2040	☑	-	-	☑	-	-

Case 9	-	☑	☑	☑	-	-
Case 10	-	☑	☑	☑	☑	-
Case 11	-	☑	☑	☑	☑	☑
Case 12 (Do-Nothing Case)	☑	-	-	-	-	-

Source: JICA Study Team

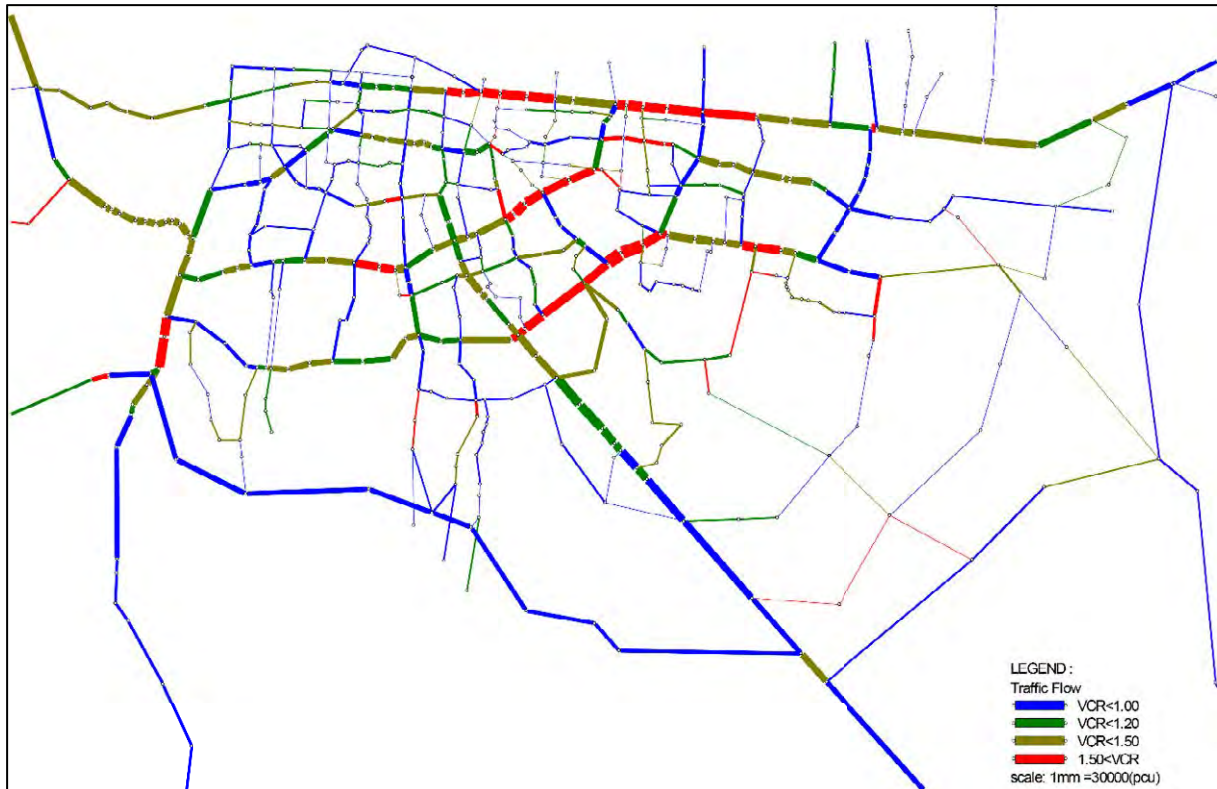
(2) Traffic Assignment Result of Each Cases

The result of future traffic assignment by each cases is shown in below figure. The result of Case 0 and Case 12 is skipped because these result is shown in the above.



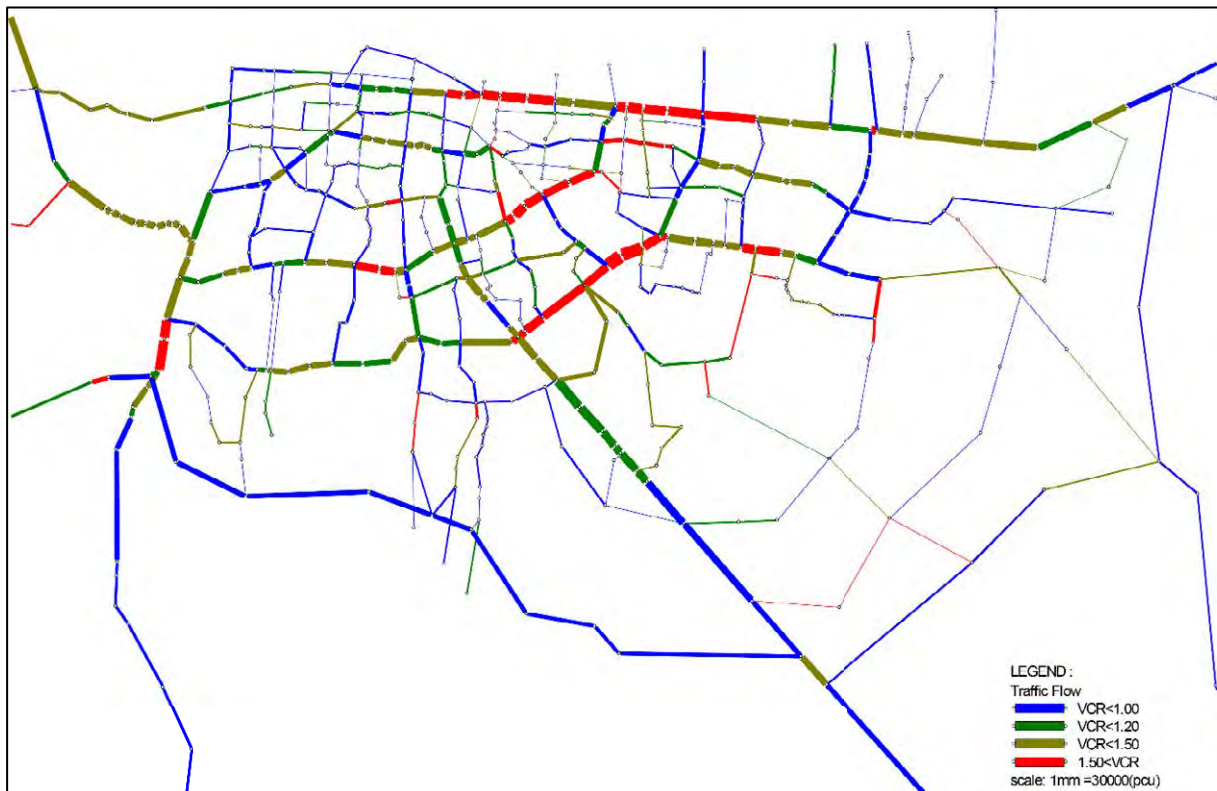
Source: JICA Study Team

Figure A.3.13 Result of Case 1



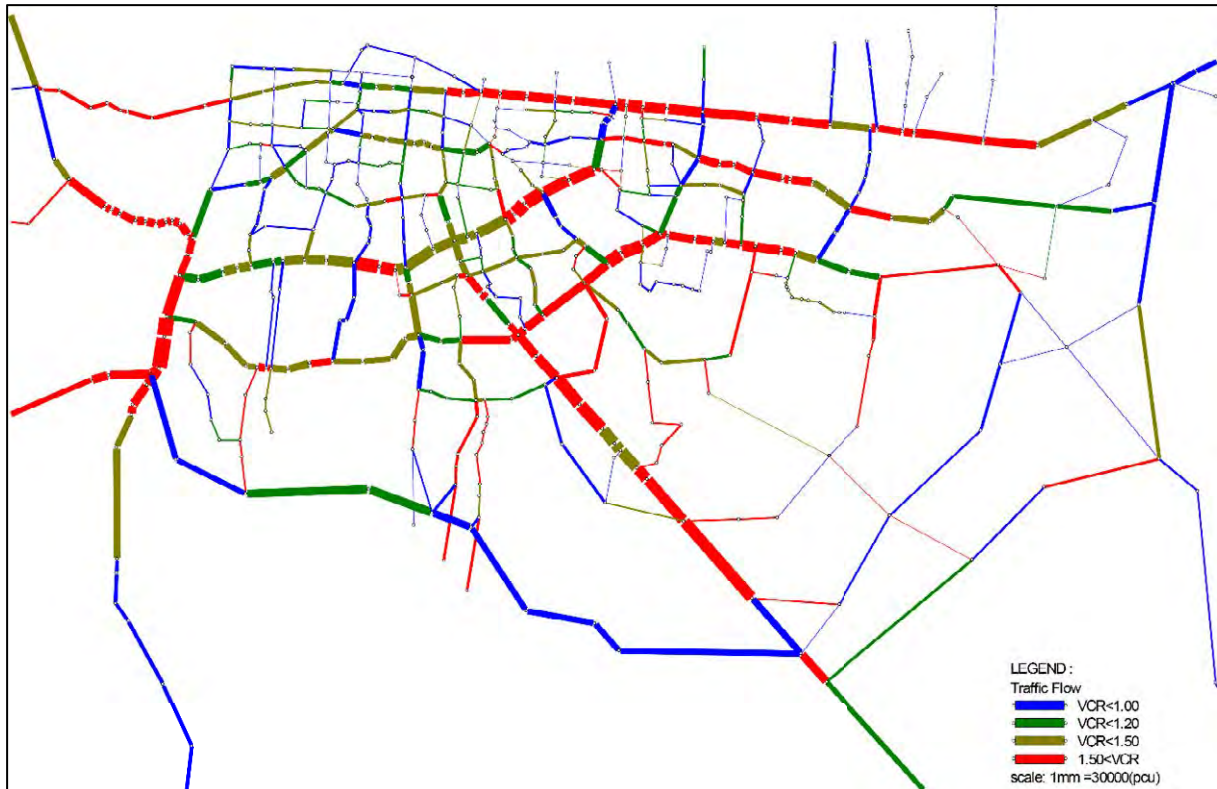
Source: JICA Study Team

Figure A.3.14 Result of Case 2



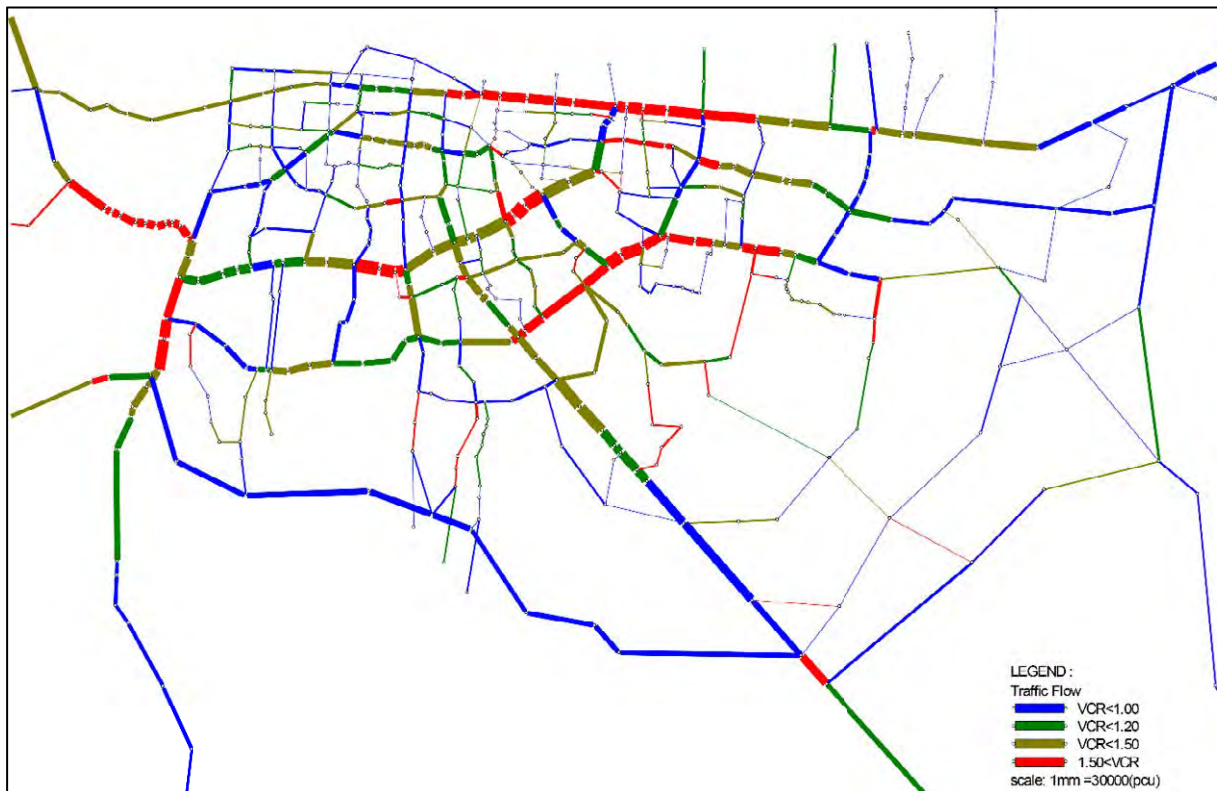
Source: JICA Study Team

Figure A.3.15 Result of Case 3



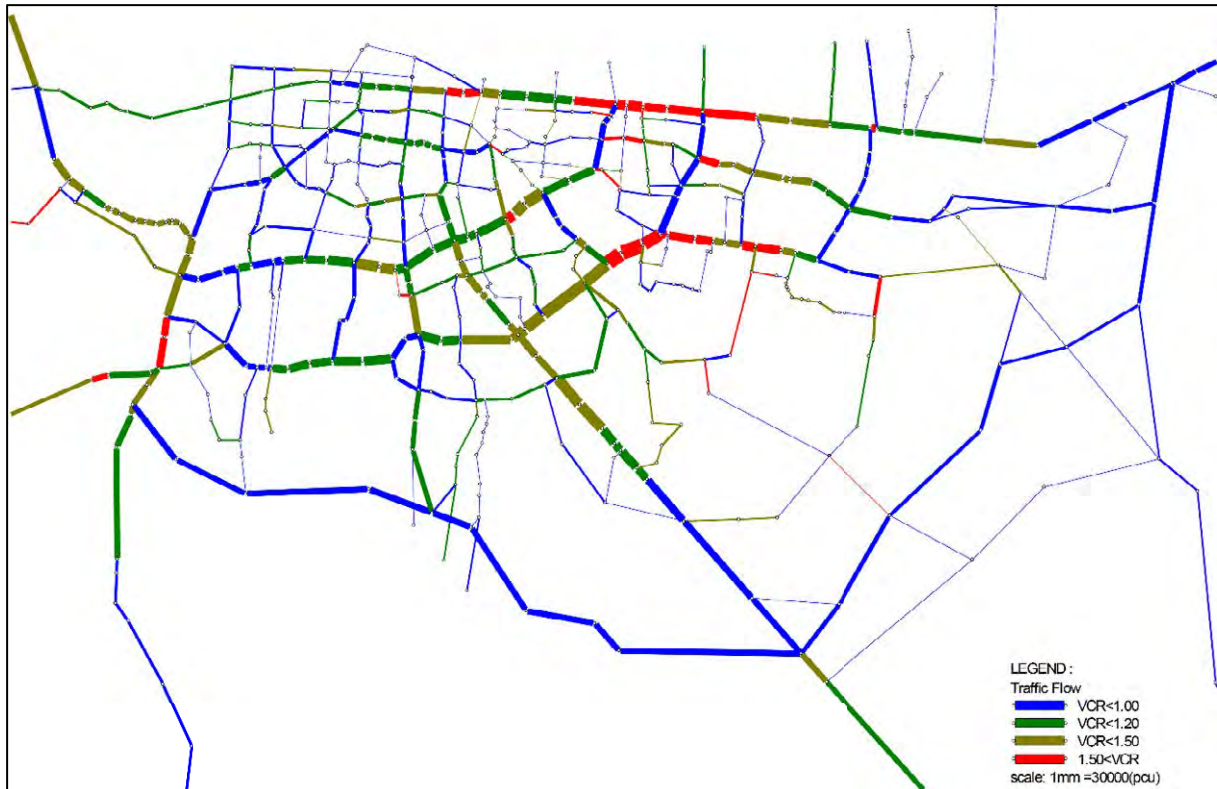
Source: JICA Study Team

Figure A 3.16 Result of Case 4



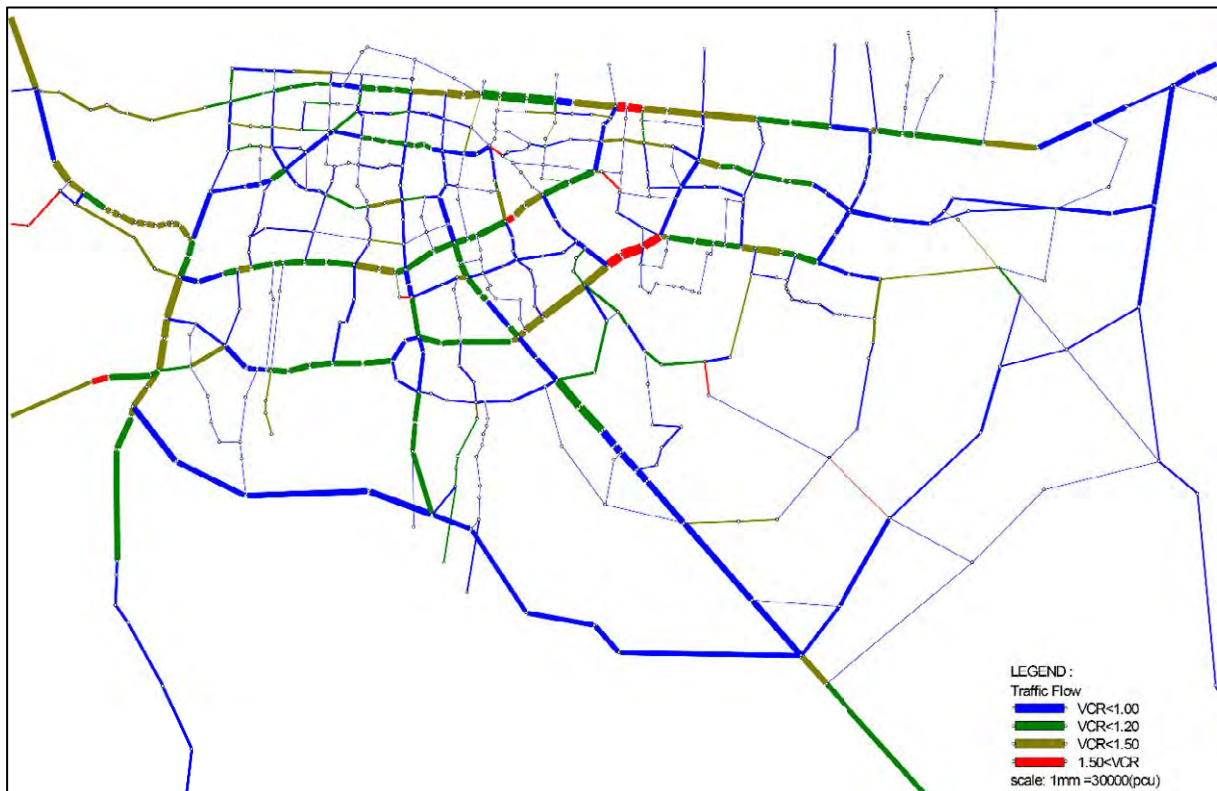
Source: JICA Study Team

Figure A 3.17 Result of Case 5



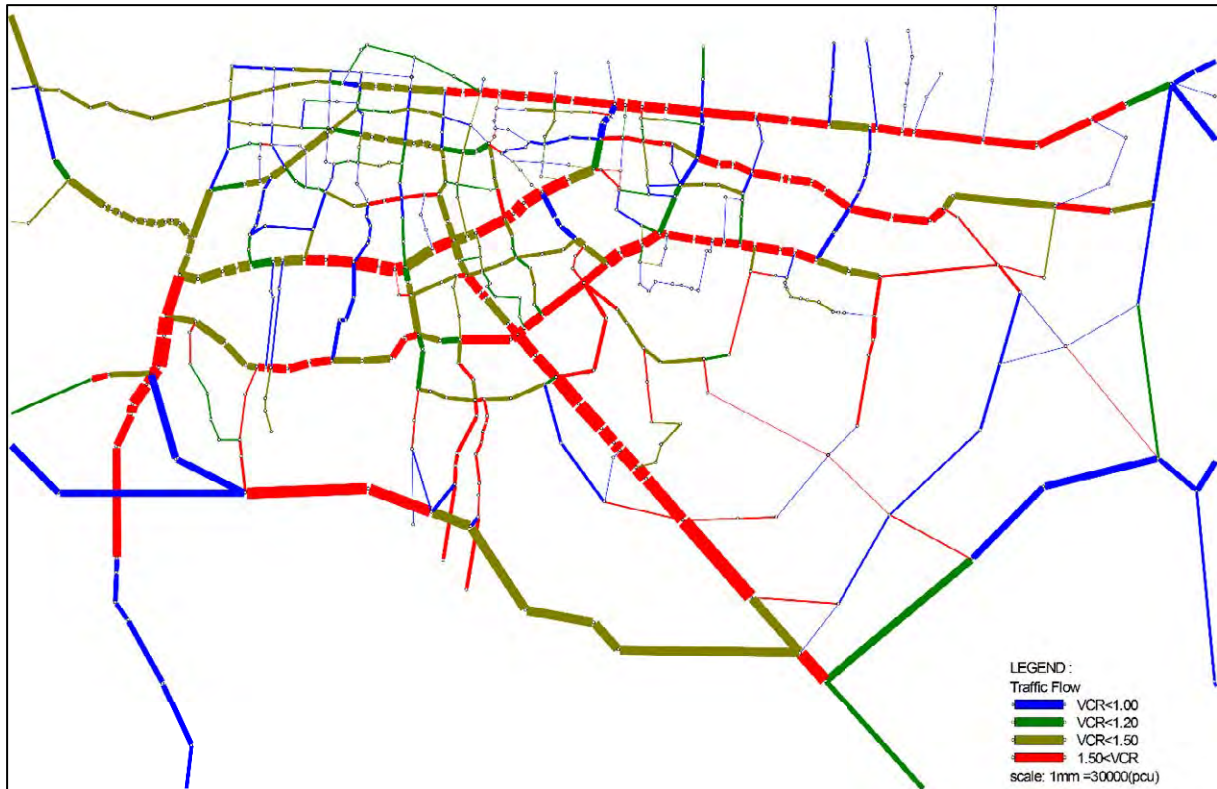
Source: JICA Study Team

Figure A.3.18 Result of Case 6



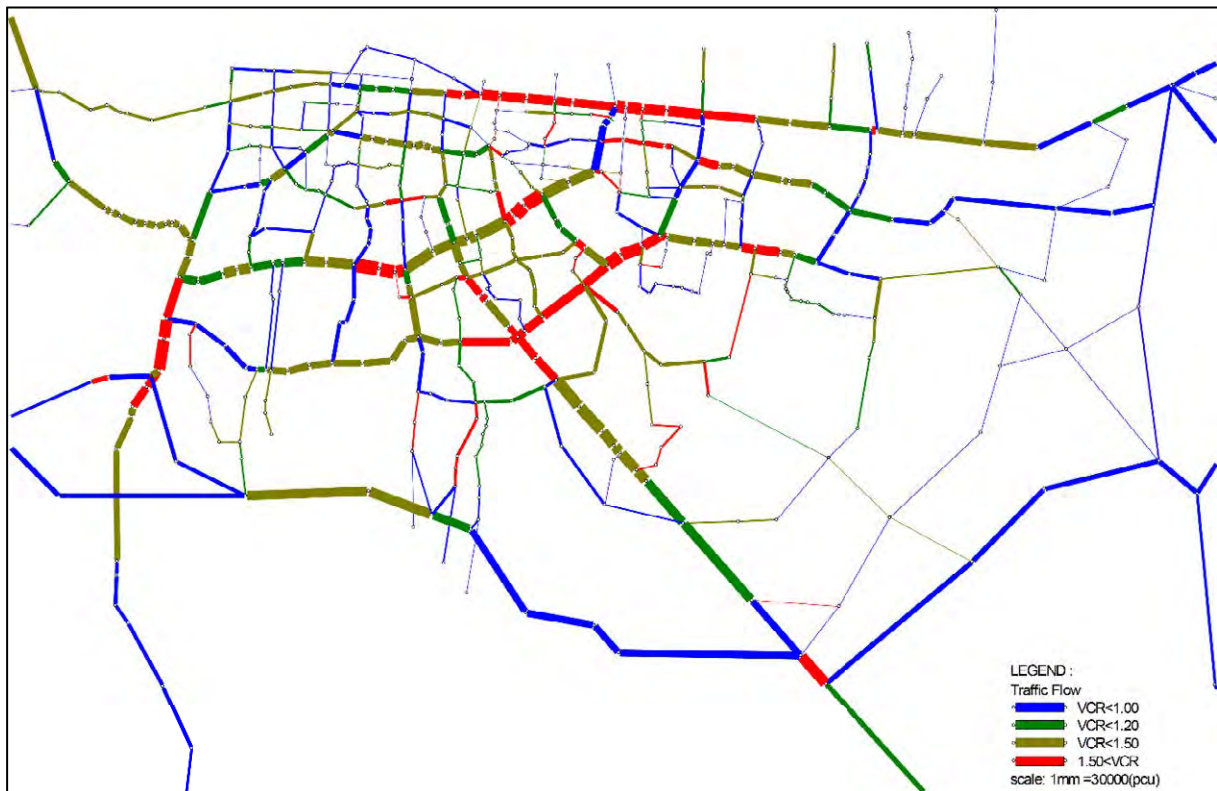
Source: JICA Study Team

Figure A.3.19 Result of Case 7



Source: JICA Study Team

Figure A.3.20 Result of Case 8



Source: JICA Study Team

Figure A.3.21 Result of Case 9



Source: JICA Study Team

Figure A.3.22 Result of Case 10

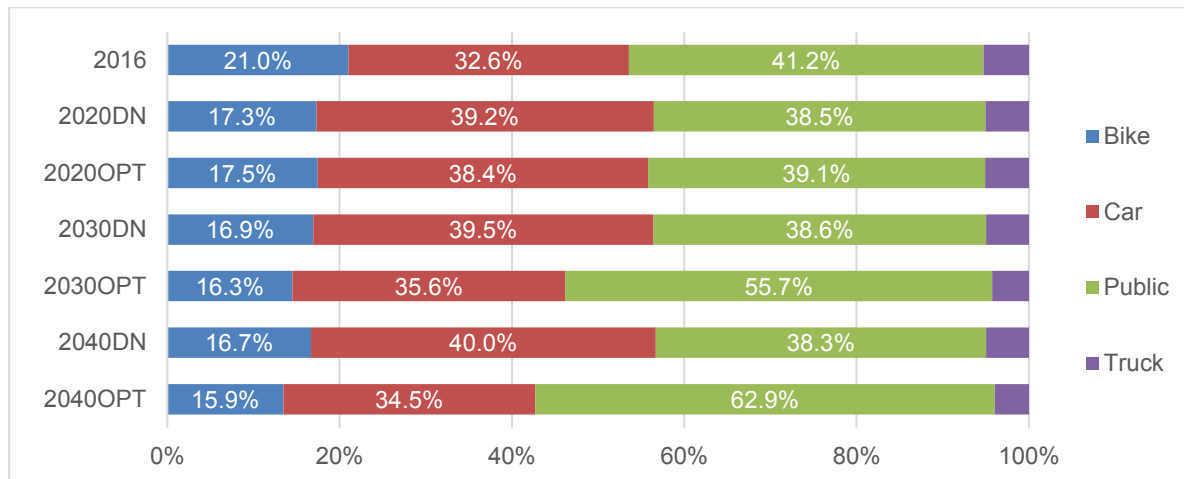


Source: JICA Study Team

Figure A.3.23 Result of Case 11

(3) Modal Share

Modal share in the future is shown in Figure A.3.24. Many people is using public bus on present situation of Managua City. Therefore, this mode is also tend to select in the future. However, vehicle share is more increasing, promote of modal change from private vehicle to public bus is needed. The cases of 2030OPT and 2040OPT are the case of introduction of mass transit, and both results show good modal change.



Source: JICA Study Team

Figure A.3.24 Result of Future Modal Share

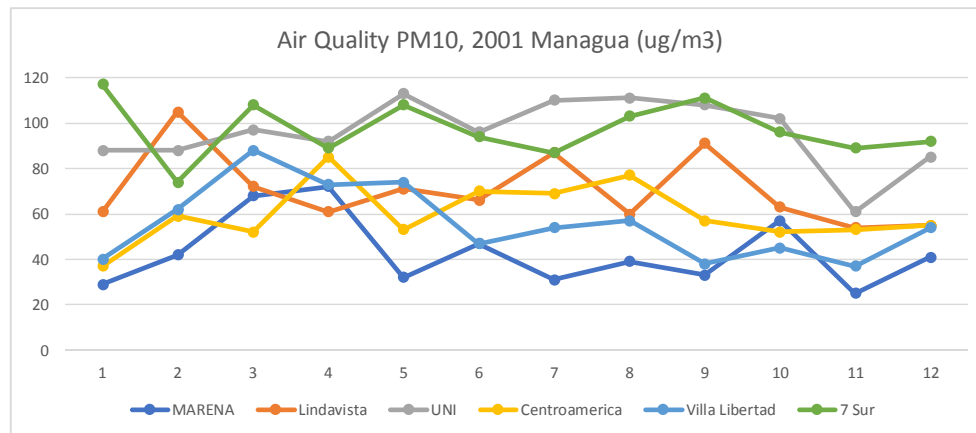
APPENDIX 4 ENVIRONMENT AND SOCIAL CONSIDERATION

4.1 Baseline Environmental Information

In this Appendix, relevant baseline appendix, measured in current studies, are summarized.

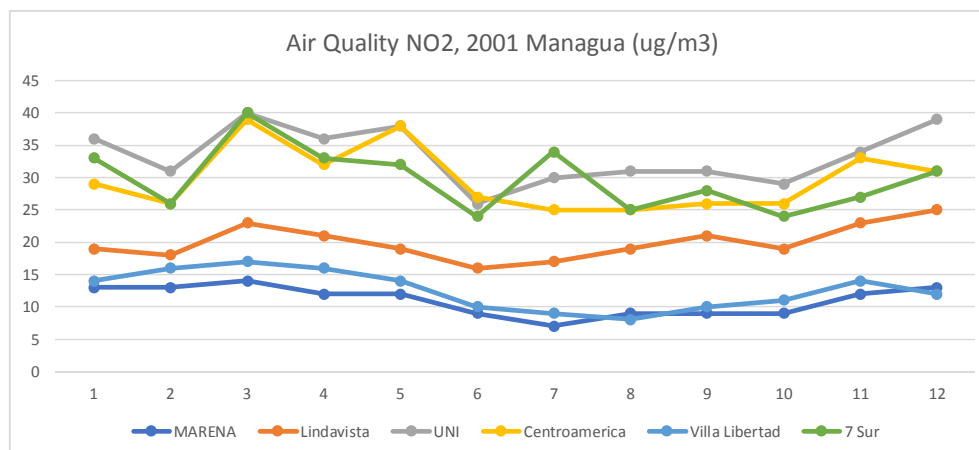
4.1.1 Urban Air Quality

Figures A.4.1 – A.4.3 summarize the monthly urban air quality data, measured at 6 points across Managua City (UNI-PIDMA, 2002).



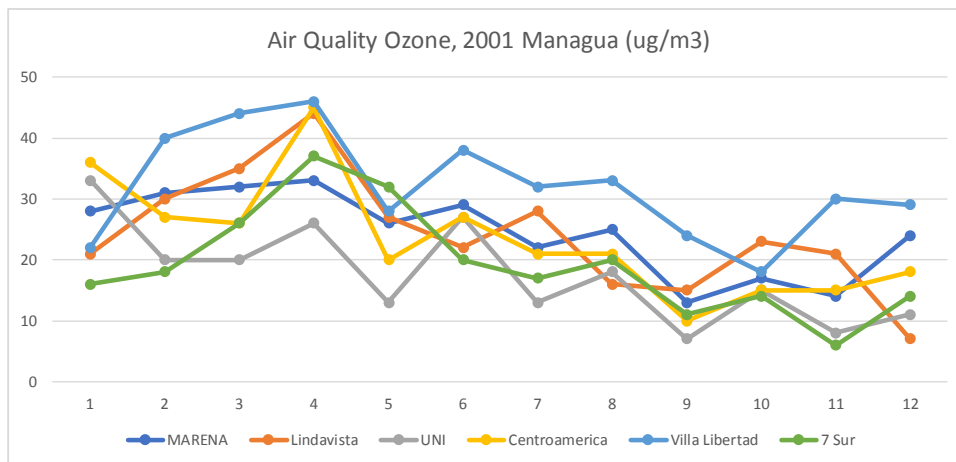
Source: UNI - PIDMA, Proyecto Aire Puro; 2001 annual report, air pollution monitoring in Managua City, Managua Nicaragua 2002

Figure A.4.1. Time Variation of Monthly Air Quality (PM10) across Managua



Source: UNI - PIDMA, Proyecto Aire Puro; 2001 annual report, air pollution monitoring in Managua City, Managua Nicaragua 2002

Figure A.4.2. Time Variation of Monthly Air Quality (NO2) across Managua



Source: UNI - PIDMA, Proyecto Aire Puro; 2001 annual report, air pollution monitoring in Managua City, Managua Nicaragua 2002

Figure A.4.3 Time Variation of Monthly Air Quality (O3) across Managua

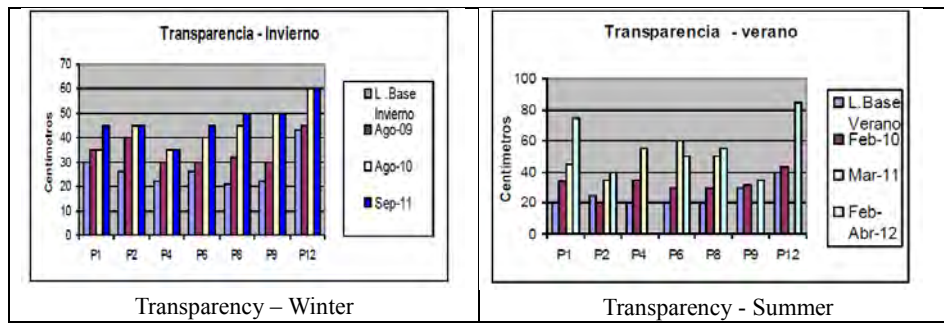
4.1.2 A2. Water Quality of Lake Managua

Lake-wide water quality survey was conducted by ENACAL in order to analyze the effect of sewerage plant that started its operation in 2009. Figure A4 shows the rough location of water quality sampling points (note: specific information of each sampling point is not obtained within this study). Figure A5 shows the water quality survey results during summer and winter season (note: specific information of each survey results are not obtained within this study).



Source: ENACAL - ESTUDIO COMPARATIVO LAGO XOLOTLAN LINEA BASE (2007-2008) EN COMPARACIÓN MONITOREOS 2009, 2010, 2011 y 2012, 2013

Figure A.4.4 Lake Water Quality Survey Points

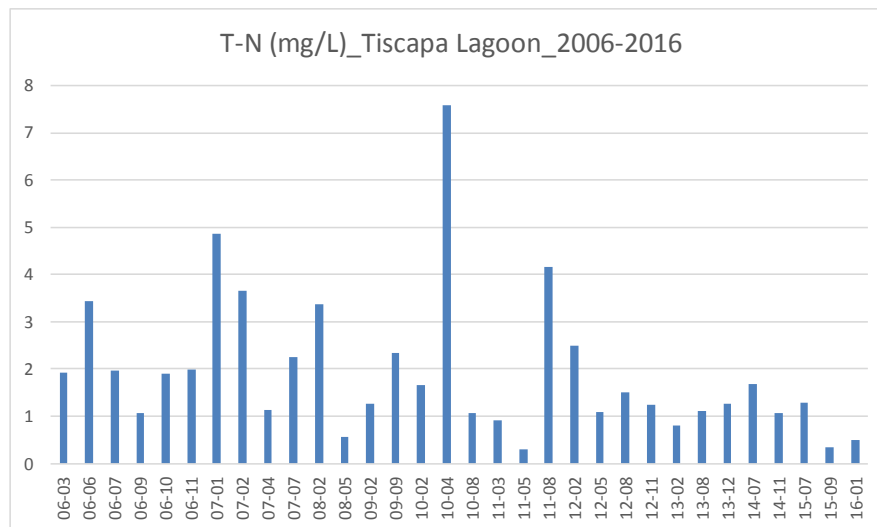


Source: ENACAL - ESTUDIO COMPARATIVO LAGO XOLOTLAN LINEA BASE (2007-2008)
EN COMPARACIÓN MONITOREOS 2009, 2010, 2011 y 2012, 2013

Figure A.4.5 Water Quality Survey Results (Transparency)

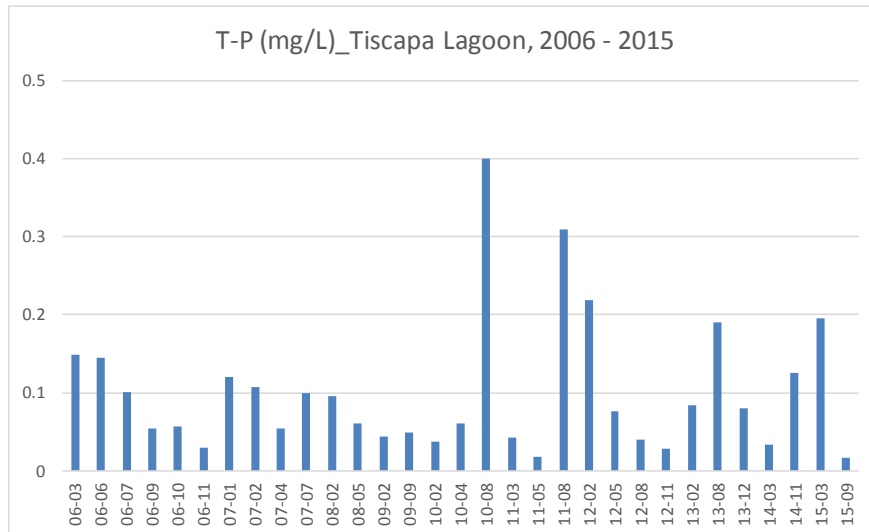
4.1.3 A3. Water Quality Monitoring of Tiscapa Lagoon

Long-term water quality monitoring is conducted at the Tiscapa Lagoon (ALMA, personal communication, 2017). Figures A5 – A8 show some of those monitoring activities, conducted for last four years. It is noted that the sampling frequency is not coherent throughout this entire monitoring activity (e.g., the way of data-processing of water quality data is not coherent among several parameter). It is important to verify the exact sampling framework by checking original sampling record sheets before using those data for the further water quality studies.



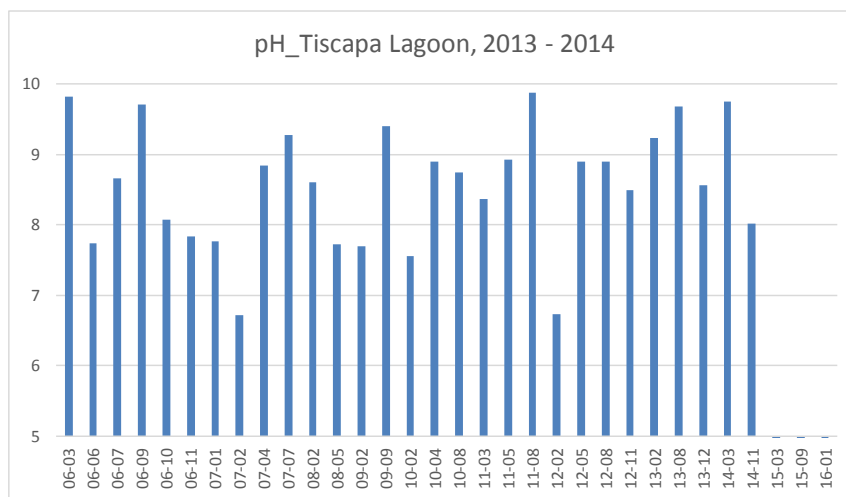
Source: ALMA, 2017

Figure A. 4.6 Long-term Water Quality Monitoring Activity of Tiscapa Lagoon (T-N).



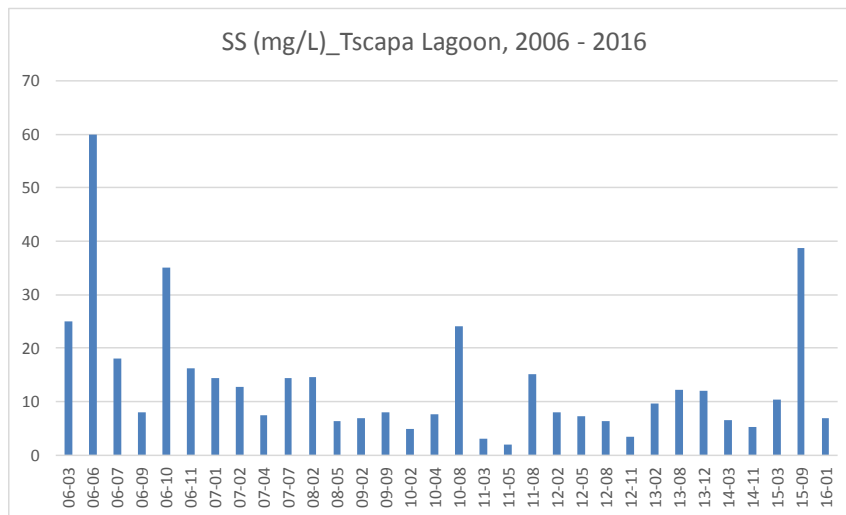
Source : ALMA, 2017

Figure A.4.7 Long-term Water Quality Monitoring Activity of Tiscapa Lagoon (T-P).



Source:ALMA, 2017

Figure A.4.8 Long-term Water Quality Monitoring Activity of Tiscapa Lagoon (pH).



Source: ALMA, 2017

Figure A.4.9 Long-term Water Quality Monitoring Activity of Tiscapa Lagoon (SS).

4.2 Awarded Drawing at PDUM-related Drawing Contest, held on April 18, 2017

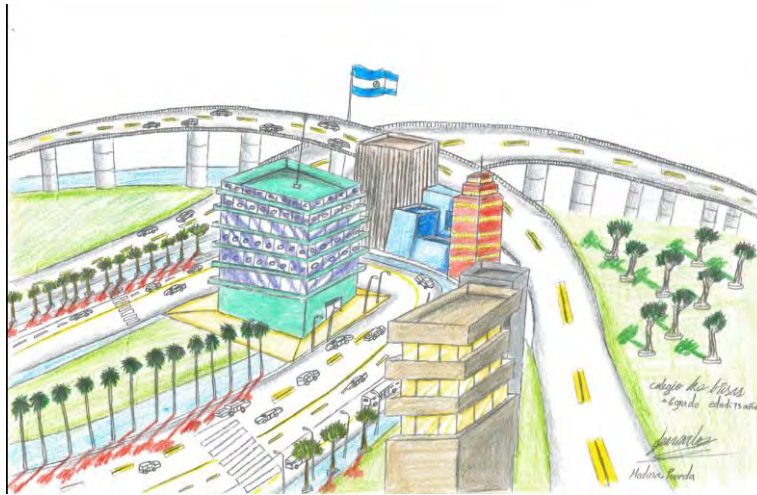


Figure A.4.10 1st place: Primary School



Figure A.4.11 2nd place: Primary School



Figure A.4.12 3rd Place: Primary School



Figure A. 4.13 1st Place: High School

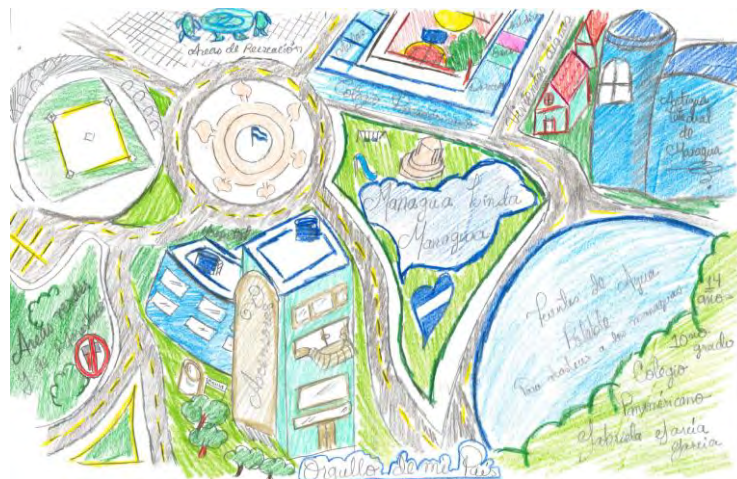


Figure A. 4.14 2nd Place: High School

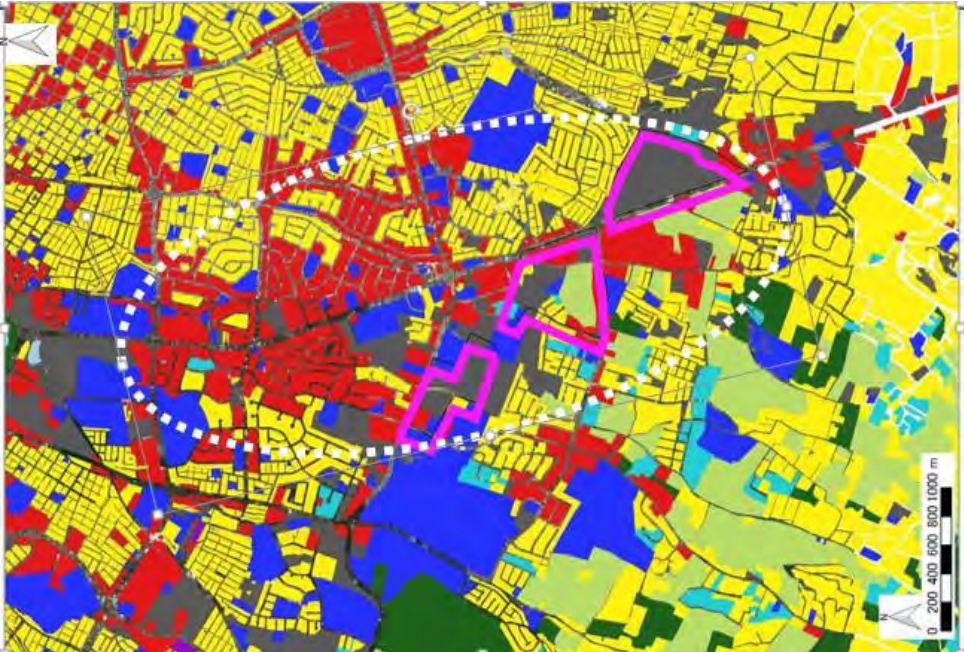



Figure A.4.15 3rd Place: High School

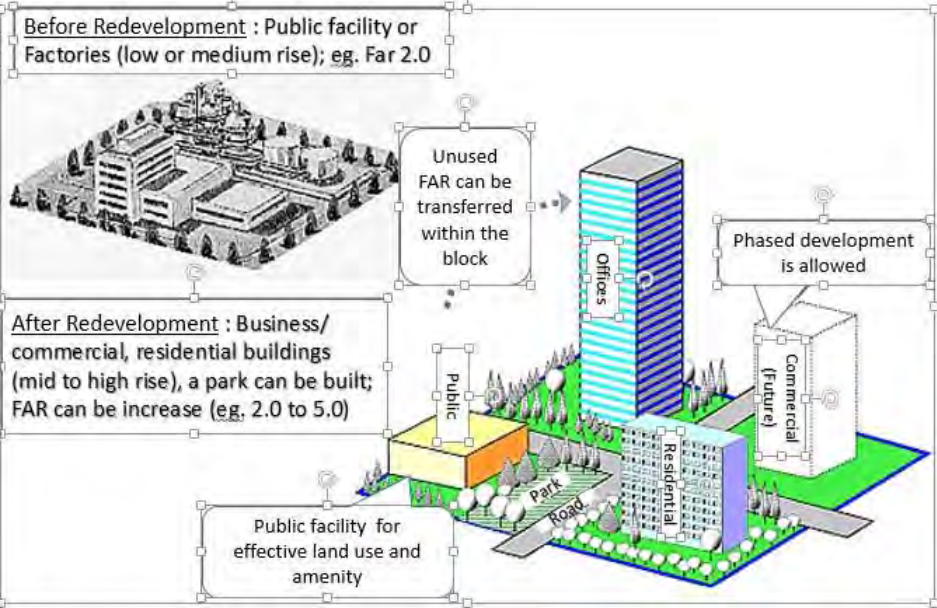
APPENDIX 5 PROJECT DETAIL CHART

5.1 Urban Planning

Table 5.1.1 Details of the New CBD Development Project in Masaya City Center Project

1. Program Title	<p><i>(Choose one from the list below)</i></p> <p><u>(i) Urban development program</u></p> <p>(ii) Urban transport development program</p> <p>(iii) Infrastructure development program</p> <p>(iv) Environment improvement program</p> <p>(v) Urban development management strengthening program</p> <p>(vi) Disaster Management Program</p> <p>(vii) Other → name a program _____</p>
2. Project Title	<u>New CBD Development Project in Carretera Masaya City Center</u>
3. Project Map	<p><i>(Insert Map)</i></p>  <p>Figure 1: New CBD Zone in Carretera a Masaya</p>

	 <p>Figure 2: Options for CBD Core Development</p>
<p>4. Background</p>	<p><i>(Describe background: allow bullet points)</i></p> <p>Managua city has developed without a clear urban centers. While the historical center of Managua needs to have city center function and be revitalized, which has been launched by IDB, an area along Carretera a Masaya has increasing accumulation of commercial and business functions. As Carretera a Masaya is expected to be a major transportation corridor for Managua in future connecting to the south and southeast, the area is expected to serve as a New CBD for Managua, accommodating business, commercial and some public functions, including multimodal terminal function, public services, etc.</p>
<p>5. Objective</p>	<p><i>(Describe objectives: allow bullet points)</i></p> <p>To create a new CBD accommodating business, commercial and some public administrative functions in harmonized environment and good transport services; To improve transportation network by creating a multimodal terminal where people can switch from public transport such as inter-city mass transit to intra city services To provide a mode for four other proposed CBD and/or Service Centers</p>
<p>6. Project Component</p>	<p><i>(Describe Project Components and Sub-Components)</i></p> <ul style="list-style-type: none"> (1) Survey of current land use <ul style="list-style-type: none"> (1-1) Land use and ownership of the new CBD zone (1-2) Land use and ownership of Options 1, 2 and 3 (2) Zonal Plan for New CBD Area <ul style="list-style-type: none"> (2-1) Basic Zonal Development Plan for New CBD area (2-2) Proposal of New Zoning Plan for New CBD area (2-3) Basic Infrastructure Plan for New CBD area (2-4) Basic Plan for New CBD Core (30 to 40 ha) (3) Development of New CBD Core <ul style="list-style-type: none"> (3-1) Overall coordination of Public and Private Partnership (3-2) Infrastructure Development (Public)

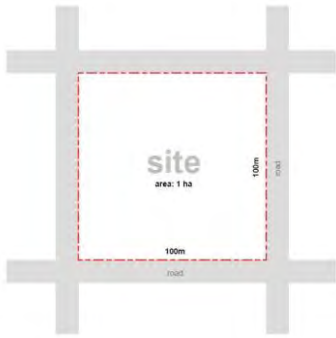

	<p>(3-3) New CBD Core (Public Portion) Development (3-4) New CBD Core (Private Portion) Development</p>  <table border="1" data-bbox="391 952 1372 1299"> <thead> <tr> <th>Function</th> <th>Area (ha)</th> <th>FAR</th> <th>Floor area (m2)</th> <th>Unit (\$/m2)</th> <th>Cost</th> <th>Cost (M\$)</th> </tr> </thead> <tbody> <tr> <td>Public*</td> <td>5</td> <td>0.5</td> <td>25,000</td> <td>600</td> <td></td> <td>15</td> </tr> <tr> <td>Commercial</td> <td>5</td> <td>2.0</td> <td>100,000</td> <td>800</td> <td></td> <td>80</td> </tr> <tr> <td>Office</td> <td>8</td> <td>5.0</td> <td>400,000</td> <td>1000</td> <td></td> <td>400</td> </tr> <tr> <td>Residen A*</td> <td>5</td> <td>1.5</td> <td>75,000</td> <td>800</td> <td></td> <td>60</td> </tr> <tr> <td>Residen B</td> <td>5</td> <td>4.0</td> <td>200,000</td> <td>1500</td> <td></td> <td>300</td> </tr> <tr> <td>Infra#</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>171</td> </tr> <tr> <td>Total (Ave)</td> <td>30</td> <td>3</td> <td>900,000</td> <td></td> <td></td> <td>1,026</td> </tr> </tbody> </table> <p>* indicates public investment (preferred), which totals \$80,000 plus infrasture (road, water supply, wastewater etc. # Infrastructure cost is assumed to be 20% of building cost.</p>	Function	Area (ha)	FAR	Floor area (m2)	Unit (\$/m2)	Cost	Cost (M\$)	Public*	5	0.5	25,000	600		15	Commercial	5	2.0	100,000	800		80	Office	8	5.0	400,000	1000		400	Residen A*	5	1.5	75,000	800		60	Residen B	5	4.0	200,000	1500		300	Infra#						171	Total (Ave)	30	3	900,000			1,026
Function	Area (ha)	FAR	Floor area (m2)	Unit (\$/m2)	Cost	Cost (M\$)																																																			
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Commercial	5	2.0	100,000	800		80																																																			
Office	8	5.0	400,000	1000		400																																																			
Residen A*	5	1.5	75,000	800		60																																																			
Residen B	5	4.0	200,000	1500		300																																																			
Infra#						171																																																			
Total (Ave)	30	3	900,000			1,026																																																			
<p>7. Regulating Organization</p>	<p><u>Organization:</u> _____ ALMA <u>Division/Department in charge:</u> _____ Planning Department</p>																																																								
<p>8. Implementation Organization (list all)</p>	<p><u>Organization:</u> _____ ALMA for New CDB Area and New CBD Core, MTI for transport Infrastructure Plan <u>Division/Department in charge:</u> _____ Project Department (ALMA); Planning Department (MTI)</p>																																																								
<p>9. Cost</p>	<p>Total Cost: USD _____ Million (describe the break down if possible such) Construction: USD _____ Million</p>																																																								


	<p>O&M: USD _____ Million / year (for how many years)</p> <p><i>(describe the breakdown by period if possible)</i></p> <table border="1"> <thead> <tr> <th>USD Million</th> <th>Short term (2017 – 2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Survey and Planning</td> <td>1*</td> <td></td> <td></td> </tr> <tr> <td>Total Cost</td> <td></td> <td></td> <td></td> </tr> <tr> <td>(Construction)</td> <td></td> <td>1,026</td> <td></td> </tr> <tr> <td>(O&M)</td> <td></td> <td>205</td> <td></td> </tr> </tbody> </table> <p>*: This should be included in Technical Cooperation Project for Urban and Transport Planning</p>	USD Million	Short term (2017 – 2020)	Mid term (2021-2030)	Long term (2031-2040)	Survey and Planning	1*			Total Cost				(Construction)		1,026		(O&M)		205	
USD Million	Short term (2017 – 2020)	Mid term (2021-2030)	Long term (2031-2040)																		
Survey and Planning	1*																				
Total Cost																					
(Construction)		1,026																			
(O&M)		205																			
10. Revenue Collection	<p><i>(Choose one and describe)</i></p> <p>(i) Possible: USD _____ Million</p> <p>(ii) Not Possible</p>																				
11. Possible Fund Source	<p>_____</p> <p>(ALMA, MTI, INVUR, SINAPRED, ENACAL, ENATREL, MINED, MINSA, EAAI, ENP, PRIVATE, ODA (Grant), ODA(Loan), ODA(Technical Assistance), etc.)</p>																				
12. Timing of Implementation	<p><i>(Choose one → consider “urgency” of the project)</i></p> <p>(i) Short: MP Formulation -2020</p> <p>(ii) Middle: 2020 – 2030</p> <p>(iii) Long: 2030 – 2040</p> <p><i>(Please specify the year. If the projects will be implemented by phase or different timing, please describe the details.)</i></p> <p>(i) Starting year of study : <u>2018</u></p> <p>(ii) Starting year of construction : <u>2020</u></p> <p>(iii) Starting year of operation : <u>2022</u></p>																				
13. Compliance with Development Visions	<p><i>(Answer all and mark with BOLD AND UNDERLINE)</i></p> <p>(i) National Development Plan: <input checked="" type="checkbox"/> YES PARTLY NO</p> <p>(ii) Sector Development Plan: <input checked="" type="checkbox"/> YES PARTLY NO</p> <p>(iii) Implementation Organization’s Dev’t Plan: <input checked="" type="checkbox"/> YES PARTLY NO</p>																				
14. Social Economic Impact	<p><i>(Fill in as much as possible)</i></p> <ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>119,000</u> ● Current demand gap: <u>360,000</u> ● Additional supply volume from the project (No. or % of the gap): <u>54,000 (15%)</u> ● Qualitative Assessment: HIGH MIDDLE LOW (Describe why: _____) → Impact on economic inequality, disabled persons, etc. 																				
15. Environmental Impact	<p><i>(Choose and Describe)</i></p> <ul style="list-style-type: none"> ● Natural Environment Impact: <input checked="" type="checkbox"/> HIGH MIDDLE LOW (Describe why: <u>It will accommodate the service sector employments which will be one of the engines of Nicaraguan economy.</u>) → Impact on air quality, water, flora, etc. ● Social Environment Impact: HIGH MIDDLE <input checked="" type="checkbox"/> LOW 																				

	(Describe why: <u>Sites are mostly unused lands</u>) → Impact on social demography, resettlement, etc.
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Source: JICA Study Team

Table 5.1.2 Details of Residential Zone Redevelopment Project

1. Program Title	(Choose one from the list below) <u>(i) Urban development program</u> (ii) Urban transport development program (iii) Infrastructure development program (iv) Environment improvement program (v) Urban development management strengthening program (vi) Disaster Management Program (vii) Other → name a program _____
2. Project Title	Residential Zone Redevelopment Project
3. Project Map	<p>(Insert Map)</p> <p>An appropriate site will be chosen later, where low-rise (1 to 2 story) residential units are densely located.</p> <p>Figure 1: Typical area</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>Figure 2: Redevelopment Scheme (Typical)</p>

																													
<p>4. Background</p>	<p><i>(Describe background: allow bullet points)</i> Most of housing areas in Managua city are very low-rise, say 1 or 2 story housing units. In order to densify the residential area and improve the living environment, redevelopment of low-rise residential area to a middle-rise residential area with collective housings will be necessary. This project provides for a model of such residential zone redevelopment.</p>																												
<p>5. Objective</p>	<p><i>(Describe objectives: allow bullet points)</i> To densify low-rise residential area with 1 or 2 story housing units into middle-rise residential area with collective housing units; To provide a model for comfortable and pleasant urban living environment; and To densify the population density to make way for a “compact city”</p>																												
<p>6. Project Component</p>	<p><i>(Describe Project Components and Sub-Components)</i></p> <ul style="list-style-type: none"> (1) Survey of current land use <ul style="list-style-type: none"> (1-1) Selection of Project Site (1-3) Survey of present land use and urban characteristics of the site (2) Zonal Plan for Redevelopment <ul style="list-style-type: none"> (2-1) Basic Zonal Development Plan (2-2) Consideration of private development scheme for implementation (2-3) Role of Public Sector in smooth implantation (3) Implementation of Residential Zone Redevelopment Project <ul style="list-style-type: none"> (3-1) Temporary Resettlement Planning (3-2) Site Preparation (3-3) Construction of Collective Housing Units and Common Service Facilities (3-4) Commissioning <table border="1" data-bbox="391 1724 1361 1915"> <thead> <tr> <th>Function</th> <th>Area (ha)</th> <th>FAR</th> <th>Floor area (m2)</th> <th>Unit (\$/m2)</th> <th>Cost</th> <th>Cost (M\$)</th> </tr> </thead> <tbody> <tr> <td>Residen A</td> <td>1</td> <td>1.2</td> <td>12,000</td> <td>700</td> <td></td> <td>84</td> </tr> <tr> <td>Infra*</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>17</td> </tr> <tr> <td>Total (Ave)</td> <td>30</td> <td>3</td> <td>900,000</td> <td></td> <td></td> <td>101</td> </tr> </tbody> </table> <p>* Infrastructure cost is assumed to be 20% of building cost.</p>	Function	Area (ha)	FAR	Floor area (m2)	Unit (\$/m2)	Cost	Cost (M\$)	Residen A	1	1.2	12,000	700		84	Infra*						17	Total (Ave)	30	3	900,000			101
Function	Area (ha)	FAR	Floor area (m2)	Unit (\$/m2)	Cost	Cost (M\$)																							
Residen A	1	1.2	12,000	700		84																							
Infra*						17																							
Total (Ave)	30	3	900,000			101																							
<p>7. Regulating</p>	<p><u>Organization:</u></p>																												

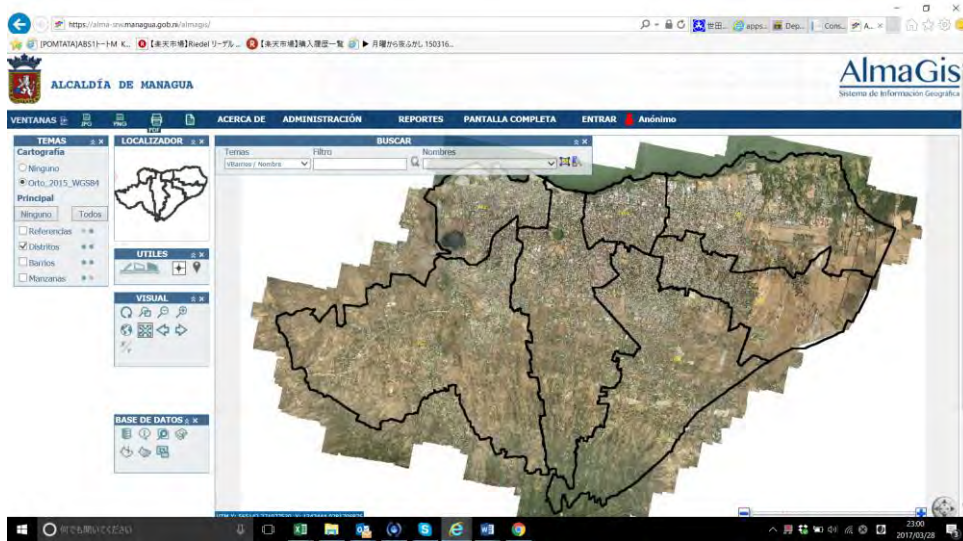
Organization	ALMA <u>Division/Department in charge:</u> Planning Department																				
8. Implementation Organization (list all)	<u>Organization:</u> ALMA for New CDB Area and New CBD Core, MTI for Infrastructure Plan <u>Division/Department in charge:</u> Project Department (ALMA); Planning Department (MTI)																				
9. Cost	Total Cost: USD _____ Million <i>(describe the break down if possible such)</i> Construction: USD _____ Million O&M: USD _____ Million / year (for how many years) <i>(describe the breakdown by period if possible)</i> <table border="1"> <thead> <tr> <th>USD Million</th> <th>Short term (2017 – 2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Survey and Planning</td> <td>0.5*</td> <td></td> <td></td> </tr> <tr> <td>Total Cost</td> <td>0.5</td> <td>6,060</td> <td>12,120</td> </tr> <tr> <td>(Construction)</td> <td></td> <td>5,050</td> <td>10,100</td> </tr> <tr> <td>(O&M)</td> <td></td> <td>1,010</td> <td>2,020</td> </tr> </tbody> </table> <p>*: This should be included in Technical Cooperation Project for Urban and Transport Planning</p>	USD Million	Short term (2017 – 2020)	Mid term (2021-2030)	Long term (2031-2040)	Survey and Planning	0.5*			Total Cost	0.5	6,060	12,120	(Construction)		5,050	10,100	(O&M)		1,010	2,020
USD Million	Short term (2017 – 2020)	Mid term (2021-2030)	Long term (2031-2040)																		
Survey and Planning	0.5*																				
Total Cost	0.5	6,060	12,120																		
(Construction)		5,050	10,100																		
(O&M)		1,010	2,020																		
10. Revenue Collection	<i>(Choose one and describe)</i> (i) Possible: USD _____ Million (ii) Not Possible																				
11. Possible Fund Source	_____ (ALMA, MTI, INVUR, SINAPRED, ENACAL, ENATREL, MINED, MINSA, EAAI, ENP, PRIVATE, ODA (Grant), ODA(Loan), ODA(Technical Assistance), etc.)																				
12. Timing of Implementation	<i>(Choose one → consider “urgency” of the project)</i> (i) Short: MP Formulation -2020 (ii) Middle: 2020 – 2030 (iii) Long: 2030 – 2040 <i>(Please specify the year. If the projects will be implemented by phase or different timing, please describe the details.)</i> (i) Starting year of study : <u>2018</u> (ii) Starting year of construction : <u>2020</u> (iii) Starting year of operation : <u>2040</u>																				
13. Compliance with Development Visions	<i>(Answer all and mark with <u>BOLD AND UNDERLINE</u>)</i> (i) National Development Plan: YES <input checked="" type="checkbox"/> PARTLY NO (ii) Sector Development Plan: <input checked="" type="checkbox"/> YES PARTLY NO (iii) Implementation Organization’s Dev’t Plan: <input checked="" type="checkbox"/> YES PARTLY NO																				
14. Social	<i>(Fill in as much as possible)</i>																				

Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>138 households</u> ● Current demand gap: <u>223,771 households</u> ● Additional supply volume from the project (No. or % of the gap): <u>0.062% of gap</u> ● Qualitative Assessment: <input checked="" type="checkbox"/> HIGH MIDDLE LOW (Describe why: _____) → The pilot project will bring POSITIVE impact to improve social and economic inequality, as it brings quality affordable housing to the otherwise socially/economically disadvantaged.
15. Environmental Impact	<p><i>(Choose and Describe)</i></p> <ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE <input checked="" type="checkbox"/> LOW (Describe why: _____) → The prototype project aims to replace the current inefficient local affordable housing model and helps to minimize urban sprawl. It will also adopt sustainability concepts and measures to everyday lifestyle and promote awareness to a cleaner built and natural environment. ● Social Environment Impact: HIGH MIDDLE <input checked="" type="checkbox"/> LOW (Describe why: _____) → The pilot project will bring substantial POSITIVE social and environmental impact as it introduces quality sustainable and affordable housing to Managua. The prototype is expected to spearhead and inspire similar projects and raise the quality of living immediately through to the long term.

Source: JICA Study Team

Details of Open GIS data portal for Urban Planning Project

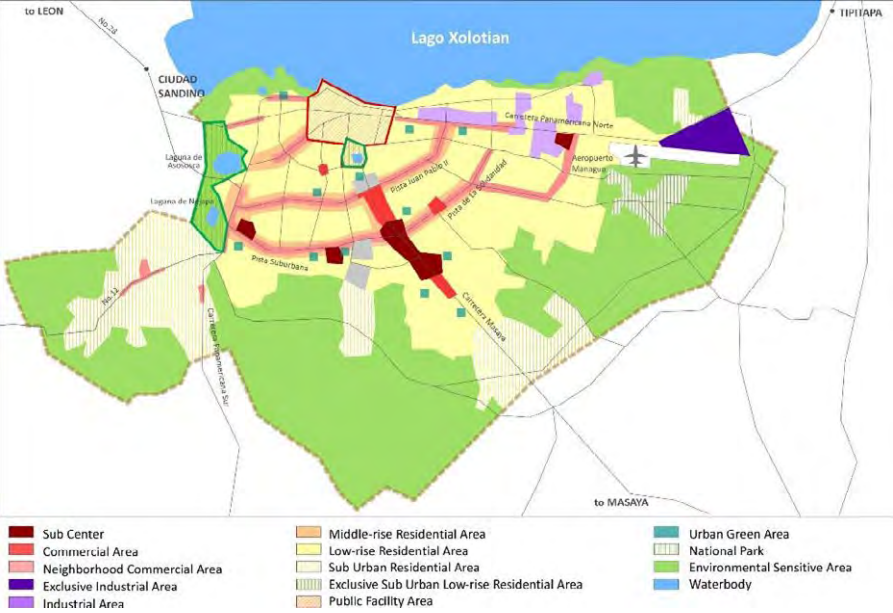
1. Program Title	<p><i>(Choose one from the list below)</i></p> <ul style="list-style-type: none"> (i) Urban development program (ii) Urban transport development program (iii) Infrastructure development program (iv) Environment improvement program <input checked="" type="checkbox"/> (v) Urban development management strengthening program (vi) Disaster Management Program (vii) Other → name a program _____
2. Project Title	Revision of address system Project

<p>3. Project Map</p>	 <p style="text-align: center;">Figure 1: Map of Managua</p>
<p>4. Background</p>	<p><u>Background of this project</u></p> <p>Nicaragua has a unique address system. The address system uses reference points and the address shows distance and direction from the reference point. However lots of reference points are not well known by people or sometime the reference point doesn't exist anymore. Therefore this system causes many people easy to get lost and difficult to deliver goods or services. Followings are disadvantage of unclear Address System (AS).</p> <ul style="list-style-type: none"> - Inefficient ineffective, and sometimes erroneous disposition of activities in space - Inadequate provision of services to the public. - Difficulties associated with provision of emergency services - Increase unnecessary trips to find the location which adds on traffic congestion - Especially for tourists, it is difficult to find the point of interest. - Difficult to attract commercial entities because it is difficult to identify locations of their clients and offer services. <p>To apply AS means that the area or the plot can easily be identify by everyone, this simple thing would bring various benefits for all, not only for people living or working in the Managua, but also for tourists and investors.</p> <p>Therefore technical assistance to revise address system is expected in following fields:</p> <ul style="list-style-type: none"> • Formulation of Revised Address System • Development GIS based revised address map and data • Disseminate of revised address system (incl. development website and pilot project in 1 or 2 District) • Maintenance and management of GIS data and GIS data portal
<p>5. Objective</p>	<p><u>Objective of Urban Component</u></p> <ul style="list-style-type: none"> • The capacity of deliver services by Urban and Environmental Department, ALMA is enhanced
<p>6. Project Component</p>	<p>(1) Capacity Building for deliver better services by Urban and Environmental Department, ALMA</p> <p>(1-1) Formulate revised address system</p> <p>(1-2) Develop GIS based address map and data</p> <p>(1-3) Design and Development of Web portal to utilize and disseminate revised address</p>

	<p>system</p> <p>(1-4) Management and maintenance of GIS data and Web portal</p> <p>(1-5) Pilot Project: Utilization of revised address system (1 or 2 District in Managua)</p> <p>(1-6) Preparation of draft bill for revised address system</p>
7. Regulating Organization	<p><u>Organization: ALMA</u></p> <p><u>Division/Department in charge: Cadastral Department (and Urban and Environmental Department)</u></p>
8. Implementation Organization (list all)	<p><u>Organization: ALMA</u></p> <p><u>Division/Department in charge: Cadastral Department (and Urban and Environmental Department)</u></p>
9. Cost	<p>Total Cost: USD <u>2.3</u> Million</p> <p>From 60 to 80 International Expert for 2 years</p> <ul style="list-style-type: none"> • Urban Planner • Land Use Planner • GIS Expert • System Engineer • Legal system Expert
10. Revenue Collection	<p><i>(Choose one and describe)</i></p> <p>(i) Possible: USD _____ Million</p> <p>(ii) Not Possible</p>
11. Possible Fund Source	<p><u>JICA Technical Assistant Program</u></p>
12. Timing of Implementation	<p><i>(Choose one → consider “urgency” of the project)</i></p> <p><u>(i) Short: MP Formulation -2020</u></p> <p>(ii) Middle: 2020 – 2030</p> <p>(iii) Long: 2030 – 2040</p> <p><i>(Please specify the year. If the projects will be implemented by phase or different timing, please describe the details.)</i></p> <p><u>(i) Starting year of study: Late 2017</u></p> <p>(ii) Starting year of construction: _____</p> <p>(iii) Starting year of operation: _____</p>
13. Compliance with Development Visions	<p><i>(Answer all and mark with <u>BOLD AND UNDERLINE</u>)</i></p> <p>(i) National Development Plan: YES <u>PARTLY</u> NO</p> <p>(ii) Sector Development Plan: YES <u>PARTLY</u> NO</p> <p>(iii) Implementation Organization’s Dev’t Plan: YES <u>PARTLY</u> NO</p>
14. Social Economic Impact	<p>YES (maybe)</p>
15. Environmental Impact	<p>NONE</p>

Source: JICA Study Team

Table 5.1.3 Public Awareness Project for Compact City Planning

<p>1. Program Title</p>	<p>(Choose one from the list below)</p> <p><u>(i) Urban development program</u></p> <p>(ii) Urban transport development program</p> <p>(iii) Infrastructure development program</p> <p>(iv) Environment improvement program</p> <p>(v) Urban development management strengthening program</p> <p>(vi) Disaster Management Program</p> <p>(vii) Other → name a program _____</p>
<p>2. Project Title</p>	<p>Public Awareness Project for Compact City Planning</p>
<p>3. Project Map</p>	 <p style="text-align: center;">Figure 1: Master Plan (tentative figure)</p>
<p>4. Background</p>	<p>In the master plan, the densification measure is considered in order to make a compact city in Managua. For this citizen's awareness and understanding of the master plan is vital for bringing it forward. Notably the people in Managua prefer living in one- or two-story buildings to above three-story ones, due to their fear for earthquake. However existing low-rise development is driving the opposite direction of compact city. Therefore, public awareness aimed at encouragement of the people moving from low-rise house to middle-rise apartment should be taken.</p>
<p>この</p>	<p>(Describe objectives: allow bullet points)</p> <ul style="list-style-type: none"> To distribute the information of the master plan and concept of compact city by means of brochure, leaflet, poster, seminar and media. To assist increasing earthquake proof buildings To promote living in mid-rise housing To encourage public transport users
<p>6. Project Component</p>	<ol style="list-style-type: none"> (1) Distribution the information of the master plan and promotion of moving from low-rise house to mid-rise house (2) Support of earthquake proof buildings by means of benefits such as technical assistance, subsidy and deregulation.


7. Regulating Organization	<u>Organization:</u> ALMA <u>Division/Department in charge:</u> Planning, Architecture and Project Department
8. Implementation Organization (list all)	<u>Organization:</u> ALMA <u>Division/Department in charge:</u> Planning, Architecture and Project Department
9. Cost	Total Cost: USD <u>25,000</u> only for (1) information distribution Note: the cost for (2) Earthquake Proof Buildings should be determined after the Needs Survey
10. Revenue Collection	--(i) Possible: USD _____ Million (ii) Not Possible
11. Possible Fund Source	<u>ALMA</u>
12. Timing of Implementation	<i>ALL</i> (i) Short: MP Formulation -2020 (ii) Middle: 2020 – 2030 (iii) Long: 2030 – 2040
13. Compliance with Development Visions	<i>(Answer all and mark with BOLD AND UNDERLINE)</i> (i) National Development Plan: YES PARTLY <u>NO</u> (ii) Sector Development Plan: <u>YES</u> PARTLY NO (iii) Implementation Organization’s Dev’t Plan: <u>YES</u> PARTLY NO
14. Social Economic Impact	<u>NONE</u>
15. Environmental Impact	<i>(Choose and Describe)</i> ● Natural Environment Impact: HIGH MIDDLE <u>LOW</u> (Describe why: _____) ● Social Environment Impact: HIGH MIDDLE <u>LOW</u> (Describe why: _____)

Source: JICA Study Team

5.2 Transport Planning

CD-1 : Transport Planning Capacity Building Project

1. Program Title	<i>(Choose one from the list below)</i> (i) Urban development program <u>(ii) Urban transport development program</u> (iii) Infrastructure development program (iv) Environment improvement program
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	<p>(v) Urban development management strengthening program</p> <p>(vi) Disaster Management Program</p> <p>(vii) Other → name a program _____</p>
2. Project Title	Transport Planning/Traffic Management Capacity Building Project
3. Project Map	<p>Entire Managua City</p> 
4. Background	<p><i>(Describe background: allow bullet points)</i></p> <p><u>Background of Transport Component</u></p> <p>ALMA has two departments related to road and its infrastructure which are Project Department and Infrastructure Department. In addition, there are IRTRAMMA as regulatory body for public transport and Traffic Police as traffic control and enforcement organization in Managua City. However, there are no traffic planning department/organization which supervises entire transportation sector in whole city. Therefore the capacity of transportation planning is inadequate. The standard and norms of road in regulatory plan is necessary to be updated in order to make appropriate transport plans and traffic management in future as well as urban planning. Furthermore, coordination capability is also important for steady implementation of plan/project and efficient traffic management because of many stakeholders traffic transport organizations in Managua as mentioned above.</p> <p>Therefore technical assistance for capacity building is expected in following fields:</p> <ul style="list-style-type: none"> • Updating road/traffic standard based on the current situation and transportation plan • Formulating coordination scheme for traffic management and implementation • Considering establishment of coordination organization for traffic and transportation planning and management
5. Objective	<p><i>(Describe objectives: allow bullet points)</i></p> <p><u>Objective of Transport Component</u></p> <ul style="list-style-type: none"> • The capacity of traffic and transportation departments and organizations are enhanced
6. Project Component	<p><i>(Describe Project Components and Sub-Components)</i></p> <p>(1) Capacity Building for Transport Planning</p> <p>(1-1) Revision of Road/Traffic Standard and Norms for Entire Managua City</p> <ul style="list-style-type: none"> - Review of Regulatory Plan - Comparison of standard and norms in Regulatory Plan and Current road traffic situation - Update of Regulatory Plan (road and transport field) - Discussion with concerned organization about update of norm and standard of Regulatory Plan

	<p>(1-2) Preparation of Traffic/Transport Management Guideline</p> <ul style="list-style-type: none"> - Analysis of current traffic situation and specify the issues - Consider and discussion for appropriate measure of traffic management - Prepare Traffic/Transport Management Guideline <p>(1-3) Pilot Project for Traffic Demand Management Project (e.g. traffic information provision to road user)</p> <ul style="list-style-type: none"> - Select of model area and target site - Conduct traffic survey for base line survey - Consult with concerned organization about schedule of implementation of pilot project - Conduct traffic survey for end line survey, and Analysis pilot project result - Utilize result of pilot project into Traffic/Transport Management Guideline
7. Regulating Organization	<p><u>For Transport Planning and Traffic Management Sector</u></p> <p><u>Organization: ALMA</u></p> <p><u>Related Organization: IRTRAMMA, Traffic Police, MTI</u></p> <p><u>Division/Department in charge: Project Department</u></p>
8. Implementation Organization (list all)	<p><u>For Transport Planning and Traffic Management Sector</u></p> <p><u>Organization: ALMA</u></p> <p><u>Related Organization: IRTRAMMA, Traffic Police, MTI</u></p> <p><u>Division/Department in charge: Project Department</u></p>
9. Cost	<p>Total Cost: USD <u> 2 </u> Million</p> <p><i>(describe the break down if possible such)</i></p> <p>From 40MM to 50MM International Expert for 3 years</p> <p>This cost is not included cost of pilot project implementation</p> <ul style="list-style-type: none"> • Transportation Planner • Road Planner • Public Transport Planner • Traffic Management Specialist / ITS Specialist • Construction Supervision and Cost Estimate Specialist • Traffic Survey / Coordinator
10. Revenue Collection	<p><i>(Choose one and describe)</i></p> <p>(i) Possible: USD _____ Million</p> <p>(ii) Not Possible</p>
11. Possible Fund Source	<p><u>JICA Technical Assistant Program</u></p>
12. Timing of Implementation	<p><i>(Choose one → consider “urgency” of the project)</i></p> <p>(i) Short: MP Formulation -2020</p> <p>(ii) Middle: 2020 – 2030</p> <p>(iii) Long: 2030 – 2040</p> <p><i>(Please specify the year. If the projects will be implemented by phase or different timing, please describe the details.)</i></p> <p><u>(i) Starting year of study: Late 2017 or early 2018</u></p> <p>(ii) Starting year of construction: _____</p> <p>(iii) Starting year of operation: _____</p>

13. Compliance with Development Visions	(Answer all and mark with <u>BOLD AND UNDERLINE</u>) (i) National Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization's Dev't Plan: YES PARTLY NO
14. Social Economic Impact	NONE
15. Environmental Impact	NONE

Source: JICA Study Team

RD-1 : Over Pass and Intersections Project

1. Program Title	(i) Urban transport development program
2. Project Title	Over Pass and Intersections Project
3. Project Map	
4. Background	<p>In the metropolitan area has expanded irregularly concentrating traffic on the Juan Pablo II, North Road, Suburban Road, Masaya Road and South Road, however, there are ways that need to connect to these main axes through intersections, In addition the old equipment must be renewed. In order to have greater fluidity in these routes are being considered some steps to unevenness; however, these have to contemplate among their geometry the incorporation of the massive transport systems.</p> <p>There have also been many black spots of accidents with more than 100 accidents in the last 10 years.</p> <p>This Master Plan recommends the renewal of intersections with improvement of design, signage and incorporation of new equipment. They have short, medium and long-term projects. For the Case of the Levels of Difference, the traffic studies must be done to</p>

	determine the type of exchange to be implemented at the point.																																																																																																																														
5. Objective	Improve intersections with redesign, new signage and intelligent traffic lights. Evaluate and implement the best solutions in Road Interchanges, giving priority to mass transport systems.																																																																																																																														
6. Project Overview	<p>In the Road Plan not only need to create new routes, carry out extensions and improvements of the existing network, but it is necessary to make better connections and the crossings should have some segregation that according to the vehicular volumes a design of Exchanges a Level, to improve the signaling, geometry and placement of traffic lights of greater technology.</p> <p>When the volumes of the crossing are very important in both directions it is necessary the placement of steps to unevenness. In the cases of the avenues that make up the vials rings such as the Juan Pablo II and Suburban Road, it is necessary to contemplate in the designs of the intersections and uneven passage the incorporation of the segregated corridors and with free heights suitable for the passage of the Mass transit buses. In this project improvements and construction have been identified in 44 intersections and the attention of 4 medium and long-term projects is being foreseen respectively.</p> <p><u>Projects of Intersections to level, SemafORIZADAS and Overpass:</u></p> <table border="1"> <thead> <tr> <th>N o</th> <th>Cod e</th> <th>PROJECTS</th> <th>DESCRIPTION</th> <th>LOCATION</th> <th>LENGTH (km)</th> <th>STATUS</th> <th>ESTIMATED COST</th> <th>Current Demand</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>I1</td> <td>Avenida Bolívar (Esc. De Manejo la Profesional)</td> <td>Installation of intelligent traffic lights and road signs</td> <td>Avenida Bolívar (Esc. 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De Manejo la Profesional)	Installation of intelligent traffic lights and road signs	Avenida Bolívar (Esc. De Manejo la Profesional)	1	Corto Plazo	500,000	20,000	2	I2	Memorial Sandino	Construcción de paso deprimido de E-W	Intersección Pista Suburbana y Pista Naciones Unidas	1	Mediano Plazo	6,000,000	40,000	3	I3	Linda Vista (35 Avenida - Paseo Las Brisas	Construction of Interchange	Int, 35 Avenida Oeste-Paseo las Brisas	0.3	Corto Plazo	2,500,000	20,000	4	I4	Larreynaga -Pista Buenos Aires (San Jacinto)	Construction of Interchange	Intersección Pista Buenos Aires -Pista Larreynaga	0.3	Mediano Plazo	3,500,000	20,000	5	I5	48 Rotonda Semáforos Iván Montenegro	Construction of Interchange	Diamante Buenos Aires - La Sabana. Carretera 2º orden	0.3	Mediano Plazo	3,796,300	20,000	6	I6	49 Rotonda Semáforos del Mercado Mayoreo	Construction of Interchange	Cruce en "T" La Sabana - El Mayoreo. Carretera 2º orden	0.3	Corto Plazo	3,796,300	20,000	7	I7	LA SUBASTA	Construction of Overpass	Intersección carretera Norte y Pista El Mayoreo	1,00	Largo Plazo	8,000,000	40,000	8	I8	59 Rotonda intersección Barrio Santa Rosa	Construction of Interchange	Intersección Las Américas. Pista de la Solidaridad	0.3	Corto Plazo	3,796,300	20,000	9	I9	61 Rotonda Entrado barrio La Primavera	Construction of Interchange	Intersección Buenos Aires con Carretera Norte (Panamericana)	0.3	Corto Plazo	3,796,300	20,000	10	I11	Altagracia 1	Installation of intelligent traffic lights and road signs	Altagracia 1	1	Corto Plazo	500,000	20,000	11	I12	Altagracia 2 (RACACHACA)	Installation of intelligent traffic lights and road signs	Altagracia 2 (RACACHACA)	1	Corto Plazo	500,000	20,000	12	I13	Altagracia 3	Installation of intelligent traffic lights and road signs	Altagracia 3	1	Corto Plazo	500,000	20,000	13	I14	Banco Popular	Installation of intelligent traffic lights and road signs	Banco Popular	1	Corto Plazo	500,000	20,000
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14	I15	Intersección Cementerio Central (La Ceibita)	Installation of intelligent traffic lights and road signs	Diagonal de Los Martires (Rafael Bermudez)	1	Corto Plazo	500,000	20,000
15	I16	Intersección Centro_Comercial Altamira	Installation of intelligent traffic lights and road signs	Pista de la Solidaridad y Altamira	1	Corto Plazo	500,000	20,000
16	I17	El Cortijo 2	Installation of intelligent traffic lights and road signs	Pista Benjamin Zeledon y Vía urbana	1	Corto Plazo	500,000	20,000
17	I18	Calle El Triunfo -Benjamin Zeledón	Installation of intelligent traffic lights and road signs	Calle El Triunfo -Benjamin Zeledón	1	Corto Plazo	500,000	20,000
18	I19	El Recreo	Installation of intelligent traffic lights and road signs	El Recreo	1	Corto Plazo	500,000	20,000
19	I20	Estatua Monseñor Lezcano	Installation of intelligent traffic lights and road signs	Estatua Monseñor Lezcano	1	Corto Plazo	500,000	20,000
20	I21	La Ceibita (Benjamin Zeledón - Camino Viejo a León)	Installation of intelligent traffic lights and road signs	La Ceibita (Benjamin Zeledón - Camino Viejo a León)	1	Corto Plazo	500,000	20,000
21	I22	Villa progreso (RUPAP)	Installation of intelligent traffic lights and road signs	Intersección de Pista Suburbana-entrada a al RUPAP,Larreynaga	0.3	Corto Plazo	500,000	20,000
22	I23	Intersección Poder_Judicial	Installation of intelligent traffic lights and road signs	Nic-1 y 3a Avenida NE y Vía urbana	1	Corto Plazo	500,000	20,000
23	I24	Intersección Poder_Judicial1	Installation of intelligent traffic lights and road signs	5a Avenida NE	1	Corto Plazo	500,000	20,000
24	I25	Villa fontana	Construction of Overpass	Intersección Pista Suburbana y camino Viejo a las Nubes	1,00	Mediano Plazo	7,000,000	40,000
25	I26	Intersección Unión_Soviética	Installation of intelligent traffic lights and road signs	Pista de la Solidaridad y Vía urbana	1	Corto Plazo	500,000	20,000
26	I27	Intersección del Memorial Sandino	Installation of intelligent traffic lights and road signs	11 Av. Suroeste con Pista Suburbana	1	Corto Plazo	500,000	20,000
27	I28	Pista Larreynaga -Carretera Norte	Construction of Interchange	Intersección Pista Larreynaga -Carretera Norte	0.3	Corto Plazo	3,500,000	20,000
28	I29	El Guanacaste (Carretera Sur - Pista Benjamin Zeledón)	Construction of Interchange	intersección Pista Benjamin Zeledón- Carretera Sur (wallmart)	0.3	Corto Plazo	3,500,000	20,000
29	I30	Pista Larreynaga -Mayoreo	Construction of Interchange	Intersección Pista Larreynaga-Pista El Mayoreo	0.3	Mediano Plazo	3.400.000	20,000
30	I31	La Tenderí (P, Larreynaga-Migración)	Construction of Interchange	Intersección Pista Larreynaga -Avenida Xolotlán	0.3	Mediano Plazo	2,500,000	20,000
31	I32	Intersección Antigua PEPSI	Construction of Interchange	Int, Carretera Norte-Ave, Xolotlán	0.3	Mediano Plazo	3,800,000	20,000
32	I33	CLUB TERRAZA	Construction of Interchange	Int, Pista Jean Paul Genie-Camino viejo a las Nubes.	0.3	Mediano Plazo	3,796,300	20,000
33	I34	Intersección Camino Viejo a Santo Domingo -Pista Jean Paul Genie	Construction of Interchange	Intersección Camino Viejo a Santo Domingo -Pista Jean Paul Genie (Rest, El Establo)	0.3	Mediano Plazo	3,500,000	20,000

	34	I35	Rotonda Centroamérica	Third level overpass	En el mismo sitio de rotonda existente	1,00	Largo Plazo	6,000,000	40,000	
	35	I36	Intersección Hospital del Niño	Construction of Overpass	Intersección Pista Suburbana -Pista El Dorado	1,00	Mediano Plazo	6,000,000	40,000	
	36	I37	Mercado Roberto Huembes	Construction of Overpass	Intersección Pista Suburbana -Avenida Las Fuentes	1,00	Mediano Plazo	6,000,000	40,000	
	37	I38	Rotonda Jean Paul Genie	Construction of Overpass	Intersección Pista Jean Paul Genie -Carretera a Masaya	1,00	Mediano Plazo	8,000,000	40,000	
	38	I39	Suburbana-Carretera Sur (BANCENTRO)	Construction of Overpass from east to south	Intersección carretera Sur con Pista Suburbana	1	Mediano Plazo	6,000,000	40,000	
	39	I40	Hospital Militar (Jonathan González PETRONIC)	Construction of Overpass	Intersección Avenida Bolívar -Pista Benjamin Zeledón	1,00	Mediano Plazo	6,000,000	40,000	
	40	I41	LOZELSA (HOSP. CENTRAL)	Construction of Overpass	Intersección Pista Suburbana y Radial Santo Domingo	1,00	Mediano Plazo	6,000,000	40,000	
	41	I42	Naciones Unidas	Construction of Overpass	Intersección Paseo Naciones Unidas (Carretera a Masaya) -25 calle suroeste	1,00	Largo Plazo	3,000,000	40,000	
	42	I43	UNIVERSITARIA	Construction of Overpass	Intersección Pistas Suburbana y Avenida Bolívar	1,00	Mediano Plazo	6,000,000	40,000	
	43	I44	Camino de Bolas (Entrada Parque de Ferias)	Construction of Overpass	Intersección Pista suburbana y camino de Bolas	1	Mediano Plazo	6,000,000	40,000	
	44	I45	Puente 46 Ciudad Sandino	Construction of Overpass	46 Nic-46	1,00	Mediano Plazo	6,000,000	40,000	
	45		Pasos a Desnivel a Mediano Plazo	Construction of Overpass	En Managua	2	Mediano Plazo	20,000,000	40,000	
	46		Pasos a Desnivel a Largo Plazo	Construction of Overpass	En Managua	3	Largo Plazo	45,000,000	40,000	
	47		Paquete de Mejoramiento de Intersecciones Existentes	Installation of intelligent traffic lights and road signs	En Managua	50	Mediano Plazo	25,000,000	20,000	
	48		Paquete de Mejoramiento de Intersecciones Existentes	Installation of intelligent traffic lights and road signs	En Managua	50	Largo Plazo	25,000,000	20,000	
						TOTAL	128.2		251,281,500	1,280,000
7. Project Component	<p>1) Preinvestment Study (1-1) Pre-investment study at the Profile, Prefeasibility and Feasibility level when applicable according to the level of investment (2) Definitive Engineering Studies (2-1) Road Improvement Program (2-2) Extension Program (3) Implementation of Programs (3-1) Construction and Supervision of Road Improvement Works (3-2) Construction and Supervision of Extension Works</p>									
8. Regulating Organization	<p><u>ALMA: Dirección General de Proyectos, Dirección General de Infraestructura, Dirección General de Medio Ambiente y Urbanismo</u> <u>Policía Nacional: Departamento de Ingeniería de Tráfico</u></p>									

9. Implementation Organization (list all)	<u>ALMA: Dirección General de Proyectos, Dirección General de Infraestructura, Dirección General de Medio Ambiente y Urbanismo</u> <u>Policía Nacional: Departamento de Ingeniería de Tráfico</u>																												
10. Cost	<p>Total Cost: USD <u>307</u> Million Construction: USD <u>254.7</u> Million O&M: USD <u>2.55</u> Million / year (for 10 years)</p> <table border="1" data-bbox="392 533 1233 913"> <thead> <tr> <th>USD Million</th> <th>Short term (2017–2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>35,509,000</td> <td>166,650,000</td> <td>104,800,000</td> </tr> <tr> <td>Pre investment Study (Engineering Studies)</td> <td>440,000</td> <td>2,000,000</td> <td>1,300,000</td> </tr> <tr> <td>(Construction)</td> <td>880,000</td> <td>4,000,000</td> <td>2,600,000</td> </tr> <tr> <td>(Supervisión of Works)</td> <td>29,389,000</td> <td>138,300,000</td> <td>87,000,000</td> </tr> <tr> <td>(O&M)</td> <td>1,800,000</td> <td>8,300,000</td> <td>5,200,000</td> </tr> <tr> <td></td> <td>3,000,000</td> <td>13,800,000</td> <td>8,700,000</td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	35,509,000	166,650,000	104,800,000	Pre investment Study (Engineering Studies)	440,000	2,000,000	1,300,000	(Construction)	880,000	4,000,000	2,600,000	(Supervisión of Works)	29,389,000	138,300,000	87,000,000	(O&M)	1,800,000	8,300,000	5,200,000		3,000,000	13,800,000	8,700,000
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11. Revenue Collection	<u>Not Possible</u>																												
12. Possible Fund Source	<u>Own resources ALMA, MTI, ODA (Technical Cooperation) JICA, IDB, BIRF, BCIE, BEI, CAF, other donors.</u>																												
13. Timing of Implementation	<p><u>(I) Short: 2017 -2020</u> (i) Starting year of study: <u>2017 - 2020</u> (ii) Starting year of construction: <u>2018 - 2022</u> (iii) Starting year of operation: <u>2019 - 2020</u></p> <p><u>(II) Middle: 2020 – 2030</u> (i) Starting year of study: <u>2020 - 2023</u> (ii) Starting year of construction: <u>2021 – 2024</u> (iii) Starting year of operation: <u>2022 - 2026</u></p> <p><u>III) Long: 2030 – 2040</u> (i) Starting year of study: <u>2030 - 2033</u> (ii) Starting year of construction: <u>2031 – 2034</u> (iii) Starting year of operation: <u>2032 - 2036</u></p>																												
14. Compliance with Development Visions	(i) National Development Plan: <u>YES</u> PARTLY NO (ii) Sector Development Plan: <u>YES</u> PARTLY NO (iii) Implementation Organization’s Dev’t Plan: <u>YES</u> PARTLY NO																												
15. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>1’280,000 persons (320,000 households)</u> ● Current demand gap: <u>800,000 persons</u> ● Additional supply volume from the project (No. or % of the gap): <u>40%</u> ● Qualitative Assessment: HIGH <u>MIDDLE</u> LOW (Describe why: <u>Reduction of travel time because there will be increased cross-sections and intelligent traffic lights, connection will be made in areas not served,</u> 																												

	<u>in addition is expected reduction of traffic accidents at traffic lights intersections)</u>
16. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE LOW (Describe why: <u>Redesign and extension of the already developed area</u>) ● Social Environment Impact: HIGH MIDDLE LOW (Describe why: <u>There are not resettlements</u>)

Source: JICA Study Team

RD-2 : Road Improvement Project and Road Extension Project

1. Program Title	(i) Urban transport development program
2. Project Title	Road Improvement Project Road Extension Project
3. Project Map	
4. Background	<p>The urban area of Managua has not maintained a continuity of the regulated hierarchy, that is to say, arteries, collectors, on which they have an established track width. This has been evidenced with the study of speeds where here are the sections of low speeds and bottlenecks. Where speeds less than 10 Kph.</p> <p>Since there are no connecting and alternate ways, the whole vehicular flow is agglomerated in the main radial tracks and the rings 2 and 3. There are no express routes, in addition only 80% of the distribution and primary collector channels have been completed since the previous planning and the growth has been greater</p> <p>This Master Plan recommends the expansion of roads to increase road capacity, because most of the network are only two lanes, as well as make improvements in geometry and incorporates semaphores and signage. They have short, medium and long-term projects.</p>
5. Objective	Improve and expand the existing road network in a complementary manner, in addition to greater interconnection between districts within the Metropolitan area and the new areas being consolidated, also expansion for the circulation of regular buses.
6. Project Overview	In this project they are going to realize extensions in the ways, that is to say, to increase rails in some cases and others to extend the length of the tracks. Likewise, improvements will be made at the level of road geometry and pavements, as well as renew the intersections in the sections with

new traffic lights and signage. We have identified 18 Road Improvement projects and 10 Road Extension projects, which are shown below and can be located on the Map.

Road Improvement Project:

No	Code	PROJECT	DESCRIPTION	LOCATION	LENGTH (Km)	STATUS	ESTIMATED COST	Actual Demand
1	M1	Alterna Carretera Las Nubes	Change the pavement structure and drainage system. road signs	Desde Pedro Obando a Vía de Evitamiento	6.8	Mediano Plazo	14,000,000	20,000
2	M2	Av. Gabriel Cardenal	Change the pavement structure and drainage system. road signs	Desde Pista Suburbana hasta Pedro Obando	1.2	Mediano Plazo	3,000,000	20,000
3	M3	Carretera a Las Nubes	Change the pavement structure and drainage system. road signs	J.P.Gennie y Vía Evitamiento	4.1	Mediano Plazo	8,000,000	20,000
4	M4	Cuarto Anillo	Change the pavement structure and drainage system. road signs	Desde la Pista Larreynaga hasta la Av. Bolívar	14.63	Mediano Plazo	35,000,000	40,000
5	M5	3a Avenida NE	Improvement of the entire road with signaling and geometry	Carretera Sur a Las Piedrecitas	1.8	Mediano Plazo	3,600,000	10,000
6	M6	35a Avenida So	Construction of 1 roundabout. Semaphorization of 3 intersections. road signs	Desde calle El Triunfo hasta ENACAL	2.95	Corto Plazo	30,000,000	100,000
7	M7	3ra Avenida Sur Este	Semaphorization of 4 intersections. And road signs	Desde Dupla Norte a Calle Colón	0.65	Corto Plazo	6,000,000	20,000
8	M8	Ciudad Belén / Carretera Norte (3.6 km)	Improvement of the entire road with signaling and geometry	La Sabana con Carretera Norte	4.2	Corto Plazo	8,000,000	10,000
9	M9	Enel Central - Rigoberto López	Road improvement and connection with ring road	Mejoramiento de la conexión de Pista Juan Pablo II con Pista Suburbana	4.7	Corto Plazo	9,000,000	20,000
10	M10	Pista Sabana grande	Improvement of 8 intersections with intelligent signaling and signaling	De rotonda Rubenia a Sabana grande	7.41	Corto Plazo	30,000,000	10,000
11	M11	Calle El Triunfo	Change the pavement structure and drainage system. road signs	Desde la 35 avenida suroeste hasta la Avenida Bolívar	3.379	Mediano Plazo	15,000,000	20,000
12	M12	Camino a San Isidro de Bolas	Road improvement and connection with ring road	Desde Pista Suburbana pista de circunvalación	4.9	Mediano Plazo	22,500,000	20,000
13	M13	Pista Benjamín Zeledón	Construction of 1 roundabout. Intelligent traffic light and signaling at 9 intersections	Desde Intersección Calle el Triunfo a Intersección con Carretera a Masaya	5.041	Corto Plazo	20,000,000	50,000
14	M14	Pista Naciones Unidas	Change the pavement structure and drainage system. road signs	Rotonda El Güegüense a rotonda El periodista	1.17	Mediano Plazo	11,700,000	20,000
15	M15	Camino a San Isidro de la Cruz Verde	Change the pavement structure and drainage system. road signs	Desde Pista Jean Paul Genie Pista de circunvalación	4.25	Mediano Plazo	22,500,000	20,000
16	M16	Carretera Norte	Improvement of the entire road with signaling and geometry	De Dupla Norte hacia el Aeropuerto	8.5	Corto Plazo	20,000,000	170,000
17	M17	Carretera Masaya	Road improvement and connection with ring road	R. J.P.Gennie-R. Ticuantepe	7.5	Mediano Plazo	15,000,000	50,000
18	M18	Santo Domingo / Roberto Huembés (2.4 km)	Improvement of the entire road with signaling and geometry	Conexión JPII y Pista La Solidaridad	2.65	Mediano Plazo	5,500,000	10,000
TOTAL					85.83		278,800,000	610,000

Road Extension Projects:

No	Code	PROJECT	DESCRIPTION	LOCATION	LENGTH (Km)	STATUS	ESTIMATED COST	Actual Demand	
1	A1	Rotonda_ElPeriodista_ ElGueguense	Extension and intersection improvements	Desde la Rotonda El Periodista hasta El Gueguense	1.265	Corto Plazo	15,000,000	20,000	
2	A2	5a Avenida SE	Extension and intersection improvements	Desde Dupla Norte hasta Calle Colón	1.305	Mediano Plazo	16,000,000	10,000	
3	A3	Pista Suburbana	Extension of 4 to 6 lanes. Construction of 7 overpasses	Desde Carretera Sur a Intersección Portezuelo	12.833	Mediano Plazo	205,328,000	240,000	
4	A4	Pista El Mayoreo	Extension of 2 to 4 lanes. Construction of 1 overpass	Intersección sabana grande a Intersección la Subasta Carretera Norte	2.98	Corto Plazo	24,390,000	10,000	
5	A5	Centroamérica_Rotonda _LaVirgen	Extension and intersection improvements	Desde Carretera Masaya hasta Pista Suburbana	2.65	Corto Plazo	25,000,000	20,000	
6	A6	Pista_Larreynaga_ CiudadBelén_GaritaTipitapa	Extension and intersection improvements	Desde la Pista Larreynaga hasta Carretera Norte	6.76	Mediano Plazo	70,000,000	10,000	
7	A7	Carretera Norte	Extension and intersection improvements	Desde la Dupla hasta la Intersección de la Antigua PEPSI	1.58	Mediano Plazo	15,800,000	20,000	
8	A8	Pista Jean Paul Genie	Extension of 4 lanes with widths from 2.75m to 3.50m. Construction of 2 roundabouts. Smart traffic lights and road signs	Desde la UNAN a Carretera a Masaya	2.77	Mediano Plazo	26,900,000	100,000	
9	A9	25 Calle Suroeste	Construction of 4 lane track. 1 overpass and 4 traffic lights intersections	De Pista El Recreo a Carretera a Masaya	2.94	Mediano Plazo	26,460,000	20,000	
10	A10	Avenida Bolívar	Extension of 4 to 6 lanes. Construction of 1 overpass	Desde Hospital Militar hasta la Pista de Circunvalación	8.6	Mediano Plazo	80,000,000	20,000	
					TOTAL		504,878,000	470,000	
7. Project Component	<p>1) Preinvestment Study (1-1) Pre-investment study at the Profile, Prefeasibility and Feasibility level when applicable according to the level of investment (2) Definitive Engineering Studies (2-1) Road Improvement Program (2-2) Extension Program (3) Implementation of Programs (3-1) Construction and Supervision of Road Improvement Works (3-2) Construction and Supervision of Extension Works</p>								
8. Regulating Organization	<p><u>ALMA: Dirección General de Proyectos, Dirección General de Infraestructura, Dirección General de Medio Ambiente y Urbanismo</u> <u>MTI: División general de Planificación, Dirección General de Vialidad</u></p>								
9. Implementation Organization (list all)	<p><u>ALMA: Dirección General de Proyectos, Dirección General de Infraestructura, Dirección General de Medio Ambiente y Urbanismo</u> <u>MTI: División general de Planificación, Dirección General de Vialidad</u></p>								
10. Cost	<p>Total Cost: USD <u>944.6</u> Million Construction: USD <u>783.2</u> Million</p>								

	O&M: USD <u>7.83</u> Million / year (for 10 years)																												
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13. Timing of Implementation	<p>(I) Short: 2017 -2020</p> <p>(i) Starting year of study : <u>2017 - 2020</u></p> <p>(ii) Starting year of construction : <u>2018 - 2022</u></p> <p>(iii) Starting year of operation : <u>2019 - 2020</u></p> <p>(II) Middle: 2020 – 2030</p>																												

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14. Compliance with Development Visions	(i) National Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization's Dev't Plan: YES PARTLY NO
15. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>1'000,000 persons (250,000 households)</u> ● Current demand gap: <u>700,000 persons</u> ● Additional supply volume from the project (No. or % of the gap): <u>30%</u> ● Qualitative Assessment: HIGH MIDDLE LOW (Describe why: <u>Reduction of travel time because traffic lanes will be increased, bus lanes will be included, connection will be made in unattended areas</u>)
16. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE LOW (Describe why: <u>Redesign and extension of the already developed area</u>) ● Social Environment Impact: HIGH MIDDLE LOW (Describe why: <u>There are not many resettlements</u>)

Source: JICA Study Team

RD-3 : New Bypass Project

1. Program Title	(i) Urban transport development Program
2. Project Title	New Bypass Project
3. Project Map	<p>ROAD PROJECTS FOR THE CITY OF MANAGUA</p> <p>Legend</p> <ul style="list-style-type: none"> New_Bypass all other values calles_ciudadasandino_181816 M_Orientalt CCHH
4. Background	In the center of the Metropolitan area conformed to ring 3 (Suburban Track), there are no alternate routes connecting East-West and South. The Conurbation between Ciudad Sandino and Managua is given but its flows converge the zone of the Cuesta of the lead and the South Road, therefore, it is interesting to give continuity to the Track Juan Pablo II by the West. Also, the

	<p>South zone requires an alternative route of the Masaya Highway.</p> <p>This Master Plan recommends the consolidation of new ways to complete the rings and radial that has not been completed by the growth that has occurred without much control.</p>																																																																																																																																							
5. Objective	Design and build new avenues in the metropolitan area that give continuity to some and interconnect with others.																																																																																																																																							
6. Project Overview	<p>En el Área Metropolitana se encuentran muchas vías sin conexión que sirvan para integrar de manera longitudinal y Transversal, además de servir como vías alternas a las colectoras y arteriales actuales, los volúmenes vehiculares se concentran sobre las vías principales sin embargo, de acuerdo a los estudios de tráfico, las vías ya no se dan abasto y es difícil las ampliaciones, es por ello se hace necesario crear nuevas alternativas. Por otro lado, se están considerando nuevos Centros de Desarrollo por lo tanto, estos deben estar muy bien integrados a la vialidad existente. En este proyecto se han considerado 13 nuevas vías que complementan con los nuevos proyectos que está desarrollando también el Ministerio de Transporte e Infraestructura (MTI).</p> <p><u>Proyecto de Nuevas Vías:</u></p> <table border="1"> <thead> <tr> <th>No</th> <th>Code</th> <th>PROJECTS</th> <th>DESCRIPTION</th> <th>LOCATION</th> <th>LENGHT (Km)</th> <th>STATUS</th> <th>ESTIMATED COST</th> <th>Current Demand</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>N1</td> <td>Circunvalación Oeste</td> <td>Track Construction linking NIC12 and NIC 28</td> <td>Entre Managua y Ciudad Sandino</td> <td>9</td> <td>Largo Plazo</td> <td>80,000,000</td> <td>20,000</td> </tr> <tr> <td>2</td> <td>N2</td> <td>Acceso Centro Servicios Oriental</td> <td>Construction Collector Access to New Sub Urban Center</td> <td>Conexión entre la Pista Larreynaga y la Carretera Norte</td> <td>1.6</td> <td>Mediano Plazo</td> <td>20,000,000</td> <td>20,000</td> </tr> <tr> <td>3</td> <td>N3</td> <td>Colectora</td> <td>Construction of Alternate Track to NIC 12</td> <td>Vía Alternativa a Nic 12</td> <td>5.2</td> <td>Largo Plazo</td> <td>52,000,000</td> <td>40,000</td> </tr> <tr> <td>4</td> <td>N4</td> <td>Colectora_CS</td> <td>Connection Track Construction</td> <td>Conexión Oeste de Managua a Ciudad Sandino</td> <td>5.7</td> <td>Largo Plazo</td> <td>57,000,000</td> <td>30,000</td> </tr> <tr> <td>5</td> <td>N5</td> <td>Centro de Conocimiento Avanzado</td> <td>Construction Collector Access to New Sub Urban Center</td> <td>Conecta la Pista Suburbana con la J.P.Gennie</td> <td>0.762</td> <td>Mediano Plazo</td> <td>8,000,000</td> <td>10,000</td> </tr> <tr> <td>6</td> <td>N6</td> <td>Centro de Servicios Occidental</td> <td>Construction Collector Access to New Sub Urban Center</td> <td>Conecta la Pista Suburbana con la Juan Pablo II, Alternativa a Carretera Sur</td> <td>1.2</td> <td>Mediano Plazo</td> <td>15,000,000</td> <td>20,000</td> </tr> <tr> <td>7</td> <td>N7</td> <td>Conexión Sur</td> <td>Construction of Track joining Av. Martyrs 1st May with the Highway to Veracruz</td> <td>Vía Alternativa a la Carretera Masaya</td> <td>11.7</td> <td>Largo Plazo</td> <td>100,000,000</td> <td>50,000</td> </tr> <tr> <td>8</td> <td>N8</td> <td>Prolongación Oeste de Jean P. Gennie</td> <td>Construction of Track J.P.Genie</td> <td>unirá J. P.Gennie desde Carretera Masaya con Av. 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7. Project Component	<p>1) Preinvestment Study</p> <p>(1-1) Pre-investment study at the Profile, Prefeasibility and Feasibility level when applicable according to the level of investment</p> <p>(2) Definitive Engineering Studies</p> <p>(2-1) Road Improvement Program</p> <p>(2-2) Extension Program</p> <p>(3) Implementation of Programs</p> <p>(3-1) Construction and Supervision of Road Improvement Works</p> <p>(3-2) Construction and Supervision of Extension Works</p>																												
8. Regulating Organization	<p><u>ALMA: Dirección General de Proyectos, Dirección General de Infraestructura, Dirección General de Medio Ambiente y Urbanismo</u></p> <p><u>MTI: División general de Planificación, Dirección General de Vialidad</u></p>																												
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10. Cost	<p>Total Cost: USD <u>821.9</u> Million</p> <p>Construction: USD <u>682</u> Million</p> <p>O&M: USD <u>6.82</u> Million / year (for 10 years)</p> <table border="1" data-bbox="391 981 1232 1361"> <thead> <tr> <th>USD Million</th> <th>Short term (2017–2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td></td> <td>148,250,000</td> <td>673,610,000</td> </tr> <tr> <td>Pre Investment Study</td> <td></td> <td>1,850,000</td> <td>8,400,000</td> </tr> <tr> <td>(Engineering Studies)</td> <td></td> <td>3,700,000</td> <td>16,770,000</td> </tr> <tr> <td>(Construction)</td> <td></td> <td>123,000,000</td> <td>559,000,000</td> </tr> <tr> <td>(Supervisión of Works)</td> <td></td> <td>7,400,000</td> <td>33,540,000</td> </tr> <tr> <td>(O&M)</td> <td></td> <td>12,300,000</td> <td>55,900,000</td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost		148,250,000	673,610,000	Pre Investment Study		1,850,000	8,400,000	(Engineering Studies)		3,700,000	16,770,000	(Construction)		123,000,000	559,000,000	(Supervisión of Works)		7,400,000	33,540,000	(O&M)		12,300,000	55,900,000
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11. Revenue Collection	<u>Not Possible</u>																												
12. Possible Fund Source	<u>Own resources ALMA, MTI, ODA (Technical Cooperation) JICA, IDB, BIRF, BCIE, BEI, CAF, other donors.</u>																												
13. Timing of Implementation	<p><u>(I) Short: 2017 -2020</u></p> <p>(i) Starting year of study: <u>2017 - 2020</u></p> <p>(ii) Starting year of construction: <u>2018 - 2022</u></p> <p>(iii) Starting year of operation: <u>2019 - 2020</u></p> <p><u>(II) Middle: 2020 – 2030</u></p> <p>(i) Starting year of study: <u>2020 - 2023</u></p> <p>(ii) Starting year of construction: <u>2021 – 2024</u></p> <p>(iii) Starting year of operation: <u>2022 - 2026</u></p> <p><u>(II) Long: 2030 – 2040</u></p> <p>(i) Starting year of study: <u>2030 - 2033</u></p> <p>(ii) Starting year of construction: <u>2031 – 2034</u></p>																												

	(iii) Starting year of operation: <u>2032 - 2036</u>
14. Compliance with Development Visions	(i) National Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization's Dev't Plan: YES PARTLY NO
15. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>420,000 persons (105,000 households)</u> ● Current demand gap: <u>210,000 persons</u> ● Additional supply volume from the project (No. or % of the gap): <u>50%</u> ● Qualitative Assessment: HIGH MIDDLE LOW (Describe why: <u>Reduction of travel time because new roads will be increased and alternate to the main trunks that are supporting the highest traffic</u>)
16. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE LOW (Describe why: <u>Design and extension of the already developed area</u>) ● Social Environment Impact: HIGH MIDDLE LOW (Describe why: <u>There are not many resettlements</u>)

Source: JICA Study Team

PT-1 : Urban public bus reorganization project

1. Program Title	(ii) Urban transport development program
2. Project Title	Urban public bus reorganization project
3. Project Map	
4. Background	<p>Traffic survey and traffic demand forecast revealed the fact that there are areas with high volume of traffic demand but without service of urban public bus. There are even passengers who are using intercity buses for their mobilization inside the city. In addition, the interview survey revealed the remarkable concerns by the citizens on comfortability and security of the existing bus services.</p> <p>Accordingly the reinforcement of public transport network is a crucial needs of the city, and the reorganization of existing bus network for the unserved areas shall be an important measure to be taken.</p>
5. Objective	<ul style="list-style-type: none"> - To serve the populated area inside the city with urban public buses - To improve the quality of service of urban public buses - All above to reduce the total volume of traffic in the city
6. Project Component	<p>(i) Reorganization of urban public bus network (ii) Increase (500) and improvement (835) of fleets All above to be done by new or renewed concession contract</p>

	<p>(1) Detailed study for reorganization (1-1) Route plan, operation plan (1-2) Financial plan including tariff system analysis (1-3) Consultation with existing concessioners (2) Conclusion of new or renewed contracts and operation</p>																
7. Regulating Organization	<p>Organization: ALMA Division/Department in charge: IRTRAMMA</p>																
8. Implementation Organization (list all)	<p>Organization: ALMA Division/Department in charge: IRTRAMMA</p>																
9. Cost	<p>Total Cost: USD <u>41.2</u> Million <i>(describe the break down if possible such)</i> Study: USD <u>0.2</u> Million Procurement: USD <u>41</u> Million <i>(describe the breakdown by period if possible)</i></p> <table border="1"> <thead> <tr> <th>USD Million</th> <th>Short term (2017 – 2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>41.2</td> <td></td> <td></td> </tr> <tr> <td>(study)</td> <td>0.2</td> <td></td> <td></td> </tr> <tr> <td>(procurement)</td> <td>41</td> <td></td> <td></td> </tr> </tbody> </table>	USD Million	Short term (2017 – 2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	41.2			(study)	0.2			(procurement)	41		
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10. Revenue Collection	<p>(i) Possible: USD <u>40-50</u> Million</p>																
11. Possible Fund Source	<p>ALMA, PRIVATE, ODA (Grant), ODA(Loan), ODA(Technical Assistance),</p>																
12. Timing of Implementation	<p>(i) Starting year of study : 2017 (ii) Starting year of operation : 2018</p>																
13. Compliance with Development Visions	<p>(i) National Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization's Dev't Plan: YES PARTLY NO</p>																
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>Whole citizens in Managua</u> ● Current demand gap: <u>15,140 passengers/day</u> <u>*passengers using intercity bus for mobilization inside the city</u> ● Additional supply volume from the project (No. or % of the gap): <u>400,000 passengers/day</u> ● Qualitative Assessment: HIGH MIDDLE LOW (Describe why: <u>Less traffic congestion, less traffic accidents, more accessibility for citizens</u>) → Impact on economic inequality, disabled persons, etc. 																
15. Environmental Impact	<p><i>(Choose and Describe)</i></p> <ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE LOW (Describe why: <u>Reduction of congestion and vehicles ...large positive impact</u>) → Impact on air quality, water, flora, etc. 																

	<ul style="list-style-type: none"> ● Social Environment Impact: HIGH MIDDLE LOW (Describe why: <u>More people will have a access to quality service. Possible price increase may disfavor the low-income population</u>) → Impact on social demography, resettlement, etc.
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Source: JICA Study Team

PT-2 : Bus terminal relocation Project

1. Program Title	(ii) Urban transport development program
2. Project Title	Bus terminal relocation project
3. Project Map	<p>— Carreteras intermunicipales principales ★ Existente (intermunicipal) ★ Existente (internacional) ● Propuesta ● Centro urbano</p>
4. Background	<p>Today the bus terminals are located inside the city without appropriate arrangement to ease the traffic congestion around the terminals. And these locations might be increasing the unnecessary traffic inside the city.</p> <p>Along with the urban development plan that aims to develop city center/subcenters near the fringe of the development area, the intercity bus terminals are planned to be relocated near the center/subcenters. The intercity buses shall accordingly be directed to these terminals and would not get inside the city.</p>
5. Objective	<ul style="list-style-type: none"> - To direct the intercity buses to the fringe of the development area - To facilitate the intercity transport - All above To reduce the total volume of traffic in the city.
6. Project Component	<ol style="list-style-type: none"> (1) Feasibility study for new bus terminals (2) Detailed design (3) Construction (4) Operation and maintenance
7. Regulating Organization	<p>Organization: MTI and ALMA Division/Department in charge: Directorate of land transport</p>
8. Implementation Organization (list all)	<p>Organization: MTI and ALMA Division/Department in charge: Directorate of land transport</p>
9. Cost	<p>Total Cost: USD <u>51.3</u> Million <i>(describe the break down if possible such)</i> Study: USD <u>0.3</u> Million</p>

	<p>Construction: USD _____ 30 _____ Million O&M: USD _____ 1.5 _____ Million / year (for how many years)</p> <p><i>(describe the breakdown by period if possible)</i></p> <table border="1"> <thead> <tr> <th>USD Million</th> <th>Short term (2017–2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td></td> <td>0.3</td> <td></td> </tr> <tr> <td>(Construction)</td> <td></td> <td>30</td> <td></td> </tr> <tr> <td>(O&M)</td> <td></td> <td>6</td> <td>15</td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost		0.3		(Construction)		30		(O&M)		6	15
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Total Cost		0.3															
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(O&M)		6	15														
10. Revenue Collection	(i) Possible: USD _____ 3 _____ Million																
11. Possible Fund Source	MTI, ALMA, ODA (Grant), ODA(Loan)																
12. Timing of Implementation	<p>Priority lane for intercity buses</p> <p>(i) Starting year of study : 2018 (ii) Starting year of design : 2018 (ii) Starting year of construction : 2020 (iii) Starting year of operation : 2022</p> <p>Restriction</p> <ul style="list-style-type: none"> - Starting year of restriction for Ciudad Sandino south access: 2025 (opening year of West terminal) - Starting year of restriction for Nejapa access: 2025 (opening year of West terminal) - Starting year of restriction for Ciudad Sandino north access: 2027 (opening year of Historical center station) - Starting year of restriction for Masaya access: 2027 (opening year of Masaya terminal) - Starting year of restriction for Tipitapa access: 2030 (opening year of East terminal) 																
13. Compliance with Development Visions	<p>(i) National Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization's Dev't Plan: YES PARTLY NO</p>																
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>Whole citizens in Managua and commuters</u> ● Current demand gap: <u>non</u> ● Additional supply volume from the project (No. or % of the gap): <u>no</u> ● Qualitative Assessment: HIGH MIDDLE LOW (Describe why: <u>Less traffic congestion, less traffic accidents</u>) → Impact on economic inequality, disabled persons, etc. 																
15. Environmental Impact	<p><i>(Choose and Describe)</i></p> <ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE LOW (Describe why: <u>Reduction of congestion and vehicles ...large positive impact</u>) → Impact on air quality, water, flora, etc. ● Social Environment Impact: HIGH MIDDLE LOW (Describe why: <u>Some resettlements may occur.</u>) 																

	→ Impact on social demography, resettlement, etc.
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Source: JICA Study Team

PT-3 : Urban Mass Transit Project

1. Program Title	(ii) Urban transport development program
2. Project Title	Urban mass transit project
3. Project Map	
4. Background	Based on the traffic demand forecast, if the current tendency of traffic demand remains same in the future, the road network of the city is supposed to be fully saturated by vehicles. The reinforcement of public transport network is a crucial needs of the city, and the introduction of mass transit systems for the sections with high traffic demand shall be the main measure to be taken.
5. Objective	<ul style="list-style-type: none"> - To connect the sections with high traffic demand (especially new city centers/sub-centers) by mass transit - To absorb the intercity traffic demand at the fringe of the city and let them transfer to urban mass transit - All above to reduce the total volume of traffic in the city.
6. Project Component	<p>(i) 4 routes of urban mass transit</p> <ul style="list-style-type: none"> - Juan Pablo II Line... 11.9km by BRT - Masaya Line ... 11.6km by AGT - Suburbana Line ... 15.0km by AGT - Panamerican Line ... 20.8km by LRT <p>(ii) 3 hub stations (terminals) with intercity connection</p> <ul style="list-style-type: none"> - West terminal station: terminal for intercity buses for south, southwest and west part of the country. Connection with Juan Pablo II Line, Panamerican Line and Suburbana Line - Metropolitan terminal station: terminal for intercity buses for southeast part of the country. Connection with Masaya Line - East terminal station: terminal for intercity buses for east and north part of the country. Connection with Panamerican Line and Suburbana Line <p>(iii) 5 hub stations</p> <ul style="list-style-type: none"> - Historical center station: Panamerican Line + Masaya Line

	<ul style="list-style-type: none"> - Pedro Joaquin station: Panamerican Line + Juan Pablo II Line - Portezuelo station: Panamerican Line + Suburbana Line - UCA station: Masaya Line + Juan Pablo II Line - Centroamerica station: Masaya Line + Suburbana Line <p>(iv) Depot for each line</p> <p>(1) Feasibility study</p> <ul style="list-style-type: none"> (1-1) Mode selection, route plan, operation plan, tariff plan and demand forecast (1-2) Preliminary design and cost estimate (1-3) Connectivity and integration plan with other modes of transport (1-4) Financial analysis <p>(2) Detailed design</p> <p>(3) Construction</p> <p>(4) Operation and maintenance</p>																				
7. Regulating Organization	<p>Organization: ALMA and new institution for transport planning (and MTI for terminals)</p> <p>Division/Department in charge: General directorate of Projects, General directorate of Infrastructure, IRTRAMMA and new institution for transport planning (and Directorate of land transport, MTI)</p>																				
8. Implementation Organization (list all)	<p>Organization: ALMA and new institution for transport planning</p> <p>Division/Department in charge: General directorate of Projects, General directorate of Infrastructure, IRTRAMMA and new institution for transport planning</p>																				
9. Cost	<p>Total Cost: USD <u>2391</u> Million</p> <p><i>(describe the break down if possible such)</i></p> <p>Study: USD <u>10</u> Million</p> <p>Construction: USD <u>1578</u> Million</p> <p>O&M: USD <u>50</u> Million / year (for how many years)</p> <p><i>(describe the breakdown by period if possible)</i></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">USD Million</th> <th style="text-align: center;">Short term (2017–2020)</th> <th style="text-align: center;">Mid term (2021-2030)</th> <th style="text-align: center;">Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td style="text-align: center;">3</td> <td style="text-align: center;">1208</td> <td style="text-align: center;">1180</td> </tr> <tr> <td>(Study)</td> <td style="text-align: center;">3</td> <td style="text-align: center;">6</td> <td style="text-align: center;">1</td> </tr> <tr> <td>(Construction)</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1058</td> <td style="text-align: center;">520</td> </tr> <tr> <td>(O&M)</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1208</td> <td style="text-align: center;">659</td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	3	1208	1180	(Study)	3	6	1	(Construction)	0	1058	520	(O&M)	0	1208	659
USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)																		
Total Cost	3	1208	1180																		
(Study)	3	6	1																		
(Construction)	0	1058	520																		
(O&M)	0	1208	659																		
10. Revenue Collection	<p>(i) Possible: USD <u>80-180</u> Million</p>																				
11. Possible Fund Source	<p>ALMA, PRIVATE, ODA(Loan)</p>																				
12. Timing of Implementation	<p>Juan Pablo II Line + stations + depot</p> <ul style="list-style-type: none"> (i) Starting year of study : 2018 (ii) Starting year of design : 2020 (ii) Starting year of construction : 2022 (iii) Staring year of operation : 2024 <p>Masaya Line + stations + depot</p> <ul style="list-style-type: none"> (i) Starting year of study : 2018 																				

	<p>(ii) Starting year of design : 2020 (ii) Starting year of construction : 2023 (iii) Starting year of operation : 2026</p> <p>Suburbana Line + stations + depot (i) Starting year of study : 2023 (ii) Starting year of design : 2025 (ii) Starting year of construction : 2028 (iii) Starting year of operation : 2031</p> <p>Panamerican Line + stations + depot (i) Starting year of study : 2028 (ii) Starting year of design : 2029 (ii) Starting year of construction : 2033 (iii) Starting year of operation : 2036</p>
13. Compliance with Development Visions	<p>(i) National Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization's Dev't Plan: YES PARTLY NO</p>
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>Whole citizens in Managua</u> ● Current demand gap: <u>15,140 passengers/day</u> <u>*passengers using intercity bus for mobilization inside the city</u> ● Additional supply volume from the project (No. or % of the gap): <u>800,000 passengers/day</u> ● Qualitative Assessment: HIGH MIDDLE LOW (Describe why: <u>Less traffic congestion, less traffic accidents, more accessibility for citizens</u>) → Impact on economic inequality, disabled persons, etc.
15. Environmental Impact	<p>(Choose and Describe)</p> <ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE LOW (Describe why: <u>Reduction of congestion and vehicles ...large positive impact</u>) → Impact on air quality, water, flora, etc. ● Social Environment Impact: HIGH MIDDLE LOW (Describe why: <u>Some resettlements may occur. Price increase may disfavor the low-income population</u>) → Impact on social demography, resettlement, etc.

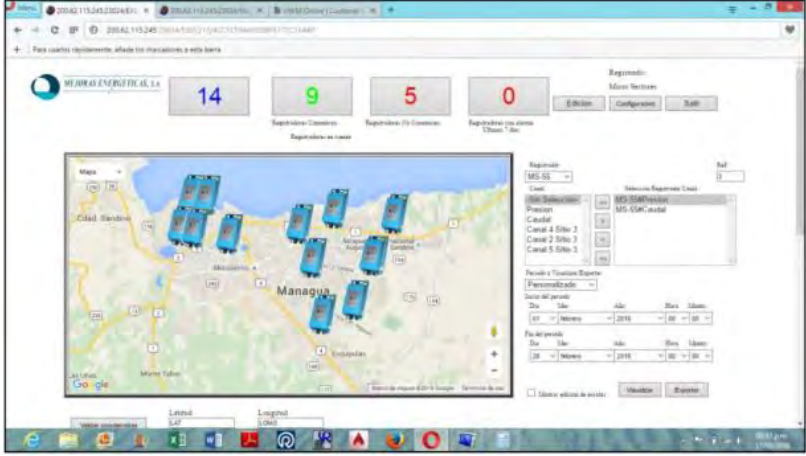
Source: JICA Study Team

5.3 Infrastructure

(1) Water Supply

WS-1 : Technical Assistance for SCADA/GIS Improvements

1. Program Title	(iii) Infrastructure development program
2. Project Title	WS-PP1 Technical Assistance for SCADA/GIS Improvements

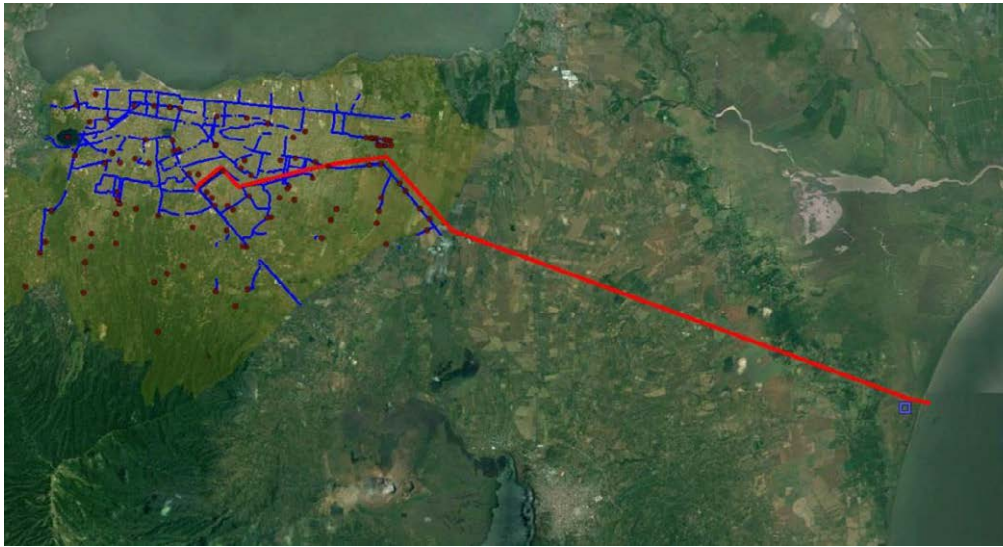
<p>3. Project Map</p>	 <p>Throughout Managua</p>																
<p>4. Background</p>	<p>ENACAL requires a standard system of SCADA, linked to a digitized model of their network, to operate efficiently. They have attempted this in the past but have been unable to locate the resources to adequately form an integrated and cohesive system.</p>																
<p>5. Objective</p>	<p>Create an accurate digital map of the network, install data acquisition instruments and transmitters, purchase computers and hardware to operate the system, and purchase and be trained in the software to utilize the system competently.</p>																
<p>6. Project Component</p>	<p>a. GIS:</p> <ul style="list-style-type: none"> • Hire and train GIS operators • Convert existing AutoCAD data to GIS • Procure suitable equipment to perform field verification • Employ field technicians to investigate precise locations of pipes and valves. • Analyze and adjust field data to create accurate GIS system. <p>b. SCADA</p> <ul style="list-style-type: none"> • Employ consultant to design and implement system • Procure instruments, gauges, transmitters, receivers, converters, communication equipment. Includes flowmeters, pressure gauges, valve positioning detectors, etc. • Data and Control System: procure computers and receiver equipment to properly receive, process, store, and display system indicators, with ability for remote operation from control room. 																
<p>7. Regulating Organization</p>	<p>ENACAL <u>Division/Department in charge: Operations, Managua</u></p>																
<p>8. Implementation Organization (list all)</p>	<p>ENACAL, ALMA <u>Division/Department in charge: ENACAL: Planning ALMA: Project Management</u></p>																
<p>9. Cost</p>	<p>Total Cost: USD 20 million</p> <table border="1" data-bbox="459 1771 1299 1962"> <thead> <tr> <th>USD Million</th> <th>Short term (2017–2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>20</td> <td>1</td> <td>1</td> </tr> <tr> <td>(Construction)</td> <td>19</td> <td>0</td> <td>0</td> </tr> <tr> <td>(O&M)</td> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	20	1	1	(Construction)	19	0	0	(O&M)	1	1	1
USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)														
Total Cost	20	1	1														
(Construction)	19	0	0														
(O&M)	1	1	1														
<p>10. Revenue Collection</p>	<p>(ii) Not Possible Project does not feature any means to collect revenue specifically for this project.</p>																

	Any additional fees must arise from standard billing of water services using the government rates allocated to ENACAL. But the entire population of Managua is the beneficiary of this project.
11. Possible Fund Source	PRIVATE, ODA (Grant), ODA(Loan) Privitization assumed to be undesirable to GON.
12. Timing of Implementation	(i) Short: MP Formulation -2020 (i) Starting year of study : <u>2018</u> (ii) Starting year of construction : <u>2019</u> (iii) Starting year of operation : <u>2020</u>
13. Compliance with Development Visions	(i) National Development Plan: Unsure, likely NO (ii) Sector Development Plan: Unsure, likely YES (iii) Implementation Organization's Dev't Plan: YES
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: 1.4 million (Entire population of Managua.) ● Current demand gap: 0.7 million (Estimating number of users with deficient water supply) ● Additional supply volume from the project: 50% (fixes deficiencies to 50% of the population). ● Qualitative Assessment: MIDDLE This project would make ENACAL more efficient, and therefore able to serve their customers to a higher degree, that is, improve the hours of service of potable water to many customers who only receive water partial hours of the day.
15. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: LOW Only involves minor construction at existing operating water supply stations in urban environment. No new land is required, construction is very mild, typically not requiring excavation or heavy equipment. ● Social Environment Impact: LOW Completed project generates no noise, no odors, no other impacts to the social environment. No heavy construction, no new lands or displaced owners. All of Managua will benefit.

Source: JICA Study Team

WS-2 : Feasibility Study for Lago Nicaragua Potable Water Treatment Plant and Transmission System

1. Program Title	(iii) Infrastructure development program
2. Project Title	Feasibility Study for Lago Nicaragua Potable Water Treatment Plant and Transmission System

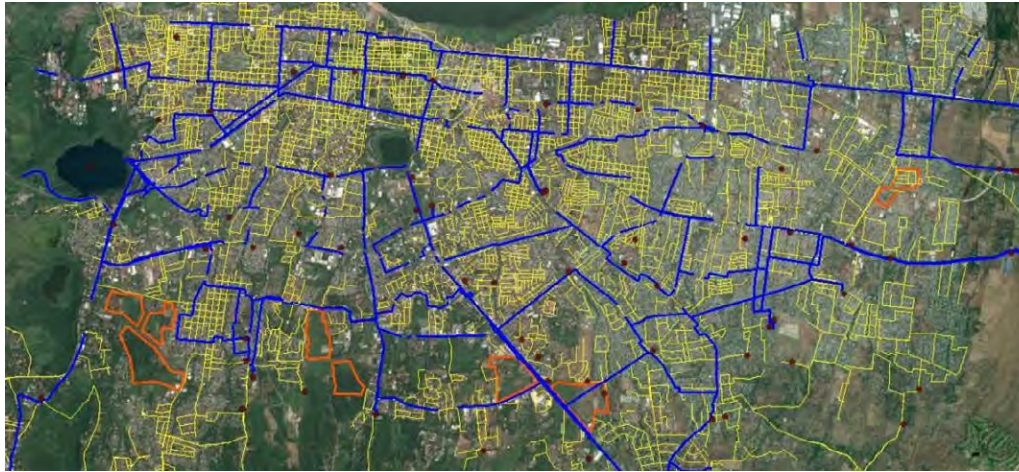
<p>3. Project Map</p>	 <p>Project would study and optimize the treatment and transmission of water from Lago Nicaragua that most likely will be required in the future.</p>
<p>4. Background</p>	<p>Managua currently utilizes groundwater for its water supply. They are currently pumping more than recommended in the JICA 2005 Study. Also, there is a fear that the quality of the water pumped from the aquifer may decline based on infiltration from Lago Managua or land use contamination. It is understood that additional water supply sources will be required at some date in the future. The aquifer capacity and projection is being studied currently in a World Bank-funded study.</p>
<p>5. Objective</p>	<p>Study and engineer a system of water treatment and transmission from Lago Nicaragua.</p>
<p>6. Project Component</p>	<p>Engineering project to study long-term water supply demands in light of restricted and degradation of groundwater supply. Assess options to treat and deliver water from Lago Nicaragua.</p> <p>a) Field Investigations</p> <ul style="list-style-type: none"> • Topographic baseline survey • Property survey • Bathymetric baseline survey • Chemical sampling and analysis of lake water • Geotechnical exploration • Environmental baseline • Social baseline <p>b) Desktop study</p> <ul style="list-style-type: none"> • Prepare population and demand projections • Compare with projected sustainability of aquifer determined in WB Study • Develop alternatives • Prepare preliminary design of alternatives • Develop evaluation criteria • Perform evaluation of alternatives • Identify most favorable alternative <p>c) Present results to Government and Citizens</p>
<p>7. Regulating Organization</p>	<p><u>ENACAL, ALMA, MINSA</u> <u>Division/Department in charge: ENACAL Planning</u></p>
<p>8. Implementatio</p>	<p><u>ENACAL</u> <u>Division/Department in charge: ENACAL Planning</u></p>

n Organization (list all)																	
9. Cost	<p>Total Cost: USD <u>5</u> Million</p> <table border="1"> <thead> <tr> <th>USD Million</th> <th>Short term (2017–2020)</th> <th>Mid term* (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>0</td> <td>5</td> <td>0</td> </tr> <tr> <td>(Construction)</td> <td>0</td> <td>*</td> <td>0</td> </tr> <tr> <td>(O&M)</td> <td>0</td> <td>0</td> <td>0</td> </tr> </tbody> </table> <p>*Projected for years 2021 - 2022. Project is only an engineering study, no construction or recurring costs is required.</p>	USD Million	Short term (2017–2020)	Mid term* (2021-2030)	Long term (2031-2040)	Total Cost	0	5	0	(Construction)	0	*	0	(O&M)	0	0	0
USD Million	Short term (2017–2020)	Mid term* (2021-2030)	Long term (2031-2040)														
Total Cost	0	5	0														
(Construction)	0	*	0														
(O&M)	0	0	0														
10. Revenue Collection	(ii) Not Possible																
11. Possible Fund Source	<u>ODA (Grant), ODA (Technical Assistance), ODA (Loan)</u>																
12. Timing of Implementation	<p>(ii) Middle: 2020 – 2030</p> <p>(i) Starting year of study : <u>2021</u></p> <p>(ii) Starting year of construction : <u>none</u></p> <p>(iii) Starting year of operation : <u>none</u></p>																
13. Compliance with Development Visions	<p>(i) National Development Plan: unsure, possibly <u>YES</u></p> <p>(ii) Sector Development Plan: unsure, likely <u>YES</u></p> <p>(iii) Implementation Organization’s Dev’t Plan: assumed to be <u>YES</u></p>																
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>1.4 million (all residents of Managua)</u> ● Current demand gap: <u>0.7 million (estimated to reflect residents without adequate water supply)</u> ● Additional supply volume from the project (No. or % of the gap): <u>0%--project does not solve any problem</u> ● Qualitative Assessment: <u>LOW</u> <u>Project does not produce any in place solutions, only identifies future implementation</u> 																
15. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: <u>LOW</u> <u>Engineering project with no impact to the natural environment.</u> ● Social Environment Impact: <u>LOW</u> <u>Engineering project with no impact to the social environment.</u> 																

Source: JICA Study Team

WS-3 : Improve water supply infrastructure to meet demand in 5 "sub-centers"

1. Program Title	(i) Urban development program (iii) Infrastructure development program
2. Project Title	<u>Improve water supply infrastructure to meet demand in 5 "sub-centers"</u>


<p>3. Project Map</p>	 <p>High-density developments are projected in the urban plan (orange areas). Additional water supply infrastructure is required to meet to satisfy demand occurring from the additional residents and workers in these areas. The image above shows the existing large-diameter transmission mains (blue) and the smaller-diameter distribution network pipes (yellow), along with the water supply wells (red circles).</p>
<p>4. Background</p>	<p>Managua's water supply system is deficient with several problems contributing to an unreliable and inconsistent water supply. There are many projects improving the system. The water system is spread out, with ~100 wells widely spaced around the city. The urban plan projects 5 "subcenters", separate locations where high-density development will be promoted. The water system surrounding and supplying these subcenters, currently sub-standard, will require improvements to satisfactorily provide the demand flows. Without performing specific modeling of the water network for each subsector, knowing the performance issues of the current system, it is assumed that local improvements will be necessary at each proposed subcenter.</p>
<p>5. Objective</p>	<p>Ensure that these proposed high-density areas have sufficient water supply to encourage development.</p>
<p>6. Project Component</p>	<p>a. Investigation and design. An engineer must evaluate true requirements for each sub-center, evaluate the existing water supply, then identify and design the required improvements for the area.</p> <p>b. Construct new well</p> <p>c. Construct new larger-diameter pipeline in the vicinity</p> <p>d. Construct new water storage tank.</p> <p>The construction will occur at all of these locations:</p> <ol style="list-style-type: none"> 1. Centro Historico 2. Ciudad Masaya 3. Occidental - Pista Suburbana 4. Oriental - Pista de Mayoría 5. Tecnológico Avanzado - Pista Suburbana
<p>7. Regulating Organization</p>	<p><u>ENACAL</u> Division/Department in charge: <u>ENACAL plan approval</u></p>
<p>8. Implementation Organization (list all)</p>	<p><u>PRIVATE</u> Division/Department in charge: <u>contracted engineer/constructor</u></p> <p>It is assumed that private entities / investors / developers will construct the sub centers according to incentives or promotions from the municipal government.</p>
<p>9. Cost</p>	<p>Total Cost: USD <u>20</u> Million</p>

	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	
	Total Cost		10	10	
	(Construction)		9	9	
	(O&M)		1	1	
10. Revenue Collection	(i) Possible: USD <u>20</u> Million (ii) Not Possible				
11. Possible Fund Source	<u>PRIVATE</u>				
12. Timing of Implementation	(ii) Middle: 2020 – 2030 (iii) Long: 2030 – 2040 (i) Starting year of study : <u>2021</u> (ii) Starting year of construction : <u>2022</u> (iii) Starting year of operation : <u>2025</u>				
13. Compliance with Development Visions	(i) National Development Plan: <u>NO</u> (ii) Sector Development Plan: <u>NO</u> (iii) Implementation Organization’s Dev’t Plan: <u>YES</u>				
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u><100,000</u> ● Current demand gap: <u>n/a</u> (locations are mostly undeveloped now) ● Additional supply volume from the project (No. or % of the gap): <u>n/a</u> ● Qualitative Assessment: <u>HIGH</u> <u>If sub-centers are developed as proposed, will need improvements to the water supply system</u> 				
15. Environmental Impact	<p>(Choose and Describe)</p> <ul style="list-style-type: none"> ● Natural Environment Impact: <u>LOW</u> <u>Will require construction in existing urban rights-of-way.</u> ● Social Environment Impact: <u>LOW</u> <u>Will require construction in existing urban rights-of-way.</u> 				

Source: JICA Study Team

WS-4 : Old and Vulnerable Pipeline Replacement Project

1. Program Title	(iii) Infrastructure development program
2. Project Title	Old and Vulnerable Pipeline Replacement Project

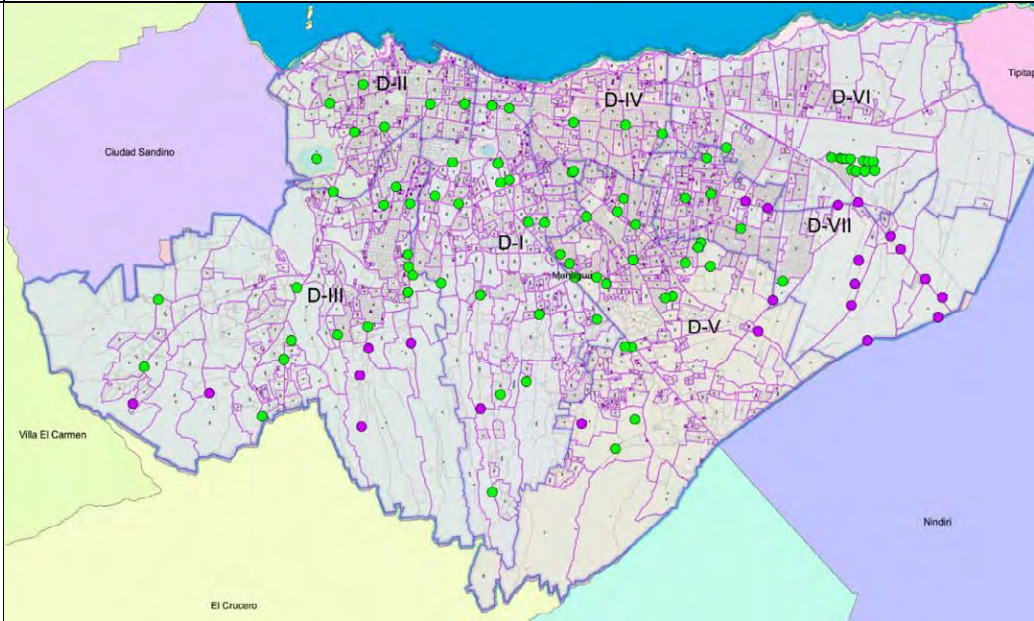
3. Project Map																								
4. Background	<p>Managua's potable water distribution system is relatively old. Many pipes are constructed of Asbestos-Cement pipe. AC pipe is known to be very fragile and susceptible to earthquakes and other natural phenomena. The AC pipe is known to be leaky, and replacing it is a goal of the program for reduction of non-revenue water. Reduction of non-revenue water is the top focus of ENACAL. A string of wells on the east, south of the airport, feed the main city center, this pipeline is vulnerable to earthquakes that would rupture the pipeline, leaving the city without water for a significant period. 115 km of pipelines have been identified for replacement.</p>																							
5. Objective	<p>Reduce real leaks, reducing non-revenue water, which in turn maximizes water resources and saves money for ENACAL and the country. Strengthen the reliability of the water system against seismic events and other potential damage to the water system.</p>																							
6. Project Component	<ol style="list-style-type: none"> 1. Perform engineering to develop plans and specifications, including refining pipe locations. 2. Let Contract to construct the replaced piping. 																							
7. Regulating Organization	<p><u>ENACAL</u> <u>Division/Department in charge: Departamento de Agua Non-Revenue.</u></p>																							
8. Implementation Organization (list all)	<p><u>ENACAL</u> <u>Division/Department in charge: Projects/Construction Supervision</u></p>																							
9. Cost	<p>Total Cost: USD <u>13</u> Million</p> <table border="1" data-bbox="384 1447 1225 1682"> <thead> <tr> <th>USD Million</th> <th>Short term (2017–2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>13</td> <td></td> <td></td> </tr> <tr> <td>(Construction)</td> <td>13</td> <td></td> <td></td> </tr> <tr> <td>(O&M)</td> <td>*</td> <td>*</td> <td>*</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>O&M could actually be considered negative, as water loss reductions are a quantifiable benefit.</p>				USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	13			(Construction)	13			(O&M)	*	*	*				
USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)																					
Total Cost	13																							
(Construction)	13																							
(O&M)	*	*	*																					
10. Revenue Collection	<p>((ii) Not Possible</p>																							
11. Possible Fund Source	<p><u>JICA</u></p>																							
12. Timing of Implementation	<p>(Choose one → consider “urgency” of the project) (i) Short: MP Formulation -2020</p>																							

n	(i) Starting year of study : <u>2018</u> (ii) Starting year of construction : <u>2019</u> (iii) Starting year of operation : <u>2021</u>
13. Compliance with Development Visions	(i) National Development Plan: <u>PARTLY</u> (ii) Sector Development Plan: <u>YES</u> (iii) Implementation Organization's Dev't Plan: <u>YES</u>
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>est. 200,000</u> ● Current demand gap: <u>n/a</u> ● Additional supply volume from the project (No. or % of the gap): <u>n/a</u> ● Qualitative Assessment: <u>LOW</u> (Describe why: <u>Citizens/customers won't really notice any benefit.</u>)
15. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: <u>LOW</u> (Describe why: <u>Only affects built-out area. Reduction of energy gained from eliminating leaky pipes is a gain.</u>) ● Social Environment Impact: <u>LOW</u> (Describe why: <u>Construction will be a nuisance, requiring excavation in trenches throughout the inner city zone.</u>)

Source: JICA Study Team

(2) Water Resource

WR-1 : Technical Assistance for Water Quality Improvement of Managua Lake


1. Program Title	(iv) Environment improvement program
2. Project Title	<u>Technical Assistance for Water Quality Improvement of Managua Lake</u>
3. Project Map	 <p>Source: JICA study team prepared based on information of ENACAL</p> <p>Locations of Existing Water Sources in the Study Area</p>
4. Background	Contamination of water resources: Managua Lake is one of the largest surface water

	resources in the country, but the water is significantly contaminated by heavy metals such as mercury, pesticide and domestic waste water. Water taken from the lake have a risk of contamination for use as tap water. Monitoring of water quality of Managua Lake and regulation of its contamination is essential to ensure safe water supply in Managua city.
5. Objective	To monitor water quality in Managua Lake. To regulate water contamination in Managua Lake
6. Project Component	(1) Review of JICA study results in 2014 for water quality evaluation on Managua Lake (2) Data and information collection and their analyses (3) Establishment of water quality monitoring system (4) Procurement of water quality test installments (5) Preparation of guidelines for regulation of water contamination (6) Capacity development of responsible staffs
7. Regulating Organization	<u>ANA</u>
8. Implementation Organization (list all)	<u>CIRA/UNAN(Centro para la Investigación en Recursos Acuáticos de Nicaragua/ Universidad Nacional Autónoma de Nicaragua)</u> , MARENA, MINSAL (Ministerio de Salud), ENACAL
9. Cost	Total Cost: USD <u>5</u> Million Construction: USD _____ Million O&M: USD _____ Million / year (for how many years)
10. Revenue Collection	(ii) Not Possible
11. Possible Fund Source	<u>Technical Assistance</u>
12. Timing of Implementation	(ii) Middle: 2020 – 2030
13. Compliance with Development Visions	(i) National Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization's Dev't Plan: YES PARTLY NO
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: _____ ● Current demand gap: _____ ● Additional supply volume from the project (No. or % of the gap): _____ ● Qualitative Assessment: HIGH MIDDLE LOW (Describe why: <u>It will contribute water supply reliability and will improve inequality of safe water availability</u>)
15. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE LOW (Describe why: <u>It will significantly contribute to improve natural environment</u>) ● Social Environment Impact: HIGH MIDDLE LOW (Describe why: <u>The project will not require resettlement.</u>

Source: JICA Study Team

(3) Sewerage and Waste Water Disposal

SW-1 : The Expansion of the Sewerage Coverage in Managua

1. Program Title	<i>(iii) Infrastructure development Project Public health protection</i>
2. Project Title	Expansion of the Sewerage Coverage in Managua Project
3. Project Map	
4. Background	<ul style="list-style-type: none"> • ENACAL has prioritized human settlements and urban areas that do not have sanitary sewer service. • ENACAL has accounted approximately 33,000 households (200,000 persons) that are using on-site sanitation systems: latrines, absorption wells, ditches, or storm water drainage channels for excreta and graywater disposal. • ENACAL has in a waiting list 1,761 households (almost 10,000 persons) that already have applied for new sewer connection (in list since the year 2014 to 2016).
5. Objectives	<ul style="list-style-type: none"> • To extend the present sewerage coverage and the treated wastewater. • Improve the quality of life (protection of public health) of hundred thousand residents of settlements and other urban areas.
6. Project Components	<ul style="list-style-type: none"> • Update of the diagnostic (identification and verification of the number of housing). Close coordination of ENACAL and neighborhood leaders. • Preparation of the studio feasibility study and final design (includes condominal systems and conventional). Prioritization of the works. • phased implementation of starting from the highest impact (the most populated and the communities with the greatest health risk.). • ENACAL have a waiting list of 1,761 households that already have applied for new sewer connection (from 2014 to 2016). ENACAL also identify a number of neighborhoods that

	<p>represent 200,000 people without sewerage service (33,300 potential connections). To cover the demand projected in the Master Plan, 20,000 new sewer connection must to be installed (until 2020). At least other 20,000 connections should be install in the period (2021 to 2025). An assumption of 80% are “Condominial” type and the other 20% are “Conventional” type. The Condominial system can cost roughly 65% of the Conventional. In the cost estimation are also included the secondary sewerage collector around the urban neighborhoods or settlements.</p> <ul style="list-style-type: none"> • Steps: <ul style="list-style-type: none"> ○ Identification, Priority, Detailed Design, and preparation of the bidding documents. ○ Bidding ○ Construction 																
7. Regulating Organization	MARENA, INAA, ENACAL																
8. Implement. Organization	ENACAL: Direction of Projects and Investment Direction of Environmental Issues																
9. Cost	<p>Total Cost: US\$ 66.4 million Other Cost: Review DD/Supervision/etc: 6 million Construction Cost: 60.4 US\$ million Cost O&M: US\$ ___million</p> <table border="1"> <thead> <tr> <th>USD Million</th> <th>Short term (2017–2020)</th> <th>Mid term (2021-2025)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>30.2</td> <td>30.2</td> <td></td> </tr> <tr> <td>(Construction)</td> <td>30.2</td> <td>30.2</td> <td></td> </tr> <tr> <td>(O&M)</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2025)	Long term (2031-2040)	Total Cost	30.2	30.2		(Construction)	30.2	30.2		(O&M)			
USD Million	Short term (2017–2020)	Mid term (2021-2025)	Long term (2031-2040)														
Total Cost	30.2	30.2															
(Construction)	30.2	30.2															
(O&M)																	
10. Revenue Collection	(i) Possible: US\$ <u>3.07</u> million/ 8 years																
11. Possible Fund Source	ODA (loan)																
12. Timing of Implementation	<p>(i) Short Term 2020</p> <p>(i) Starting year of study: <u>2017-2018</u></p> <p>(ii) Starting year of construction: <u>2018</u></p> <p>(iii) Starting year of operation: <u>2020</u></p>																
13. Compliance with Development Visions	<p>(i) Nacional Development Plan: YES PARTLY NO</p> <p>(ii) Sector Development Plan: YES PARTLY NO</p> <p>(iii) Implementation Organization Dev. Plan: YES PARTLY NO</p>																
14. Social and Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the project: <u>224,000 persons</u> ● Current demand gap: <u>~ 35%</u> ● Additional supply volume from the project (No. or % of the gap): <u>~ 4%</u> ● Qualitative Assessment: HIGH MIDDLE LOW ● (Describe why: <u>it will improve the life conditions of many hundred thousand of residents.</u> 																
15. Environmental Impact	<p>(Choose and Describe)</p> <ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE LOW Describe why: <u>it is an urban area, It had been already impacted</u> ● Social Environment Impact: HIGH MIDDLE LOW Describe why: <u>It will improve sanitation and will reduce also contamination of storm water drainage channels.</u> 																

Source: JICA’s study team

SW-2 : Details of The Renewal and Improvement of Deteriorated Sewers Project


1. Program Title	<i>(iii) Infrastructure development project</i>																
2. Project Title	Renewal and Improvement of Deteriorated Sewers																
3. Project Map																	
4. Background	The Sewerage Master Plan of the city of Managua /1998) identified 140 km of collectors in bad condition. Within its program of “Immediate Actions” were renewed 40 km of collectors, pending other 100 km away.																
5. Objectives	<ul style="list-style-type: none"> • renewal, re-habilitation and/or capacity reinforcement of the collectors that are damaged or sub-dimensioned. • Reduce the costs of operation and maintenance of systems damaged. • To improve the service to the user. 																
6. Project Components	<ul style="list-style-type: none"> • Update of the diagnostic (CCTV inspection) • Detailed design and technical dossier for tender + construction supervision • <u>Construction or rehabilitation of 120 km of sewers</u> 																
7. Regulating Organization	INAA, ENACAL																
8. Implement. Organization	ENACAL: Direction of Project and Investment Direction of Operations																
9. Cost	<p>Total Cost: US\$ 13.6 million Other Cost: CCTV/DD/Supervision/etc.: 1.6 millon Construction Cost: US\$12 millon Cost O&M: US\$ <u>0.0 millon</u></p>																
	<table border="1"> <thead> <tr> <th>USD Million</th> <th>Short term (2017 – 2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>12</td> <td></td> <td></td> </tr> <tr> <td>(Construction)</td> <td>12</td> <td></td> <td></td> </tr> <tr> <td>(O&M)</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	USD Million	Short term (2017 – 2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	12			(Construction)	12			(O&M)			
USD Million	Short term (2017 – 2020)	Mid term (2021-2030)	Long term (2031-2040)														
Total Cost	12																
(Construction)	12																
(O&M)																	

10. Revenue Collection	(i) Possible:0.05 million/3 yr (includes only new connections, assumed 10% of the benefited families)
11. Possible Fund Source	Currently does not have. Possible technical assistance for detailed design and bidding documents with KfW. Potential for funding by ODA (loan)
12. Timing of Implementation	(i) Short term 2020 (i) Starting year of study: <u>2017-2018</u> (ii) Starting year of construction: <u>2018</u> (iii) Starting year of operation: <u>2019-2020</u>
13. Compliance with Development Visions	(i) Nacional Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization Dev. Plan: YES PARTLY NO
14. Social and Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the project: <u>85,800 persons</u> ● Current demand gap: <u>~35%</u> ● Additional supply volume from the project (% of the gap): <u>0.31% (new connections)</u> ● Qualitative Assessment: HIGH MIDDLE LOW ● (Describe why: (i) it will reduce the flow pressure over small collectors, (ii) Will reduce maintenance time, cost and effort (the number of clogging and repairs) (iii) to provide services to middle and low income neighborhoods.
15. Environmental Impact	<p><i>(Choose and Describe)</i></p> <ul style="list-style-type: none"> ● <i>Natural Environment Impact: HIGH MIDDLE LOW</i> <i>Describe why: it is an urban area. It had been already impacted</i> ● <i>Social Environment Impact: HIGH MIDDLE LOW</i> <i>Describe why: <u>pipng system will run along the existing road.</u></i>

Source: JICA's study team

SW-4 : Design Review and Construction of Interceptor 2 – Second Phase

1. Program Title	<i>(iii) Infrastructure development project</i>
2. Project Title	Design Review and Construction of Interceptor 2 – Second Phase
3. Project Map	

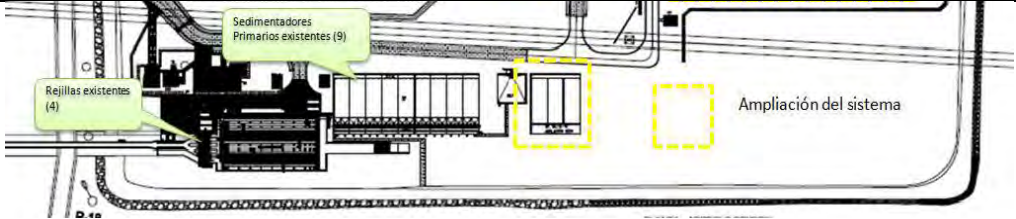
																	
4. Background	<ul style="list-style-type: none"> • Interceptor No.1 is a 7.5 km length coastal main trunk sewer that collects most of the total sewage flow of the city. From Interceptor No.1, the sewage is conveyed by a pressurized pipe to Interceptor No.2 (first span), that is a gravity flow main trunk sewer, 7.5-km length, and diameters between \varnothing 1,400-mm to \varnothing 2,000-mm (reinforced fiberglass pipe - GRP) that leads sewage to the Cesar Sandino Managua Wastewater Treatment Plant (MWWTP). • At present, Interceptor No.1 is overcharged and lack of capacity. • The second upstream span of Interceptor No.2 is still pending of construction by ENACAL by lack of funds. 																
5. Objectives	<ul style="list-style-type: none"> • Release of the flow pressure on Interceptor No.1, by collecting the sewage flow generated in the Southern part of the City (from Juan Pablo II Ave. to the South). It means to re-allocate sewage flows, through the new gravity flow Interceptor No.2 (second span). • At the present situation, extended sewerage drainage basins require pumping at EBAS- S to be conveyed to the MWWTP, this results in high electricity bills (high operational cost). 																
6. Project Components	<ul style="list-style-type: none"> • The upstream span of Interceptor No.2, is 8.5-km length and diameters between \varnothing 900-mm to \varnothing 1,200-mm (reinforced fiberglass pipe - GRP). For a maximum flow of 2.13 m³/sec. • It has already detailed design (DD), however the design should be reviewed and the bidding documents updated. • Also, it includes, nine (9) vortex valves at the interception point of other the main collectors. • Steps: <ul style="list-style-type: none"> ○ Review of existing detailed design and preparation of the bidding documents. ○ Bidding ○ Construction 																
7. Regulating Organization	INAA, ENACAL																
8. Implement. Organization	ENACAL: Direction of Project and Investment Direction of Environmental Issues ALMA soon will initiate the rehabilitation and expansion of the Juan Pablo II Ave. (widening lanes and sidewalks, and other road improvements)																
9. Cost	Total Cost: US\$ 14.42 million Other Cost: Review DD/Supervision/etc: 1.3 million Construction Cost: 13.12 US\$ millon Cost O&M: US\$ <u>0.12 million/2 yr</u> <table border="1" data-bbox="411 1615 1249 1809"> <thead> <tr> <th>USD Million</th> <th>Short term (2017–2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>13.12</td> <td></td> <td></td> </tr> <tr> <td>(Construction)</td> <td>13</td> <td></td> <td></td> </tr> <tr> <td>(O&M)</td> <td>0.12</td> <td></td> <td></td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	13.12			(Construction)	13			(O&M)	0.12		
USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)														
Total Cost	13.12																
(Construction)	13																
(O&M)	0.12																
10. Revenue Collection	(i) Possible: US\$ <u>0.18</u> million/yr (by new house connections)																
11. Possible Fund Source	BCEI through ALMA, as part of the remodeling works of Juan Pablo II Avenue.																
12. Timing of Implementation	<u>High Priority (very urgent).</u> Short term: 2017																

	(i) Starting year of study /review of DD and updated of Bidding Docs: <u>2017</u> (ii) Starting year of construction: <u>2018</u> (iii) Starting year of operation: <u>2020</u>
13. Compliance with Development Visions	(i) Nacional Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization Dev. Plan: YES PARTLY NO
14. Social and Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the project: <u>400,000 persons</u> ● Current demand gap: <u>~ 35% (sewerage coverage)</u> ● Additional supply volume from the project (% of the gap): <u>~ 2.33% (only new connections)</u> ● Qualitative Assessment: HIGH MIDDLE LOW ● (Describe why: (i) it will reduce the flow pressure and avoid overflows in small collectors, (ii) it will help ENACAL to reduce electricity consumption, and (iii) it will allow to provide services to middle and low income neighborhoods.
15. Environmental Impact	<p><i>(Choose and Describe)</i></p> <ul style="list-style-type: none"> ● <i>Natural Environment Impact: HIGH MIDDLE LOW</i> <i>Describe why: it is an urban area, It had been already impacted, new lanes at the Juan Pablo II Ave. will be constructed</i> ● <i>Social Environment Impact: HIGH MIDDLE LOW</i> <i>Describe why: new piping system will run along the existing road.</i>

Source: JICA's study team

SW-5 : Details Additional Measures to Increase the Treatment Capacity of the WWTP Managua

1. Program Title	<i>(iii) Infrastructure development project</i>
2. Project Title	Additional Measures to Increase the Treatment Capacity of the WWTP Managua
3. Project Map	


																	
<p>4. Background</p>	<ul style="list-style-type: none"> The plant began operations in the year 2009 with facilities to treat the design flow of 2.11 m³/sec, corresponding to the first phase. Management by BIWATER In the year 2013 was carried out some improvements in equipment to enhance the operation of the WWTP, The planning of the facilities considered to achieve an average capacity of 2.72 m³/sec in the year 2025. Actual average influent flow is 1.8 m³/sec according to the coverage. 																
<p>5. Objective</p>	<ul style="list-style-type: none"> Complete the facilities of the plant according to his master plan design, to reach 2.93 m³/sec of treatment capacity, to cover requirements of the year 2030. 																
<p>6. Project Component</p>	<ul style="list-style-type: none"> The facilities required in the second phase, which consists in: one (1) aerated grit chamber and degreaser; three (3) primary settling tanks; two (2) secondary settling tanks; two (2) trickling filters; one (1) Anaerobic Digester; two (2) vessels of solar drying, one (1) sludge mechanical dewatering unit. 																
<p>7. Regulating Organization</p>	<p>MARENA, INAA, ENACAL</p>																
<p>8. Implementation Organization</p>	<p>ENACAL – Direction of Project and Investment Direction of Environmental Issues General Direction of Operations, Department of Sewerage and Wastewater Treatment Plant Managua</p>																
<p>9. Cost</p>	<p>Total Cost: US\$ 14.12 million Other Cost: DD/Supervision/etc: 1.62 million</p> <p>Construction Cost: 12.5 US\$ millon Costo de O&M: US\$ 1.6 millon/year</p> <table border="1" data-bbox="387 1749 1233 1977"> <thead> <tr> <th>USD Million</th> <th>Short term (2017–2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>12.5</td> <td></td> <td></td> </tr> <tr> <td>(Construction)</td> <td>11.6</td> <td></td> <td></td> </tr> <tr> <td>O&M BIWATER Management</td> <td>0.9</td> <td></td> <td></td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	12.5			(Construction)	11.6			O&M BIWATER Management	0.9		
USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)														
Total Cost	12.5																
(Construction)	11.6																
O&M BIWATER Management	0.9																
<p>10. Revenue</p>	<p>(i) Possible: US\$ 0.27 million/3 yr</p>																

Collection	
11. Possible Fund Source	Potentially by KfW (financial assistance)
12. Timing of Implementation	(i) Short term -2020 (i) Starting year of study: <u>2017-2018</u> (ii) Starting year of construction: <u>2018-2019</u> (iii) Starting year of operation: <u>2020-2021</u>
13. Compliance with Development	(i) Nacional Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization Dev. Plan: YES PARTLY NO
14. Social Economic Impact	(Fill in as much as possible) <ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>112,000 persons</u> ● Current demand gap: <u>%</u> ● Additional supply volume from the project (% of the gap): <u>%</u> ● Qualitative Assessment: HIGH MIDDLE LOW (Describe why: <u>it will improve the water quality of Managua Lake</u>)
15. Environmental Impact	(Choose and Describe) <ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE LOW Describe why: <u>the area had been already impacted by the existing facilities</u> ● Social Environment Impact: HIGH MIDDLE LOW Describe why: <u>construction will be developed in the actual WWTP land</u>

Source: JICA's study team

(4) Solid Waste Management

WM-1 : New Sanitary landfill & intermedia treatment facility development project (Phase 1)

1. Program Title	(iii) Infrastructure development program (iv) Environment improvement program
2. Project Title	<u>New Sanitary landfill & intermedia treatment facility development project (Phase 1)</u>
3. Project Map	
4. Background	<ul style="list-style-type: none"> ◆ Existing waste sanitary landfill sites will be closed in 2020 according to estimates of waste amount in the future. ◆ Incinerator in a private concession scheme was considered. However, there is no information on specific progress with regards to incineration. Furthermore, even if incineration is introduced, a new disposal site will be necessary from 2024 by the estimated waste amount in the future. ◆ Development of a new sanitary landfill is an urgent issue as the construction work takes 6-7 years (including FS, B/D, D/D and Biding).

	<ul style="list-style-type: none"> ◆ Regarding a new disposal site, regional disposal sites with neighboring municipalities was proposed in "Managua City solid waste management strategy plan (2010)" supported by UNHABITAT. It is urgent that to formulate for a regional disposal site plan including investigation for the feasibility of the plan and the operating organization." 								
5. Objective	<ul style="list-style-type: none"> ● To improve solid waste management infrastructure to cope with the increase in waste volume due to population and economic activity expansion (Phase 1) 								
6. Project Component	<ul style="list-style-type: none"> <input type="checkbox"/> Development of regional disposal site plan (including others municipality) <ul style="list-style-type: none"> ◆ Survey of the current situation ◆ Review of the existing city development plan and Managua City Solid Waste Comprehensive Management Strategic Plan (UNHABIATA: 2010) ◆ Review & study of scope of municipality coverage. ◆ Review & study of alternative waste management systems. ◆ Review & study of the location for a new disposal site ◆ Building consensus with participating municipalities ◆ Consideration of a management organization. ◆ Basic facility planning including intermediate treatment <input type="checkbox"/> Development of a new disposal site <ul style="list-style-type: none"> ◆ Feasibility study ◆ Design (basic, detailed) ◆ Bidding ◆ Construction ◆ Test run <input type="checkbox"/> Development of an intermediate treatment facility (within the existing final disposal site Acahualinca) <ul style="list-style-type: none"> ◆ Feasibility study ◆ Design (basic, detailed) ◆ Bidding ◆ Construction ◆ Test run <input type="checkbox"/> Development of a large-scale transportation facility (within the existing final disposal site: Acahualinca) <ul style="list-style-type: none"> ◆ Feasibility study ◆ Design (basic, detailed) ◆ Bidding ◆ Construction ◆ Test run 								
7. Regulating Organization	<p><u>Organization:</u> ALMA, MARENA, INFOM, Others cities <u>Division/Department in charge:</u> Directorate General for Public Cleaning, EMTRIDES</p>								
8. Implementation Organization (list all)	<p><u>Organization:</u> ALMA <u>Division/Department in charge:</u> Directorate General for Public Cleaning, EMTRIDES</p>								
9. Cost	<p>Total Cost: USD <u>72</u> Million Construction: USD <u>72</u> Million O&M: USD _____ Million / year (for how many years)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">USD Million</th> <th style="width: 25%;">Short term (2017–2020)</th> <th style="width: 25%;">Mid term (2021-2030)</th> <th style="width: 25%;">Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td style="text-align: center;">2</td> <td style="text-align: center;">70</td> <td></td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	2	70	
USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)						
Total Cost	2	70							

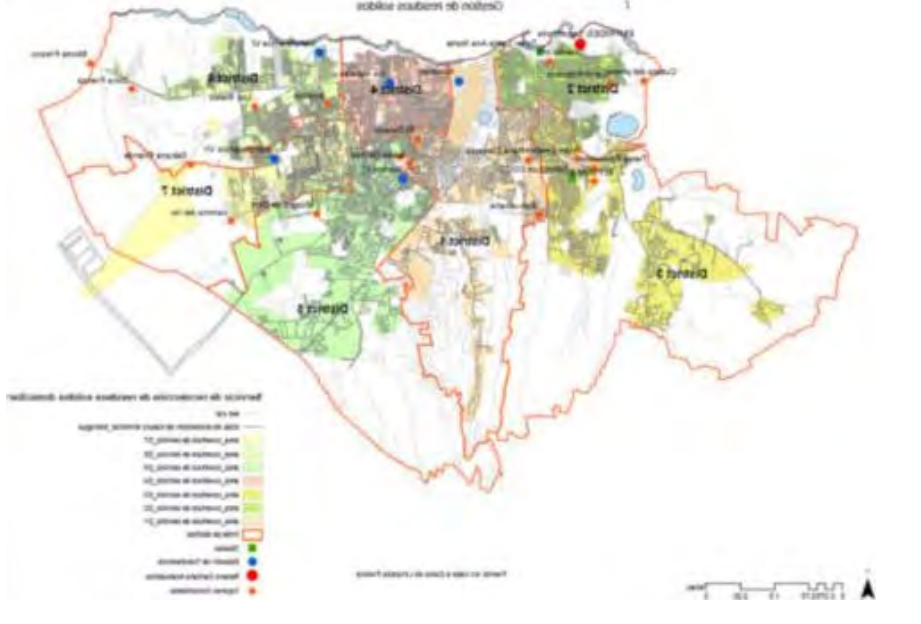
	(Construction)		70		
	(O&M)				
10. Revenue Collection	(i) Possible: USD _____ Million (ii) Not Possible				
11. Possible Fund Source	<u>ODA(Loan), BID</u>				
12. Timing of Implementation	<p><u>(i) Short: 2020</u> <u>(ii) Middle: 2020 – 2030</u> (iii) Long: 2030 – 2040 (i) Starting year of study : 2018-2019: (1) Survey of current situation & Sanitary landfill development plan 2020-2023: (2) FS, D/D, Bidding (ii) Starting year of construction : 2023 (iii) Starting year of operation : 2025</p>				
13. Compliance with Development Visions	(i) National Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization’s Dev’t Plan: YES PARTLY NO				
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>1,772,054 (2030)</u> ● Current demand gap: <u>The capacity of the final disposal site is still remaining now. However, it is expected to be deficient after two years.</u> ● Additional supply volume from the project (No. or % of the gap): <u>100%</u> ● Qualitative Assessment: HIGH MIDDLE LOW (Describe why: Provision of safe and hygienic living environment to all citizens through appropriate waste management) 				
15. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE LOW (Describe why: There would be an environmental impact around the disposal site from the construction of a new landfill site. However, the environmental impact for the entire city is rated moderate, as the environmental impact would be reduced by implementing appropriate solid waste management.) ● Social Environment Impact: HIGH MIDDLE LOW (Describe why: Resettlements) 				

Source: JICA Study Team

	<ul style="list-style-type: none"> Current status survey, analysis and planning for management of hazardous waste and construction waste etc. 																
7. Regulating Organization	<p>Organization: ALMA Division/Department in charge: <u>Directorate General for Public Cleaning, EMTRIDES</u>, Environmental management department, District office, Environmental Management Department</p>																
8. Implementation Organization (list all)	<p>Organization: ALMA Division/Department in charge: L.P, EMTREDE, ALMA Environmental management department, District office</p>																
9. Cost	<p>Total Cost: USD <u>6</u> Million Construction: USD _____ Million O&M: USD _____ Million / year (for how many years)</p> <table border="1"> <thead> <tr> <th>USD Million</th> <th>Short term (2017–2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>4</td> <td>2</td> <td></td> </tr> <tr> <td>(Construction)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>(O&M)</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	4	2		(Construction)				(O&M)			
USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)														
Total Cost	4	2															
(Construction)																	
(O&M)																	
10. Revenue Collection	<p>(i) Possible: USD _____ Million (ii) Not Possible</p>																
11. Possible Fund Source	<p><u>ODA(Technical Assistance)</u></p>																
12. Timing of Implementation	<p>(i) Short: -2020 (ii) Middle: 2020 – 2030 (iii) Long: 2030 – 2040</p> <p>(i) Starting year of study : 2018-2022 (ii) Starting year of construction : (iii) Starting year of operation :</p>																
13. Compliance with Development Visions	<p>(i) National Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization’s Dev’t Plan: YES PARTLY NO</p>																
14. Social Economic Impact	<ul style="list-style-type: none"> # of beneficial persons (household) from the projects: <u>1,772,054 (2030)</u> Current demand gap: _____ Additional supply volume from the project (No. or % of the gap): <u>100%</u> Qualitative Assessment: HIGH MIDDLE LOW (Describe why: Provision of safe and hygienic living environment to all citizens through appropriate waste management) 																
15. Environmental Impact	<p>(Choose and Describe)</p> <ul style="list-style-type: none"> Natural Environment Impact: HIGH MIDDLE LOW (Describe why: Since it is a software component for improving waste disposal, the environmental impact is considered to be small) Social Environment Impact: HIGH MIDDLE LOW (Describe why: No resettlements) 																

Source: JICA Study Team

WM-3 : Equipment for collection & transportation procurement project

1. Program Title	(iii) Infrastructure development program (iv) Environment improvement program
2. Project Title	<u>Equipment for collection & transportation procurement project</u>
3. Project Map	
4. Background	<ul style="list-style-type: none"> ◆ Many vehicles are in need of repair and maintenance from aging and frequent breakdowns. ◆ Due to the lack of collection and transportation capacity, waste removal from the living environment in the city area is not fully achieved, and illegal dumping sites exist due to this. ◆ Waste transportation facilities are unsanitary because of lack of equipment capacity.
5. Objective	<ul style="list-style-type: none"> ● Improvement of collecting and transporting capacity by updating aged equipment
6. Project Component	<ul style="list-style-type: none"> ◆ Procurement of waste collection and transportation equipment <ul style="list-style-type: none"> ◆ Feasibility study ◆ Design (basic, detailed) ◆ Bidding ◆ Construction ◆ Test run ◆ Construction of transportation station facilities and procurement of equipment <ul style="list-style-type: none"> ◆ Feasibility study ◆ Design (basic, detailed) ◆ Bidding ◆ Construction ◆ Test run
7. Regulating Organization	<p>Organization: ALMA Division/Department in charge: Directorate General for Public Cleaning, EMTRIDES</p>
8. Implementation Organization (list all)	<p>Organization: ALMA Division/Department in charge: <u>Directorate General for Public Cleaning, EMTRIDES</u></p>

9. Cost	Total Cost: USD <u>18</u> Million			
	Construction: USD <u>17</u> Million			
	O&M: USD _____ Million / year (for how many years)			
	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)
Total Cost	1	17		
(Construction)		17		
(O&M)				
10. Revenue Collection	(i) Possible: USD _____ Million (ii) Not Possible			
11. Possible Fund Source	<u>ODA(Grant), ODA(Loan), BID</u>			
12. Timing of Implementation	<u>(i) Short: 2020</u> <u>(ii) Middle: 2020 – 2030</u> (iii) Long: 2030 – 2040 (i) Starting year of study : 2019 (ii) Starting year of construction : 2020 (iii) Starting year of operation : 2022			
13. Compliance with Development Visions	(i) National Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization’s Dev’t Plan: YES PARTLY NO			
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>1,772,054 (2030)</u> ● Current demand gap: _____ ● Additional supply volume from the project (No. or % of the gap): <u>100%</u> ● Qualitative Assessment: HIGH MIDDLE LOW (Describe why: Provision of safe and hygienic living environment to all citizens through appropriate waste management) 			
15. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE LOW (Describe why: The influence of exhaust gas from waste collection vehicles is considered.) ● Social Environment Impact: HIGH MIDDLE LOW (Describe why: No resettlements) 			

Source: JICA Study Team

5.4 Disaster Prevention

DM-1 : Project for Establishment of Permanent Office and Staff for Disaster Management with Training Program

1. Program Title	<u>(vi) Disaster Management Program</u>
2. Project Title	<u>Project for Establishment of Permanent Office and Staff for Disaster Management with Training Program</u>
3. Project Map	Location: COMUPRED of ALMA and CODIPRED of District Offices I-VI
4. Background	SINAPRED has a permanent office and staff for disaster management with training program, however, COMUPRED of ALMA and CODIPRED of District Offices I-VII of ALMA does not have permanent office and staff for disaster management with training program, which resulted in insufficient operation and management for disaster management cycle. Besides, some buildings of district office of ALMA are

	not structurally safe due to non-resistant structures for earthquake, which will not fully function as an emergency base.																
5. Objective	To establish permanent office and staff for disaster management, and to prepare training program for COMUPRED of ALMA and CODIPRED of District Offices I-VII of ALMA																
6. Project Component	(1) Study on Selection of Office (Location) of District Offices I-VII of ALMA, and Method of Establishment of Office by Repair or New Construction as a Permanent Office for Disaster Management (2) Study on Appointment of Permanent Staff for Disaster Management (3) Preparation of Training Program (3-1) Preparation of Training Program (3-2) Capacity Building for Permanent Staff																
7. Regulating Organization	<u>Organization: ALMA</u> <u>Division/Department in charge: Directorate of Urban Planning, COMUPRED and CODIPRED of District Offices I-VII of ALMA</u>																
8. Implementation Organization (list all)	<u>SINAPRED, etc.</u> <u>Directorate of Territorial Organization of SINAPRED, etc.</u>																
9. Cost	Total Cost: USD <u>2.1</u> Million (describe the breakdown by period if possible) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">USD Million</th> <th style="width: 25%;">Short term (2017–2020)</th> <th style="width: 25%;">Mid term (2021-2030)</th> <th style="width: 25%;">Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>2.1Mil USD</td> <td></td> <td></td> </tr> <tr> <td>(Construction)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>(O&M)</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	2.1Mil USD			(Construction)				(O&M)			
USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)														
Total Cost	2.1Mil USD																
(Construction)																	
(O&M)																	
10. Revenue Collection	<u>Not Possible</u>																
11. Possible Fund Source	<u>ALMA with ODA (Grant and Technical Cooperation)</u>																
12. Timing of Implementation	<u>(i) Short: MP Formulation -2020</u> (ii) Middle: 2021 – 2030 (iii) Long: 2031 – 2040 (i) Starting year of study : <u>2018</u> (ii) Starting year of construction : _____ (iii) Starting year of operation : _____																
13. Compliance with Development Visions	(i) National Development Plan: <u>YES</u> PARTLY NO (ii) Sector Development Plan: <u>YES</u> PARTLY NO (iii) Implementation Organization’s Dev’t Plan: <u>YES</u> PARTLY NO																
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>? persons</u> ● Current demand gap: <u>N/A</u> ● Additional supply volume from the project (No. or % of the gap): <u>N/A</u> ● Qualitative Assessment: <u>HIGH</u> MIDDLE LOW (Describe why: <u>Reduction of Disaster Risk</u>) 																
15. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE <u>LOW</u> (Describe why: <u>No Pollution expected</u>) ● Social Environment Impact: HIGH MIDDLE <u>LOW</u> (Describe why: <u>No Resettlement</u>) 																

Source: JICA Study Team

**DM-2: Project for Update of Hazard Map and Dissemination to Citizen for Understanding/
Community Based Disaster Risk Reduction Management System**

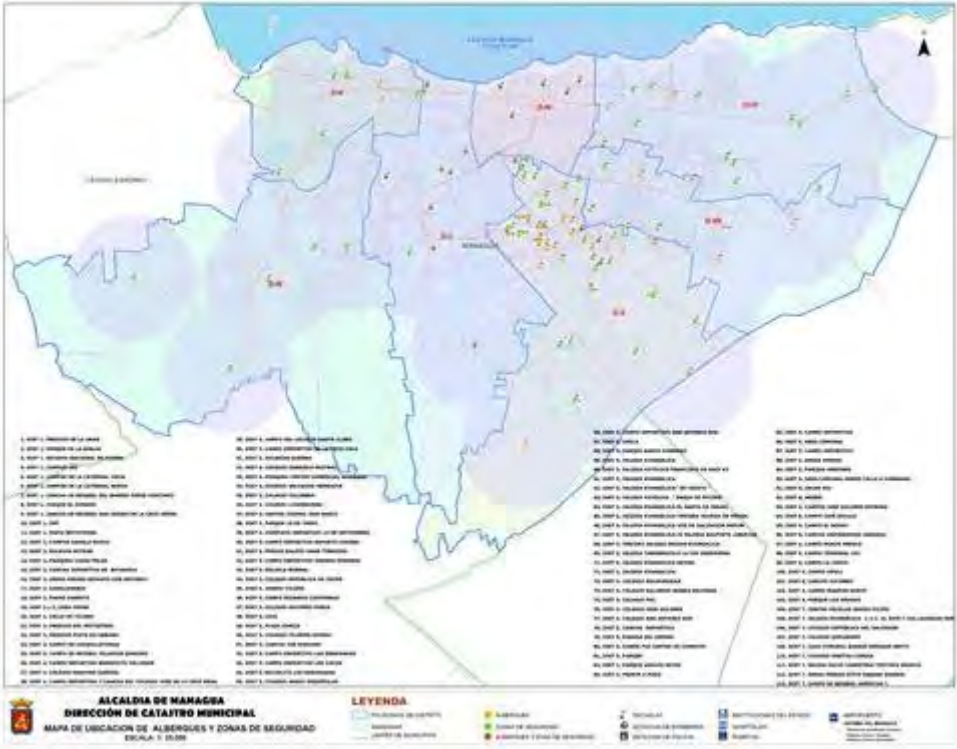
1. Program Title	<u>(vi) Disaster Management Program</u>		
2. Project Title	<u>Project for Update of Hazard Map and Dissemination to Citizen for Understanding/ Community Based Disaster Risk Reduction Management System</u>		
3. Project Map	Location: COMUPRED of ALMA and CODIPRED of District Offices I-VI		
4. Background	Joint Working Group consisting of SINAPRED, INETER and ALMA prepared hazard potential map with 3 level classification (A, B and C). The map shall be updated time to time, when necessary. Further, dissemination to citizen for understanding seems not enough. Accordingly, more efforts to dissemination on what does it mean “hazard”?, where is hazard area?, when hazard area becomes dangerous?, who will do as measures for hazard area?, why it is necessary?, how it will be done?, etc., will be necessary. Then, community based Disaster Risk Reduction Management (DRRM) system will be established.		
5. Objective	To update hazard map and to disseminate to citizen for understanding/ To establish community based disaster risk reduction management system for COMUPRED of ALMA and CODIPRED of District Offices I-VII of ALMA		
6. Project Component	(1) Update of Hazard Map and Dissemination to Citizen for Understanding (1-1) Update of Hazard Map (1-2) Dissemination to Citizen for Understanding (2) Community Based Disaster Risk Reduction Management System (2-1) Community Based Disaster Risk Reduction Management System		
7. Regulating Organization	<u>Organization: INETER /SINAPRED/ALMA</u> <u>Division/Department in charge: Directorate of Hydrology of INETER, Directorate of Territorial Organization of SINAPRED, Directorate of Urban Planning of ALMA</u>		
8. Implementation Organization (list all)	<u>Organization: INETER /SINAPRED/ALMA, etc.</u> <u>Division/Department in charge: Directorate of Hydrology of INETER, Directorate of Territorial Organization of SINAPRED, Directorate of Urban Planning of ALMA, etc.</u>		
9. Cost	Total Cost: USD <u> 2.7 </u> Million <i>(describe the breakdown by period if possible)</i>		
	USD Million	Short term (2017–2020)	Mid term (2021-2030)
	Total Cost	0.35	1.12
	(Construction)		
	(O&M)		
10. Revenue Collection	<u>Not Possible</u>		
11. Possible Fund Source	<u>ODA (Technical Cooperation)</u>		
12. Timing of Implementation	<u>(i) Short: MP Formulation -2020</u> <u>(ii) Middle: 2021 – 2030</u> <u>(iii) Long: 2031 – 2040</u> (i) Starting year of study : <u> 2018 </u> (ii) Starting year of construction : <u> </u>		

	(iii) Starting year of operation : _____
13. Compliance with Development Visions	(i) National Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO (iii) Implementation Organization's Dev't Plan: YES PARTLY NO
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u> ? persons</u> ● Current demand gap: <u> N/A</u> ● Additional supply volume from the project (No. or % of the gap): <u> N/A</u> ● Qualitative Assessment: HIGH MIDDLE LOW (Describe why: <u>Reduction of Disaster Risk</u>)
15. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE LOW (Describe why: <u>No Pollution expected</u>) ● Social Environment Impact: HIGH MIDDLE LOW (Describe why: <u>No Resettlement</u>)

Source: JICA Study Team

DM-4: Project for Improvement of Public Emergency Facilities for Disaster Preparedness

1. Program Title	<u>(vi) Disaster Management Program</u>
2. Project Title	<u>Project for Improvement of Public Emergency Facilities for Disaster Preparedness</u>
3. Project Map	Location: COMUPRED of ALMA and CODIPRED of District Offices I-VI
4. Background	<p>The three (3) public emergency facilities for disaster risk reduction management are considered, i.e., (1) Emergency Operation Center, (2) Emergency Base, and (3) Emergency Evacuation Area as follow:</p> <p>a) Emergency Operation Center</p> <p>SINAPRED will function as nationwide emergency operation center including Managua City, while COMUPRED of ALMA will act as a key office/center for the Managua city.</p> <p>b) Emergency Base (like Civic Core in Japan)</p> <p>Emergency base will be a building for relocation and information center in an emergency situation, while in a normal condition, it will be utilized for a place for education purpose/ dissemination to citizen for understanding disaster preparedness, ceremony and/or any events, etc. The related agencies have been making efforts on education and dissemination to citizen by their program such as disaster drill (4 times a year) and so on, however, more public education and disaster awareness are required to achieve disaster preparedness, which needs not only such place but also program for school and related agencies.</p> <p>From the above, ALMA is under consideration to propose in the Master Plan, such emergency base like Civic Core in Niigata, Japan, to be provided in each district.</p> <p>c) Emergency Evacuation Area (Open Space and Building)</p> <p>Open space (park, school ground, football area, etc.) would be one of the emergency areas which will equip with requisites for use in the event of disaster. It shall be utilized for the purpose of not only destination of escape but also base for rescue, relief and temporary housing purposes, while building (shelter, etc.) would be one of the emergency areas which will equip water supply facilities, toilet, etc. for temporary use for dislocated families.</p> <p>The emergency area shall be located under the conditions that (i) along main arterial road, (ii) in the vicinity of hazard area, and (iii) nearer to city center and sub-centers. Time required for escape/evacuation is quite limited when disaster occurs. Thus the place having higher elevation, and/or safer space shall be provided along the escape road.</p> <p>Locations and number of emergency evacuation area shall be planned taking into account</p>


	<p>the population distribution in danger area, escape road network, distance from the houses, and possible distance for escape on foot, which is assumed at about 2 km radius (30 minutes at a walking speed of 1m/sec on average among the aged, handicapped and children). If the existing emergency evacuation area is located outside the houses with such distance, additional emergency evacuation area shall be planned.</p> <p>Following disaster management map was prepared with ALMA. More integrated map shall be prepared.</p> 																
5. Objective	To improve Public Emergency Facilities for Disaster Preparedness																
6. Project Component	<p>(1) Study on Selection of Emergency Base (like Civic Core in Japan, see attachment)</p> <p>(2) Study on Improvement of Emergency Evacuation Area (Open Space and Building)</p> <p>(2-1) Improvement of Emergency Evacuation Area (Open Space and Building)</p> <p>(2-2) Capacity Building for Permanent Staff.</p>																
7. Regulating Organization	<p><u>Organization: ALMA</u></p> <p><u>Division/Department in charge: Directorate of Urban Planning, COMUPRED and CODIPRED of District Offices I-VII of ALMA</u></p>																
8. Implementation Organization (list all)	<p><u>SINAPRED, etc.</u></p> <p><u>Directorate of Territorial Organization of SINAPRED, etc.</u></p>																
9. Cost	<p>Total Cost: USD <u> 1 </u> Million</p> <p><i>(describe the breakdown by period if possible)</i></p> <table border="1" data-bbox="405 1839 1251 2022"> <thead> <tr> <th>USD Million</th> <th>Short term (2017–2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>1</td> <td></td> <td></td> </tr> <tr> <td>(Construction)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>(O&M)</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	1			(Construction)				(O&M)			
USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)														
Total Cost	1																
(Construction)																	
(O&M)																	

10. Revenue Collection	<u>Not Possible</u>
11. Possible Fund Source	<u>ODA (Technical Cooperation)</u>
12. Timing of Implementation	<p><u>(i) Short: MP Formulation -2020</u> <u>(ii) Middle: 2021 – 2030</u> <u>(iii) Long: 2031 – 2040</u></p> <p>(i) Starting year of study : <u>2018</u> (ii) Starting year of construction : _____ (iii) Starting year of operation : _____</p>
13. Compliance with Development Visions	<p>(i) National Development Plan: <u>YES</u> PARTLY NO (ii) Sector Development Plan: <u>YES</u> PARTLY NO (iii) Implementation Organization's Dev't Plan: <u>YES</u> PARTLY NO</p>
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>? persons</u> ● Current demand gap: <u>N/A</u> ● Additional supply volume from the project (No. or % of the gap): <u>N/A</u> ● Qualitative Assessment: <u>HIGH</u> MIDDLE LOW (Describe why: <u>Reduction of Disaster Risk</u>)
15. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE <u>LOW</u> (Describe why: <u>No Pollution expected</u>) ● Social Environment Impact: HIGH MIDDLE <u>LOW</u> (Describe why: <u>No Resettlement</u>)

Source: JICA Study Team

DM-5: Project for Development of Emergency Transportation Network

1. Program Title	<u>(vi) Disaster Management Program</u>
2. Project Title	<u>Project for Development of Emergency Transportation Network</u>
3. Project Map	Location: COMUPRED of ALMA and CODIPRED of District Offices I-VI
4. Background	<p>Emergency transportation network shall be provided for smooth activities in an emergency situation such as escape, rescue and relief of citizen by relevant government agencies. The escape transportation network plays an important role for providing route for the citizen to escape from disaster to safer place before disaster, while the rescue and relief transportation network provides immediate treatment, and supply relief goods and materials for dislocated families after disaster.</p> <p>Emergency road transport network shall form a belt line linking among city center, new sub-centers, emergency operation center, emergency base, emergency evacuation areas, airport, sea port, etc. The most effective route with shortest distance to and from the above areas shall be analyzed by each District.</p> <p>Emergency air and water transportation network shall be assigned at the existing airport and seaport, but heliport at the rooftop of the emergency operation center or emergency base shall be developed in the future.</p> <p>Signboards and lights will also be provided in the night time in the emergency transportation network</p>


	<p>Following evacuation road map was prepared by ALMA. More integrated map shall be prepared.</p> 																
5. Objective	To develop Emergency Transportation Network																
6. Project Component	<p>(1) To study on development of emergency road transport network (1-1) Establishment of emergency road transport network (1-2) Dissemination of emergency road transport network</p> <p>(2) To study on development of emergency air and water transportation network (2-1) Establishment of emergency air and water transport network (2-2) Dissemination of emergency air and water transport network</p> <p>(3) To study on development of signboards and lights in night time in emergency transportation network (3-1) Preparation of signboards and lights (3-2) Capacity Building for operation</p>																
7. Regulating Organization	<p><u>Organization: ALMA</u> <u>Division/Department in charge: Directorate of Urban Planning, COMUPRED and CODIPRED of District Offices I-VII of ALMA</u></p>																
8. Implementation Organization (list all)	<p><u>SINAPRED, etc.</u> <u>Directorate of Territorial Organization of SINAPRED, etc.</u></p>																
9. Cost	<p>Total Cost: USD <u>1</u> Million</p> <p><i>(describe the breakdown by period if possible)</i></p> <table border="1" data-bbox="459 1686 1297 1877"> <thead> <tr> <th>USD Million</th> <th>Short term (2017 – 2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>1</td> <td></td> <td></td> </tr> <tr> <td>(Construction)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>(O&M)</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	USD Million	Short term (2017 – 2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	1			(Construction)				(O&M)			
USD Million	Short term (2017 – 2020)	Mid term (2021-2030)	Long term (2031-2040)														
Total Cost	1																
(Construction)																	
(O&M)																	
10. Revenue Collection	<u>Not Possible</u>																
11. Possible Fund Source	<u>ODA (Technical Cooperation)</u>																

12. Timing of Implementation	<p>(i) Short: MP Formulation -2020</p> <p>(ii) Middle: 2021 – 2030 (iii) Long: 2031 – 2040</p> <p>(i) Starting year of study : <u>2018</u></p> <p>(ii) Starting year of construction : _____</p> <p>(iii) Starting year of operation : _____</p>
13. Compliance with Development Visions	<p>(i) National Development Plan: <u>YES</u> PARTLY NO</p> <p>(ii) Sector Development Plan: <u>YES</u> PARTLY NO</p> <p>(iii) Implementation Organization's Dev't Plan: <u>YES</u> PARTLY NO</p>
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>? persons</u> ● Current demand gap: <u>N/A</u> ● Additional supply volume from the project (No. or % of the gap): <u>N/A</u> ● Qualitative Assessment: <u>HIGH</u> MIDDLE LOW (Describe why: <u>Reduction of Disaster Risk</u>)
15. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE <u>LOW</u> (Describe why: <u>No Pollution expected</u>) ● Social Environment Impact: HIGH MIDDLE <u>LOW</u> (Describe why: <u>No Resettlement</u>)

Source: JICA Study Team

DM-6 : Project for Study, Design and Installation of the Flood Early Warning System for the Urban Area of Managua City

1. Title of the program	<u>(vi) Disaster Management Program</u>
2. Title of the program	Project for Study, Design and Installation of the Flood Early Warning System for the Urban Area of Managua City
3. Map of the project	-
4. Background	<p>Since the flood damage caused by Hurricane Mitch (1998) were serious in this country, concerned agencies made efforts to implement prevention and mitigation measures in the areas, especially the areas with population at high risk.</p> <p>The works related to the Flood Early Warning Systems were first carried out in order to prevent damages to the life and assets of the people. The INETER, through the General Directorate of Water Resources, DGRH, focused its efforts on the establishment of Early Warning Systems for floods, community-based systems and other automatic (real-time monitoring) systems with economic and technical supports from international cooperation.</p> <p>The city of Managua, is habitually affected by floods, therefore INETER considered necessary of installation of a System of Early Warning for Flood that is in function of the monitoring of the precipitation and runoff.</p>

	 <p>Mapa de estaciones hidrometeorológica satelital</p>
<p>5. Objective</p>	<p>Design the Integrated Early Warning System for floods, within the southern subbasin of Lake Managua (urban area of Managua), according to the main axes of operation of the SATs (Surveillance, Forecast, Communication and Response).</p>
<p>6. Component</p>	<ol style="list-style-type: none"> 1. Densify the hydrometeorological surveillance network: It is intended to increase the network of satellite hydrometeorological stations considering 1 station per 20 km², for a total of approximately 40 stations; To this we read the 18 stations already installed in Managua, for a total of 22 new stations to be installed. The network would consist of: <ul style="list-style-type: none"> • 18 pluviotelemetric stations (satellite / Sutron) • 12 rainfall stations (GPRS transmission) • 10 stations Hydropluviotelectric (satellite) • 2 special hydrometric stations (level measurement by means of laser sensor) 2. Creation of the Hydrometeorological Information System (hydrometeorological data base), this component includes the creation of a system to store all the information generated by the different meteorological models (eg Radar), hydrological as well as all the information generated for the City of Managua that will serve as input for different studies <ul style="list-style-type: none"> • Acquisition of meteorological, hydrological and database management software. • Special computer equipment (high-capacity storage and processing computers) • Training in hydrological and meteorological forecasting. 3. Flood Hazard Studies: This component consists of maps of flood hazards at critical sites in the previously identified urban area. <ul style="list-style-type: none"> • Hydraulic and hydrological modeling of the urban area of Managua (priority microbasins) 4. Institutional Strengthening (requirement): a fundamental component that will allow us to be efficient and efficient in hydrometeorological surveillance, for this we need the hiring of personnel that allow us to perform continuous shifts in addition to a space where the Hydrometeorological Forecast Center and / O The Hydrometeorological Operations Center <ul style="list-style-type: none"> • Recruitment • Structural improvement (creation of the Hydrometeorological Operations

	Center, COH, expansion of the Hydrometeorological Forecast Center)Mejora estructural (creación del Centro de Operaciones Hidrometeorológico, COH, ampliación del Centro de Pronostico Hidrometeorológico)																
7. Regulator Organization	<u>Organization: INETER /SINAPRED/ALMA</u> <u>Division/Department in charge: Directorate of Hydrology of INETER, Directorate of Territorial Organization of SINAPRED, Directorate of Urban Planning of ALMA</u>																
8. Implementation Organization (list of all)	<u>Organization: INETER /SINAPRED/ALMA, etc.</u> <u>Division/Department in charge: Directorate of Hydrology of INETER, Directorate of Territorial Organization of SINAPRED, Directorate of Urban Planning of ALMA, etc.</u>																
9. Cost	Total Cost: USD <u>1.5</u> Million <i>(describe the breakdown by period if possible)</i> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>USD Million</th> <th>Short term (2017–2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>1.5</td> <td></td> <td></td> </tr> <tr> <td>(Construction)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>(O&M)</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	1.5			(Construction)				(O&M)			
USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)														
Total Cost	1.5																
(Construction)																	
(O&M)																	
10. Revenue Collection																	
11. Possible Source of the Fund	<u>ODA (Subsidy and technical cooperation)</u>																
12. Implementation Time	(i) Short: Formulation MP -2020 (ii) Medium: 2021 – 2030 (iii)Long: 2031 – 2040 (i) Starting year of study : <u>2018</u> (ii) Starting year of construction : _____ (iii) Staring year of operation : _____																
13. Compliance with Development Visions	(i) National Development Plan: <u>YES</u> PARCIAL NO (ii) Sector Development Plan: <u>YES</u> PARCIAL NO (iii) Implementation Organization Development Plan: <u>YES</u> PARCIAL NO																
14. Social-Economic Impact	<ul style="list-style-type: none"> ● Beneficiaries (households) of the projects: <u>1.5 million people</u> ● Current area of demand: Nicaraguan capital ● Additional project delivery volume (No. or% of space): _____ ● Qualitative evaluation: <u>HIGH</u> MEDIUM LOW (Describe why: <u>Disaster risk reduction</u>) 																
15. Environmental Impact	<ul style="list-style-type: none"> ● Impact of the natural environment: HIGH MEDIUM <u>LOW</u> (Describe why: It does not cause pollution) ● Social Environmental Impact: HIGH MEDIUM LOW (Describe why: _____) 																

Source: JICA Study Team

DM-7 : Project for Consideration on Environment including Solid Waste Management

1. Program Title	<u>(vi) Disaster Management Program</u>
2. Project Title	<u>Project for Consideration on Environment including Solid Waste Management</u>

	(This Project will be implemented under proposed "Project for Consideration of Environment including Solid Waste Management".)																
3. Project Map	Location: COMUPRED of ALMA and CODIPRED of District Offices I-VI																
4. Background	One of the causes of flooding from the river channel is due to garbage/solid waste inside the channel and micropresa dumped by local residents. Annual maintenance cost spent by ALMA for removal of these garbage/solid waste from the channel and micropresa are very big. Accordingly, education to the local residents to consider this issue as part of the environment is also very important.																
5. Objective	To develop education to the local residents																
6. Project Component	(1) To consider environment including Solid Waste Management																
7. Regulating Organization	<u>Organization: ALMA</u> <u>Division/Department in charge: Directorate of Urban Planning, COMUPRED and CODIPRED of District Offices I-VII of ALMA</u>																
8. Implementation Organization (list all)	<u>SINAPRED, etc.</u> <u>Directorate of Territorial Organization of SINAPRED, etc.</u>																
9. Cost	Total Cost: USD <u>6</u> Million <i>(describe the breakdown by period if possible)</i> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>USD Million</th> <th>Short term (2017–2020)</th> <th>Mid term (2021-2030)</th> <th>Long term (2031-2040)</th> </tr> </thead> <tbody> <tr> <td>Total Cost</td> <td>4</td> <td>2</td> <td></td> </tr> <tr> <td>(Construction)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>(O&M)</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)	Total Cost	4	2		(Construction)				(O&M)			
USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)														
Total Cost	4	2															
(Construction)																	
(O&M)																	
10. Revenue Collection	<u>Not Possible</u>																
11. Possible Fund Source	<u>ODA (Technical Cooperation)</u>																
12. Timing of Implementation	<u>(i) Short: MP Formulation -2020</u> <u>(ii) Middle: 2021 – 2030</u> <u>(iii) Long: 2031 – 2040</u> (i) Starting year of study : <u>2018</u> (ii) Starting year of construction : _____ (iii) Starting year of operation : _____																
13. Compliance with Development Visions	(i) National Development Plan: <u>YES</u> PARTLY NO (ii) Sector Development Plan: <u>YES</u> PARTLY NO (iii) Implementation Organization's Dev't Plan: <u>YES</u> PARTLY NO																
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>? persons</u> ● Current demand gap: <u>N/A</u> ● Additional supply volume from the project (No. or % of the gap): <u>N/A</u> ● Qualitative Assessment: <u>HIGH</u> MIDDLE LOW (Describe why: <u>Reduction of Disaster Risk</u>) 																
15. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE <u>LOW</u> (Describe why: <u>No Pollution expected</u>) ● Social Environment Impact: HIGH MIDDLE <u>LOW</u> (Describe why: <u>No Resettlement</u>) 																

Source: JICA Study Team

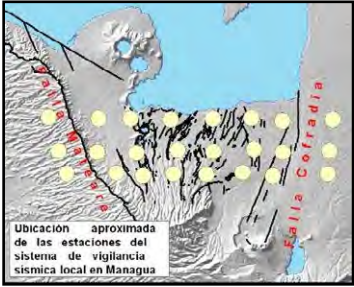
DM-8 : Project for Assessment of Earthquake Resistance for Existing Buildings, and Study on Improvement for Earthquake-Resistant Buildings

1. Program Title	<u>(vi) Disaster Management Program</u>		
2. Project Title	<u>Project for Assessment of Earthquake Resistance for Existing Buildings, and Study on Improvement for Earthquake-Resistant Buildings</u>		
3. Project Map	Location: ALMA		
4. Background	There are still many buildings in Managua City, unsafe structurally against earthquake. Some buildings of district office of ALMA are also not structurally safe due to old and non-resistant structures for earthquake, which will not fully function as an emergency base. Therefore, some study and improvement by structural and non-structural measures are important. Therefore, this project was proposed to grasp current situation of buildings and to find a way for improvement for earthquake.		
5. Objective	To improve situation of buildings against earthquake in ALMA		
6. Project Component	(1) Assessment of Earthquake Resistance for Existing Buildings (2) Study on Improvement for Earthquake-Resistant Buildings		
7. Regulating Organization	<u>Organization: ALMA</u> <u>Division/Department in charge: Directorate of Urban Planning, COMUPRED and CODIPRED of District Offices I-VII of ALMA</u>		
8. Implementation Organization (list all)	<u>SINAPRED, etc.</u> <u>Directorate of Territorial Organization of SINAPRED, etc.</u>		
9. Cost	Total Cost: USD <u> 1 </u> Million <i>(describe the breakdown by period if possible)</i>		
	USD Million	Short term (2017 – 2020)	Mid term (2021-2030)
	Total Cost	1	
	(Construction)		
	(O&M)		
10. Revenue Collection	<u>Not Possible</u>		
11. Possible Fund Source	<u>ODA (Grant and Technical Cooperation)</u>		
12. Timing of Implementation	<u>(i) Short: MP Formulation -2020</u> <u>(ii) Middle: 2021 – 2030</u> <u>(iii) Long: 2031 – 2040</u> (i) Starting year of study : <u> 2018 </u> (ii) Starting year of construction : _____ (iii) Starting year of operation : _____		
13. Compliance with Development Visions	(i) National Development Plan: <u>YES</u> PARTLY NO (ii) Sector Development Plan: <u>YES</u> PARTLY NO (iii) Implementation Organization's Dev't Plan: <u>YES</u> PARTLY NO		
14. Social Economic Impact	● # of beneficial persons (household) from the projects: <u> ? persons </u> ● Current demand gap: <u> N/A </u> ● Additional supply volume from the project (No. or % of the gap): <u> N/A </u> ● Qualitative Assessment: <u>HIGH</u> MIDDLE LOW (Describe why: <u> Reduction of Disaster Risk </u>		
15. Environmental	● Natural Environment Impact: HIGH MIDDLE <u>LOW</u>		

Impact	(Describe why: <u>No Pollution expected</u>) <ul style="list-style-type: none"> ● Social Environment Impact: HIGH MIDDLE LOW (Describe why: <u>No Resettlement</u>)
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Source: JICA Study Team

DM-9 : Improvement of Earthquake Disaster Prevention and Warning System

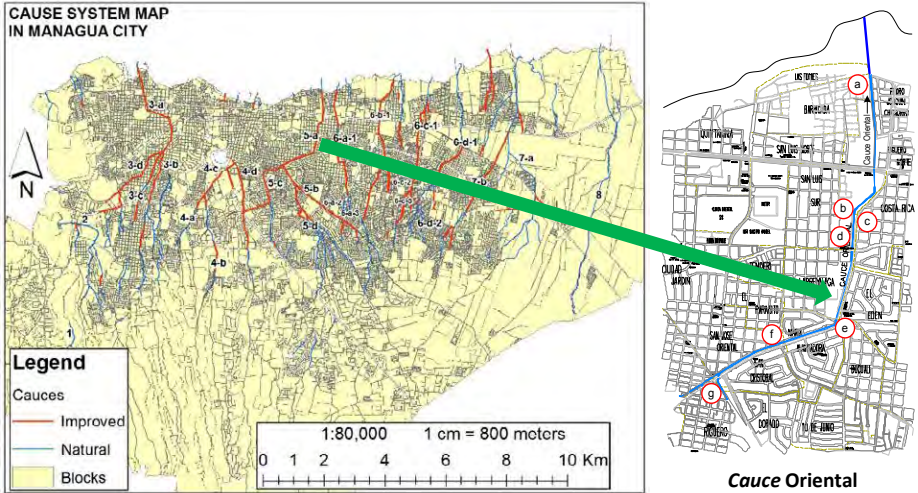
1. Title of the program	<u>(vi) Disaster Management Program</u>
2. Title of the program	<u>Improvement of Earthquake Disaster Prevention and Warning System</u>
3. Map of the project	Location: Metropolitan area of Managua and nearby
4. Background	Managua from recent historical times (postcolonial) has experienced seismicity with events that, without being large earthquakes, have caused increasing damage to both human and infrastructure. With the current localization error of earthquakes and the high density of faults in the urban area, it is difficult to say what geological fault is the generator of the local telluric events; in addition, the low density of seismic stations prevents to define the mechanism of rupture of these earthquakes. The densification of seismic stations would solve these two things and the real-time seismic monitoring would allow to locate the premonitory earthquakes of a larger earthquake. Residents of Managua mention that before the destructive earthquakes of 1972 they felt earthquakes; Instrumentally it would be possible to record many earthquakes of low magnitude, even imperceptible to the population and to graph the epicenters in the map of geological faults of Managua to identify which fault is the one that has been activated with days before the occurrence of some moderate event, in addition the mechanisms of rupture would be defined, which, for the most part, would be repetitive for the same fault.
5. Objective	To Improve Disaster Prevention and Warning System
6. Component	<p>(1) Strengthen of the Earthquake Prevention and Warning System</p> <p>(1-1) Study and proposal of the System of prevention and warning for extreme local earthquakes in Managua</p> <p>(1-2) Acquisition and installation of 25 seismic stations in Managua</p> <div style="text-align: right;">  </div> <p>(1-3) Articulation of the system of stations to the Seismic Central via router / radio</p> <p>(1-4) Elaboration of software for monitoring of Managua in real time</p> <p>(1-5) Design of communication protocol of warnings and recommendation of alerts.</p>
7. Regulator Organization	<p><u>Organization: INETER /SINAPRED/ALMA</u></p> <p><u>Division/Department in charge: Directorate of Hydrology of INETER, Directorate of Territorial Organization of SINAPRED, Directorate of Urban Planning of ALMA</u></p>
8. Implementation	<u>Organization: INETER /SINAPRED/ALMA, etc.</u>

Organization (list of all)	Division/Department in charge: Directorate of Hydrology of INETER, Directorate of Territorial Organization of SINAPRED, Directorate of Urban Planning of ALMA, etc.			
9. Cost	Total Cost: USD <u>1</u> Million <i>(describe the breakdown by period if possible)</i>			
	USD Million	Short term (2017–2020)	Mid term (2021-2030)	Long term (2031-2040)
	Total Cost	1		
	(Construction)			
	(O&M)			
10. Revenue Collection				
11. Possible Source of the Fund	<u>ODA (Subsidy and technical cooperation)</u>			
12. Implementation Time	<p>(i) Short: Formulation MP -2020</p> <p>I) First year: Project Preparation. Design of network geometry, site recognition, seismic station accommodation request, seismic equipment identification and accessories, software preparation</p> <p>II) Second year: Acquisition of equipment, assembly of stations, laboratory test, construction of equipment protection conditions</p> <p>III) Installation and testing of the network; Software testing and issuing warnings</p> <p>(ii) Medium: 2021 – 2030</p> <p>(iii) Long: 2031 – 2040</p> <p>(i) Starting year of study : <u>2018</u></p> <p>(ii) Starting year of construction : _____</p> <p>(iii) Starting year of operation : _____</p>			
13. Compliance with Development Visions	<p>(i) National Development Plan: <u>YES</u> PARCIAL NO</p> <p>(ii) Sector Development Plan: <u>YES</u> PARCIAL NO</p> <p>(iii) Implementation Organization Development Plan: <u>YES</u> PARCIAL NO</p>			
14. Social-Economic Impact	<ul style="list-style-type: none"> ● Beneficiaries (households) of the projects: <u>2.2 million people</u> ● Current area of demand: Nicaraguan capital ● Additional project delivery volume (No. or% of space): _____ ● Qualitative evaluation: <u>HIGH</u> MEDIUM LOW (Describe why: <u>Earthquake disaster risk reduction</u>) 			
15. Environmental Impact	<ul style="list-style-type: none"> ● Impact of the natural environment: HIGH MEDIUM <u>LOW</u> (Describe why: It does not cause pollution) ● Social Environmental Impact: HIGH MEDIUM LOW (Describe why: _____) 			

Source: JICA Study Team

FM-1 : Structural Improvement of Priority *Cauces* Project

1. Program Title	(iii) Infrastructure development program (vi) Disaster Management Program
2. Project Title	<u>Structural Improvement of Priority <i>Cauces</i> Project</u>

<p>3. Project Map</p>	 <p>Source: JICA study team prepared based on information of ALMA</p> <p style="text-align: center;">Locations of <i>Cauce Oriental</i> as Priority One</p>
<p>4. Background</p>	<p>Shortage of flow capacity of cauces: Large scale floods often overflow from <i>cauces</i> (drainage canals). Fundamental data to study flood measures including existing flow capacity and probable floods of each <i>cauces</i> are no available. Assessment of existing flow capacity of each <i>cauce</i> against probable floods will be a first step of the improvement works. It is expected that study on master plan of flood drainage in Managua city supported by IDB will contribute to understand the current conditions. On the other hand, it is clarified that floods of <i>Cauce Oriental</i> often overflow and make significant damage on Pista Juan Pablo II highway. The drainage section of ALMA considers that flood of <i>Cauce Oriental</i> is one priority issue on flood management in Managua city. Improvement of flow capacity of the <i>cauce</i> is highly required to ensure safe traffic on the highway.</p>
<p>5. Objective</p>	<p>To improve flow capacity of priority <i>cauce</i></p>
<p>6. Project Component</p>	<p>(1) Review of the master plan of flood drainage in Managua city (2) Selection of facilities to be improved (3) Design of improvement works (4) Construction works</p>
<p>7. Regulating Organization</p>	<p><u>Drainage section in ALMA</u></p>
<p>8. Implementation Organization (list all)</p>	<p><u>Drainage section in ALMA</u></p>
<p>9. Cost</p>	<p>Total Cost: USD <u>30</u> Million Construction: USD _____ Million O&M: USD _____ Million / year (for how many years)</p>
<p>10. Revenue Collection</p>	<p>(ii) Not Possible</p>
<p>11. Possible Fund Source</p>	<p><u>Loan or Grant for ALMA</u></p>
<p>12. Timing of Implementation</p>	<p>(i) Short: MP Formulation -2020</p>
<p>13. Compliance with Development Visions</p>	<p>(i) National Development Plan: YES PARTLY NO (ii) Sector Development Plan: YES PARTLY NO</p>

	(iii) Implementation Organization's Dev't Plan: <u>YES</u> PARTLY NO
14. Social Economic Impact	<ul style="list-style-type: none"> ● # of beneficial persons (household) from the projects: <u>approximately 200,000 person</u> ● Current demand gap: _____ ● Additional supply volume from the project (No. or % of the gap): _____ ● Qualitative Assessment: <u>HIGH</u> MIDDLE LOW (Describe why: <u>It will contribute safe traffic against flooding</u>)
15. Environmental Impact	<ul style="list-style-type: none"> ● Natural Environment Impact: HIGH MIDDLE <u>LOW</u> (Describe why: <u>It is improvement of the existing drainage canal paved by concrete</u>) ● Social Environment Impact: HIGH MIDDLE <u>LOW</u> (Describe why: <u>The project will not require resettlement because project sites will be within public land</u>)

Source: JICA Study Team