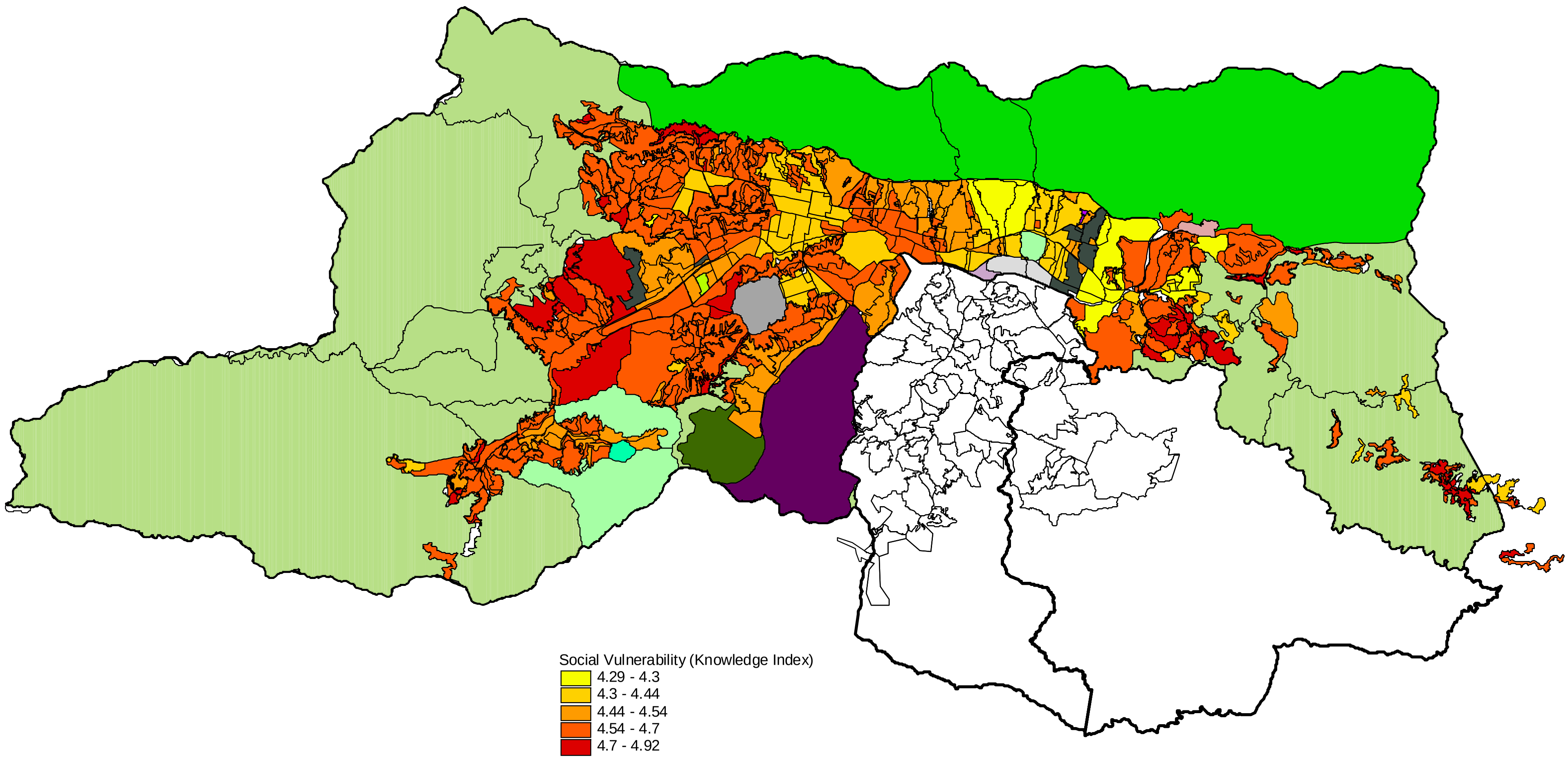


Figure 5.5.2 Social Vulnerability Map (Knowledge of Disaster Index)

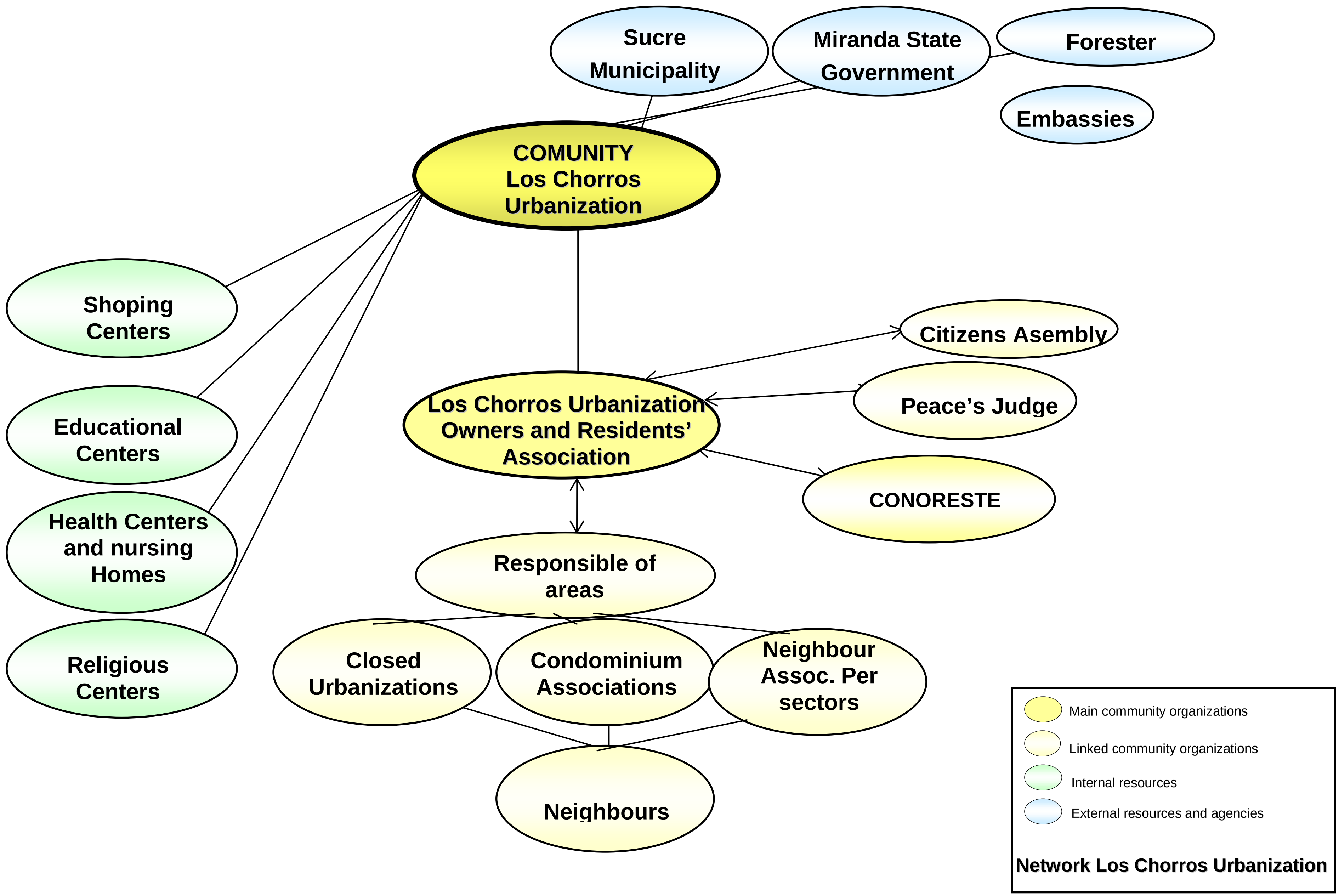


Figure 5.5.3 Social Network in Los Chorros

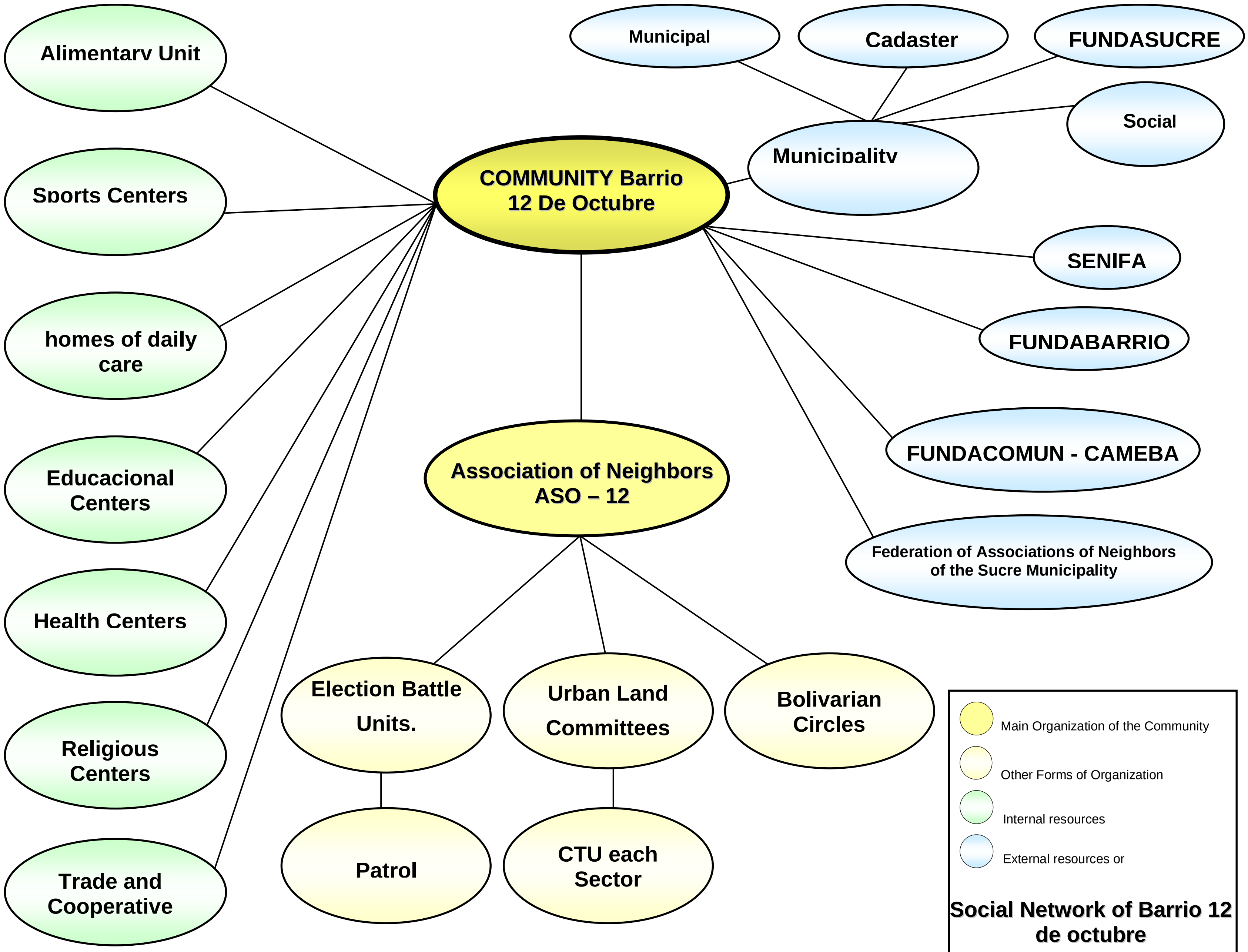


Figure 5.5.4 Social Network in 12 de Octubre

Level-2: Preparedness Period until Warning and Evacuation

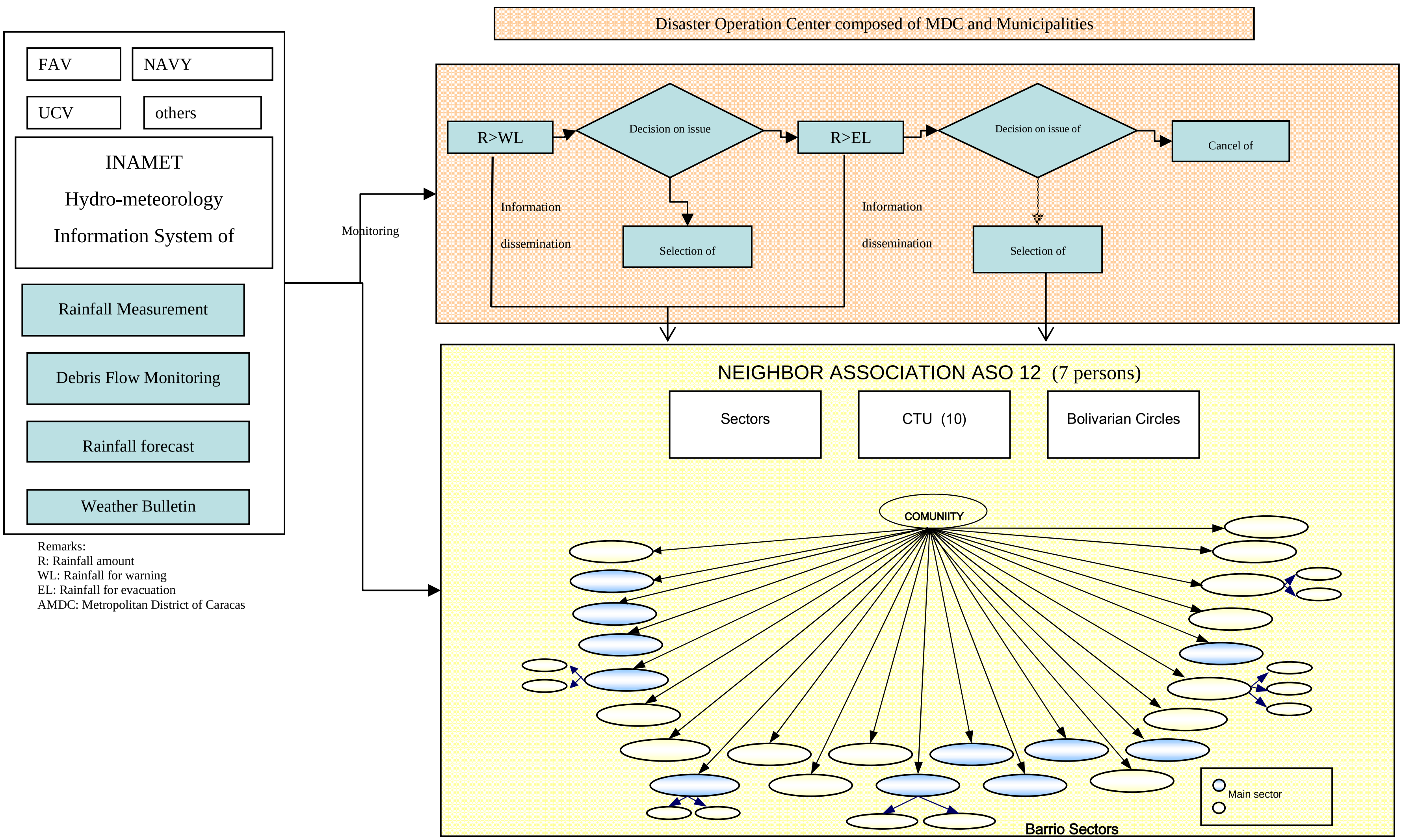
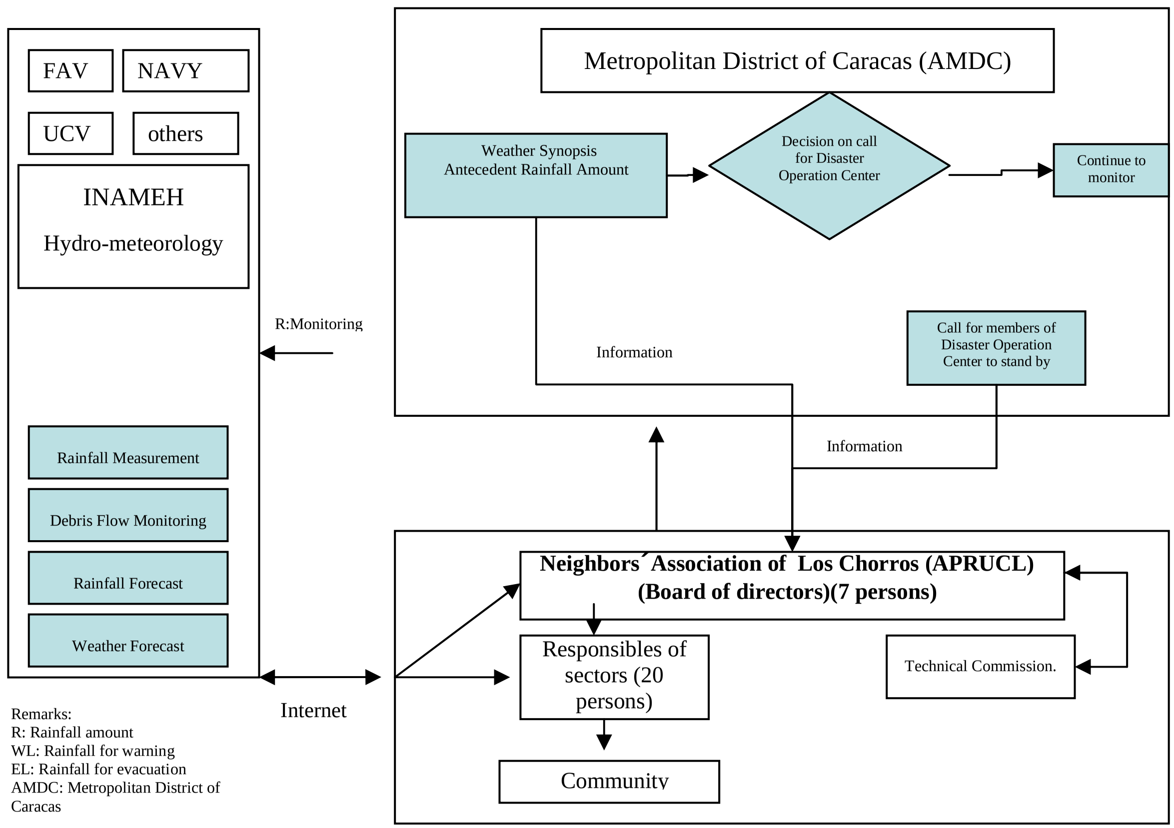


Figure 5.5.5 Proposal of Modification of Early Waning System in Preparedness Period 12 de Octubre

Level-1: Normal time till Preparedness



Remarks:
R: Rainfall amount
WL: Rainfall for warning
EL: Rainfall for evacuation
AMDC: Metropolitan District of Caracas

Figure 5.5.6 Proposal of Modification of Early Waning System in Preparedness Period Los Chorros

Level-2: Preparedness Period until Warning and Evacuation

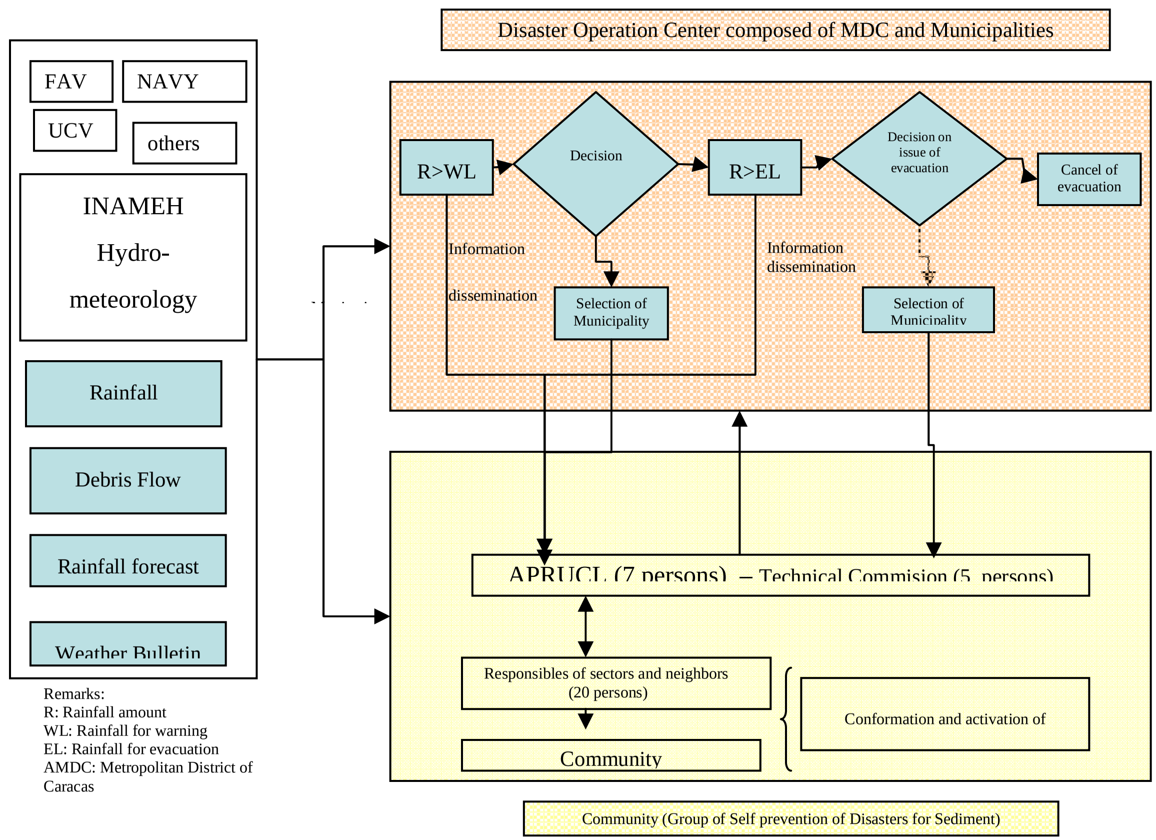


Figure 5.5.7 Proposal of Modification of Early Waning System in Preparedness Period Los Chorros

CHAPTER 6

DISASTER SCENARIOS

"The communitarian participation is

the key piece in prevention and mitigation of disasters"

Marielba Guillen

CHAPTER 6. DISASTER SCENARIOS

6. 1 Disaster Scenarios

6. 1. 1. Significance of Disaster Scenarios

When making a plan for disaster prevention, it is necessary to analyze the mechanism of disaster: what is the natural hazard, what are the human activities there, what damage is caused, what is the capacity of the society to cope with the situation, and what is the vulnerability of the society.

A good method to clarify the disaster mechanism, is to create risk maps showing the present configuration of the city, superimposed by natural hazard maps. A risk map shows the physical damage caused by the natural hazard. In this Study, a social capacity/vulnerability map was created in order to see its geographical distribution to visualize the locations of physical risks and social capacity/vulnerability. The combination of physical risk map and social capacity/vulnerability map will show the scenario of disaster more clearly.

The disaster scenario is neither a forecast nor a prediction. It is just an assumption tool to facilitate analysis of the disaster mechanism. Therefore, people need to avoid emphasizing the result of the disaster scenario as if it was a kind of disaster prediction. Nonetheless, the disaster scenario always should accompany a disaster management plan, since it is prepared based on the scenario.

When abundant information is available on repeating hazard phenomena, it is possible to analyze them statistically and make a simulation with a design return period. However, in this Study, for both earthquakes and sediment disasters, available data is limited and such statistical analysis is difficult. Therefore, the Study Team agreed with the Counterpart Team that past real phenomena of earthquakes and sediment disasters are to be simulated for disasters scenarios.

6. 1. 2. Earthquake Disaster Scenarios

As seen in Chapter 3, earthquake disasters have the following characteristics when compared to other types of disasters:

- Occurrence of disastrous earthquake is infrequent, compared to meteorological disasters.

- It is still very difficult to make an earthquake prediction. Early warning is not effective for earthquake disasters.

- Once a major earthquake happens, it will affect a wide area.

- Major cause of death due to earthquake disaster is collapse of buildings.

In this section, interpretation of the calculated disaster scenarios is discussed.

(1) Historical 1967 Earthquake

Although the magnitude of this earthquake would be moderate compared to that of the 1812 earthquake, the affected area would be toward the western part, due to the close proximity to the earthquake fault, and in the Valley due to the amplification of ground motion by subsoil. Both of the 1967 and the 1812 earthquake had occurred along San Sebastian fault system, which is the most active fault around Caracas. Generally an earthquake with smaller magnitude has higher possibility of occurrence than those with a larger magnitude. Therefore, the 1967 earthquake can be considered as the most likely case among four scenarios in this study.

(2) Historical 1812 Earthquake

This is the worst earthquake in Venezuelan history. Affected area is widely spread out over the whole Valley due to its large magnitude and close distance to the fault segment. The probability of occurrence of this earthquake is smaller than that of 1967 earthquake.

(3) Historical 1878 Earthquake

The southern part of Caracas would suffer some damage, because the fault is located south of the city.

(4) Hypothetical Avila Fault Earthquake

There is no record of earthquake occurring from this fault in history since the foundation of Caracas, but the seismicity and fault study shows that this fault is active. In this sense, this type of earthquake will occur with least probability among four scenarios.

6. 1. 3. Sediment Disaster Scenarios

In Caracas there are two serious sediment disasters on record: the December 1999 disaster and February 1951 disaster. In fact, the Caracas December 1999 disaster is one of the most serious in terms of sediment on record. The affected areas for December 1999 mostly concentrated in the western part of Caracas, whereas it is reported that in 1951, the disaster uniformly affected Caracas from east to west. It is recommended that the sediment disaster scenarios in the Study should consider those two disasters.

For the selection of sediment disaster scenarios, both rainfall amount and regional distribution are quite significant. In Caracas, the rainfall in December 1999 was relatively more concentrated on the western part of the area. This can be supported by the evidence of the steep slope failure in El Avila at that time. The rainfall amount in 1999 in El Avila is still difficult to evaluate accurately; however, from the flooding conditions in the urban area it can be concluded that it is the highest on record. The February 1951 flood brought quite uniformly distributed rainfall over the Avila from the west to the east.

In the debris flow simulations, rainfall amount with three different return periods were assumed: namely, 10 years, 100 years and 500 years.

According to the comparison of the simulation results and the flood mark survey of the December 1999 flood, it is concluded that the phenomenon in December 1999 coincides well with the simulation results with the return period of 100 years, considering only the southern part of El Avila .

Regarding the slope failure / landslide disaster, all risky area caused by slope failures and landslides were identified in the Study Area. These areas are defined as the risky area and the number of the houses in the risky areas were counted.

6. 2 Capacity and Vulnerability of the Study Area for Disaster Prevention

6. 2. 1. Disaster Management Administration/Legislation

The core of the disaster management administration for the Metropolitan District of Caracas is the Civil Protection of ADMC. The Civil Protection is an organization backed up by the “Law of The National Organization of Civil Protection and Administration of Disasters” enacted in November 2001. According to the law, the national government and each state government and local government must have their own unit of “Civil Protection” in order to administer the disaster management activity.

However, the responsibility of the Civil Protection focuses on three phases of disaster management (namely “preparation”, “emergency response” and “rehabilitation”) leaving the aspect of “mitigation” or “prevention” outside a clear role defined in the law. This leads to the lack of concept of long term plans in the Civil Protection disaster management administration, such as reinforcement of buildings and infrastructures, construction of sediment control structures, land use regulation and urban planning taking into account the disaster management concept. There are national level organizations such as Ministry of Infrastructure, Ministry of Environment/Natural Resources, Ministry of Planning and Development and Ministry of Interior and Justice, which are relevant to such mitigation or prevention measures.

The “Law of The National Organization of Civil Protection and Administration of Disasters” is a significant step for the country to integrate efforts for disaster management. As the law and the organization of Civil Protection, which was created based upon the law are still young, related regulations and ordinances for civil protection and disaster administration have not been prepared yet. Neither National Disaster Prevention Plan nor the Guidelines for Regional Disaster Prevention Plan have been formulated so far. This lack of practical plan or guidelines is impeding the real practice of the responsibilities of the Civil Protection.

The summary of the capacity and the vulnerability in terms of disaster management administration/ legislation in the Metropolitan District of Caracas is as follows:

(1) Civil Protection has a firm legislation background of “Law of The National Organization of Civil Protection and Administration of Disasters” as the core of the disaster management administration of the Metropolitan District of Caracas.

(2) Because of the short history of the law and the Civil Protection itself, national disaster prevention plans, guidelines for regional disaster prevention plan and disaster management regulations and related ordinances are lacking.

(3) According to the law, three stages of disaster management cycle (namely “preparation for emergency response”, “emergency response” and “rehabilitation”) are covered as the responsibility of the Civil Protection. However, the stage of “mitigation” is not mentioned nor well recognized as the responsibility of the Civil Protection.

(4) Various ministries such as Ministry of Interior and Justice, Ministry of Infrastructure, Ministry of Planning and Development and Ministry of Environment/Natural Resources are relevant national governmental organizations for mitigation measures.

6. 2. 2. Social Capacity and Social Vulnerability

Based on the social vulnerability survey conducted in the Study, the study area was categorized into 15 socially similar sub-areas. For each of the 15 zones, social capacity/vulnerability index was assigned based on the social survey.

Social capacity/vulnerability index is calculated from various social indices that are classified into five groups: namely knowledge index (education level, information availability, experiences of disasters, etc.), economic index (income level, possession of disaster insurance, possession of house tenant, etc.), facility index (accessibility to emergency exit, possession of emergency tools, etc.), community activity index (information from community, etc.) and demographic index (age structure of the family, etc.).

Since these social capacity/vulnerability indices are unique ones for this study, it is not possible to compare these figures with the ones of other cities in the world.

However, these indices do show the variation of social capacity/vulnerability of the Metropolitan District of Caracas. In this Study, this social capacity/vulnerability map was created in order to quantify the results of social survey.

The social capacity/vulnerability maps show that the socially vulnerable areas are concentrated in barrio areas since knowledge index, economic index, facility index, community activity index and demographic index all show high vulnerability values.

Figure 6.2.1 shows the social capacity/vulnerability map with the total capacity/vulnerability index.

6. 3 Proposal of Base Disaster Scenarios for Disaster Prevention Plan

6. 3. 1. Basic Concept of Disaster Scenario Selection

In order to make a disaster prevention basic plan, it is necessary to select disaster scenarios as the base for the plan. It must be noted again that the selected scenarios are just assumptions for the base of the plan and not predictions of disaster phenomena.

The selection of scenarios should be made based on the following criteria:

1. The scenarios should be selected among simulated results by sound engineering considerations.
2. The scenarios should be selected through a close discussion between engineers and planners.
3. The scenarios should be selected according to the degree of importance of the target area.
4. It is possible to consider plural number of scenarios according to the timeframe of the plan.

The simulation results of both earthquake disaster and sediment disaster were performed with all information available so far and with close cooperation of the top level academic body in each field in Venezuela: namely, the FUNVISIS and the Institute of Fluid Mechanics of Central University of Venezuela.

The importance of the Metropolitan District of Caracas is large because of its large population and large accumulation of assets and the function as the capital city of the country. Considering this importance of the target area, the conservativeness for preparation of the plan is justified.

The Study Team organized meetings with the Counterpart Team in order to discuss the matter and to select the disaster scenarios for making the basic disaster prevention plan at early stage of the Third Study in Venezuela . The disaster scenarios were selected as discussed below.

6. 3. 2. Earthquake Disaster

(1) Selection of Disaster Scenarios

Table 6.3.1 illustrates how to make priority among different scenarios from the viewpoint of possibility of occurrence and degree of its impact. The scenario to be regarded as the top priority should be the one with high possibility and high impact, and then high possibility with medium impact.

From the viewpoint of the displacement of the fault, the earthquakes from San Sebastian fault have the highest possibility, because they have the highest activities among other faults; La Victoria fault comes next, and then comes Avila. When magnitude of each scenario is considered, 1967 has higher possibility than 1812, because a smaller earthquake has higher possibility to occur than the ones with larger magnitude. The possibility of Hypothetical Avila Earthquake should be carefully interpreted, because the magnitude for this scenario is set to be the lower than maximum probable magnitude for this fault, so that the return period of an earthquake with this magnitude size can be shorter.

From the viewpoint of earthquake impact, 1812 or Avila would have a higher impact than others, because of its Magnitude or close distance, and then 1967 and 1878 follows after these cases.

Considering these factors, the relationship between disaster scenario, and terms and goals for prevention plans is summarized in Table 6.3.2. An earthquake similar to 1967 is the scenario for the first priority and for short term planning, while those similar to 1812 should be achieved with longer time planning. The cases of 1878 earthquake and Avila Fault earthquake are treated as references.

It should be noted that the preventive efforts to cope with the higher priority scenario should also be valid for scenario with lower priority, because once necessary measures are taken for a higher priority scenario, it should be a successful step to better prepare for any disaster in the long run.

(2) Result of Damage Estimation

The results of the damage estimation based on the scenario are summarized in Table 6.3.3.

(3) Hazard Maps and Risk Maps

The hazard maps and risk maps of earthquake disaster prevention are presented in Figure 6.3.1 and 6.3.2. Figure6.3.1 shows the distribution of earthquake motion intensity expressed in MMI. Figure 6.3.2 shows the distribution of ratios of heavily damaged buildings in each micro zone.

6. 3. 3. Sediment Disaster

(1) Result of Damage Estimation

Table 6.3.4 shows the damage estimation by the scenario debris flow with the return period of 100 years.

Table 6.3.5 shows the estimated number of houses in risky area of slope failure or landslides.

(2) Hazard Maps and Risk Maps

The debris flow hazard map is shown in Figure 6.3.3. The landslide/steep slope failure hazard map is show in Figure 6.3.4. The debris flow risk map and the landslide/steep slope failure risk map are shown in Figure 6.3.5 and 6.3.6 respectively. The risk maps classify the hazard area by house density and it is possible to estimate the damage in the area.

6. 3. 4. Disaster Scenario and Social Capacity/Vulnerability

Comparison of Figs.6.2.1, 6.3.2 ,6.3.5 and 6.3.6 shows that,

(1) The area of heavy earthquake damage coincides with socially vulnerable area, meaning that most vulnerable areas are exposed to high risk of earthquake disasters.

(2) The area of debris flow disaster overlie both socially vulnerable and less socially vulnerable areas.

(3) The area of slope failure and landslide disaster overlie socially vulnerable areas.

Therefore, it is necessary to watch the vulnerability of the society together with the physical risk in preparation of the disaster prevention plan.

6. 4 Problems for Disaster Prevention Plan

The problems for disaster prevention plan for the Metropolitan District of Caracas are summarized as follows:

(1) There is possibility of large scale earthquake disaster and sediment disaster in the area but mitigation measures are not being implemented to cope with the possible situation.

(2) According to the “Law of The National Organization of Civil Protection and Administration of Disasters”, the mitigation phase of the disaster mitigation management cycle is not well defined and the responsibility is not clear.

(3) “Law of The National Organization of Civil Protection and Administration of Disasters” defines the responsibility of the Civil Protection clearly but the regulations and the guidelines following the law are not ready and causing some confusion in application of the law.

(4) A large degree of social diversification is causing a large difference of social capacity /vulnerability in the area and there is a tendency that physical risk in earthquake distribution tends to coincide with the distribution of social vulnerability.

Therefore, the disaster prevention basic plan should take into account of the following concepts:

(1) The plan should be based on the scenarios simulated by scientific methodology.

(2) The definition of responsibilities for implementation of the mitigation projects is one of the key issues in plan preparation.

(3) The plan should be based on the spirit of the “Law of The National Organization of Civil Protection and Administration of Disasters” and the plan should be revised when the regulations and guidelines are prepared in future based on the law.

(4) The plan should take into account not only the physical risk distribution, but also the distribution of social capacity/vulnerability of the area to cope with disasters.

Table 6.3.1 Possibility of Occurrence and its Impact

Scenario	Fault System	Slip Rate of Fault	Magnitude	Possibility of Occurrence	Estimated Maximum Seismic Intensity in Caracas	Estimated Impact
1967	San Sebastian	5mm/year	6.6	High	VIII	Medium
1812	San Sebastian	5mm/year	7.1	Medium	IX	High
1878	La Victoria	0.55 mm/year	6.3	Medium	VII	Medium
Avila	Avila	- 0.4mm/year	6.0	Medium-Low	IX	High

Table 6.3.2 Disaster Scenarios and Disaster Prevention Plan

	Disaster		Plan
Scenario	Possibility	Impact	Term
1967	High	Medium	Short
1812	Medium	High	Long
1878	Medium	Medium	Reference
Avila	Medium-Low	High	Reference

Table 6.3.3 Results of Damage Estimation

	1967 Earthquake	1812 Earthquake
Heavy Damage Buildings (no.)	10,000	32,000
Human Casualties (no.)	4,900	20,000
Bridge Collapses on Main Roads (no.)	0	15
Damage in Viaduct (place)	0.3	4.16
Water Supply Pipe Damage (Max. places / 250,000 m^2)	0.0	0.53
Telephone Line Damage (%)	0.07	0.25
Gas Station Leakage (%)	0.14	2.00

Table 6.3.4 Property in Yellow and Rd Zones of Debris Flow Disaster

	Yellow Zone		Red Zone	
	Area (km^2)	Estimated Affected Buildings (no.)	Area (km^2)	Estimated Affected Buildings (no.)
Urban Area	2.80	9,800	0.38	1,400
Barrio Area	0.32	4,500	0.11	1,300
Total	3.12	14,300	0.49	2,700

Table 6.3.5 Number of Buildings in Risky Area of Slope Failure or Landslide

	No. of houses on risky slopes	No. of houses in the affected area	Total
Slope Failure	6,800	5,500	12,300
Landslide	400	100	500

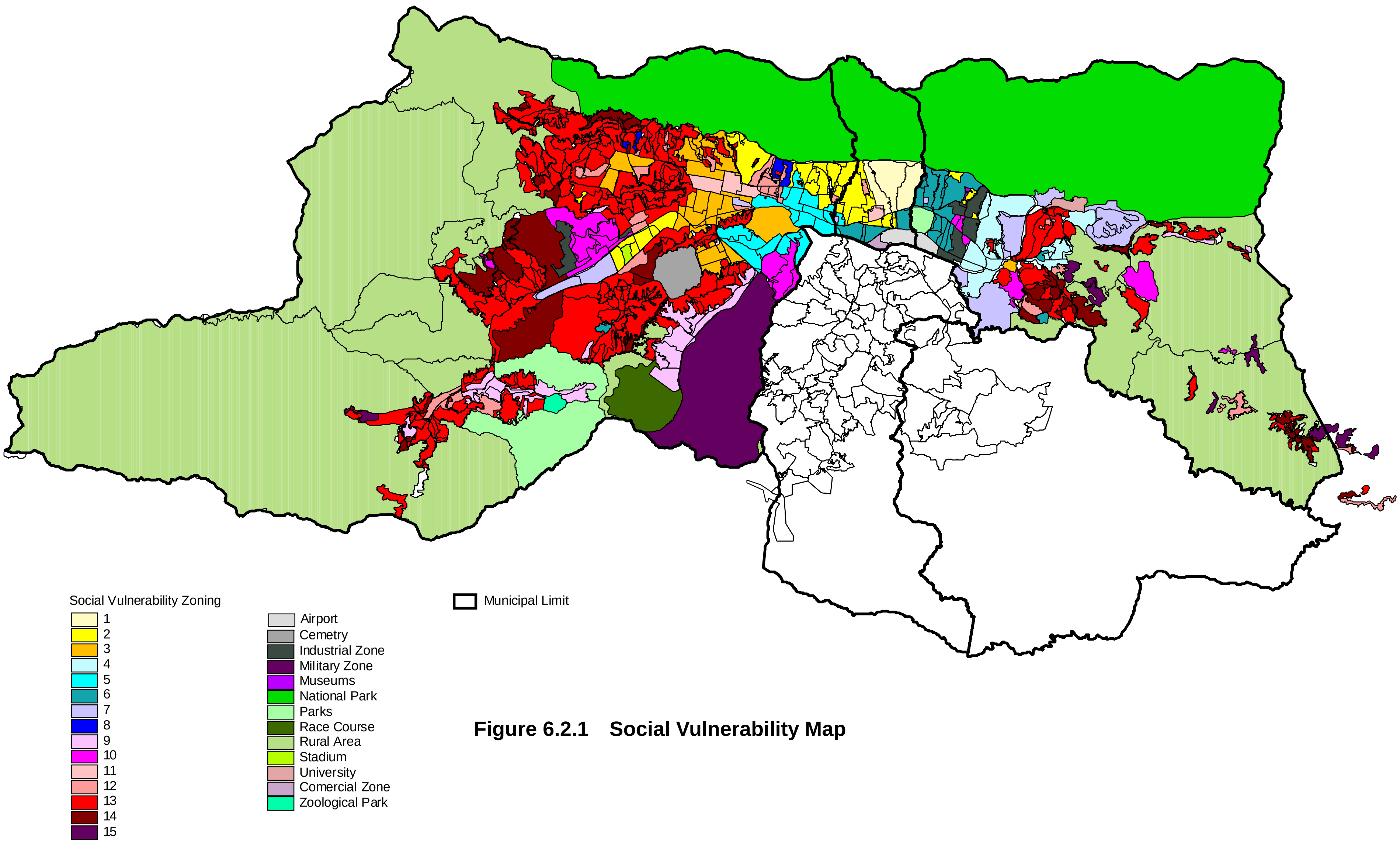
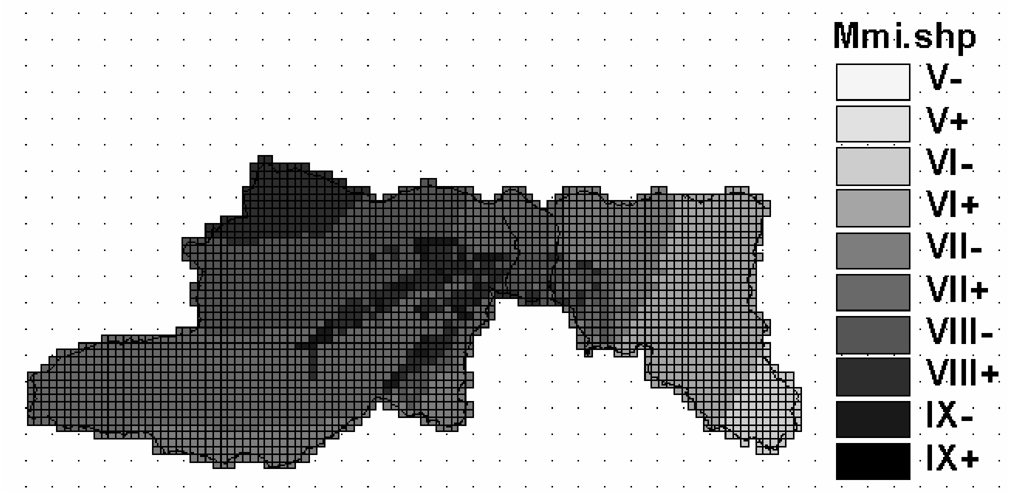


Figure 6.2.1 Social Vulnerability Map

(Estimated Seismic Intensity for the 1967 Earthquake)



(Estimated Seismic Intensity for the 1812 Earthquake)

Figure 6.3.1 Hazard Map of Earthquake Disaster

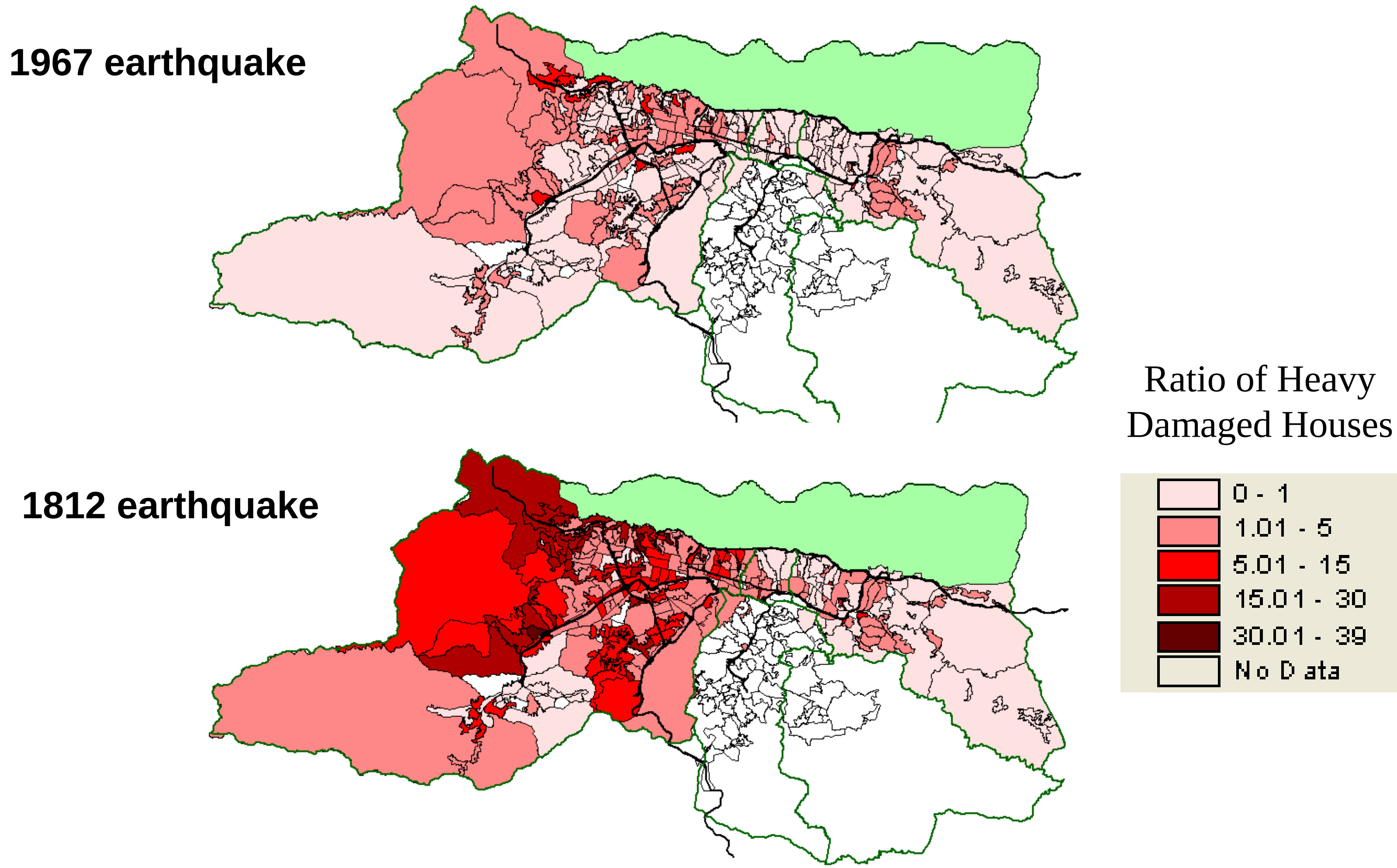


Figure 6.3.2 Risk Map of Earthquake Disaster

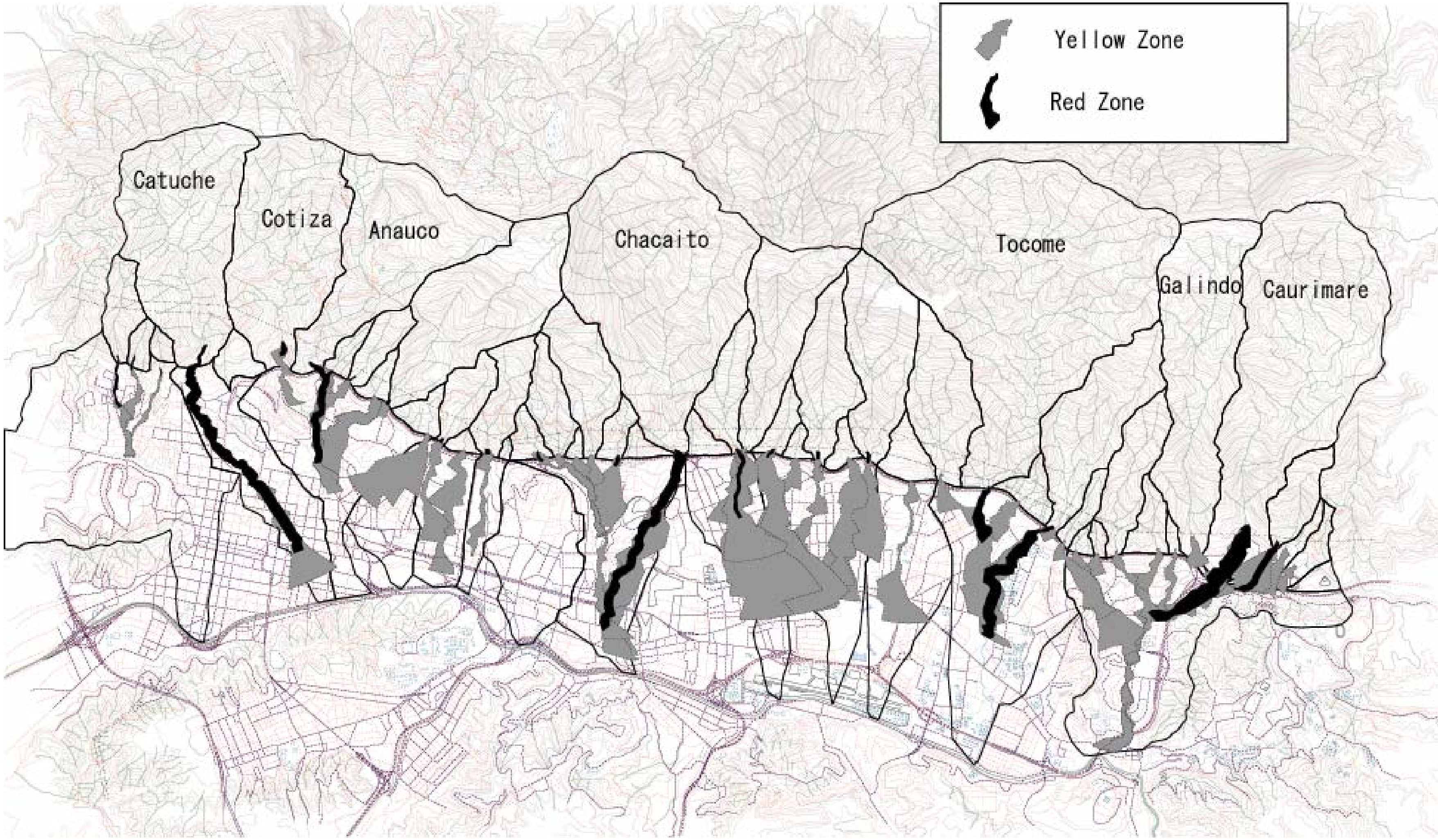


Figure 6.3.3 Hazard Map for Debris Flow Scenario

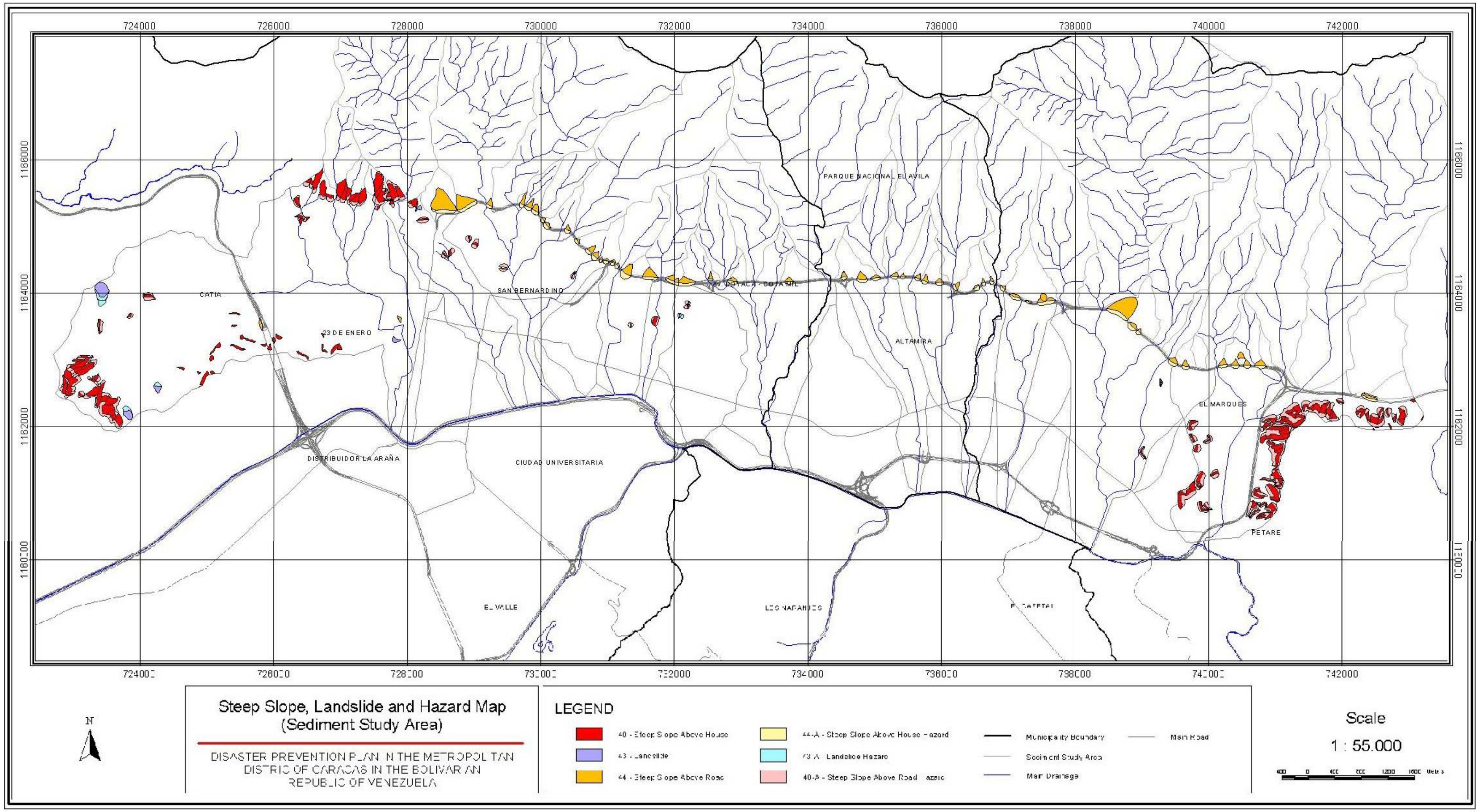


Figure 6.3.4 Hazard Map for Landslide and Steep Slope Failure

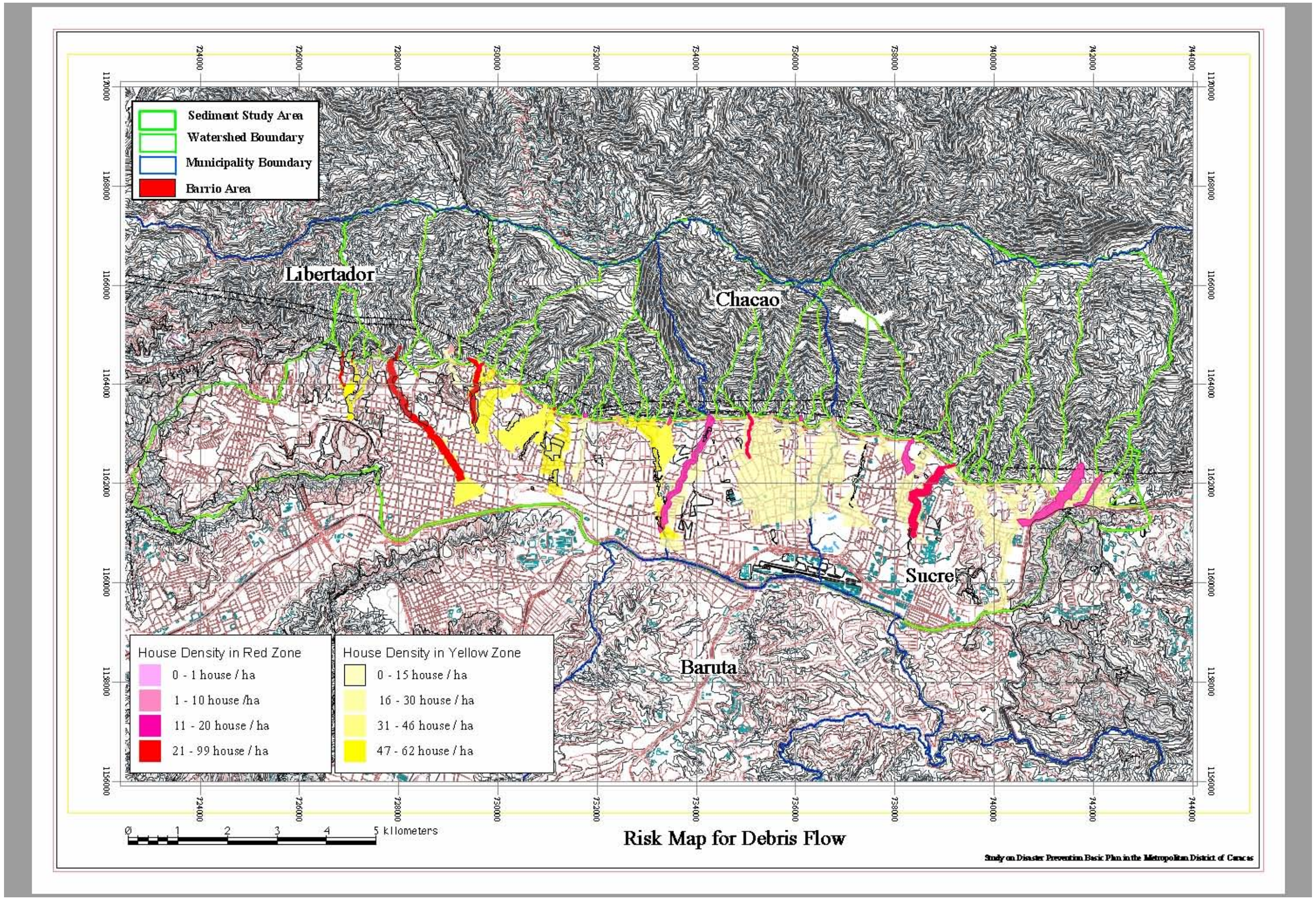


Figure 6.3.5 Risk Map for Debris Flow

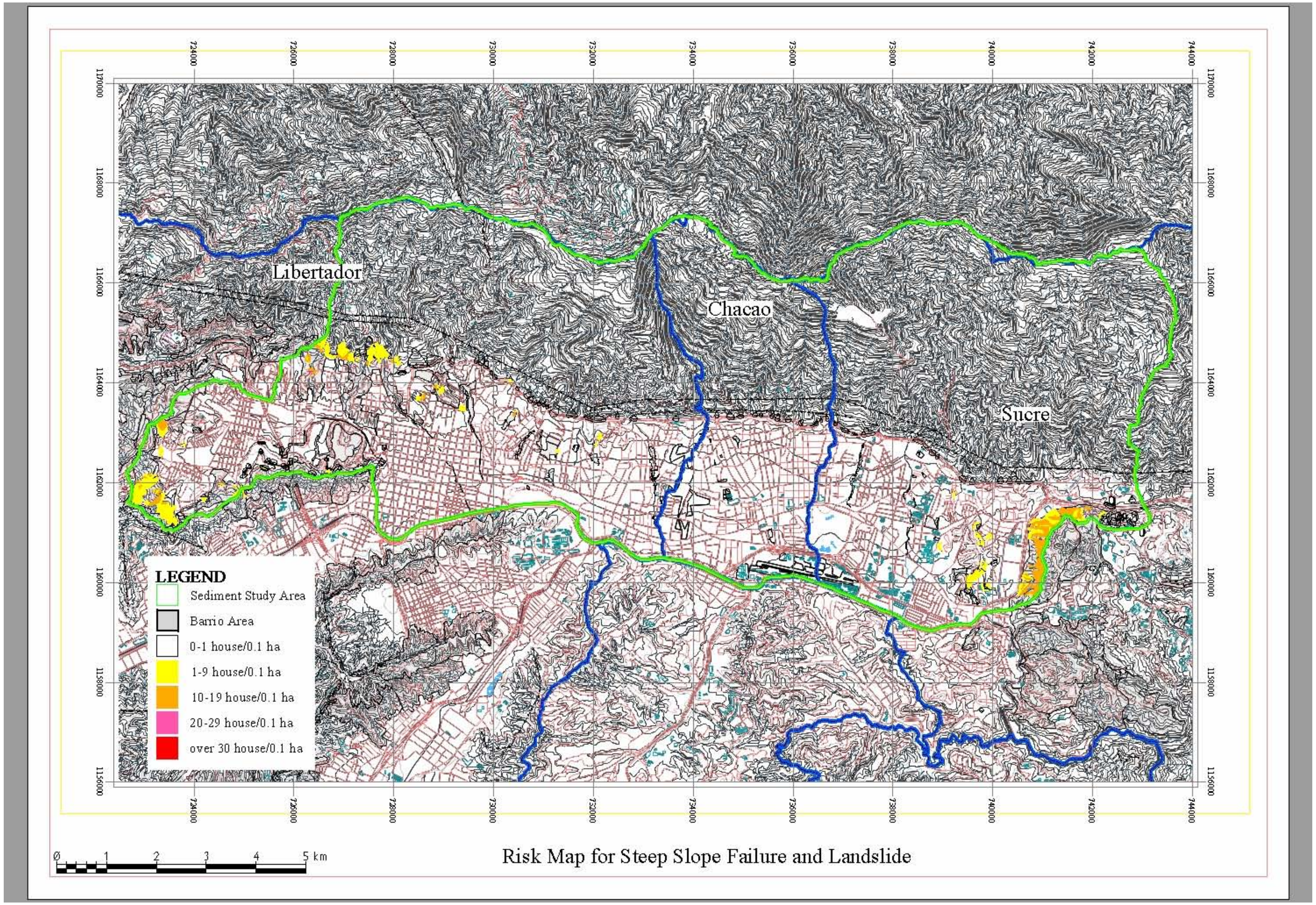


Figure 6.3.6 Risk Map for Steep Slope Failure and Landslide

CHAPTER 7

PLANNING BASIS

"Caracas, help us

not to allow that your cradle becomes a disaster"

Karen Jiménez

CHAPTER 7. PLANNING BASIS

7. 1 Basis of the Plan

Targets of the plan (namely, area, year, protection, disaster types, scale of disasters and basic strategy of the plan) are defined in this section.

7. 1. 1. Target Area

The target area for the plan is the Study Area of this study. For earthquake disaster prevention plan, the three municipalities of Libertador, Chacao and Sucre are the target area for the plan. For sediment disaster prevention plan, the limited area along the 20 mountain streams are the target areas of the plan.

7. 1. 2. Target Year

The target year of the plan is 2020, 16 years after 2004. The plan should look at a foreseeable period and at the same time long enough into the future to make a complete plan covering the four stages of disaster management (namely, “mitigation”, “preparation for emergency”, “emergency response” and “rehabilitation”).

In order to make the plan more programmatic, it is a good idea to set the intermediate target year as the short term target. Dividing the whole 16 years of plan period into two parts, the first half will be for the short term targets and the whole plan period will be for the implementation of all the master plan projects.

Therefore, the target years of the plan will be defined as follows:

2012: the midterm target year to accomplish short term projects

2020: the final target year to accomplish all master plan projects

7. 1. 3. Targets for Protection

Generally in disaster prevention planning, there are three targets for protection. They are human lives (or human safety), property (or assets or stock), and functions (or activities or flow).

The Metropolitan District of Caracas is the most important city in Venezuela in the sense that it has the above three important targets to be safeguarded.

The Metropolitan District of Caracas has a population of 3.1 million, which is one-eighth of the total population of the country, and it is has the largest population among the various cities in the country. The Metropolitan District of Caracas has the largest number of assets of buildings, infrastructures and lifelines to sustain the large number of people and the all human activities of the people, including political, economical, commercial, industrial, financial and cultural activities in the city. At the same time, the Metropolitan District of Caracas has important functions as the capital of the country. All the functions of legislation, justice and administration are concentrated in the city. The headquarters of the Central Bank of Venezuela is situated in Caracas. Various national museums and a national theater are distributed in the city.

Thus, the Metropolitan District of Caracas has all three targets for protection: namely, human lives, property and functions, with the most significant scale among all cities in the country.

Therefore, in the plan preparation, those three targets for protection are set and the goal are defined as follows:

1. To protect human lives
2. To protect properties
3. To protect functions of the capital city

7. 1. 4. Target Disaster Types

The type of the disasters dealt with in the plan are defined as "earthquake disaster" and "sediment disaster". The "sediment disaster" is composed of "debris flow disaster" and "landslide/steep slope failure disaster".

There will be other kinds of natural disasters relevant in the target area, such as flood disaster along the Guaire River or fire disaster in El Avila. However, considering the magnitude of the damage induced, earthquake disaster and sediment disaster will be the two main disaster types to be considered further.

7. 1. 5. Target Scale of Disasters

Due to the size of the Metropolitan District of Caracas, the target scale of disaster prevention should be large enough considering the amount of damage once a disaster occurs.

However, this plan with a planning period of 16 years, will not deal with a catastrophic disaster which may occur once in a thousand year period.

7. 1. 6. Basic Strategy of the Plan

Clear relationship between the protection targets and the plan

As the protection targets are defined as “human lives”, “properties” and “functions” , the plan should have clear relationship with those of targets. The relationship of the master plan projects with each protection target is clearly defined in the plan.

Four stages of disaster management cycle

In order to make a comprehensive disaster prevention plan, the Study will deal with the four stages of disaster management. However, the emphasis of the plan is placed on “mitigation” and “preparation for emergency”, while the stages of “emergency response” and “rehabilitation” are dealt with less emphasis.

Structural and Non-structural measures

The plan is composed of structural and non-structural policies since disaster management is accomplished as a result of appropriate combination of both, especially when the financial resources are limited to invest in large scale structural measures for mitigation of disaster. In the study, after setting the target scale of disaster, an appropriate combination of structural and non-structural measures will be sought in order to accomplish the objectives.

Consideration of social capacity and vulnerability

The plan considers not only physical risk of the problem but also social capacity/vulnerability of the target area. In the plan process, a physical risk map as a combination of natural hazard map and a human activity base map is created for both earthquake disaster and sediment disaster. And at the same time, social capacity/vulnerability map is prepared to see the risk as a function of physical risk and social capacity/vulnerability. The plan of structural measures and of non-structural measures are discussed through the analysis of those physical risk maps and social capacity/vulnerability maps.

Consideration of institutional framework

In order to make a workable plan, the institutional framework for the implementation of each policy is proposed based upon the discussion with the Counterpart Team, taking into account the local legal framework, historical background and existing institutional set up. Basically, the institutional framework is planed by applying existing institutional/organizational set up so that they will be able to take immediate action within the existing framework.

<u>Consideration of Financial Sources</u>

For the implementation of a plan, the financial background is necessary. Without financial support, no plan can be implemented. Therefore, the plan is being prepared with the possible financial sources to support each policy.

CHAPTER 8

DISASTER PREVENTION BASIC PLAN

"One Threat well-known and handled by the Community,

is a calculated risk"

Marielba Guillen

CHPATER 8. DISASTER PREVENTION BASIC PLAN

8. 1 General

The disaster prevention master plan was formulated for the three municipalities in the Metropolitan District of Caracas. The master plan is composed of twenty different projects, among which six major projects are selected in order to attain the three main objectives of the plan, namely "making a safer Caracas (mitigation)", "acting effectively in emergency (preparation)" and "strengthening coordination between the government and the citizens (coordination). Recommendations were made for "emergency response plan" and "rehabilitation plan".

8. 2 Structure of the Plan

The plan is composed of three parts: namely earthquake disaster prevention plan, sediment disaster prevention plan and common disaster prevention plan.

The earthquake disaster prevention plan is composed of a mitigation plan. The sediment disaster prevention plan is composed of a mitigation plan and a preparation plan. The common disaster prevention plan is composed of a common plan for earthquake disaster prevention and sediment disaster prevention in two stages of disaster management cycle, namely mitigation and preparation. Regarding emergency plan response and rehabilitation plan, recommendations were made based on the result of the study.

In Supporting Report S1, an example of a regional disaster prevention plan taking the case of the Metropolitan District of Caracas by using a similar format as a regional disaster prevention plan in Japan.

8. 3 Organization Plan

According to the "Law of the National Organization of Civil Protection and Administration of Disasters", Civil Protection in all levels such as national, states, metropolitan, and municipal, is in charge of preparation of the disaster prevention plan.

According to the law, the Civil Protection of the regional government has to prepare their regional disaster prevention plan according to the guideline prepared by the National Organization of Civil Protection and Administration of Disaster. However, neither the national plan for disaster prevention nor the national guidelines for regional disaster prevention plans are ready yet.

Therefore, the disaster management organization plan for the plan is being prepared based on the basic idea of the law above.

The law states the responsibilities of the regional Civil Protection in Article 16 as follows:

1. To define and approve the plans of civil protection, preparation and attention of disasters of the states and municipalities, in accordance with the guidelines emanating from the National Coordinating Committee of Civil Protection and Administration of Disasters,

2. To contribute with functional and operational resources for the services of prevention and fire-fighting, and of search and rescue within the geographic areas of their responsibility,

3. To promote and to develop citizen self-protection,

4. To design plans and to develop educational and training programs for the communities in local practice of risk management and civil defense ,and

5. To promote and to support development and maintenance in training and qualification of the personnel of services, which are related to Civil Protection and Administration of Disasters.

It is interpreted that regional Civil Protection is responsible for coordination, promotion and logistics in disaster prevention activities especially in search and rescue operation for emergency response, citizen self-protection/education and training for preparation for emergency.

The responsibility of Civil Protection for mitigation measures and rehabilitation measures is not defined here.

Based on the discussion between the JICA Study Team and the Venezuelan counterpart team, the responsibility definition was made for all the twenty master plan projects. This responsibility definition should be discussed further especially between the Metropolitan Government and the National Government. The master plan projects are listed in Table 8.2.1. Table 8.3.1 shows the proposed responsibilities of related agencies.

8. 4 Main Objectives and Major Projects of the Plan

In order to protect human lives, properties and functions of the city, three main objectives were defined in the plan as;

1st main objective: Making a safer Caracas (mitigation) ,

2nd main objective: Acting effectively in emergency (preparation for emergency response),

3rd main objective: Strengthening of Coordination between the government and the citizens

The first objective is to implement mitigation measures in order to make Caracas safer and the second objective is to implement preparation measures for effective emergency response.

In order to attain those three objectives, various projects were proposed, among which seven major projects were defined.

They are

For "Making a safer Caracas"

Major Project 1:	Seismic reinforcement of buildings
Major Project2:	Seismic reinforcement of bridges
Major Project3:	Debris flow control structures
Major Project4:	Resettlement of People in Risky Area

For "Acting effectively in emergency"

Major Project5:	Early warning and evacuation for debris flow disaster prevention
Major Project6:	Emergency command center

For "Strengthening of Coordination between the government and the citizens"

Major Project7:	Strengthening community activities

8. 5 Master Plan Projects

The master plan projects are listed in Table 8.2.1. The description of each project is tabulated in Table 8.5.2 to Table 8.5.25 as a format of project sheet. The relationship of the master plan projects is described in Figure 8.5.1. Each project is described below according to the classification according to disaster types.

8. 6 Earthquake Disaster Prevention Plan

8. 6. 1. Earthquake Disaster Scenario and Effect of Master Plan Projects

(Earthquake Disaster Scenario)

According to the earthquake scenario simulation, the damage estimated when two scenario earthquakes occur in Caracas is summarized as follows:

1967 earthquake

This scenario has higher probability of occurrence than the scenario of 1812 earthquake. The frequency of occurrence will be once in 50 to 100 years.

The intensity of earthquake in Caracas area reaches VIII in MMI. The ratio of heavy damaged buildings are high in the west-north area of Caracas and in some micro zones, the ratio of heavily damaged buildings is 5 to 15 % of all the buildings. As the average, 3 % of all the buildings of the area, around 10,000 buildings, are heavily damaged. Among the 10,000 building heavily damaged, 90% are houses of barrio area and 10 % are building in formal area. The number of injured people including deaths by the damaged buildings is estimated to be as high as 4,900. A large proportion of this comes from the barrio area.

No damage is estimated on bridges, water supply pipelines and telephone cables.

As the epicenter of the earthquake is located at the Caribbean coast to the north of Caracas, the northern coast of the country, Vargas state will be more influenced by the earthquake and more serious damage may occur in Vargas.

1812 earthquake

This scenario has lower probability of occurrence than the scenario of 1967 earthquake. The frequency of occurrence will be once in 200 to 500 years.

The intensity of earthquake in Caracas area reaches IX in MMI scale. The ratio of heavy damaged buildings are high in the west-north area of Caracas and in some micro zones, the ratio of heavily damaged buildings is 30 to 40 % of all the buildings, around 32,000 buildings. As an average, 10 % of all the buildings of the area are heavily damaged. Among the 32,000 building heavily damaged, 90% are barrio area houses and 10 % are buildings in the formal area. The number of injured people including deaths by these damaged buildings is estimated as high as 20,000. A large proportion of this comes from the barrio area.

Some damage is estimated on bridges. 17 out of 115 of bridges on major road may fall down and four piers may collapse along the viaduct. No serious damage is expected on water pipeline and telephone cables.

Since the epicenter of the earthquake is located on the Caribbean coast to the north of Caracas, the northern coast of the country, Vargas state will be more influenced by the earthquake and more serious damage may occur in Vargas.

(Effect of Master Plan Projects)

By implementing the master plan mitigation projects, namely building reinforcement and bridge reinforcement, the damage on buildings and bridges will be reduced significantly.

<u>1967 earthquake case</u>

Number of heavily damaged buildings will be reduce from 10,000 to 1,300 and the number of casualties will be reduced from 4,900 to 400.

<u>1812 earthquake case</u>

Number of heavily damaged buildings will be reduced from 32,000 to 5,300 and the number of casualties will be reduced from 20,000 to 2,300.

Number of falling down of bridge girders will be reduced from 17 to 0 and the number of piers collapsed will be reduced from four to zero.

8. 6. 2. Mitigation Plan for Earthquake Disaster Prevention

<u>Seismic Reinforcement of Buildings (Project No.1)</u>

The project is described in Table 8.5.2.

Reinforcement of buildings is not a perfect method, but it is a very effective for disaster mitigation. As it is technically possible to analyze the strength of structures against anticipated intensity of earthquake, once the design force or design criteria become clear, it is possible to design reinforcement of buildings. However, reinforcement of buildings involves not only technical matters, but also financial and institutional matters.

The building reinforcement project will be carried out in the following process.

(Rapid Visual Screening)

Around two thirds of all the buildings in the study area are estimated to need seismic reinforcement. Therefore, the first step is to do rapid visual screening of all the risky buildings. According to the discussion with the counterpart team members, this operation can be performed by the government.

(Detail Seismic Evaluation)

After selecting risky buildings through the rapid visual screening, it is necessary to carry out detail seismic evaluation to identify the risky buildings more precisely. The opinions were divided among the counterpart team as to whether this process can be done by the government or should be done by the owner of the buildings.

(Design Of Reinforcement)

For those building to be identified as really risky, detail design for reinforcement will be done by consultants.

(Reinforcement Operation)

Based on the design, the reinforcement will be made for the building by contractors.

This project will give benefit to more than 2 million people in the area assuming that two thirds of all the buildings should be reinforced.

The project cost of the building reinforcement was estimated roughly. The reinforcement cost for each type of building was assumed to be 5 to 25 % of the construction cost of the building depending upon the type of building. The total project cost is estimated as US$2.6 billion including the rapid visual screening, the detailed seismic evaluation, design and construction.

Basically the owners of the buildings have to bear the burden the reinforcement cost in order to protect themselves. However, in order to promote the project, some good incentives should be invented such as government subsidy and tax exemption. Designation and publication of accomplishment notice board or certification board of reinforcement in the case of public places such as hotels or shopping centers are proposed.

(Institutional Considerations)

The Technical Code promoted by the Venezuelan Foundation for Seismic Research (FUNVISIS) and the Fund for Quality Certification and Normalization of the Ministry of Production and Commerce (FONDONORMA), is legally supported by the Law of Technical Normative and Quality Control (art 10 and 14) and is clear about the recommendations that must be followed for the seismic resistance of buildings.

This code establishes on its chapter 12, the regulation that applied to the buildings that have been constructed before the year 2001 (year on which the code was revised and approved). On this matter, the application scenario defined on Chapter 12-2 says:

"National, regional or municipal authorities, as is proceeded and determined by laws, will determinate the ways to guarantee the evaluation, improvement or demolition of any of the existing

buildings that do not follow the recommendations of this code. This normative also applies to the construction that are not supported by engineering projects"

Nevertheless the apparent utility of this legal tool could have for a seismic reinforcement program, the information recovered on institutions as the National Council of Housing, the Institute for Building Development, the Institute of Structural Materials and Models and the recently created Ministry of Housing, shows that there have never been an institutional program, apart of some research activities developed for academic research groups on seismic reinforcement of building as a matter of public security.

This apparent contradiction between what is established in the seismic code and the institutional praxis is not exclusive, as we could know in conversations with other technical committees that collaborate with the Fund for Quality Certification and Normalization of the Ministry of Production and Commerce (FONDONORMA). The common problem founded is that, nevertheless those normative are good enough to define what must be done in every case, there is no institutional structure to supervise the implantation of the normative. In other words, what must be solved is who and how will control the implementation of the rule and not the existence or the quality of the normative.

The Study Team proposed that the Ministry of Housing, the FUNVI of ADMC and the engineers office of the municipalities to be in charge of the project.

The Ministry of Housing should make the national policy of seismic reinforcement and ADMC should make the policy on barrio house reinforcement. While the municipality should implement the project in urban area, the project in barrio area should be promoted by the Ministry of Housing.

Seismic Reinforcement of Bridges (Project No.2)

The project is described in Table 8.5.3.

According to the simulation of 1967 earthquake, no damage is simulated for the 115 bridges on main roads in the study area. No damage is simulated in water supply pipelines or telephone cable networks. This shows that the infrastructures and lifelines are comparatively safe against 1967 scale earthquake in Caracas.

However, in the case of 1812 earthquake, the simulation shows that 17 out of 115 bridges on the main roads in the study area may fall down because of deflection of piers. In the same cases, around four piers of the elevated highways have risk of destruction .

The bridge reinforcement plan was prepared based on the simulation results and priority was placed according to the degree of importance from the viewpoint of function of the main road network.

The main road network is the critical transportation system in Caracas since it is a city in a valley isolated from the surrounding areas.

The total project cost for bridge reinforcement is estimated as US$11 million including bridge collapse prevention works and reinforcement of piers.

In this plan, the rehabilitation of the Viaduct No.1 on the Caracas-La Guaire highway is not included since the information of the work is not available. However, the rehabilitation work of the structure is urgent and important as the highway is this freeway is one of the main arteries, which crosses the city from west to east.

(Institutional Considerations)

Bridges in the metropolitan districts cross roadways controlled by three different levels of government. When the bridges are located on autopistas, the Minister of Infrastructure shall reinforce and maintain the bridges. Assistance in design of reinforcement efforts can be provided by public entities such the Institute for Materials and Structural Models at UCV and the Center for Materials Technology at the Institute for Engineering.

8. 7 Sediment Disaster Prevention Plan

8. 7. 1. Sediment Disaster Scenario and Effects of Master Plan Projects

(Sediment Disaster Scenario)

According to the simulation, the damaged estimated by the sediment disaster scenario are;

Debris Flow Disaster

Because of the heavy rainfall with a probability of once in hundred years, debris flow occurs along twenty mountain streams and give heavy damage in the Caracas urban area. The number of buildings in red zone is 2,700 and the number of people in the red zone is estimated as 19,000.

Landslide and Steep Slope Failure

Because of heavy rainfall, landslide and steep slope failure occur at many places in the area. It will not occur at one time but the number of buildings in such risky area is 13,000 and the number of people in such risky area is estimated as 90,000.

(Effects of Master Plan Projects)

Debris Flow Disaster

By implementing the debris flow control structures as planed in the master plan, the sediment flow will be trapped by the Sabo structure and will be discharged safely in the improved channels. Prior to the implementation of channels works, the people who lived in the risky area along the mountain streams should be relocated to a safer place. The number of buildings damaged will be reduced from 2,700 to zero.

By implementing the early warning and evacuation system, the lives of the people will be saved significantly, even before the implementation of the debris flow control structures or if a larger scale debris flow occurs and the debris flow structures can not contain all the debris flow.

(landslide and Steep Slope Failure)

By implementing the slope protection works and drainage improvement in barrio area, the risk of landslide or steep slope failure will be reduced significantly. The number of houses in the risky slope area at present is estimated as 13,000. It will save the properties and human lives now in those area exposed to risk.

8. 7. 2. Mitigation Plan for Sediment Disaster Prevention

Debris Flow Control Structures (Project No. 3)

The Project is described in Table 8.5.4.

Debris flow control structures were planned along all mountain streams in the study area. The structures are Sabo dams, debris flow channel works and water flow channel works. It was planned to install the structures progressively starting from smaller projects targeting smaller scale debris flow up to larger projects targeting lager scale debris flow phenomena.

Since the total investment cost is large when the design scale of the structures has the same scale of the scenario debris flow (return period of 100 years), the short term plan with a smaller scale (return period of 25 years for sabo structures and 10 years for water flow channels) was prepared. The target year of the short term plan is 2012.

In the short term plan, almost all sabo structures composed of sabo dams and debris flow channels were included, while in the long term plan, a large part of the water flow channels in the lower reaches was included.

The construction cost for the short term plan is US$ 108 million and that of the long term plan is US$ 141 million without including the land acquisition and resettlement cost.

This project will give benefit to the people living in the risky areas along the mountain streams. The total umber of people who receive benefit is estimated as 19,000.

The summary of the project is tabulated in Table 8.7.1.

(Institutional Aspect)

Ministry of Environment and Natural Resources (MARN) through Vice Minister for Water, General Office of Environmental Works, Office of Environmental Engineering related to water resources that are in charge of developing, executing and maintaining hydrologic projects at the national level.

Slope Protection Structures (Project No.4)

The project is described in Table 8.5.5.

Slope protection structures such as grating crib work, soil-nailing and retaining wall were studied in a model case. It was concluded that such slope protection structures are feasible only when the value of the protection target is high enough compared with the cost of protection structures.

Therefore, it is included in the master plan as one of the structural projects and more detailed investigation was recommended to assess the feasibility of each risky slope for 13 places for house protection and 50 places for road protection.

Ministry of Infrastructure will be in charge of protection works for protection of the main roads and the Office of Works or Infrastructure of municipality government will be responsible for slope protection works to protect buildings.

Drainage Improvement in Barrios (Project No.5)

The project is described in Table 8.5.6.

Observing the poor drainage condition in the barrio area, it was proposed to improve it in order to improve the stability of the slopes where many barrio houses are located.

The Faculty of Architecture and Urbanism, the Central University of Venezuela, has been studying the drainage problem of barrio area and proposing low cost improving method.

This proposal is included in this master plan so that further study and implementation of the project should be promoted.

The Ministry of Housing will be responsible for drainage improvement of barrios as a part of barrio environment improvement scheme.

8. 7. 3. Preparation Plan for Sediment Disaster Prevention

Resettlement of People in Risky Area (Project No.6)

The project is described in Table 8.5.7.

Living away from risk of disaster is the best way to prevent disaster-caused damage. However, it is difficult to move all the people living in areas susceptible to risk in Caracas. Among the relocation of the houses in risky areas, in this project, houses in the river channel are covered. Around 1,000 houses (around 7,000 people) located in the mountain stream channel, which are highly risky in debris flow damage.

This relocation operation shall be a voluntary one after publication of hazard/risk maps, education of people and community activity promotion at that area.

The constitution and the organic municipal law require, for relocation, the obligation of the state to expropriate occupied lands. When there is an expropriation of private lands and buildings the value of both is paid to the occupants by the state. When public lands and buildings are expropriated, only the value of the buildings is to be repaid.

New relocation sites should be located in areas where adequate public services can be provided and are in job expansion areas of the metropolitan district.

Municipality shall be required to keep all high risk areas as open space (or off-limit area), with no new uses permitted.

Early Warning and Evacuation for Debris Flow Disaster Prevention (Project No.7)

The project is described in Table 8.5.8.

As the preparation measures for sediment disaster prevention, early warning system was proposed composed of “rainfall monitoring”, “debris flow monitoring”, “analysis of information”, “transfer of information”, “decision making for alert”, “alert dispatching” and “evacuation by the alert”.

A draft agreement was prepared in order to establish an institutional framework for the early warning and evacuation for debris flow disaster prevention. (Chapter 4)

8. 8 Common Disaster Prevention Measures

8. 8. 1. Common Mitigation Plan

Land Use and Development Control in the Risky Area (Project No.8)

The project is described in Table 8.5.9.

According to the simulation result of 1967 earthquake and 1812 earthquake, the distribution of building damage was concentrated in north-western part of the study area since both cases have epicenters in the northwest of Caracas. However, this does not mean that east part or south part of the city is safe from any earthquake disaster. The simulation results of 1878 earthquake case shows high intensity of vibration in the southern part of the city, and the Avila fault earthquake case shows high intensity vibration distribute from east to west. It can be said that the Study area is equally risky to earthquakes. It is not recommended to identify a safer part of the area in terms of earthquakes or to modify the configuration of the city.

On the other hand, topographic differences influence the damage to buildings. As applied in the Study, it is reasonable to assume that houses on slopes are more physically vulnerable than houses on a flat plains if the basic structures are the same.

The simulation results shows that 90 % of all the buildings heavily damaged by both 1967 and 1812 earthquakes are in barrio areas and around 40% of the houses in barrio area are located on slopes with gradients larger than 20 degrees. Therefore, the most vulnerable houses are the houses in barrio areas, especially those built on the slopes.

It is best to live away from risk from the beginning, and so living away from risky area should be the fundamental policy in the area. However, it is not realistic to plan to relocate all the barrio houses in risky area as the millions of people have to be relocated.

In order to avoid any further increase of number of houses and people living in risky areas, it is absolutely necessary to regulate housing development in risky areas, in this case on slopes. In the formal area, the municipal authority should regulate land development of any kind in risky areas identified in the hazard maps and risk maps prepared in the Study.

For barrio areas, where formal regulation cannot be applied, there should be some measures to stop the development of new barrio areas from the viewpoint of disaster management.

It is estimated that population increase between 2001 and 2020 is 0.8 million, among which, half would belong to barrio and would go to live in a risky area without any restriction policy. By implementing the strict policy of land use and development control, it is possible to reduce the number of people in risky area by 0.4 million.

Development of Open Space (Project No.9)

The project is described in Table 8.5.10.

Development of open spaces in the area are proposed from threes view points as (1) Barrio area, (2) Area redevelopment in urban area lacking open space, and (3) Reserved open spaces for shelters.

Publication of Hazard Maps and Risk Maps (Project No.10)

The project is described in Table 8.5.11.

By publishing hazard maps and risk map, awareness of people on disaster management will be enhanced and promotion of mitigation measures will be accelerated. The information on risky areas will discourage people to buy and live in a house in risky areas and automatically discourage new housing developments in risky areas. In that sense, publication of hazard maps and risk maps is a good tool for disaster mitigation.

This method of using hazard maps and risk maps may bring about arguments from the viewpoint of real estate market. The discussion should be continued in Venezuelan side.

Education of People (Project No.11)

The project is described in Table 8.5.12 to Table 8.5.15.

In order to mobilize people to avoid risk and mitigate hazard, education of people is the most important program. Formal education on disaster prevention is being carried out at a higher educational level but on the elementary school level and high school level, not much effort is being made. It is necessary to launch a program so that disaster management is included in the elementary school level as well as high school level of formal education.

Education through community is more important than formal education in the sense that the education is more locally characterized and more practical for the specific community.

The first step of education for mitigation measures is to give people knowledge on disasters, for example utilizing hazard maps and risk maps. The proposed mitigation measures in this plan such as “reinforcement buildings”, “sediment control structures” and “land use regulation in risky area” must be promoted by education through formal or community education.

Strengthening of Community Activities For Disaster Prevention (Project No.12)

The project is described in Table 8.5.16 and Table 8.5.17.

In order to promote mitigation measures such as reinforcement of buildings and early warning and evacuation, strong community unity is required.

8. 8. 2. Common Preparation Plan

Emergency Command Center (Project No.13)

The project is described in Table 8.5.18.

An emergency command center is proposed as one of the preparation measures. The functions and the facilities of the center is described below. This project involves not only building construction, but also setting up of disaster management information system, planning of emergency response drills, emergency response training and institutional coordination operations.

Center Function: To coordinate all of the emergency and assistance recourses, and provide logistic support during a disaster event. Coordination means using available resources to accomplish a common task.

Center Users: Caracas Metropolitan District and Municipal Civil Protection .

Center Size in m^2: to be determined, but at least 1,000 m^2. Designed with ability to hold simultaneous meetings with different size groups.

Equipment: all electronic and telecommunications equipment, and mapping systems needed to support logistic coordination. Self sustaining electrical generation and air filtration systems. Ability to receive satellite images. Linkages to military agencies and national ministries, and major utility (infrastructure companies).

Training for operations: A minimum of two disaster coordination simulation exercises with the key decisions makers at the municipal, district and national levels on an annual basis. At minimum, these simulations will cover earthquake, landslide/flood events. The purpose is to establish the coordination and decision making sequencing required during a disaster event. All senior staff of the municipal alcades and the Alcaldia Mayor shall participate in the simulation training, with the major NGO’s in the region, and the major utilities (infrastructure companies).

Coordination: An agreement of cooperation will be signed by the Alcaldia Mayor and the municipal alcade for participation in Center operations.

Operations and maintenance: Joint effort based on written agreement between the Alcade Mayor and the National Office of Civil Protection.

Education of People (Project No.11)

In order to prepare for good emergency response it is absolutely necessary to educate and train people to be involved in the operation. The education program will include alert system, alert information dissemination, evacuation operation, rescue operation, first aid and sheltering.

Integrated drill for emergency response will be a part of the practical education for the people as a preparation measure.

Strengthening of Community Activities For Disaster Prevention (Project No.12)

For early warning and evacuation operation as well as for rescue operation, strong community activity is the most important factor for the success.

During a large disaster when the formal rescue operation by governmental agencies are occupied by a limited portion of the victims, neighbors who constitute the community are the ones who can really rescue people.

Evacuation operation after getting alert of debris flow or slope failure is practical only when the community has solidarity and a leader who dispatches the evacuation order and has credibility as a leader of the community.

These kind of solidarity and credibility can be forged through strong daily activity of the community and promotion of it will be the key issue for disaster preparation.

Publication of Hazard Maps and Risk Maps (Project No.10)

The hazard maps and risk maps can be a crucial tool in the case of emergency response operation. If the information on risky areas and resources such as open spaces or schools are well disseminated through publication of hazard maps and risk maps, it will help the people to move effectively to escape from such risky areas.

Development of Disaster Information System (Project No. 14)

The project is described in Table 8.5.19.

The disaster information system is a complete data base for disaster management. The system can be used in all four stages of disaster management, namely “mitigation”, “preparation”, “emergency response” and “rehabilitation”.

The data base shall be stored at the Information Technology Department of ADMC and the related organizations, as members of the consortium, will be able to access to the data base through internet.

The consortium will be formed based on the agreement, which will state the obligations and the privileges of the members. All the members have to update and maintain all the information related to disaster management provided by them.

One of the main users is the Civil Protection of ADMC at the Emergency Command Center, which will act as the command center in case of emergency.

Stockpiling of Food, Water, and Goods (Project No.15)

The project is described in Table 8.5.20.

Through the disaster scenario of earthquake and sediment disaster, the number of refugees were simulated. In the case of 1967 earthquake case, around 70,000 people will lose their houses and become disaster refugees. The stockpiling of required food, water and goods are estimated and planned for storage.

Emergency Transportation Network (Project No. 16)

The project is described in Table 8.5.21.

In the case of 1967 earthquake scenario, a total of 10,020 heavily damaged building will produce about 912,000 tons of debris, or some 701,000 m^3 of debris. Part of such debris will block the road access. Also objects fallen off from buildings will block roads.

Network of roads for emergencies will be propagated by the committee to the municipalities and organizations responsible for primary emergency responses (rescue and medical operation), in order to respond effectively to the emergency situation in case of earthquake.

Important facilities related to disaster management should be prioritized who respond to the emergency situations. To connect them efficiently in emergency situation, emergency road networks within the Metropolitan Caracas will be established, and be recognized by the committee, and organizations responsible for primary emergency responses (rescue and medical operation and other related organizations).

Evacuation Plan and Evacuation Drills (Project No. 17)

The project is described in Table 8.5.22.

Based on the 1967 earthquake scenario, 10,000 houses will be heavily damaged. These people have to be evacuated first to safe place and then sheltered. A total of around 70,000 people should be evacuated and sheltered. Those refugees are concentrated in barrio areas which are with very limited open space and thereby difficult to evacuate and access to rescue.

Evacuation plan shall include the following items:

- Identification of area needing evacuation
- Estimated number of evacuees
- Evacuation place, facilities, and logistics of necessary things
- Evacuation routes
- Evacuation procedure
- Evacuation map preparation, distribution and public relations
- Evacuation drill (simulation exercise)

Rescue Operation Plan (Project No. 18)

The project is described in Table 8.5.23.

Based on the simulation result of 1967 earthquake, it is proposed to study the rescue operation plan.

Medical Treatment Plan (Project No. 19)

The project is described in Table 8.5.24.

To organize necessary ambulatories as the first line of medical response and hospitals to cover the necessities, assuming at least 1967 scenario where there would be 4,510 injured persons and from this number, 451 persons would need to be hospitalized. At present, there is no plan to prepare the medical response in case of disaster in Caracas.

Mental Care and Support Skills in Disaster Prevention (Project No. 20)

The project is described in Table 8.5.25.

The role of mental care, psychological and counseling to affected people is extremely crucial by shown from previous disasters experiences like Vargas(Debris flow in Venezuela), Hanshi-Awaji (Earthquake in Japan), and Bam (earthquake in Iran) as well as physical recovery from disaster damage. Therefore, in this project, specialists of mental care, psychological and counseling for disaster from different background are nurtured with specific skills particularly for rehabilitation stage from disaster. As preparation stage of disaster management, mental care training programs targeted disaster recovery are provided, and through these project, the specialists are expected to work as professional team in each stage of recovery from any type of disaster (short, middle and long term).

Through this project, the following skills are mastered:

1) To mitigate impact of trauma and understand stress of affected from disaster to recovery (Methods of treatment are differently prepared between Sediment Disaster and Earthquake etc.).
2) To encourage affected people to acquire problem- solving skills and support copying skills for recovery through communication.
3) To improve counseling skills and knowledge for affected people's anticipating concerning topics during recovery such as health care, housing, and economic assistance information, living issue in temporal shelter, employ opportunity, etc by taking advantage of team member's background.

An important point is that this project is targeted not only technical personnel but also kind of specialists from own experience like retired persons with specific skills or civil volunteers who have experience of recovery from disaster etc. In addition, it is also considered to exchange specialists with certain countries, which have experienced like Kobe prefecture, in Japan.

8. 8. 3. Recommendation for Emergency Response

As there is no written emergency response plan for disaster prevention, the plan should be formulated as soon as possible and to be included in the basic plan.

The emergency response plan should include the following items;

- Organization for Emergency Response Plan without Early Warning

The organization set up to cope with a disaster without early warning such as earthquake disasters should be defined clearly.

- Organization for Emergency Response Plan with Early Warning

The organization set up to cope with a disaster with early warning such as debris flow disasters should be defined clearly as discussed in the agreement among the related agencies.

- Gathering and Modification of the Damage Information

In order to act effectively for rescue operation, it is necessary to gather accurate information rapidly and transform it to a correct place. As the emergency command center is the center for all command in an emergency, the information should be accumulated there.

- Collaboration with Related Agencies

Good collaboration with national government and other local governments is a must for ADMC during emergency response. It is recommended to make a prior agreement between ADMC and the national government as well as between ADMC and the other local government for collaboration actions.

- Early Warning, Evacuation and Rescue Operation

The responsibilities of related organizations such as the Civil Protection, Fire Fighters, Hospitals, Red Cross and etc. should be defined clearly. Here the Civil Protection should stick to the role of planning and coordination while the Fire Fighters should do the field operation work clearly defined in the law.

- Transportation

There should be a way to gather information of damage on transportation network such as roads and subways. Emergency network plan should be formulated to cope with the situation taking into account the priority of transportation.

- Accommodation

Accommodation plan should include setting up of refugee camps and utilization of vacant public apartment for temporary accommodation for disaster refugees.

- Provision of Necessary goods

Collection and distribution policy of food, water and necessary goods should be included in the plan.

- Debris Treatment

Debris treatment, such as building debris, garbage and human waste should be treated in order and role definition should be clearly described in the plan.

- Reception of Foreign Aid

The Secretary of International Cooperation of ADMC should be responsible for receiving aid from foreign countries.

- Lifeline

All the private and the public organizations in charge of lifelines such as water, gas, electricity, telephone and so on should response in emergency in order to assess the damage on the lifelines and take required actions for quick recovery. They should have their own plan of emergency response.

- Security

Security is one of the most important issue during emergency operation in order to realize effective action such as evacuation. The police of ADMC as well as each municipality should be responsible for security during emergency.

- Recovery of Infrastructures

The relevant ministries should response in emergency in order to assess the damage on the infrastructure and take required actions. Each ministry should have their own plan for monitoring and recovery after disasters.

8. 8. 4. Recommendations for Rehabilitation

The rehabilitation plan should include such items as;

- Reconstruction of houses

Promotion of reconstruction of houses should be stated as the responsibility of the national as well as the local governments.

- Collection of donations

A committee is recommended to be formed in order to discuss the methodology how to receive, distribute and utilize donations collected from in and out of the country.

- Redevelopment plan of risky area

It is an essential part of the rehabilitation plan to refrain people from coming back to the risky area again after the disaster is over. In order to realize the policy, it is necessary for the government to act accordingly in time.

The process should be as follows;

(1) designation of disaster area

The government should designate a disaster area where people should not come back to live on because of the risk of disaster in future.

(2) acquisition of the land by the government

The government should compensate the land owners of the designated disaster area and acquire the land in order to avoid people to come back.

(3) redevelopment plan

After acquiring the risky land, the government should make a redevelopment plan of the area. Basically, the place should be used as a park or a conservation area.

(4) legislation of prohibition of resettlement of people in the same risky area

The government should establish a law or decree specifying the place and prohibit resettlement of people in the place. Collaboration with the community surrounding the place and the collaboration with the police is indispensable to enforce the policy.

8. 9 Maintenance and Operation Plan of Master Plan Projects

For each master plan project, operation and maintenance plan was made.

(1) Reinforcement of Buildings

Reinforcement of buildings is not a single event project but it requires constant observation and maintenance. Due to straining or fatigue of the construction materials, the resistance of the buildings diminishes within time.

Therefore, it is necessary to carry out periodical observation by using rapid visual screening method for every building. The owner of the building is responsible for the maintenance of the structure.

It is proposed to carry out periodical rapid visual screening for every building every 30 years after construction.

(2) Reinforcement of Bridges

Reinforcement of bridges also needs periodical observation and maintenance. The Ministry of Infrastructure has a manual for maintenance of bridges and it is recommended to add an item of inspection from the view point of anti-seismicity in the maintenance manual. The owners of the bridges have responsibility for maintenance.

(3) Debris Flow Control Structures

It is necessary to take out sediment accumulated upstream of Sabo dams periodically in order to maintain the retaining capacity of the dams. The removal of sediment from the dam pocket is done by each municipality government where the dam is located.

The maintenance plan of Sabo dams is described in Chapter 4.

It is necessary to inspect and repair concrete civil structures such as Sabo dams and channels as they will deteriorate by weathering and wearing by flow of water and sediments. Generally, 1 % of the initial construction cost should be spent annually in order to maintain the function of concrete civil structures. These kind of maintenance operation should also be done by each municipal government where the structure is located.

(4) Slope Protection Structures

Those slope protection structures such as concrete framework or anchors have to be periodically inspected and maintained in order to keep their functions. When concrete framework is damaged or a anchor is loosened, it has to be repaired. The municipal government is responsible for that and the annual cost for maintenance will be 1 % of the construction cost.

(5) Drainage Improvement in Barrios

Frequent inspection and maintenance work is required in order to maintain the function of drainage system in barrios. The most probable problem is clogging of drainage system because of thrown garbage by neighbors.

It is necessary for the community of barrio to advocate the community people about the important function of the drainage in order to save their lives and property and encourage them to maintain the function by periodical inspection and removal of garbage from the drainage system especially during rainy seasons.

(6) Early Warning and Evacuation System for Debris Flow Disaster Prevention

maintenance of equipments

It is necessary to maintain and operate the equipments, such as rainfall gauging system , water level staff gauges and weir sensor system. The maintenance of rainfall gauging system and weir sensor system shall be done by the owner of the system, the Ministry of Environment and Natural Resources. The water level staff gauges shall be maintained by the community.

The maintenance of rainfall gauging system include payment of telephone bill for data transmission, payment of electricity to operate the receiving computer and change of batteries for rainfall date sending device.

Periodical inspection and maintenance is required for every electrical and mechanical part of the system. Periodical replacement of parts is also required to keep the good condition of the machines.

Operation of Institutional System

In order to activate the early warning and evacuation system as a whole in an emergency when the system is really needed, it is necessary to practice the activity of the system. The Metropolitan Civil Protection is responsible for such kind of practice, namely periodical drill.

It is proposed to do such kind of drill in two levels. One is drill on the desk and the other one is real field drill.

The drill on the desk will be carried out by the representatives of each organization involved, such as the Ministry of Environment, the Metropolitan Civil Protection, the Operation Control Center, the Municipality Civil Protection, the Central University of Venezuela and Community Organization. This drill on the desk is proposed to be carried out twice a year.

The field drill will be carried out mobilizing all personnel related to this system including residents who are supposed to evacuate. This drill is proposed to be carried out once a year at the end of rainy season, say November 1st.

(7) Land Use and Development Control in the Risky Area

Implementation of this project is done by each municipality government. In order to assure of the implementation policy, it is proposed that the Urban Planning and Environment Department of ADMC shall monitor any change of land use or new development of the area by renewing the land use map of the area and referring the hazard maps.

(8) Development of Open Space

Implementation of this project is done by each municipality government. In order to assure of the implementation policy, it is proposed that the Urban Planning and Environment Department of ADMC shall monitor the development of open spaces in the area and encourage the policy to the municipal government.

(9) Publication of Hazard Maps/Risk Maps

Implementation of this project is done by each municipality government. In order to assure of the implementation policy, it is proposed that the Civil Protection of ADMC shall monitor the publication of hazard maps and risk maps of each municipal government of the area.

(10) Education of People

Education of people for disaster prevention is carried out by various institutions, from universities to NGOs.

In order to assure the implementation of the projects, the Metropolitan Civil Protection shall periodically monitor the progress of the project planned.

(11) Strengthening of Community Activity for Disaster Prevention

The Metropolitan Civil Protection is responsible for overall planning and coordination for the promotion of community activity for disaster prevention.

It is recommended that ADMC Civil Protection shall designate one personnel for this special task of monitoring the implementation of the projects considering the importance of this project in order to assure the community activity aspect of major projects.

(12) Resettlement of People in Risky Area

When the implementation of resettlement is realized, it is necessary to keep the area from new invasion of people. This maintenance task should be realized by the cooperation of the

Ministry of Environment and Natural Resources, the Urban Planning and Environment Department of ADMC, the municipal government, the police of ADMC and municipal government and community organization.

In order to keep away from people from risky along the mountain streams, the best way is to construct a new channel where new invasion is difficult structurally. Before the structure is completed, the community organization and police of ADMC as well as police of municipality shall watch the place so that any new invasion should not take place.

(13) Emergency Command Center

The structure will be used daily by the personnel of ADMC Civil Protection and to be maintained by basically ADMC. Municipal government shall also contribute the maintenance of the center based upon the agreement between the Mayor of ADMC and mayors of the municipalities.

The maintenance operation include hardware maintenance such as buildings and equipments, electricity to run the system and software such as disaster management information system and communication software.

The maintenance cost of the civil structure will be 1 % of the initial cost while the maintenance cost of communication and data base hardware will be 5% of the initial cost. For the maintenance of the disaster management information system, it is proposed that related organizations for disaster prevention should form a consortium to run the system. In this system, the server of the data base placed at the Information Technology Department of ADMC and the Emergency Command Center is one of the users of the data base.

(14) Stockpiling of Food, Water and Goods

Stockpiling of food, water and goods should be maintained periodically so that the quality of the stockpiled things are maintained. One way of maintenance of quality is to dispatch the stockpiled things periodically at such occasion as annual drill for disaster prevention activity city wide.

(15) Emergency Transportation Network

In order to maintain the function of the emergency transportation network, the roads designated should be maintained so that it will function well during emergency. The grade for maintenance of the designated routs should be higher than the other road system. The owner of the road shall be responsible for the maintenance of the road.

(16) Evacuation Plan and Evacuation Drill

The evacuation plan should be practiced by periodical drill organized by ADMC Civil Protection together with the municipality Civil Protection.

(17) Rescue Operation Plan

The rescue operation plan should be practiced through periodical drills and the plan should be revised according the lesson from the drills.

(18) Rescue of Medical Treatment

The medical treatment plan should be practiced through periodical drills and the plan should be revised according the lesson from the drills.

(19) Mental Care and Support Skills in Disaster Situation

The mental care training program should be practiced so that required number of personnel will be trained.

(20) Development of Disaster Management Information System

The Disaster Management Information Data base will be placed in the server of the Information Technology Department of ADMC.

The maintenance of the data base shall be done by the consortium of the users of the system. The consortium members will be Metropolitan Civil Protection, National Civil Protection, Municipality Civil Protection, Fire Fighters' Department, ADMC Urban Planning and Environmental Department, National Cartographic Institute, FUNVISIS, IMF-UCV and so on.

Each member of the consortium has a privilege to access the data base and use it, while their obligation is to update the information which they provided when the data base was formed.

ADMC Civil Protection will be the coordinator of the consortium and will be responsible for the whole system.

8. 10 Project Cost

The project cost is listed in Table 8.10.1. The total cost of all the project will be around US$2.8 billion and the largest portion of it is for reinforcement of buildings. The next largest item is construction of debris flow control facilities. It means that structural mitigation measures in both earthquake disaster prevention and sediment disaster prevention share the largest proportion of the project cost. The project cost for non-structural measures is comparatively small.

8. 11 Effect of Master Plan Projects

The effect of the proposed master plan projects are summarized as follows;

- Even 1967 scale earthquake attacks the area, the number of buildings collapse will be reduced from 10,000 to 1,300. And the number of casualties will be reduced from 4,900 to 400.

- Even 1812 scale earthquake attacks the area, the number of buildings collapse will be reduced from 32,000 to 5,300. And the number of casualties will be reduced from 20,000 to 2,300.

- Even 1812 scale earthquake attacks the area, no serious damage will be generated on the bridges of the main road while without project, the road transportation is interrupted around Arana and other places of main road.

- Even with rainfall with the scale of one in hundred years occurs and debris flow happens in the mountain streams, the flow will be contained in the Sabo dams and the improved channels, causing any damage along the streams, while without the projects, 2,700buildings damaged and as many as19,000 people are injured or die.

- Even with a large amount of rainfall of any scale and debris flow happens in the mountain streams, people along the streams will be able to evacuate before the event and no casualties are generated.

- By implementing the relocation of 1,000 families in risky area along the mountain stream to a safer place, their lives and properties will be saved by the project, without which their lives and properties are in danger.

- By implementing the land use plan and land use regulation referring the hazard maps at present, it can be save the lives and properties of the people by the projects, without which they might migrate into the risky area and expose their lives and properties in risk in future. The number of people who get this benefit will be 400,000 by the year 2020.

8. 12 Implementation Program

Implementation program was prepared for the master plan projects. Fig.8.12.1 shows the implementation schedule of all the projects.

8. 13 Strengthening Community Activities for Disaster Prevention

Disaster strikes certain vulnerable area in which community people are central actors to protect themselves and help each other with neighbors from disaster just as case of Kobe earthquake proved. Therefore, it is effective and powerful to cope with disaster as *community entity* and integral part of their survival strategy. Thus, Civil Protection, which is a responsible agency of capacitating citizens for disaster management, needs to take the first initiative for working with community for the scheme.

The role of functioning community organizations like Neighborhood Association and existence of reliable leaders are enormously important in any stage of disaster cycle as shown in Figure18.13.1. Based on actual proof by the Pilot Study (Refers to S24 in the Supporting Report), Figure18.13.1 is proposed as an ideal model of strengthening community for disaster prevention. Innovate point in the model is that mutual role of Intermediate Group/Organization that is not certain specialists like rescue group but interdisciplinary personnel including socio-anthropologist and communicator as well as engineers of sediment and earthquake are taken greatly account for strengthening community. Besides, the manuals on how to work for disaster management *from point of community,* which are separately produced for Barrio and urban area, were produced and provided to CP and the communities. (refer to "Data Book")

As an example, brief project description of the way to promote reinforcement program as mitigation of earthquake damage is presented as follows;

- To design and develop awareness raising activities with all stakeholders such as Municipal Engineers, Construction Unions (groups the brick layers and job chiefs in the informal building sector), Chamber of Construction, and Venezuelan Institute of Civil Engineers), CONAVI and research programs such as IDEC, all efforts sponsored by Alcaldía Metropolitan.

- To design and execute pilot projects in each Alcaldía with social networks, in most risky barrio and urbanization areas. Progressive participatory demonstrations workshops on reinforcement techniques stimulated and carried out by municipal authorities, neighborhood associations and building owners in micro areas.

- To expand to a broader program including human, technical and financial support taking into account the construction sector and the metropolitan government to improve building standards enforcement and stimulate reinforcement and upgrading of building in risky area.

- To production and distribution of effective educational booklets and mass media spots that stimulates low cost upgrading of buildings in risky areas according to hazard and risk maps (slope failure, degree of slope, earthquake disaster scenario).

In addition, the JICA Study Team practiced publicity activities for the purpose of disaster prevention. The efforts greatly contributed to disaster prevention activities. For example, in participatory workshop, risk and evacuation route map were made by community participants. And total numbers of 200 T-shirts with the Study Team Slogan selected out of 135 candidates were provided to all C/P and related persons for the Study promotion. Beside, notice boards of past high water level were set up in the 12 de Octubre and Los Chorros communities and other eight communities as reminders of disaster to stimulate preparation intention. Moreover, the poster selection on disaster prevention topic in 4 schools have conducted at this moment, and the distinguished ones will be used for raising awareness of the prevention activities as exhibitions.

8. 14 Selection of Priority Projects

8. 14. 1. Meaning of Priority Projects

In this JICA Study, one of the purposes is to do a feasibility study on the priority project(s) among master plan projects. Because of time and budget constraints, it is necessary to choose two projects for the feasibility study of the priority projects. The priority project(s) for the study do not necessarily mean that other projects are not important, but simply that the selection is just for the study purpose.

The study of other master plan projects will continue in the forth study period in Venezuela for two months. The fifth study period in Venezuela for two months will be devoted only for the priority project(s) selected herein.

8. 14. 2. Selection Criteria

The criteria for the selection of priority project(s) are listed as follows:

- Significance
- Urgency
- Immediate consequences
- Technical feasibility
- Economic feasibility
- The result of initial environmental examination
- Prospect of financial sources
- Social necessity

- Intention of counterpart

Because of the constraints of the study period and the study budget, it is necessary to select two projects for the feasibility study in this JICA Study.

As there are two disaster types involved in the study, it will be appropriate to select one project from earthquake disaster prevention and another from sediment disaster prevention.

8. 14. 3. Selection of the Priority Project for Earthquake Disaster Prevention

The simulation result of the two scenario earthquakes suggest that a large number of casualties will be brought about by building collapse.

As the first goal of the plan is to protect human lives from the disaster, a project contributing to it will be the priority project.

Building reinforcement will be the almost only probable way in order to attain the first goal of the plan, to protect human lives.

Referring to the criteria for the selection, “building reinforcement” policy satisfies the criterion of “significance”, “urgency”, “immediate consequence”, “less impact on environment”, social necessity (protection of lives)”. The items of “technical feasibility”, “economic feasibility” and “financial sources” are interrelated. The issue is whether it is possible to find a good reinforcement methodology, which is technically feasible and at the same time with low cost so that finance is easier.

Therefore, in the feasibility study stage, the main focus of the study will be to identify the most appropriate method of reinforcement of buildings to accomplish the purpose.

8. 14. 4. Selection of the Priority Project for Sediment Disaster Prevention

In the case of sediment disaster, as stated in the disaster scenario, symptom phenomena exists which can be detected and utilized to dispatch an evacuation alert. Considering the first goal of the plan, protection of human lives, candidates for priority projects in mitigation and preparation stages have been figured out. Representing the mitigation measures, construction of sediment control structures including sabo dams is proposed as a candidate of priority project. Representing the preparation measures, early warning system is proposed as another candidate of priority project.

The two alternatives of priority projects were compared in Table 8.14.1. Discussion was made between the JICA Study Team and the counterpart team on the selection of the priority project from the two alternatives, and it was finally decided to choose “early warning system” as one of the priority project for feasibility study.

This does not mean that “sediment control structure” has less priority. “Sediment control structures” and “early warning and evacuation” are both important in two different stages of disaster management cycle: namely “mitigation” and “preparation for emergency response”. In this study, “early warning and evacuation” is selected only for study purpose.

Table 8.2.1 Proposed Master Plan Projects

No.	Project rename	Disaster Type	Measure Type	description of the project
1	Seismic reinforcement of buildings	Earthquake	Structure	180,000 buildings shall be reinforced based on 2001 building code and other criteria
2	Seismic reinforcement of bridges	Earthquake	Structure	17 bridges and 400 piers shall be reinforced against 1812 earthquake
3	Debris flow control structures	Sediment	Structure	84 Sabo Dams and 22 km of channel improvement for 1/100 year debris flow
4	Slope protection structures	Sediment	Structure	identification of risky slopes and to implement slope protection works
5	Drainage improvement in barrios	Sediment	Structure	improvement of drainage in barrio area in order to reduce the risk of steep slope failure and landslide
6	Resettlement of people in risky area	Sediment	Non-Structure	1,000 houses along the mountain streams to be relocated
7	Early waning and evacuation for debris flow disaster prevention	Sediment	Non-Structure	early warning and evacuation system for debris flow disaster prevention
8	Land use and development control in risky area	Common	Non-Structure	to control future land use in order not to increase the population and properties in risky area
9	Development of open space	Common	Non-Structure	development of open spaces as disaster prevention resources
10	Publication of hazard maps and risk maps	Common	Non-Structure	publication of hazard maps/risk maps
11	Education of people	Common	Non-Structure	promotion of education for disaster prevention in high, middle and primary level institution as well as through media
12	Strengthening of community activity for disaster prevention	Common	Non-Structure	promotion of community activity for disaster prevention especially in the field of "early warning and evacuation" and "reinforcement of buildings".
13	Emergency command center	Common	Structure/Non-Structure	anti-seismic structure equipped with disaster information system and communication system
14	Development of emergency information system	Common	Non-Structure	information system composed of database, computers with software
15	Stockpiling of food, water and goods	Common	Non-Structure	stockpiling of food, water based on the 1967 earthquake scenario
16	Emergency transportation network	Common	Non-Structure	road network plan to connect important buildings after 1967 scale earthquake
17	Evacuation plan and evacuation drills	Common	Non-Structure	evacuation plan after 1967 scale earthquake, evacuation drill plan
18	Rescue operation plan	Common	Non-Structure	rescue operation plan including institutional framework, equipments and community activities
19	Medical treatment plan	Common	Non-Structure	medical treatment plan based on the number of injured people in 1967 earthquake scenario
20	Mental care and support skills in disaster situation	Common	Non-Structure	implementation of mental care training

Table 8.3.1 (1) Responsibility Definition for Master Plan Projects (1)

No.	Project Name	National Government	Metropolitan Government	Municipality Government
1	Seismic Reinforcement of Buildings	Ministry of Housing, FUNVISIS	FUNVI	Engineering Office
2	Seismic Reinforcement of Bridges	Ministry of Infrastructure	-	-
3	Debris Flow Control Structures	Ministry of Environment and Natural Resources	-	-
4	Slope Protection Structures	Ministry of Infrastructure	-	Engineering Office
5	Drainage Improvement in Barrios	Ministry of Housing	-	-
6	Resettlement of People in Risky Area	Ministry of Planning and Development	Urban Planning/Environment	Engineering Office
7	Early Warning and Evacuation for Debris Flow Disaster Prevention	Ministry of Environment and Natural Resources	Civil Protection	Civil Protection
8	Land Use and Development Control in the Risky Area	Ministry of Planning and Development	Urban Planning/Environment	Engineering Office
9	Development of Open Space	Civil Protection	Civil Protection, Urban Planning/Environment	Civil Protection
10	Publication of Hazard Maps and Risk Maps	Civil Protection	Civil Protection	Civil Protection

Table 8.3.1 (2) Responsibility Definition for Master Plan Projects (2)

No.	Project Name	National Government	Metropolitan Government	Municipal Government
11	Education of People	Civil Protection	Civil Protection	Civil Protection
12	Strengthening of Community Activities For Disaster Prevention	Civil Protection	Civil Protection	Civil Protection
13	Emergency Command Center	-	Civil Protection	Civil Protection
14	Development of Disaster Information System	Civil Protection	Civil Protection	Civil Protection
15	Stockpiling of Food, Water, and Goods	Civil Protection	Civil Protection	Civil Protection
16	Emergency Transportation Network	Ministry of Infrastructure	Civil Protection	-
17	Evacuation Plan and Evcuation Drills	Civil Protection	Civil Protection	Civil Protection
18	Rescue Operation Plan	Civil Protection	Civil Protection	Civil Protection
19	Medical Treatment Plan	Ministry of Health	Secretary of Health	-
20	Mental Care and Support Skills in Disaster Prevention	Ministry of Health	Secretary of Health	-

Table 8.5.2 Project Sheet (1)

<table>
<tr><td>Project No.</td><td colspan="5">1</td></tr>
<tr><td>Project name</td><td colspan="5">Seismic Reinforcement of Buildings</td></tr>
<tr><td>Type of Disaster</td><td colspan="5">earthquake</td></tr>
<tr><td>Stage of Disaster Management</td><td colspan="5">Mitigation</td></tr>
<tr><td>Type of Project</td><td colspan="5">structural</td></tr>
<tr><td>Objectives</td><td colspan="5">Safeguard of human lives, properties and functions of the capital from building collapse by earthquake disaster.</td></tr>
<tr><td>Brief description of the project</td><td colspan="5">The target for seismic reinforcement of buildings is all existing buildings in Urban, Rural and Barrio area in Caracas study area. Those building structures have both engineering and non-engineering buildings. Since all engineering buildings (except the single family buildings) must be obtained the planning permit before commencement of building work, the engineering buildings are located in Urban area and the high-rise apartment houses in Rural area. Non-engineering buildings are located in Barrio because of these were did not submitted and/ or not required planning permit with engineering inspection of it.
Since these existing buildings except built after 1983 with planning permit basically have seismic vulnerability, all buildings will be screened and judged safe or unsafe structure by Rapid Visual Screening Method and Seismic Evaluation based on Seismic Code on 2001 , and refer to FEMA 178 and 237, and Seismic Evaluation Code for Existing Reinforced Concrete Buildings in Japan.
The reinforcement methods are provided for formal and informal buildings respectively.
Then, all unsafe structures have to strengthen by effective reinforcement methods for each types of structure.

For the promotion of seismic strengthen of all unsafe buildings, Government and Alcaldia have to plan and do for proceeding and spreading.
For example,
a) Screening fee for RVS: Government will pay full fee (100%: with upper limit) after received the evidence of RVS records.
b) Government will provide the seismic evaluation methods for Reinforced Concrete, Steel structure and Masonry buildings as soon as possible. The full (100%: with upper limit) of evaluation fee for Barrio and Rural Area will be pay by Government. Government will set up the supporting and enlighten system for citizen and building owners such as financial aid with low rate of interest for detail evaluation and reinforcement work (within three years).</td></tr>
<tr><td>Location of the project</td><td colspan="5">All area in Caracas</td></tr>
<tr><td rowspan="7">Total project cost</td><td></td><td colspan="2">Total Project Cost</td><td colspan="2">Public Charge (sample)</td></tr>
<tr><td>Total:
Average (/16year)</td><td>4,954,200M.Bs
309,600M.Bs</td><td>2,581M.$
161.3M$</td><td>464,200M.Bs
29,000M.Bs</td><td>242.3M.$
15.1M.$</td></tr>
<tr><td>Break down:</td><td>(M. Bs)</td><td>(M. $)</td><td>(M. Bs)</td><td>(M. $)</td></tr>
<tr><td>Reinforcement Cost of buildings:</td><td>3,488,100</td><td>1,817</td><td>122,800</td><td>64.0</td></tr>
<tr><td>RVS Fee for all buildings:</td><td>29,900</td><td>16</td><td>29,900</td><td>16.0</td></tr>
<tr><td>Seismic Evaluation Fee:</td><td>750,200</td><td>391</td><td>299,500</td><td>156.0</td></tr>
<tr><td>Reinforcement Design Fee:</td><td>686,000</td><td>357</td><td>12,000</td><td>6.3</td></tr>
<tr><td>Project duration</td><td colspan="5">2020 (2005 ~ 2020)</td></tr>
<tr><td>Planning agency</td><td colspan="5">Ministry of Housing</td></tr>
<tr><td>Implementing agency</td><td colspan="5">Ministry of Housing/ Municipality Engineering Office</td></tr>
<tr><td>Maintenance and operation agency</td><td colspan="5">Ministry of Housing</td></tr>
<tr><td>Financial sources</td><td colspan="5">Building Owners / Government</td></tr>
</table>

Table 8.5.3 Project Sheet (2)

Project No.	**2**				
Project name	**Seismic Reinforcement of Bridges**				
Type of Disaster	earthquake				
Stage of Disaster Management	Mitigation				
Type of Project	structural				
Objectives	Safeguard of human lives and preservation of the transportation function by preventing the bridge collapse by earthquake.				
Brief description of the project	One hundred and fifteen (115) bridges on the express highway were selected for the seismic damage estimation in consideration of the significance of emergency activity for rescue and transportation at the time of earthquake occurrence. Most of bridges were constructed before 1967 and no serious damage was reported when an earthquake occurred in 1967 except one minor damage of the pier at the interchange Pulpo. The results of damage estimation of bridges indicate the existing bridges are strong enough against the scenario earthquake 1967 and the damage estimation also shows the same result. If the displacement of girders induced by earthquake exceeds the bridge seat width, the deck slab will fall down and the bridge could not maintain the function, even substructure and foundations are not got damage. Depending on the type of bridge and the purpose, the prevention measure against the bridge falling down is different. There are two major countermeasures. One is to allow the displacement but prevent the deck slab falling down by widening the seat, and the other is to control the movement of girders within the length of seat. It is recommended that the countermeasure of widening of seat width is most effective for prevention of bridge falling down, because any force shall not act to the substructure due to the displacement of girders and could protect the substructure. The reinforcement of the pier is recommended based on the experience of the Hanshin/Awaji Disaster. The vertical seismic force in that disaster was exceeding the design force and the piers were collapsed due to the extra sharing force and especially single column pier got serious damage. After the experience of hazardous earthquake, bridges located on the trunk road and express highway were strengthened at the pier. The bridges located at the most vulnerable area, interchange Arana and Pulpo were constructed before 1967 and superstructures are supported by small piers of rigid frame and single piers. As for the damage of bridge foundation, no damage was reported in the Hanshin/Awaji Disaster. It is considered that the foundation in the ground is not easily affected by the earthquake and the ultimate strength of foundation is fairly large and not so easily damaged like a structure on the ground. From these points of view, the prevention measures against bridges falling down and reinforcement of pier are recommended.				
Location of the project	Express Highway in Caracas				
Total project cost		Total Project Cost			
	Total: **Average (/16year)**	**21,180M.Bs** **1,324M.Bs**	**11.03M.$** **0.69M$**		
	Break down:	(M. Bs)	(M. $)		
	Bridge Investigation and Reinforcement Plan:	80	0.04		
	Bridge Reinforcement (I) Prevention of Bridge Falling Down:	10,700	5.57		
	Bridge Reinforcement (II) Reinforcement of Pier:	10,400	5.42		
Project duration	2020 (2005 ~ 2020)				
Planning agency	MINFRA / Alcaldia Mayor				
Implementing agency	MINFRA / Alcaldia Mayor				
Maintenance and operation agency	MINFRA / Alcaldia Mayor				
Financial sources	MINFRA / Alcaldia Mayor				

Table 8.5.4 Project Sheet (3)

Project No.	**3**
Project name	**Debris Flow Control Structures**
Type of Disaster	sediment
Stage of Disaster Management	mitigation,
Type of Project	structural
Objectives	To mitigate the physical damage (human lives, properties and functions of the city) in Caracas caused by debris flow and flood generated from the heavy rainfall in the south slope of the Avila.
Brief description of the project	The subjective area of the sediment control structure is the south slope of the Avila (totally forty seven (47) mountain stream watershed) and their alluvial fans until the Guaire River. The structure types of the sediment control structure are Sabo Dam in the 47 mountain stream watershed, Channel Works for the alluvial fan apex of the major streams such as Catuche, Chacaito, Tocome and Caurimare, and Water Channel Works for the critical sections in the alluvial fans until the Guaire River. In terms of the design level, there are 2 cases to be set, namely, “Scenario Case” and “Short term Case”. The scenario case is of 100 years return period regarding rainfall and of the sediment runoff compatible to the event of Dec. 1999 in Caracas. The short term case is of 25 years return period for Sabo Dam and 10 years return period for Channel Works and Water Channel Works. The principal quantity for each works are as follows, +Sabo Dam: 84 units for Scenario Case and 81 units for Short term Case +Channel Works: 3.3 km for both Scenario Case and Short term Case +Water Channel Works: 19 km for Scenario Case and 8 km Short term Case. Among the proposed Sabo Dams for Short term Case, some prioritized Sabo Dams are recommended in the Master Plan.
Location of the project	Sediment Study Area (South slope of the Avila and the left side of the Guaire River between Qda. Caroata and Qda. Caurimare)
Total project cost	
Project duration (between year 2004 and 2020)	2005-2020
Planning agency (primary and secondary)	MARN (ADMC, Central University of Venezuela)
Implementing agency (primary and secondary)	MARN (ADMC, Municipalities)
Maintenance and operation agency (primary and secondary)	ADMC and MARN, Municipalities
Financial sources	Central Government and ADMC

Table 8.5.5 Project Sheet (4)

Project No,.	**4**
Project name	**Slope Protection Structures**
Type of Disaster	sediment
Stage of Disaster Management	mitigation
Type of Project	structural
Objectives	To safeguard human lives and properties in risky area of slope failure.
Brief description of the project	Slope inspection shall be conducted for all slope that is identified as hazard slope in this project. The result is put on GIS system in PC. These data shall be updated on database system, and the established of the system by which related organs which is necessary to use the data can refer freely to data is preferable. According to the result, master plan of slope protection shall be established, and be decided priority target slopes. The site investigation as geological survey shall be conducted for each slopes and basic design of countermeasure.
Location of the project	Libertador, Chacao, Sucre Municipality
Total project cost	
Project duration (between year 2004 and 2020)	2005-2007
Planning agency (primary and secondary)	Municipality Government
Implementing agency (primary and secondary)	Municipality Government
Maintenance and operation agency (primary and secondary)	Municipality Government
Financial sources	Municipality Government

Table 8.5.6 Project Sheet (5)

Project No	**5**
Project name	**Drainage Improvement in Barrios**
Type of Disaster	sediment
Stage of Disaster Management	mitigation
Type of Project	structural
Objectives	Safeguard human lives and properties in barrio area on risky slopes
Brief description of the project	Slope inspection shall be conducted for all slope that is identified as hazard slope in this project. The result is put on GIS system in PC. These data shall be updated on database system, and the established of the system by which related organs which is necessary to use the data can refer freely to data is preferable. Collection of the actual situation of drainage system by site inspection and result of interview with representative of Barrios that be secreted from the steep slope and landslide database. Planning and construction of drainage system of each barrios.
Location of the project	Libertador, Sucre Municipality
Total project cost	
Project duration (between year 2004 and 2020)	2005-2007
Planning agency (primary and secondary)	Municipality Government Ministry of Housing
Implementing agency (primary and secondary)	Municipality Government Ministry of Housing
Maintenance and operation agency (primary and secondary)	Municipality Government Ministry of Housing
Financial sources	Municipality Government Ministry of Housing

Table 8.5.7 Project Sheet (6)

Project No.	**6**
Project name	**Relocation of people from risky areas**
Type of Disaster	Common
Stage of Disaster Management	mitigation
Type of Project	nonstructural
Objectives	To protect people from debris flow disaster, relocate people from the risky area, especially those living in quebrada river channels
Brief description of the project	Living away from risk of disaster is the best way to prevent disaster-caused damage. However, it is difficult to move all the people living in risky areas in Caracas. Among the relocation of the houses in risky areas, in this project, houses in the river channel are covered. Around 1,500 families (around 7,000 persons) living in approximatey 1,000 buildings in the quebrada river channel over 3% slope, which are highly risky in debris flow damage under the 100-year return period of rain. The constitution and the organic municipal law require, for relocation, the obligation of the state to expropriate occupied lands. When there is an expropriation of private lands and buildings the value of both is paid to the occupants by the state. When public lands and buildings are expropriated, only the value of the buildings is to be repaid. **Component of the project** - Specify the risk area - Select families to be relocated - Identify new relocation sites for those affected - Design new relocation sites **Planning process** - Establish a ad-hoc committee composed of urban planning, municipal engineering and civil protection - Relocation plan shall be made with the subject community participated from the begining - While relocation occurs within a municipal boundary, there is a need for a metropolitan wide plan for relocation. The Alcaldía Metropolitana should appoint a technical secretariat from an existing office to coordinate the inter-institutional requirements of the overall plan **New relocation site condition** New relocation sites should be located in areas where adequate public services can be provided and are in job expansion areas of the metropolitan district. **Development control afterward** Municipality shall be required to keep all high risk areas as open space (or off-limit area), with no new uses permitted.
Location of the project	Area of high risk in debris flow under 100-year return period, within the sediment study area
Total project cost	49.2 million US$ (without land cost) 60.9 million US$ (including land cost)
Project duration (between year 2004 and 2020)	2005-2020
Planning agency (primary and secondary)	Primary: Municipality Secondary: AMDC planning secretary, funding agencies at national and municipal level, such as CONAVI

Implementing agency (primary and secondary)	Primary: Municipality Secondary: CONAVI, or other finance agencies
Maintenance and operation agency (primary and secondary)	Primary: Municipality Secondary:
Financial sources	Housing funding agencies like CONAVI

Note: Buildings in risky quebrada are Caroata: 618, Catuche: 38, Anauco: 86, Mariperez: 7, Chacaito: 111, Seca: 113, Sebucan:11, Agua de Maiz:55, Tocome: 0, Caurimare: 0 (Total: 1039), say 1,000.
The number of buildings are calculated based on figure divided the total high risk area by the average building area on a GIS. Each barrio building hosts 1.57 households according to Census 2001 data and the GIS barrio area data of the Team. From the 2001 census, average number of a family is 4.5 persons.

Table 8.5.8 Project Sheet (7)

Project No.	**7**
Project name	**Early Warning and Evacuation System for Debris Flow Disaster Prevention**
Type of Disaster	sediment
Stage of Disaster Management	preparation
Type of Project	non-structural
Objectives	To safeguard human lives from debris flow disaster caused by heavy rainfall
Brief description of the project	Since current management condition of hydro-meteorology information for early warning is not established because of disperse location and collection of information, weak and indistinct institutional responsibility and division of duty etc. In order to improve this current condition, the following major components for reinforcement intuitional coordination and arrangements, are included as proposed project. Reinforcement Major Institution's Information Management System (National, ADMC, and three (3) municipalities. 1) Setting up Early Warning Operation Room in the proposed Emergency Operation Center in ADMC 2) Improvement of Hydrological Monitoring System (Rainfall station and Debris flow sensor, whose data transmission system should be compatible to MARN system) 3) Establishment of effective Information Distribution System between MARN, ADMC and municipalities offices. 4) Preparation of Early Warning General Guideline such as critical rainfall, etc. Transformation Technical Information to Local Message and Proper Action Communities require understandable and easy signs in the timely moment for evacuation in emergency. Interaction among Civil Protection in each municipality and communities are crucial from ordinal moment as well as emergency situation. To encourage the network and strengthen community capacity for disaster management, the following components are required. 1) Identifications of community groups and agencies with primary responsibility in each rivers. 2) Constructive and process – oriented workshops in the communities for raising awareness and empowerment to put disaster topic into daily's life agenda (the third experts, intermediate and supporting group, NGOs etc.) (For 36 persons/month). 3) Periodical meetings for planning monitoring and updating (3 times / year) 4) Participatory courses for community – based disaster management linked with PC municipalities (Risk management, organizing tools, DIG, hydrological measurement, etc (For 36 persons/month).
Location of the project	Sediment Study Area (South slope of the Avila and the left side of the Guaire River between Qda. Caroata and Qda. Caurimare)
Total project cost	
Project duration (between year 2004 and 2020)	2005-2008 for both components
Planning agency (primary and secondary)	**ADMC (Initiatives)** Primary- ADMC, MARN, Central University of Venezuela, NGOs Secondary- Municipalities, Communities (Neighborhood Associations, Voluntary Groups)
Implementing agency (primary and secondary)	**ADMC (Initiatives)** Primary-ADMC, Communities (Neighborhood Associations, Voluntary Groups) Secondary- MARN, Municipalities
Maintenance and operation agency (primary and secondary)	**ADMC and MARN, Municipalities** Primary - Civil Protection in AMDC, INAMET, and Civil Protection in Municipalities Secondary - Communities (Neighborhood Associations, Voluntary Groups)
Financial sources	Central Government / ADMC

Table 8.5.9 Project Sheet (8)

Project No.	8
Project name	**Land use and Development control in the risky area**
Type of Disaster	common
Stage of Disaster Management	mitigation
Type of Project	nonstructural
Objectives	To prevent Caracas from becoming more vulnerable than the present time for the future population
Brief description of the project	To develop the urban structure resistant to disasters, local development plan shall be formulated based on the hazard and risk information. The future population of Caracas is estimated 3.5 million in 2020. And without any countermeasures, 0.2 million of the increasing population are highly likely to be new barrio dwellers who are thought to live on rather risky areas. The risky area of land slide, slope failure and debris flow, and seismic vulnerable area under the 1967 earthquake scenario are to be identified. **Identify and designate risky areas** Based on the hazard and risk map, the risky areas will be identified. **Local urban plan based on the hazard and risk map** Each municipality should make its local urban plan based on the identified risky areas. And with new information on damage estimation and urban vulnerability analysis, all the municipalities and AMDC shall revise and formulate the local development plans periodically. **Control of new development (invasion) of barrio** Most of barrios are located in vulnerable areas, so the municipalities should prevent new invasion of barrio from such risky area. **Spillover housing policy for potential barrio population** When controlling the potential barrio population, in order to absorb them, an overspill housing development policy shall be accompanied. Otherwise, such overspill population will start invading some risky area and settle on risky areas as barrio dweller. It is a huge task to completely cover a population of some 0.2 million until 2020. Almost 44,000 families (4.5 persons/family) shall be accommodated in housings like low cost or social housings. It is imminent to prepare the Metropolitan urban plan to absorb these people somewhere in Caracas or in satellite cities, which would be preferable with employment opportunities. (For detailed description of the project, see Supporting Report S2: 8.4.1)
Location of the project	The whole study area
Total project cost	--
Project duration (between year 2004 and 2020)	2005-2007 (3 years)
Planning agency (primary and secondary)	Primary: Municipality Secondary: Planning direction, AMDC
Implementing agency (primary and secondary)	Primary: Municipality Secondary: Police
Maintenance and operation agency (primary and secondary)	Primary: Municipality Secondary: Planning direction AMDC
Financial sources	Municipalities and AMDC

Table 8.5.10 Project Sheet (9)

Project No.	**9**
Project name	**Development of Open Space**
Type of Disaster	common
Stage of Disaster Management	Preparation
Type of Project	nonstructural
Objectives	To enhance the area evacuation capacity both in open space and facilities, especially in the areas lacking such capacity.
Brief description of the project	In order to create open space in areas lacking open spaces for evacuation and rescue operation, in the built-up down town areas, the densification will be promoted to create more open space; and in barrio areas, comprehensive barrio area improvement should be planned. The following action plans will be included and this will be consistent with "Evacuation Plan." And also, these components shall be planned in participatory manner with community people concerned. (1) Barrio area As often pointed out, barrio areas are highly likely to be isolated in the case of earthquake. The components include: - Plaza-type open space creation at the center of community - Public hall construction that can accommodate evacuees, and service as response base - widening of roads, especially those connecting with major road, to secure the access in the event of disaster - Building retrofitting of barrio houses standing along with the roads, trails, or stairs in the barrio community so as to secure more accessibility for evacuation and rescue operation in the event of disaster. This component shall be harmonized with building retrofitting program. The priority barrio areas are those of high building collapse and less evacuation capacity such as those barrios located in Sucre, Antimano, La Vega, El Valle, San Juan, El paraiso, Santa Rosalia, La Pastora, and San Bernandino in Libertador municipality, and some part of Petare in Sucre municipality. (2) Area redevelopment in urban area lacking open space In the urban area, older built-up area has less open space and narrower roads than newly developed urbanization areas. Such areas are more vulnerable to the earthquake disaster. The narrow roads are likely to be blocked in the event of earthquake in the areas of high risk of building collapse, thereby evacuation is difficult. To this end, area redevelopment shall be planned by densification to widen roads and create open space like parks, plazas and green areas. The priority areas are: some parts of San Juan, El paraiso, Santa Rosalia, La Pastora, and San Bernandino in Libertador municipality.

	(3) Reserved open spaces for shelters In the 1967 earthquake scenario, 76,400 persons are estimated to become evacuees. To accommodate them, shelter areas are considered. Undeveloped land less than certain slope should be reserved for such purpose. (For detailed description of the project, see Supporting Report S2: 8.5.1)
Location of the project	The whole study area
Total project cost	--
Project duration (between year 2004 and 2020)	2005-2007 (3 years)
Planning agency (primary and secondary)	Primary: Municipality Secondary: Planning direction, AMDC
Implementing agency (primary and secondary)	Primary: Municipality Secondary: Police
Maintenance and operation agency (primary and secondary)	Primary: Municipality Secondary: Planning direction AMDC
Financial sources	Municipalities and AMDC

Table 8.5.11 Project Sheet (10)

Project No.	**10**
Project name	**Publication of** **Hazard Maps and Risk Maps**
Type of Disaster	common
Stage of Disaster Management	Mitigation, Preparation, Emergency Response,
Type of Project	nonstructural
Objectives	To save human lives and properties from disasters through dissemination of disaster information in a format showing the exact location of natural hazards and the base map indicating the human activity in the area
Brief description of the project	To publicize hazard maps and risk maps in terms of earthquake disasters and sediment disasters to the public. The method of publication will be; (1) To place the maps in the municipality office so that any citizen can access them. (2) To distribute the maps to the community leaders so that they will be able to disseminate information to the community people. (3) To place them on the web-site of ADMC or municipalities so that it can be accessible from the public.
Location of the project	-
Total project cost	-
Project duration (between year 2004 and 2020)	2005-207 (three years)
Planning agency (primary and secondary)	Civil Protection of ADMC and municipalities
Implementing agency (primary and secondary)	Civil Protection of ADMC and municipalities
Maintenance and operation agency (primary and secondary)	Civil Protection of ADMC and municipalities
Financial sources	Civil Protection of ADMC and municipalities

Table 8.5.12 Project Sheet (11-1)

Project No.	**11-1**
Project name	**Professional and High Education in Risk and Disaster Management**
Type of Disaster	earthquake, sediment ,common
Stage of Disaster Management	Mitigation, preparation
Type of Project	Nonstructural
Objectives	1. Professional development for disaster managers 2. Mainstreaming risk approach in university programs 3. Inclusion of risk/disaster approach into curriculum for professional educators
Brief description of the project	1. Establishment of a Disaster Management Professional Program Caracas. 2. Sponsoring periodical workshops, seminars and exchange programs for upgrading knowledge for primary response agencies, decision makers and academics. 3. Revision, design and implementation of Curriculum Program for Professional Educators with the Risk and Disaster approaches
Location of the project	Caracas Metropolitan District
Total project cost	1. Professional development $ 2.7 2. Curricula Enhancement with Risk Reduction $ 3.1 3. Risk and disaster training for educators $ 1.2 Total Cost $ 7.0 million
Project duration (between year 2004 and 2020)	All period
Planning agency (primary and secondary)	Ministerio de Educación Superior OPSU – Consejo Nacional de Universidades
Implementing agency (primary and secondary)	Ministerio de Educación Superior COMIR / UCV (Comisión de Mitigación de Riesgos)
Maintenance and operation agency (primary and secondary)	Ministerio de Educación Superior All Universities Universidad Pedagógica Experimental Libertador
Financial sources	Ministerio de Planificación, FIDE

Table 8.5.13 Project Sheet (11-2)

Project No.	**11-2**
Project name	**Risk and Disaster Training for Primary, Middle and High School Education Programs**
Type of Disaster	earthquake, sediment ,common
Stage of Disaster Management	Mitigation, preparation
Type of Project	Nonstructural
Objectives	1. Inserting Risk and Disaster Programs in Metropolitan District Schools 2. Risk and Disaster Educational Materials for Schools and Students
Brief description of the project	1. Curriculum review, institutional approval and adoption; training program for teachers 2. Production of pedagogical materials and work books for teachers and students, for classroom home and community disaster preparation and risk reduction
Location of the project	Caracas Metropolitan District
Total project cost	1. Curriculum development & training $ 2.1 2. Materials and publications $ 1.9 Total Cost $ 4.0 million
Project duration (between year 2004 and 2020)	All period
Planning agency (primary and secondary)	Ministerio de Educación Fundación para Edificaciones y Dotaciones Escolares
Implementing agency (primary and secondary)	Ministerio de Educación Fundación para Edificaciones y Dotaciones Escolares
Maintenance and operation agency (primary and secondary)	Ministerio de Educación Fundación para Edificaciones y Dotaciones Escolares Alcaldía Metropolitana, Depto. Educación de Alcaldías Chacao, Libertador, Sucre
Financial sources	Ministerio de Educación

Table 8.5.14 Project Sheet (11-3)

Project No.	**11-3**
Project name	**Media Programs for Disaster Preparation and Risk Reduction**
Type of Disaster	earthquake, sediment ,common
Stage of Disaster Management	Mitigation, preparation
Type of Project	Nonstructural
Objectives	Increase public awareness by producing and dissemination media programs about risk reduction measures and disaster preparation for general public
Brief description of the project	1. Design, production and distribution of multimedia educational programs for general public use and community use 2. TV, radio and press programs, spots, videos, CDs, Raising awareness and training programs for journalists and media decision-makers
Location of the project	Caracas Metropolitan District, and beyond
Total project cost	$3,000,000
Project duration (between year 2004 and 2020)	Fifteen years period
Planning agency (primary and secondary)	Ministerio de Comunicación e Información
Implementing agency (primary and secondary)	Cámara de Medios de Comunicación, Cámara Venezolana de Radio Difusión, OFDA, Protección Civil Nacional / Metropolitana National College of Journalists
Maintenance and operation agency (primary and secondary)	Ministerio de Educación Fundación para Edificaciones y Dotaciones Escolares Alcaldía Metropolitana, Depto. Educación de Alcaldías Chacao, Libertador, Sucre
Financial sources	CANTV, Empresa de Seguros, CAF, PREANDINO

Table 8.5.15 Project Sheet (11-4)

Project No.	**11-4**
Project name	**Community Education** **for Preparation and Risk Reduction**
Type of Disaster	earthquake, sediment ,common
Stage of Disaster Management	Mitigation, preparation
Type of Project	Nonstructural
Objectives	Community Education and Educational Leadership Development
Brief description of the project	1. Design, Study and Implementation of highly effective Education Programs for risk and disaster prevention, specific for distinct types of communities in each Alcaldía 2. Development of an Integrated Community Program for disaster management and organizing, including operational techniques, capacity building, community activities for risk reduction, promoting multipliers and trainers in each Alcaldía
Location of the project	Alcaldías, Parroquias, Barrios, Urbanizations
Total project cost	Design of Community Education Program $ 1.5 Training and Multiplying Program $ 1.5 Total Cost $ 3,0
Project duration (between year 2004 and 2020)	Fifteen years period
Planning agency (primary and secondary)	Protección Civil Metropolitano and Protección Civil Municipal UCV Communication and Education professionals
Implementing agency (primary and secondary)	Protección Civil Metropolitano in coordination with Protección Civil Municipal, Centro Gumilla
Maintenance and operation agency (primary and secondary)	Protección Civil Metropolitano in coordination with Protección Civil Municipal Voluntary Community Groups
Financial sources	Alcaldía Metropolitana District, PC Metropolitan, Municipios PC's, FIDE, International Agencies such as PAHO

Table 8.5.16 Project Sheet (12-1)

Project No.	**12-1**
Project name	**Strengthening Community Activity for Disaster Preparation**
Type of Disaster	Earthquake
Stage of Disaster Management	Mitigation (Seismic Upgrading)
Type of Project	Structural and Nonstructural
Objectives	People in Caracas have to protect themselves against earthquake disaster, to reduce human casualty and property loss by means of strengthening the existing buildings by themselves with municipal support. The goal is to execute an incremental program for promotion of daily activities for seismic upgrading in urbanization and barrio area (for 950 buildings)
Brief description of the project	Barrio building experiencing damage in 1967 was relatively low due to low rise (1-2 stories). Since then most of these have extended upward to 4 to 6 stories without reinforcement or engineering supervision. Vulnerability on the majority of barrio houses is very high and serious damage will occur. Protection policies are necessary. Seismic strengthening is a good policy for this purpose. Local and metropolitan authorities are required to adopt policies and execute a reinforcement program with citizens living in risky conditions. Daily activities recommended include motivation towards citizens, institutional officials, Ministry Departments, municipal authorities, building law enforcement, reinforcement program and search and obtain financial support. The proposed project has four components: 1. Design and develop awareness raising activities with all stakeholders such as Municipal Engineers, Construction Unions (groups the brick layers and job chiefs in the informal building sector), Chamber of Construction, and Venezuelan Institute of Civil Engineers), CONAVI and research programs such as IDEC, all efforts sponsored by Alcaldía Metropolitan. 2. Design and execute pilot projects in each Alcaldía with social networks, in most risky barrio and urbanization areas. Progressive participatory demonstrations workshops on reinforcement techniques stimulated and carried out by municipal authorities, neighborhood associations and building owners in micro areas. 3. Expand to a broader program including human, technical and financial support taking into account the construction sector and the metropolitan government to improve building standards enforcement and stimulate reinforcement and upgrading of building in risky area. 4. Production and distribution of effective educational booklets and mass media spots that stimulates low cost upgrading of buildings in risky areas according to hazard and risk maps (slope failure, degree of slope, earthquake disaster scenario).
Location of the project	Barrio areas and Urbanization
Total project cost	1. Motivation Program (5 year program) $ 1.6 2. Planning and Implementing Pilot Projects (5 year program) $ 3.15 3. Support Program (5 year program) $ 0.64 4. Raising Awareness (5 year program) $ 0.64 Total Cost $ 6.03 million
Project duration (between year 2004 and 2020)	20 years period: 1-Motivation program towards all stakeholders about building reinforcement urgency (1 year) 2-Planning and Implementing Pilot Projects in selected barrio and urbanizations (5 years) 3-Support Program: resource identification (5 years) 4-Raising awareness: Dissemination program including mass media materials (5 years)
Planning agency (primary and secondary)	Alcaldía Metropolitano: Engineering and Planning Departments as well as Protección Civil Alcaldías from each Municipio: Engineering and Planning Departments
Implementing agency (primary and secondary)	Alcaldías from each Municipio Neighborhood associations and building owners
Maintenance and operation agency (primary and secondary)	Alcaldías Building owners
Financial sources	Building owners, Alcaldías, private sector

Table 8.5.17 Project Sheet (12-2)

Project No.	**12-2**
Project name	**Strengthening Community Activity for Disaster Preparation**
Type of Disaster	Sediment
Stage of Disaster Management	Mitigation (Early Warning) Community capacity building approach
Type of Project	Nonstructural
Objectives	Promote community activities related to sediment disaster in the areas close to the 20 quebradas and risky area by sediment
Brief description of the project	1. In depth micro assessment of hazard, risk and social vulnerabilities and capacities of all communities next to each quebrada and in flood area 2. Implementing a protocol in each municipality about early warning starting with pilot selected communities 3. Participatory field demonstration (such as DIGs, periodical drills, daily hydrological observation, preparing and updating emergency plans) to increase confidence on communities about how they should act in case of emergencies. 4. Community workshops to stress prevention policies (such as enforce zoning laws and relocation policies) in coordination with municipal authorities. 5. Production and dissemination of educational materials related with practical activities done by communities themselves during and for disaster prevention 6. Develop training and field practices on leadership/facilitator skills to increase capabilities and effectiveness of community`s organization in case of sediment disaster 7. Institutions and communities workshops and plans on how to lobby resources (for the communities and by themselves) and implement outcomes of plans, to ensure sustainibility of the project (financial, technical, operationally).
Location of the project	People and communities in risky area next to 20 quebradas of Sucre, Libertador and Chacao
Total project cost	
Project duration (between year 2004 and 2020)	Up to 10 year
Planning agency (primary and secondary)	Protección Civil Metropolitano in close coordination with Protección Civil Municipal, Gestión & Planificación Urbana of each Alcaldía
Implementing agency (primary and secondary)	Protección Civil Municipal, Voluntary Groups, Municipal Engineers Offices Neighborhood associations, CLPP, CAELs
Maintenance and operation agency (primary and secondary)	Protección Civil Municipal Voluntary Neighborhood Groups, community teachers, schools, local networks and individuals
Financial sources	Alcaldías, MARN, PC Metropolitan District, International Agencies

Table 8.5.18 Project Sheet (13)

Project No.	**13**
Project name	**Emergency Command Center**
Type of Disaster	
Stage of Disaster Management	Preparation, emergency response, rehabilitation
Type of Project	structural and nonstructural
Objectives	1. To operate an Emergency and Disaster Command and Control Center (COE).capable of managing major emergencies to large disasters 2. To centralize emergency and disaster information functions in one location (171, early warning systems, data base management). 3. Training of public personnel, NGOs, and community groups in disaster response simulations and improvement in overall capacity 4. To provide coordination of activities for emergency and disaster: operations, planning/intelligence, logistics, financial administration, and command.
Brief description of the project	Design and build an Emergency and Disaster Command and Control Center (COE). The COE will have functions for preparedness (training); mitigation (early warning system), and response (171, and coordination of operations, planning and intelligence , logistics.
Location of the project	Preferred location aeropuerto la carlota, or a location that is secure and has good access
Total project cost	(a) Building, isolated base, 4000 square meters, site preparation and parking, and furnishings = $1.83 million US (b) instrumentation and equipment = $1.09 million US
uuip	
Planning agency (primary and secondary)	Secretaria de Securidad Ciudana (ADMC)
Implementing agency (primary and secondary)	Obras Publicas (ADMC)
Maintenance and operation agency (primary and secondary)	Primary for building – Obras Publicas (ADMC) Secondary for operations: Secretaria de Securidad Ciudana (ADMC)
Financial sources	FIDE, Alcaldia Mayor

Table 8.5.19 Project Sheet (14)

Project No.	**14**
Project name	**Development of disaster information system**
Type of Disaster	common
Stage of Disaster Management	mitigation, preparation, emergency response, rehabilitation
Type of Project	nonstructural
Objectives	1. Uniform and consistent Metropolitan info system 2. Reliable/precise for the given time period and scale 3. Info system that can be used by legitimate user any time, all the time and from anywhere
Brief description of the project	Identification of data warehouse Uniform data collection and storage convention Data sharing agreements Data maintenance agreement Data use (publication, analysis etc)
Location of the project	Whole study area
Total project cost	US$5 Million
Project duration (between year 2004 and 2020)	2004-2007
Planning agency (primary and secondary)	Primary: Technological Division, ADMC Secondary: FUNVISIS, IMME, IMF, CENAMB, PC, Bombero, IGVSB, CANTV, EDC, METRO, Hidrocapital, MARN, Planning Secretary, ADMC etc.
Implementing agency (primary and secondary)	Primary: Technological Division, ADMC , PC, Bombero Secondary:
Maintenance and operation agency (primary and secondary)	Primary: Technological Division, ADMC Secondary: FUNVISIS, IMME, IMF, CENAMB, PC, Bombero, IGVSB, CANTV, EDC, METRO, Hidrocapital, MARN, Planning Secretary, ADMC etc.
Financial sources	

Table 8.5.20 Project Sheet (15)

Project No.	**15**
Project name	**Stockpiling of food, water and goods**
Type of Disaster	Common
Stage of Disaster Management	Preparation
Type of Project	Nonstructural
Objectives	To implement the Sphere Project - Humanitarian Charter and Minimum Standards in Disaster Response on: water supply and sanitation, nutrition, food aid, shelter and site planning, and health services, since ADMC does not have any plan to organize the administration of help.
Brief description of the project	With the decentralization process, ADMC is in charge to coordinate the direct administration of help, and according with the 1967 scenario there could be 45,000 persons needing support. ADMC implementing the Sphere project will have the capacity to organize the response of assistance provided to people affected by disasters, and to enhance the accountability of the humanitarian system in disaster response. The project will be considering the scenario of 1967 earthquake, including number of affected buildings, persons needing shelters, injured people, deaths and the present capacity of response. For this purpose, these subjects will be developed considering minimum standards: • Water supply and sanitation: There will be a necessity of 2,025,000 liters for 3 days. Other aspects will be excreta disposal, vector control, solid waste management, drainage, and hygiene promotion. • Nutrition and food aid: The necessity of kilocalories will be 283,500,000 [(6,300 kcal/person) 45,000persons]. Guidelines to evaluate the requirements and target population, and the management of the resources (logistics and distribution). • Shelter and site planning. The aspects to be covered will be housing, clothing, household items, site selection and planning. • Health services. A checklist will be used for Initial Health Assessment. Measles control and other health services will be implemented according to a weekly surveillance report.
Location of the project	Metropolitan District of Caracas
Total project cost	US$ 40,000
Project duration (between year 2004 and 2020)	2004-2007
Planning agency (primary and secondary)	P: PC Met S: Secretaría de Salud de la ADMC, MSDS, FUNVISIS, INPARQUES, HIDROCAPITAL, Red Cross, NGOs, bomberos, private companies, army.
Implementing agency (primary and secondary)	P: PC Met S: PC in each Municipality.
Maintenance and operation agency (primary and secondary)	P: PC Met S: PC in each Municipality
Financial sources	Own resources

Table 8.5.21 Project Sheet (16)

Project No.	**16**
Project name	**Emergency Transportation Network**
Type of Disaster	earthquake
Stage of Disaster Management	preparation emergency response
Type of Project	structural, nonstructural
Objectives	To secure the emergency road network in order to rescue people, conduct relief activities, and transport goods and people promptly and effectively in the event of earthquake disaster.
	Caracas has no recognized emergency transportation network among the government agencies. It is indispensable to designate the primary and secondary network of emergency roads in order to do rescue and relief activities, and transport goods, people, etc., promptly and effectively. In the case of 1967 earthquake scenario, a total of 10,020 heavily damaged building will produce about 912,000 tons of debris, or some 701,000 m^3 of debris. Part of such debris will block the road access. Also objects fallen off from buildings will block roads. Most of the debris is produced in barrio areas, thereby the access should be secured to barrio areas. **Committee on Emergency Transportation Network** A committee on Emergency Transportation Network shall be established with Civil Protection as lead agency to plan the emergency transport. The committee will decide the responsibilities of the related organizations and agencies in emergency road operation. The committee constitutes Civil Protection Metropolitan, MINFRA, municipalities Engineers offices, and traffic police. **Emergency Road Network within Metropolitan District** Emergency road network will be propagated by the committee to the municipalities and organizations responsible for primary emergency responses (rescue and medical operation), in order to respond effectively to the emergency situation in case of earthquake. Establishment of Emergency Road network Important facilities related to disaster management should be prioritized who respond to the emergency situations. To connect them efficiently in emergency situation, emergency road networks within the Metropolitan Caracas will be established, and be recognized by the committee, and organizations responsible for primary emergency responses (rescue and medical operation and other related organizations. Use of emergency road network In order to use the emergency road efficiently, MINFRA and other road administrators will be responsible for removing the debris and primarily response to the damaged infrastructure on the emergency roads. The municipalities of Metropolitan District are responsible to investigate the area affected, and report to MINFRA and the competent road administrators at once. **Secure Access to Metropolitan Caracas (Land and air transportation)** In order to respond to the accommodation of people and commodities donated domestically and internationally, Caracas should have transportation to access the transportation hubs like Simon Bolivar International airport and the military airport in Caracas. **Public notification of Emergency Transportation Network** Emergency transportation Network will be informed to all related agencies by Metropolitan Civil Protection in order to respond effectively in the emergency situation. Signs of emergency roads should be set up on the roads to notify the public. **Traffic Control on the emergency roads** After the disaster happens, the traffic shall be control on emergency roads for a smooth operation. - Publicity about traffic control on emergency roads - Procurement of equipment for traffic control in emergency
Location of the project	Major roads in the whole study area
Total project cost	- Planning: - Procurement of heavy equipment for debris clearance: - Sign of emergency roads:
Project duration (between year 2004 and 2020)	2005-2007 (3 years)
Planning agency (primary and secondary)	Primary: Civil Protection (Metropolitan and municipality), Police, MINFRA, Municipality (road administrators) Secondary:
Implementing agency (primary and secondary)	Primary: MINFRA, Municipality, Police, Municipalities Secondary:
Maintenance and operation agency (primary and secondary)	Primary: Municipalities Secondary: MINFRA, Police
Financial sources	Municipalities, State government, (MINFRA),

Table 8.5.22 Project Sheet (17)

Project No.	17
Project name	**Evacuation plans and evacuation drills**
Type of Disaster	Earthquake
Stage of Disaster Management	Preparation
Type of Project	nonstructural
Objectives	To formulate the evacuation plan for an efficient and effective evacuation after the disaster event for saving as many people as possible
Brief description of the project	At present time, Evacuation plan for earthquake disasters of the disaster management related organization such as bomberos, police, Civil Protection, municipalities are not established. Based on the 1967 earthquake scenario, 10,020 houses will be heavily damaged. These people have to be evacuated first to safe place and then sheltered. A total of around 76,400 people should be evacuated and sheltered. Libertador will have some 67,700, Chacao, 1,300 and Sucre 8,500. Those refugees are concentrated in barrio areas which are with very limited open space and thereby difficult to evacuate and access to rescue. **Evacuation Plan** Evacuation plan shall include the following items: • Identification of area needing evacuation • Estimated number of evacuees • Evacuation place, facilities, and logistics of necessary things • Evacuation routes • Evacuation procedure • Evacuation map preparation, distribution and public relations • Evacuation drill (simulation exercise) **Commission on Evacuation Plans** Evacuation planning is a task that addresses multiple organization participation because there are many sectors involved (health, rescue, security, communications, water, temporary shelter, food, transport, trauma and relocation). A Commission on Evacuation Plans (CEP) needs to be established for this counter measure. This commission shall have representatives from the following institutions: • Office of Civil Protection and Administration of Disasters (PCAD) of the ADMC who serves as the technical secretariat for the development of the plan and its implementation strategies. • Civil protection institutes from all the municipalities. • Firefighters • Major volunteer organizations • Linked non governmental organizations (NGOs) • Park agencies (INPARQUE, Municipalities) • University Central of Venezuela • Private Communications Companies • Municipal agencies in charge of roads • Police • Barrio group representative • Medical sector

	Evacuation Drill There should be drill (simulation exercises) of an evacuation conducted with citizens to promote preparedness among the participating agencies. These simulations should be done frequently with the medical sector and the education sector. Special attention shall be given to the highest risk areas in the city, and how they will be evacuated. Comprehensive Evacuation Drills In order to enhance the capacity of the related agencies, community, and other related institutions, periodical drills of disaster response is necessary. Through the drills, coordination will be enhanced among the related agencies centered CP AMDC and municipalities. And along with the drills, various disaster prevention plans, guidelines, and manuals are necessary to be improved through the result of the drills. For this purpose, a various drill shall be designed to verify the procedures to response. Table-top exercise of government agencies Image training to response to disaster events is very important to the governmental officers in charge of disaster situation. Table-top exercise shall be conducted in a manner.
Location of the project	The whole study area
Total project cost	--
Project duration (between year 2004 and 2020)	2005-2007 Drill shall continue periodically every year.
Planning agency (primary and secondary)	Primary: Protection Civil (AMDC) Secondary: Protection Civil (Municipality),
Implementing agency (primary and secondary)	Primary: Municipality Secondary:
Maintenance and operation agency (primary and secondary)	Primary: Protection Civil (AMDC) Secondary: Protection Civil (Municipality)
Financial sources	

Note: The refugee numbers are calculated by multiplying the number of heavily damaged houses by the average number of family members of each municipality.

Table 8.5.23 Project Sheet (18)

Project No.	**18**
Project name	**Rescue Operation Plan**
Type of Disaster	Common
Stage of Disaster Management	Preparation
Type of Project	Nonstructural
Objectives	To improve the capacity of PC Metropolitana to manage the S&R activities considering that the bomberos and approximately 90 volunteers groups in capacity to provide S&R support are not effectively organized.
Brief description of the project	To coordinate, organize and include all the actors in the flowchart of response in case of disaster, according with their present conditions and capacities, the project will consider the following recommendations: • Bomberos and volunteers groups have to be organized according to the risk maps (area of influence) and their specialties: training (to train new volunteers and teach them theoretical and practical aspects); planning and operations; registration and control; legal aspects; communications, among others. • The project has to provide leading capacity to PC Metropolitana to coordinate all the S&R activities. As a result, there will be an institutionalization process of these groups thus benefiting their updating (through training activities, drills and simulation exercises), equipping and the creation of strategic alliances so that private companies can collaborate with these activities. • Qualified actors in S&R have to be identified to support PC Metropolitana in conducting the process of certification and re-certification process for all the people performing S&R activities. For this purpose, will be also necessary to standardize contents and establish methodologies to be used to transfer capacities.
Location of the project	Metropolitan District of Caracas
Total project cost	US$ 40,000
Project duration (between year 2004 and 2020)	2004-2007
Planning agency (primary and secondary)	P: PC Met S: Bomberos, volunteer groups, PC in each Municipality, MSDS, private companies, Red Cross, NGOs.
Implementing agency (primary and secondary)	P: PC Met S: Bomberos, PC in each Municipality, volunteer groups.
Maintenance and operation agency (primary and secondary)	P: PC Met S: PC in each Municipality
Financial sources	Own resources

Table 8.5.24 Project Sheet (19)

Project No.	**19**
Project name	**Medical Treatment Plan**
Type of Disaster	Common
Stage of Disaster Management	Preparation
Type of Project	Nonstructural
Objectives	To organize necessary ambulatories as the first line of medical response and 03 hospitals to cover the necessities, assuming at least 1967 scenario where there would be 4,510 injured persons and from this number, 451 persons would need to be hospitalized. At present, there is no plan to prepare the medical response in case of disaster in Caracas.
Brief description of the project	There are 03 chosen hospitals located in Sucre and Libertador. In Sucre because the numbers of persons who will need a bed exceed the hospital capacity they have. And two big hospitals in Libertador where the largest number of injured people will come from. Each hospital will work with a net of ambulatories in charge of the triage. To achieve the objective, the following actions have to be developed: • To organize a network between each hospital and the ambulatories where the triage will be made. Each ambulatory included in a network will know to which hospital the patients have to be transferred, considering the mean of transportation and communication. • To evaluate the hospital's autonomy in terms of its services and its source of electricity, gas, water, food, and medical supplies. • To implement an efficient system of alerts and staff assignments. • To organize a unified medical command. • To plan the conversion of all usable space into clearly defined areas for efficient triage, for patient observation, and for immediate care. • To plan the prompt removal of casualties when necessary to the places where medical care facilities are more appropriate and definitive. • To maintain updated a special medical census for disaster cases. • To plan procedures for prompt transfer of patients within the hospital. • To organize security arrangements to keep curious persons from entering triage areas and to protect staff from hostile actions. • To specify evacuation procedures and routes. • To establish a public information center. The local police, rescue groups, and ambulance teams will be informed of the resources of each hospital previously. Also the public will be informed about what to do in case they were injured.
Location of the project	Libertador and Sucre Municipalities
Total project cost	US$ 411,765
Project duration (between year 2004 and 2020)	2004-2006
Planning agency (primary and secondary)	P: Secretaría de Salud de ADMC S: MSDS, PAHO, Red Cross, public hospitals, private clinics, PC Met, PC in each Municipality, HIDROCAPITAL, private companies.
Implementing agency (primary and secondary)	P: Secretaría de Salud de ADMC S: MSDS, PC Met, PC in each Municipality, public hospitals, private clinics.
Maintenance and operation agency (primary and secondary)	P: Secretaría de Salud de ADMC S: MSDS, PC Met, PC in each Municipality, public hospitals, private clinics.
Financial sources	US$161,765 (local resources), US$250,000 external resources

Table 8.5.25 Project Sheet (20)

Project No.	**20**
Project name	**Mental Care and Support Skills in Disaster Situation**
Type of Disaster	Common
Stage of Disaster Management	Preparation
Type of Project	Nonstructural
Objectives	To provide professional mental care, psychological and counseling skills for rehabilitation stage from any kind of disaster to social workers, doctors, nurses, teachers, NGOs, civil volunteers, and other possible actors with some experiences in specific field. To organize network of mental care teams after the mental care training finished as a means of preparation in case of disaster
Brief description of the project	The role of mental care, psychological and counseling to affected people is extremely crucial by shown from previous disasters experiences like Vargas(Debris flow in Venezuela),Hanshi-Awaji (Earthquake in Japan), and Bam (earthquake in Iran) as well as physical recovery from disaster damage. Therefore, in this project, specialists of mental care, psychological and counseling for disaster from different background are nurtured with specific skills particularly for rehabilitation stage from disaster. As preparation stage of disaster management, mental care training programs targeted disaster recovery are provided, and through these project, the specialists are expected to work as professional team in each stage of recovery from any type of disaster (short, middle and long term). Through this project, the following skills are mastered: 1) To mitigate impact of trauma and understand stress of affected from disaster to recovery (Methods of treatment are differently prepared between Sediment Disaster and Earthquake etc.). 2) To encourage affected people to acquire problem- solving skills and support copying skills for recovery through communication. 3) To improve counseling skills and knowledge for affected people's anticipating concerning topics during recovery such as health care, housing, and economic assistance information, living issue in temporal shelter, employ opportunity, etc by taking advantage of team member's background. An important point is that this project is targeted not only technical personnel but also kind of specialists from own experience like retired persons with specific skills or civil volunteers who have experience of recovery from disaster etc. In addition, it is also considered to exchange specialists with certain countries, which have experienced like Kobe prefecture, in Japan.
Location of the project	Caracas, Venezuela
Total project cost	**I will get the estimation cost by the end of August**
Project duration (between year 2004 and 2020)	2005-2007
Planning agency (primary and secondary)	Primary 1) Civil Protection National cooperated with Governmental Emergency Committee Secondary 2) Civil Protection Metropolitan
Implementing agency (primary and secondary)	Primary 1) Civil Protection Metropolitan Secondary 2) Cooperating agency such as hospitals, University in metropolitan
Maintenance and operation agency (primary and secondary)	Primary 1) Civil Protection National Secondary 2) Civil Protection Metropolitan
Financial sources	National Government

Table 8.7.1 Summary of Debris Flow Control Structures

Phase	I	II
Term of the Plan	Short Term Plan	Long Tem Plan
Target Year	2012	2020
Design Rainfall Return Period	25 years for sabo structures 10 years for water channel	100 years
Number of sabo dams	81	84
Total length of debris flow channel	3,250 m	3,250 m
Total length of water flow channel	19,348 m	7,998 m
Construction Cost (million US$)	108	141

Table 8.10.1 Cost of Master Plan Projects

No.	Project rename	Cost (MUSD)
1	Seismic reinforcement of buildings	2,581
2	Seismic reinforcement of bridges	11
3	Debris flow control structures	141
4	Slope protection structures	－
5	Drainage improvement in barrios	－
6	Resettlement of people in risky area	49
7	Early waning and evacuation for debris flow disaster prevention	1
8	Land use and development control in risky area	－
9	Development of open space	－
10	Publication of hazard maps and risk maps	－
11	Education of people	17
12	Strengthening of community activity for disaster prevention	6
13	Emergency command center	3
14	Development of emergency information system	5
15	Stockpiling of food, water and goods	－
16	Emergency transportation network	－
17	Evacuation plan and evacuation drills	-
18	Rescue operation plan	－
19	Medical treatment plan	1
20	Mental care and support skills in disaster situation	-
	Total	2,815

Table 8.14.1 Comparison of Two Projects for Selection of Priority Project

Project	**Sabo structures**	**Early warning system**
Disaster management stage	mitigation	Preparation for emergency response
Benefit	save the lives and the properties regardless of the behavior of the people	save the lives depending upon the behavior of the people
Environmental impact(natural)	impact on El Avila National Park is comparatively large	impact on El Avila National Park is comparatively small
Environmental impact(social)	impact of resettlement on people along the channel	no impact of resettlement on people along the channel
Cost	US$100-200 million depending upon the design scale	US$1-5 million depending upon the system grade
Finance	finance of the central government or International Institutions are required	finance of the Metropolitan government can finance the amount
Proposed Implementing agency	Ministry of Infrastructure or Ministry of Environment and Natural Resources	Ministry of Environment and Natural Resources, Civil Protection, Fire Fighters, Community
Collaboration of agencies	Collaboration for Implementation is necessary among financial source, implementing agency, maintenance agency and environmental impact assessment agency.	Collaboration of operation agencies is absolutely necessary. Especially, vertical coordination among central government, Alcaldia government, municipal government and community is necessary.
Technology *Examples in Venezuela*	civil engineering examples in Vargas	information technology examples in Maracay and in Catuche community

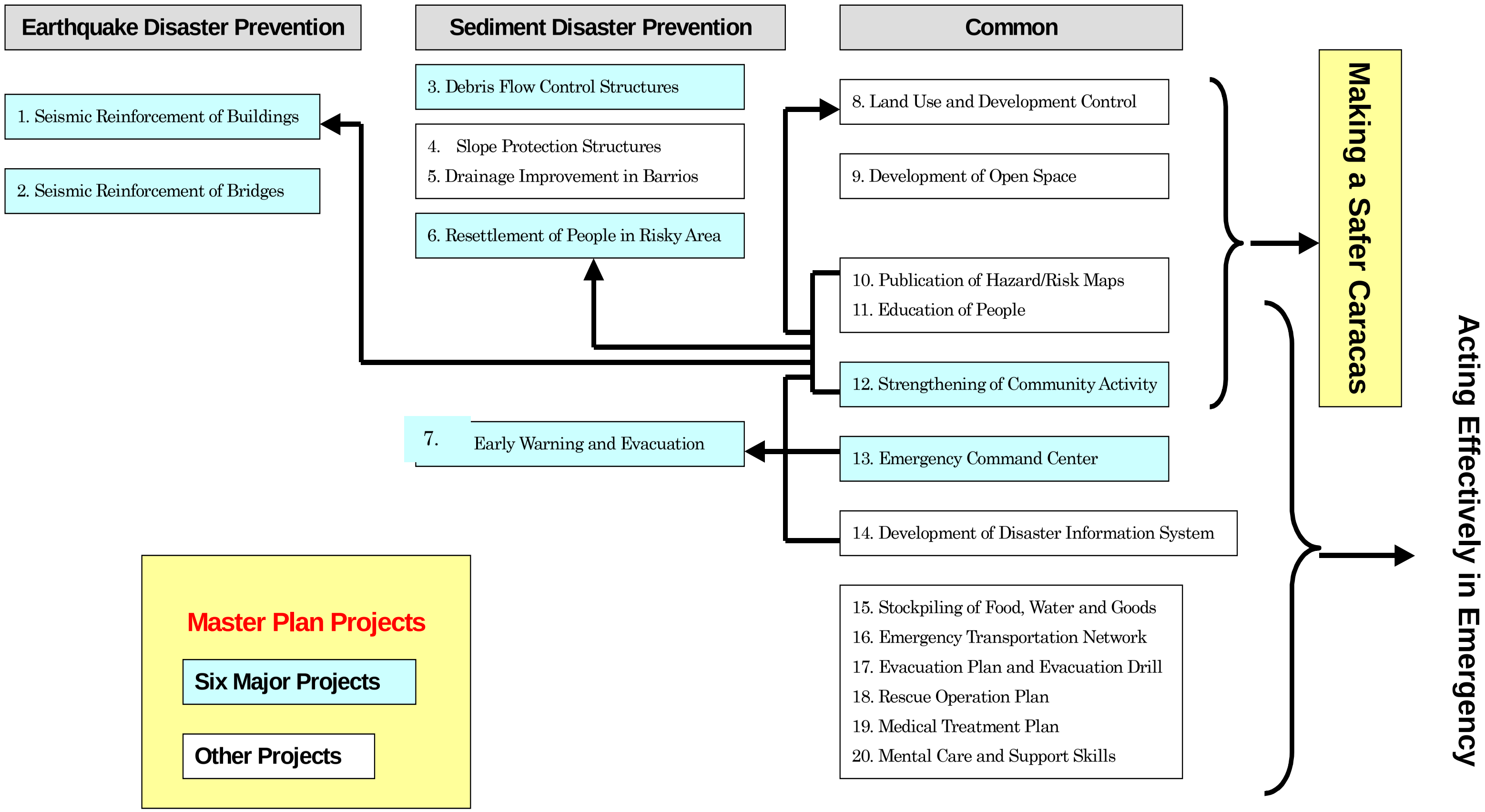


Figure 8.5.1 Relationship of Master Plan Projects

No.	Project rename	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	Seismic reinforcement of buildings																
2	Seismic reinforcement of bridges																
3	Debris flow control structures																
4	Slope protection structures																
5	Drainage improvement in barrios																
6	Resettlement of people in risky area																
7	Early waning and evacuation for debris flow disaster prevention																
8	Land use and development control in risky area																
9	Development of open space																
10	Publication of hazard maps and risk maps																
11	Education of people																
12	Strengthening of community activity for disaster prevention																
13	Emergency command center																
14	Development of emergency information system																
15	Stockpiling of food, water and goods																
16	Emergency transportation network																
17	Evacuation plan and evacuation drills																
18	Rescue operation plan																
19	Medical treatment plan																
20	Mental care and support skills in disaster situation																

Figure 8.12.1 Implementation Schedule of Master Plan Projects

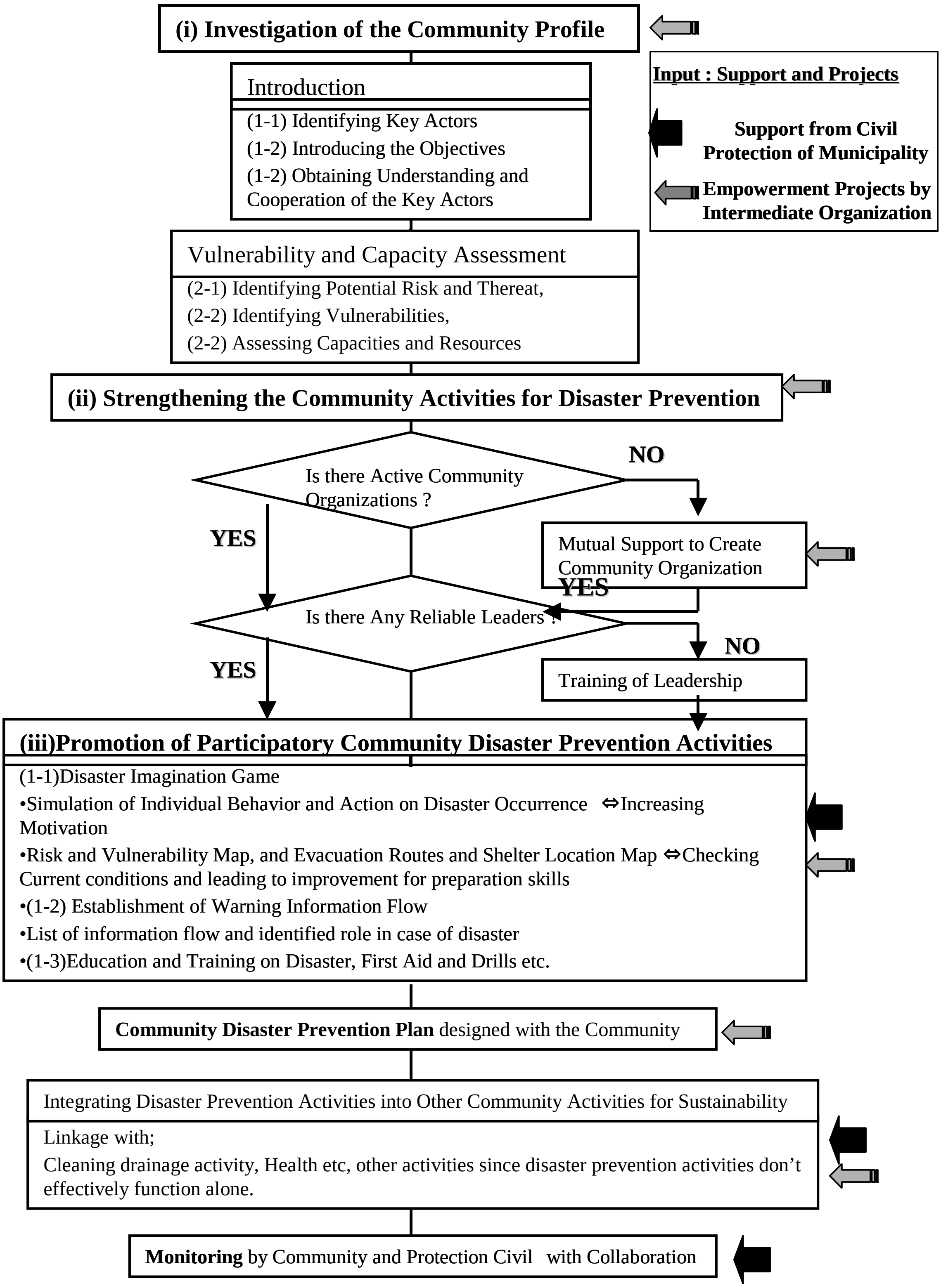


Figure 8.13.1 Process of Strengthening Community Activities for Disaster Prevention

CHAPTER 9

EVALUATION OF MASTER PLAN

"Because the prevention of disasters is part of your life"

Antonio Aguilar M.

CHAPTER 9. EVALUATION OF MASTER PLAN

9. 1 General

The Study Team has proposed various projects that comprise the master planto achieve the goals of the basic plan: namely, 1) protection of human life, 2) protection of property,and 3) maintenance of urban function, by reducing the risk caused by the natral disasters.

In this chapter, the master plan as a whole is evaluated in various apects for justification of the plan.

9. 1. 1. Evaluation Criteria

For evaluation of the master plan, the following criteria are set:

Economic aspect:	In economic aspect, the master plan is evaluated in terms of cost and benefit. The secondary goal of the master plan is to protect property, and the third goal is to protect urban functions, and whose damage reduction is counted in economic aspect.
Financial aspect:	The maste plan is evaluated in the total prject cost and budget size of the implementing agencies.
Social aspect:	The primary goals is to protect human lives. In social aspect, the master plan is evaluated in how much the master plan as a whole contribute to reduction of human casualty.
Technical aspect:	This will evaluate if the master plan can be conducted by local techinology level.
Environmental aspect:	Project that include physical works may give impact on environment of the influence area of the master plan. This iinclludes social impacct on the residents of the project site, such as expropriation of land and relocation of people for the master plan.

9. 1. 2. Summary of Master Plan Projects

Table 9.1.1 summarizes the expected effect and costs of the master plan projects.

9. 1. 3. Summary of Master Plan Project Evaluation

Table 9.1.2 shows summarized feature of each master plan ptoject in each evaluation criteria.

9. 2 Evaluation Results

This section describes the master plan as a whole in each evaluation criteria.

9. 2. 1. Economic Aspect

The proposed master plan projects will not eliminate all the damage when the scenario disasters occur and the benefit calculated as the damage reduction by the master plan projects will be less than the total damage anticipated without the master plan projects. In fact, structural projects such as the reinforcement of buildings and debris flow control project do not show economic feasibility based on the estimation with only quantified variables, although the reinforcement of buildings project shows that the cost and benefit of the project are almost even in the provisional economic analysis.

9. 2. 2. Financial Aspect

Total cost for the master plan is about 2.8 billion US$, more than 90% of which is that for reinforcement of buildings, US$ 2.58 billion followed by Debris flow control structure project, US$ 141 million (5 %), and resettlement of people from the risky area, US$ 49 million (1.7%). The total cost of the master plan is five times larger that the annual budget of the Metropolitan District of Caracas in 2003, around US$600 million. Even dividing them by 16, the number of years for the master plan period from 2005 to 2020, the average annual cost is around US$ 176 million. This is still around 30 % of the AMDC's annual budget. Accordingly the Metropolitan Government of Caracas cannot afford to finance all the projects. However, not all the projects should be shouldered by AMDC. Some projects such as reinforcement of buildings, and bridge reinforcement should be financed not only by the Metropolitan government, but also by other financial sources.

For example, the cost for the reinforcement of buildings which accounts for more than 90 % of the total cost should not be shouldered 100% by the public sector. The principle of building reinforcement financing will be by the building owners regardless whether it is public or private. However, for reinforcement of buildings, the financial burden for public and private sectors has not decided yet. The Metropolitan Government can fulfill the duty of protection of citizen by promoting building reinforcement in some way or another. In the case of bridge reinforcement of important highways, the beneficiary of the project is not only the Metropolitan Government but also the central government of the republic as these projects are important to protect the functions of the capital city.

Therefore, the cost of the master plan projects should be compared with the total budget of the central government as well as budget of AMDC as beneficiaries are not only the AMDC but also the entire country.

The budget of the country is about US$ 26 billion (2003), MIFRA's budget is US$ 1.9 billion (2003), and newly established Ministry of Housing has US$ 625 million (2004). The average annual cost for the master plan, around 176 MUS$ is around 0.7% of the annual budget of the country (2003) and 9% of the MINFRA's budget, and 2.8% of Ministry of Housing budget (2004).

In financial aspect, the most critical is determination of the appropriate proportion among the governmental agencies, and amount of subsidy or other incentives to private sector and individual people by the government to promote the master plan projects.

9. 2. 3. Social Aspect

The plan targeting to protect the human life and combination of all the proposed projects will significantly reduce the number of human casualties in both earthquake disaster cases and sediment disaster cases.

For example, among the master plan projects, the reinforcement of buildings alone would reduce the number of human casualties from 4,900 to 400 in the case of the 1967 earthquake scenario. Debris flow control, including sabo dam and river channel work, will protect 19,000 people in the sediment study area from a debris flows. Likewise, with the implementation of the early warning system, the same 19,000 people would evacuate from a debris flows. Furthermore, rescue and medial operation related projects, evacuation related projects are expected to save more people's life. With relocation project, some 7,000 people are expected not to suffer from sediment disaster. Land use and future development control will protect around 400 thousand potential barrio people from the risk.

As described above, the master plan projects will contribute considerably t in social aspect. Thus, the master plan is justified from social point of view.

9. 2. 4. Technical Aspect

Two projects of "building reinforcement" and "early warning system were thought to technically difficult among the master plan projects before the feasibility study about the technical aspects of the two projects. However, even the two projects have been judged technically feasible with the local technology level.

It is not difficult to inspect, design and implement the building reinforcement of engineering buildings with proper engineering design and construction. However, a large proportion of the buildings subject to reinforcement is in barrio area, where buildings are constructed without any design drawings, or constructed in a non-engineering way, which was thought to lead to technical difficulty in their reinforcement. To study the technical aspect of reinforcement of barrio houses, the JICA Study Team conducted a breaking test of four models of real barrio houses: that is, 1) a house without reinforcement,

2) a house with reinforcement of grade beam, 3) a house with reinforcement of grade beam and brick wall, and 4) a house with reinforcement of grade beam and concrete block wall. These houses were built with prevailing, ordinary construction method for barrio houses. The results of the test show that it is feasible to reinforce barrio houses with the prevailing local construction technologies. With reinforcement by the grade beam (model 1) improve the strength of the barrio house by 40 %. And the results of the test clearly shows that barrio houses can be reinforced by conventional technique used in construction of ordinary barrio houses.

"Early warning" is a very sophisticated technique dealing with various information and technical judgment. Large-scale meteorological information as well as local information is essential for rainfall amount observation. Prediction of debris flow phenomenon or slope failure phenomena requires accumulation of data on rainfall amount and debris flow phenomena. MARN has experience of early warning system outside the Study Area and it is likely that they can apply that to the study area. And as for the information collection and analysis, based on the preliminary threshold rainfall amount the JICA study team has established, MARN can advance the system accumulating the additional data and modifying the analytical model. In respect to communities who are at the other end of the communication of the early warning system, they have proved themselves to be effective in the early warning system through the pilot study at communities.

9. 2. 5. Environmental Aspect

(1) Initial Environmental Examination (IEE) of the master plan projects

1) Screening

The master plan projects were screened according to the screening checklist of JICA's guidelines. Table 7.2.5 presents the summary of the screening of the master plan projects.

2) Scoping

The scoping is focused on the sub-project of sediment control structures. The following summarized the IEE on sediment control structure.

This project will induce relatively insignificant adverse impacts as compared with the sediment disaster control project of closed type sabo dams that significantly change sedimentation patterns in the downstream of the river. Unstable living environment is considerably stabilized by embankment. Improved landscape of the river surroundings will further improve the living environment. Several possible adverse impacts were, nevertheless, identified in the construction and operation phase of the project. The major potential project impacts include the possibility of relocations of people, ecological impacts by anticipated changes in water quality by the structural measures in thel Ávila National Park and temporary traffic disruption in neighborhood.

Venezuelan expropriation law has some gaps with the spirit behind the JICA's new Guidelines, thereby some of the potential beneficiaries that live in barrio areas will necessarily be worse-off with the project implementation. This adverse impact will last long directly to the livelihood of the population, resulting in hardship and impoverishment unless appropriate measures are carefully planned and carried out. Accordingly, to minimize such adverse impact on the livelihood of the affected people, a project specific guideline needs to be developed by undertaking social survey.

Other issues associated particularly with sediment control structures are: (i) surface water hydrology, (ii) direct impact of construction works in urban settings, and (iii) other offsite impacts of construction works. Although dam construction projects frequently induce alteration of hydrology and resultant changes in sedimentation pattern in the downstream of the structure, the expected extent of the impact is judged limited because: 1) open type structure was incorporated in the structure design, by which changes in sedimentation pattern will be minimized, and 2) the volume of sediment supplied from one watershed is limited in comparison with total volume of sediment flowing down the Guaire river. However, the Social Environmental Consideration Study (SEC study) performed in the subsequent period is to include an assessment on the issue through interviews of the downstream residents as it is expected to emerge in the long run as a cumulative impact if the project is multiplied to other targeted watersheds.

The project of sabo dam construction will affect the natural environment of El Avila, which is a national park and well preserved area. Discussions have been held on the issue with the Office of National Parks, a part of Ministry of Environment and Natural Resources. According to the discussion, by taking proper legal procedures and taking careful management in design, construction process and in maintenance stage of the project, it is possible to proceed with the project. Table 7.2.6 shows the environment impact in sediment control projects.

(2) Social Impact

There are two kinds of resettlement proposed in the master plan. The first resettlement is to resettle the people in the risky areas to safer areas for their own sake. The second resettlement is to resettle the people in the course of the structural measures such as channel improvement in the urban area as mentioned above.

Both resettlements benefit to the people who resettle as they move away from their own risks. However, it is necessary to let them understand their risks so that they will resettle voluntarily. The resettlement procedure should carefully consider local legal procedures. And according to the social survey with a barrio community in the topic of relocation, resettlement plan shall be formulated with the people in a participatory way so that they will feel the ownership of the plan and the part of the plan, that is a key to the relocation project implementation.

9. 3 Overall Evaluation of Master Plan

The evaluation of the master plan is summarized as follows:

(1) Economic — It is rather difficult to conduct economic evaluation of the entire master plan. According to the economic evaluation of the reinforcement of buildings, which occupies more than 90% of the total cost of the master plan, cost surpasses benefit considerably.

(2) Financial — Total cost of the master plan accounts for around 3% of GDP of the country, about 10% of the national budget. Taking into account the importance of the capital city in various aspects, it is worthwhile to invest in the master plan projects.

(3) Social — In the scenario cases of earthquake and sediment disasters, damage estimated are a total of 5,000 human death and injury in the 1967 earthquake scenario, and 20,000 human death and injury in the 1812 earthquake scenario, and human life and property of some 20,000 people in the sediment scenario of the rain of a 100 year return period. With the master plan projects, such damage are estimated to be reduced by one order in the earthquake scenario cases, and damage in the sediment disaster is likely to be minimized. Thus, effect on social aspect of the master plan is huge.

(4) Technical — All the master plan projects are feasible with the local technology.

(5) Environmental — Sabo dam, within the debris flow control project, is to be constructed in national park, the Avila. MARN has already admitted this structure in the national park on the condition that the dam will be designed and constructed taking into account natural environment.

In sum, master plan is justified by its large positive effect on reduction of damage caused by the disaster scenario for both earthquake and sediment disasters.

Table 9.1.1 Summary of Master Plan Projects (1/2)

No.	Project	Outline	Expected effect	Cost
1	Reinforcement of buildings	182,700 buildings shall be reinforced based on 2001 building code (urban) and 10% of the construction cost of new houses (barrio)	- 182,700 buildings are to be reinforced by 2020 and seismic resistance will be improved. - Heavily damaged building s 10,000 to 1,300; human casualties from 4,900 to 440 - Direct damage reduction of buildings: 375.4 MUS$; direct + indirect damage reduction: 582.9 MUS$ - Maximum Annual cost during the MP period (around 190 MUS$)	2,581 USD
2	Reinforcement of bridges	17 bridges and 400 piers shall be reinforced against 1812 earthquake	- 17 bridges and 400 piers shall be reinforced and road transportation will be secured and maintain road transportation, thereby secure socio-economic activities even in the 1812 earthquake scenario. - Expected reduction in damaged bridges: 17.4 MUS& (17 bridges) - More than 40,000 vehicles/ day at Arana are secured and socio-economic activities are maintained.	11 M USD
3	Debris flow control structures	86 Sabo Dams and 20 km of channel improvement for 1/100 year debris flow	- 2715 buildings in urban and barrio areas will be protected from debris flows. - Expected Reduction of damage to assets = 93.5 M US$ - Approximately 19,000 people will be protected from debris flows	141 M US
4	Slope protection structures	identification of risky slopes and to implement slope protection works	- Protection of houses on and around the steep slope in the sediment disaster study area. - Approximately 12,347(steep slope failure), 540 (landslide), total 12,887 buildings are located in the slope affected area - Approximately 90,000 people could be protected from potential disaster	-
5	Drainage improvement in barrios	improvement of drainage in barrio area in order to reduce the risk of steep slope failure and landslide	- Protection of barrio houses from land slide - All barrio population (1.4 million) will benefit	-
6	Resettlement of people in risky area	1,000 buildings (1500 households, 7,000 persons) along the mountain streams to be relocated	- 1,500 families (7,000 people) living in the mountain streams will be protected	49.2 MUS$ (without land)
7	Early waning system for debris flow disaster prevention	early warning and evacuation system for debris flow disaster prevention	- 9,000 people in the sediment study area would evacuate from debris flows at a return period of 100 years. - Improvement of prevention capacity against debris flow disaster by strengthening related agencies and community	1.18 MUS$
8	Land use and development control in the risky area	control on future land use in order not to increase the population and properties in risky area	- Protection of people who are likely to live in risky area in the future, particularly future barrio population (0.4 million) will be protected.	-
9	Development of open space	development of open spaces as disaster prevention resources	- Affected people (some 76,400) under the 1967 earthquake scenario will be likely to evacuate. 19,400 in urban & rural area and 57,000 in barrio area. - In particular, barrio area and down town area are estimated short of evacuation spaces in the 1967 earthquake scenario.	--
10	Publication of hazard maps/risk maps	publication of hazard maps and risk maps	- All the Caracas people will be prepared against natural disasters, thereby reduce the damage.	

Table 9.1.2 Summary of Master Plan Projects (2/2)

No.	Project	Outline	Expected effect	Cost
11	Education of people	promotion of education for disaster prevention in high, middle and primary level institution as well as through media	- Level of prevention and preparation of people against natural disaster will be raised and thereby reduce the damage.	17 MUS$
12	Strengthening of daily community activity for disaster prevention	promotion of community activity for disaster prevention especially in the field of "early warning and evacuation" and "reinforcement of buildings".	- Community capacity against natural disaster will be improved through daily activity for good response against debris flow by early warning system and by reinforcing g their houses. Those living in 20 mountain stream and those who need reinforcement are benefited.	6.03 MUS$
13	Emergency command center	anti-seismic structure equipped with disaster information system and communication system	- Emergency response operation will be secured and indirect damage will be reduced by efficient and effective operation by the center.	2.92 MUS$
14	Development of emergency information system	information system composed of database, computers with software	- Improvement of plans and operations for disaster prevention, preparation, response, recovery & reconstruction will be assisted.	5 MUS$
15	Stockpiling of food, water and goods	stockpiling of food, water based on the 1967 earthquake scenario	- Food and other necessities are to be secure for at least three days for the 1967 earthquake scenario.	40,000 US$
16	Emergency transportation network	road network plan to connect important buildings for emergency command and activities	- Rescue operation and relief activities are to be secured b y securing transportation.	--
17	Evacuation plan and evacuation drills	evacuation plan after 1967 scale earthquake, evacuation drill plan	- All the citizens are expected to raise their capacity against disaster. Especially, expected victims of the 1967 scenario (76,400 persons)	--
18	Rescue operation plan	rescue operation plan including institutional framework, equipments and community activities	- Improvement of rescue operation capability to save human lives	40,000 US$
19	Plan of medical treatment	medical treatment plan based on the number of injured people in 1967 earthquake scenario	- 4500 people will be safely treated and 430 people will be hospitalized in case of the 1967 scenario earthquake.	411,000 US$
20	Mental Care and Support Skills in Disaster Situation	implementation of mental care training	- Improvement of treatment for around 4,300 injuries. - Those who are expected to suffer from PTDS, around 11% of the victim, are to be treated better.	-
	Total			2.8 billion US$

Table 9.1.3 Evaluation Summary of Each Project (1/2)

No.	Project	Economic	Finance	Social	Technical	Environment
1	Reinforcement of buildings	Large effect in reduction of damage of buildings	- Large cost is needed - Financial burden shall be determined. - Institutional financial support will be needed, especially for barrio families	Large effect in human damage reduction	- Not significant: Field test proves that no technical difficulties - Amount for reinforcement is large	- Noise, air pollution accompanied by the construction, some effect on traffic are anticipated but can be minimized
2	Reinforcement of bridges	Relatively large in reduction of damage to asset	Not significant impact	Large effect in socio-economic activities	Able to handle with the existing technology	Not significant impact
3	Debris flow control structures	Large damage reduction in property	Relatively large cost	Large impact on human damage reduction	Able to handle with the existing technology	- Natural environmental impact to the Avila, in water quality, hydrology, and eco system, which should be studied further in EIA - Environment impact has already been discussed with MARN. - Possible involuntary resettlement of people in the river channel work is anticipated.
4	Slope protection structures	Large damage reduction in property	Relatively costly compared with properties to be protect	Large effect on reduction of human damage	Able to handle with the existing technology	Relocation of people who live on the slope is anticipated
5	Drainage improvement in barrios	Relative effect on property	Large cost to cover all the barrio area	Large effect on barrio people (1.4 million)	Able to handle with the existing technology	Not significant impact
6	Resettlement of people in risky area	- Not significant impact	Relatively large cost will needed	- Relatively large number of people will be protected	Able to handle with the existing technology	Resettlement shall be designed in a voluntary way and plan shall be made in a participatory way
7	Early waning system for debris flow disaster prevention	Not significant impact	Not significant	Large effect on Large number of people	- Data accumulation is needed for better analysis for issuance of warning, while the system is operated	Not significant impact
8	Land use and development control in the risky area	Relative effect on the potential damaged buildings	Not significant	- Large effect on reduction of potential human damage in barrio area	Able to handle with the existing technology	Not significant impact
9	Development plan of open space	Not significant impact	- In barrio area, public support will be needed.	- Protect people indirectly - Urban amenity will be improved	Able to handle with the existing technology	Not significant impact

Table 9.1.4 Evaluation Summary of Each Project (2/2)

No.	Project	Economic	Finance	Social	Technical	Environment
10	Publication of hazard maps/risk maps	- Possible negative effect on property value	Not significant	- Large number of population will be benefited - Not direct impact to reduce human damage	Able to handle with the existing technology	Not significant impact
11	Education of people	Not significant impact	Not significant	- Large population will be benefited	Able to handle with the existing technology	Not significant impact
12	Strengthening of daily community activity for disaster prevention	Not significant impact	Not significant	- Large population will be benefited	Able to handle with the existing technology	Not significant impact
13	Emergency command center	Not significant impact	Not significant	- Maintain disaster management functions in emergency - Not direct reduction of human damage	Not difficult	Not significant impact
14	Development of emergency information system	Not significant impact	Not significant	- Maintain emergency oepration -Relatively small impact on reduction of human damage	Not difficult	Not significant impact
15	Stockpiling of food, water and goods	Not significant impact	Not significant	- Evacuee will be secured with the basic necessities and survive	Not difficult	Not significant impact
16	Emergency transportation network	Not significant impact	Not significant	Maintain emergency operation	Not difficult	Not significant impact
17	Evacuation plan and evacuation drills	Not significant impact	Not significant	Evacuees will be protected	Not difficult	Not significant impact
18	Rescue operation plan	Not significant impact	Not significant	Relative impact on reduction of human damage	Not difficult	Not significant impact
19	Plan of medical treatment	Not significant impact	Not significant	Relative impact on reduction of human damage	Not difficult	Not significant impact
20	Mental Care and Support Skills in Disaster Situation	Not significant impact	Not significant	Relative impact on reduction of human mental damage	Not difficult	Not significant impact

Table 9.2.1 Environmental Analysis of the Master Plan

Type	Disaster type	Project	Environmental Issues
Structural	Earthquake	Reinforcement of buildings	Potential impacts of the works may include noise and air pollution during the construction phase. However, they are judged insignificant as the project sites may locate in heavy traffic areas where pollution is already taking place and they have localized and temporary nature. Temporary interruption of traffic is, on the other hand, may need to be minimized through preparation of appropriate protocol, which needs to be developed when detailed construction plan become available most probably at the detailed design phase of the project.
		Reinforcement of bridges	
	Sediment	Debris flow control structures	Involuntary resettlement is an anticipated impact in the densely populated residential area. The extent of the impact, at the time of report writing, resulted from involuntary resettlement is uncertain, as the information on project location is not available. In addition, construction of sediment control structures in the national park may have a certain degree of impact involving changes of water quality and hydrology and resultant adverse effects on aquatic ecosystem.
		Slope protection structures	Major potential adverse impacts are not anticipated.
	Common	Emergency Command Center	The environmental impact of the project is judged insignificant because major project activity includes interagency coordination, information management and other non-structural measures to address problems in information management in emergency situation.
Non-structural	Common	Resettlement of people in risky area	The principal spirit of the project is to resettle the people living in risky areas on a voluntary basis to safer areas. The degree of project impact is uncertain due to limited project design information including project sites, methodology of resettlement, needs of site rehabilitation of out-going areas and consensus in incoming sites. Coherent adherence to the spirit needs to be ensured through close monitoring of project design.

Table 9.2.2 Impact Matrix of Sediment Control Project

Project: JICA Sediment Control Project

Project Impact Matrix

Project Actic	Phase		Overall Assessment	Social Environment										Natural Environment									Pollution Control							Beneficial Impacts
				Involunrary Settlement	Economic activities	Traffic and Public	Split of Communities	Cultural Asset Issues	Water and common Rights	Public Health Conditions	Waste Disposal	Hazards(Risk)	Other Social Issues	Topography and Geology	Soil Erosion	Groundwater hydrology	Surface water hydrology	Coastal Hydrology	Fauna and Frola	Meteology	Landscape Impact	Other Natural Issues	Air pollution	Water Pollution	Soil Contamination	Noise and Vibration	Land Subsidence	Offensive Odor	Other Impact	
Sediment Control Structures /Access Road	Planning	Land Acqusition/Relocation																												
	Construction	Land Alter/Spatial Occup.	○												○				○					○						
		Equipment servicing / fuelling	○																					○						
		Quarries and borrow sites	○							○													○							
	Operation	Spatial Occupation	○																○											
		Facility Operation																												◎
Minor modification of highway strucutres	Planning	Land Acqusition/Relocation																												
	Construction	Land Alter/Spatial Occup.	○			○					○																			
		Equipment servicing / fuelling	○																							○				
		Quarries and borrow sites	○							○													○							
	Operation	Spatial Occupation																												
		Facility Operation																												◎
Channel Work Consolidation and Revetment Works	Planning	Land Acqusition/Relocation	◎	◎																										
	Construction	Land Alter/Spatial Occup.	○								○																			
		Equipment servicing / fuelling	○			○																	○			○				
		Quarries and borrow sites	○							○													○							
	Operation	Spatial Occupation	○				○																							◎
		Facility Operation	○														○													

CHAPTER 10

FEASIBILITY STUDY OF PRIORITY PROJECTS

"Disasters happen - we are prepared"

Michael Schmitz

CHAPTER 10. FEASIBILITY STUDY OF PRIORITY PROJECTS

10. 1 General

Feasibility study on two priority projects for the study was conducted. The priority projects for the study are "seismic reinforcement of buildings" and "early warning and evacuation for debris flow disaster prevention".

Based on the concept of the master plan, more detail technical, institutional and community study was conducted on both subjects.

Technical study for seismic reinforcement was done mainly for assessment of the strength of a barrio house and engineering reinforcement methodology by using a field test on seismic reinforcement of barrio houses. Technical study for early warning and evacuation placed emphasis on study of critical rainfall value to trigger debris flow from El Avila to the Caracas urban area.

Institutional study for seismic reinforcement focused on existing institutional framework for the project. The institutional study on early warning and evacuation was carried out by preparing a draft agreement to be signed by the related agencies involved such as the Ministry of Environment and Natural Resources, the Metropolitan District of Caracas, three municipalities in the study area and Central University of Venezuela.

The community aspect for both projects were studied through a social survey. Two communities for each project were selected, one from urban area and the other from barrio area, in order to study the feasibility of the project from the view point of community.

The feasibility of the project was studied from the view point of "economic aspect" and "financial aspect" as well.

The overall evaluation result of the two priority project is that both of them are feasible and are necessary to be implemented as soon as possible.

10. 2 Seismic Reinforcement of Buildings

10. 2. 1. Field Test of Seismic Reinforcement of Buildings

A field test on seismic reinforcement of barrio houses were conducted as one of the item of additional survey for feasibility study. The detail of the test is described in the Supporting Report S7.

The purposes of the test are ;

- to assess the strength of a real barrio house

- to assess the effect of seismic reinforcement of barrio houses

The model barrio houses were constructed on a slope by using the same design concept, the same materials, the same construction techniques and the same workers who construct real barrio houses.

Four same type of models were constructed first, and the three of them were reinforced with three different techniques in order to assess the effect of different reinforcement techniques. The four models were destroyed by a static horizontal force using two hydraulic jacks.

The result is summarized as;

- the strength of existing barrio houses was assessed ,

- the analysis of barrio house strength of each story by using the result of the field test revealed the fact that one story and two story barrio houses can stand the earthquake intensity of 1967 scale earthquake, which well explain the damage record of 1967 earthquake,

- the analysis of barrio houses strength of each story showed that three and more storied barrio houses have high probability of collapse by the earthquake intensity of 1967 earthquake,

- previously assumed damage function of barrio houses in the Mastet Plan are correct judging from the result of the field test,

- the reinforcement by adding grade beams at the foundation makes the structure stronger by 40% against earthquake,

- the reinforcement by adding clay brick walls or concrete brick walls does not improve the strength of the structure so much, and

- it is possible to estimate the relationship between the reinforcement cost and the reinforcement effect of barrio houses.

10. 2. 2. Technical Study of Seismic Reinforcement of Buildings

(1) Seismic Code of Buildings to be Applied

The judging base of the seismic evaluation and reinforcement plan for each criteria are applied as following seismic code of Venezuela;

- For the judging base of the seismic reinforcement plan of normal existing buildings is applied the seismic code of Venezuela 2001 “NORMA VENEZOLANA COVENIN 1756-98”.

- For the public building’s and buildings in use for a great number of people such as shopping mall and stadium etc. are applied the seismic code of Venezuela 2001 with use coefficient of 1.15.

- For the most strict judging base of the seismic evaluation of existing key facilities is applied the current seismic code of Venezuela 2001 with use coefficient of 1.30.

- For the judging base of the seismic reinforcement plan of non engineering existing buildings in Barrio and Rural area isthe result of the field test of this Study.

(2) Proposed Procedure for Seismic Reinforcement

The seismic reinforcement plan is proceeded on following procedure;

Firstly, necessity of seismic reinforcement of the subject building is judged according to the result of seismic evaluation with seismic capacity as strength and ductility. Then, the feasibility of reinforcement methods is judged on structural condition and building function, and requirement with building owner and/or building operator. If the building has very low seismic capacity, and/or non-economical feasibility. In such special cases, it is judged to use restrictively or to be demolished.

In normal case, the subject building will be reinforced by following procedure;

- Prior investigation; hearing on the building function and special requirements etc. from building owner and/or operator and original design architect, and survey for condition of structural components.

- Definition of reinforcing target; reinforcing for lack of strength or ductility, and/or mixed them.

- Selection of reinforcement methods; adequate reinforcement methods for each structure.

- Planning of reinforcement; due to effect of reinforcement, and building function and use.

- Confirmation of reinforcing effect; estimation of seismic capacity and cost of new reinforced structure

(3) Selection of Seismic Reinforcement Methods for Each Building Type

Seismic reinforcing methods were studied for each type of structures such as RC Structural Buildings, Steel Structural Buildings, Brick and Adobe Masonry Structural Buildings and Non-Engineering Buildings in Barrio and Rural Area .

After applying the above policy, new damage functions were created and new damage estimation was made with seismic reinforcement project.

As a conclusion, the project of seismic reinforcement of buildings is technically feasible including barrio houses.

10. 2. 3. Institutional Study of Seismic Reinforcement of Buildings

Institutional study started from the assessment of existing institutional and legal structure for seismic reinforcement of buildings.

The latest building code is the one issued in 2001. However, when a new building code is imposed, the code is applied for a new building construction after the imposing date of the code and the buildings, which has been existing before the imposing of the code, is immune from the application of the new code.

There is no law or policy of seismic reinforcement of buildings in the central government or local governments now. Therefore, an institutional framework is newly proposed in the study for the purpose of this project.

(1) National government

A new ministry named "Ministry of Housing" was created recently merging various housing development authorities before, making CAONAVI as the core of the organization. The Ministry of Housing is in charge of policy making of all building in the country and the project of seismic building reinforcement should be in the hand of the ministry in terms of basic policy making.

As the problem of weak buildings against earthquake is huge and it is necessary for the central government to take initiative for the solution although basically the project should be carried out by the owners of the buildings.

Regarding the barrio houses, according to the social survey, it is rather difficult for barrio people to pay all the cost of the building reinforcement although the reinforcement cost is averagely 10 % of the new construction cost. Therefore, it is necessary for the Ministry of Housing to take initiative in barrio house reinforcement by introduction of subsidy for the cost.

Following responsibilities are proposed for the Ministry of Housing;

- legislation of policy and procedure for seismic reinforcement of buildings
- establishment of building code
- reinforcement methods recommended
- to implement government building reinforcement
- to initiate barrio house reinforcement project

(2) Metropolitan Government of Caracas

ADMC is in charge of disaster prevention of the Metropolitan District of Caracas and it should prepare a basic policy of seismic reinforcement of buildings in the area. The unique feature of the Metropolitan District of Caracas is that half of the population live in barrio houses and those barrio houses are most vulnerable structurally against earthquake.

Therefore, ADMC should prepare a policy on how to cope with the seismic reinforcement of barrio buildings.

Following responsibilities are proposed for ADMC

- preparation of risk maps of ADMC
- preparation of ordinances for the purpose
- preparation of barrio houses reinforcement policy
- to implement government building reinforcement

(3) Municipality Government

The municipality governments have authority to give permission for building development. Therefore, the municipal government is the one, which will implement the project directly.

It is proposed that the engineers office of each municipality will perform the rapid visual screening based on the methodology authorized by FUNVISIS. The municipality office shall have the authority to designate safe buildings after the RVS and issue an official sign of seismic safety.

The municipal government also shall promote the policy of seismic reinforcement of buildings by employing various incentives such as subsidy of reinforcement cost or tax exemption for reinforced buildings.

10. 2. 4 Community Study of Seismic Reinforcement of Buildings

Two communities were selected for survey of building reinforcement policy. The two communities are La Margarita in La Vega and San Bernardino.

The social survey was conducted in order to assess the acceptability and willingness to invest for the building reinforcement policy.

As a part of the survey, Mr. Yamazaki, who is in charge of Seismic Disaster Prevention and Ms. Chaverri, who is in charge of People's Organization went into the two communities with local consultant and had meetings with the people, starting from the presentation of the field test survey and the proposal of the JICA Study Team on seismic reinforcement of buildings and listened to their opinion about the proposal.

The result of the survey is summarized as;

- People in barrio have wrong perception about the strength of their houses because of few damage in 1967 earthquake, when most of the barrio houses were one or two storied.
- It is possible to let the people in barrio to realize the present risk of their houses by utilizing the photos, videos and charts showing the field test result of this Study.
- Once the people in barrio area realize their risk, they are concerned about the strength of their houses but affordability of seismic reinforcement is low and they are expecting subsidy by the government.
- People in urban area have knowledge in vulnerability of their houses and they can afford the cost but there is a strong distrust toward the policy of the government. It is necessary to forge credibility toward the government before mobilizing them for reinforcement projects.

10. 2. 5 Project Summary of Seismic Reinforcement of Buildings

The project has the following three components;

- Rapid Visual Screening (RVS) and Detail Seismic Evaluation
- Seismic Reinforcement Design
- Seismic Reinforcement Work

A total number of 180,000 out of 310,000 existing buildings, or 58% of all buildings in the Study Area are to planned to be reinforced. The detailed distribution of buildings for each step is summarized in Table 10.2.1.

1) Reinforcement Target

<u>Building in Urban Area</u>

2001 seismic code of Venezuela 2001 "Norma Venezolana COVENIN 1756-98”

<u>Buildings in Barrio and Rural Area</u>

Based on the field test of the Study, reinforcement method was proposed according to the number of stories of the building.

2) Project Implementation Schedule

The project implementation schedule is shown in Figure 10.2.1.

The RVS will take thee years starting from 2005 and the actual reinforcement work can start in 2007 up to 2020. At the initial stage of the time schedule, institutional arrangement will be necessary to implement the project smoothly.

10. 2. 6 Effect of the Project

With the project of seismic reinforcement of buildings, damage is estimated to reduce as shown in Table 10.2.2.

The effect of the project is impressive as both the number of heavily damaged buildings and the number of casualties will be reduced by one decimal order in both cases of 1967 earthquake scenario and 1812 earthquake scenario.

10. 3 Early Warning and Evacuation for Debris Flow Disaster Prevention

10. 3. 1. Technical Study of Early Warning and Evacuation

In order to assess the technical feasibility of the project of "early warning and evacuation for debris flow disaster prevention", a study was made on two aspects. The one aspect is the global meteorological phenomenon which will cause a heavy rainfall triggering debris flow disaster in Caracas. Another aspect is the relationship between the rainfall amount and the occurrence of debris flow.

Regarding the global meteorological phenomenon causing heavy rainfall in Caracas, the historical two prominent events in 1951 and 1999 both occurred in the dry season in Caracas, in February and in December, respectively. In both cases, the cause of the long and heavy rainfall was brought about by the cold weather front developed from a low pressure in the Caribbean Sea. As the samples are only 1951 and 1999 events, it is difficult to conclude that debris flow occurs in Caracas, only when the cold weather front comes from the Caribbean Sea. However, it may be said that it is necessary to watch the phenomenon as an important symptom of debris flow. This kind of global meteorological phenomenon has been observed and publicized by MARN for a long time and it is possible to obtain the information through the WebPages of MARN nowadays. Much more, the activation of INAMEH, global meteorological observation will become more intensive utilizing rainfall observation radar system.

The Study Team collected information on rainfall amount and the occurrence of debris flow in Caracas, Vargas and Maracay. Because of the small number of records of debris flow phenomena and also few records of precise rainfall phenomena, it is not an easy task to draw a conclusion of critical value for early warning and evacuation for Caracas.

The Study Team proposed a pilot value for early warning utilizing available information and proposed to enhance the diagram by accumulating more information on rainfall and occurrence of debris flow.

As a conclusion, early warning and evacuation project for debris flow disaster prevention is technically feasible utilizing the existing technical skills and existing institutional framework.

10. 3. 2. Institutional Study of Early Warning and Evacuation

The Study Team proposed an institutional framework for early warning and evacuation based on the existing government institutional framework.

Basically, existing government institution can coordinate to establish a system.

However, a new organization, which is in charge of observation and analysis of local meteorological and hydrological phenomena of Caracas and Vargas, in the Ministry of Environment and Natural Resources , was proposed.

It is also proposed for the Ministry of Environment and Natural resources to establish a protocol for early warning and evacuation system for debris flow disaster prevention or flood disaster prevention nationwide.

The Study Team proposed a draft agreement which will be signed among the related agencies for the early warning and evacuation system for debris flow disaster prevention. The proposed agreement is shown in Chapter 4 of this Main Report.

10. 3. 3. Community Study of Early Warning and Evacuation

Two communities were selected for survey on this particular subject . They are Los Chorros in an urban area and 12 de Octubre in barrio area.

The survey result shows that ;

- People in both urban area and barrio area have correct perception about the sediment disasters as they have experiencing frequent inundation and slope failure problems.
- In both communities, there exist strong community unity and hierarchy system of communication. There are also physical space for the community to have daily meeting among the members.
- In urban community, knowledge level on sediment disaster is high and people can access information from MARN directly through Web-site, while in barrio community, internet access is impossible.
- In both communities, people are willing to collaborate with governmental institution for sediment disaster prevention once such kind of collaboration is proposed by the institution such as the Civil Protection of the Municipal Government.

10. 3. 4. Project Summary of Early Warning and Evacuation

(1) Project outline

The project of early warning and evacuation for debris flow disaster prevention covers 47 mountain streams area with the total 2,700 buildings and 19,000 people.

The project involves the Ministry of Environment and Natural Resources, the Civil Protection of ADMC, the Civil Protection of each municipality, the Central University of Venezuela and the community.

The project is composed of publication of hazard map/risk maps, establishment of agreement among the related organizations, installation of required equipments for observation and communication and capacity building of personnel.

(2) Implementation schedule

The implementation schedule of the project is shown in Figure 10.4.1.

The first step of the project is establishment among the institutions and installation of equipments. As a long term scheme, capacity building of the regional office of MAR and operation and maintenance of the Operation Control Center and the Emergency Command Center are included.

10. 3. 5. Effect of the Project

By implementing the project, it is possible to safeguard the lives of the people living in the risky area of debris flow.

According to the hazard map and the risk map prepared by the Study Team, the total number of buildings in risky areas of debris flow is 2,700 including urban area and barrio area. The total number of residents estimated in the area is 19,000.

Therefore, 19,000 citizens in the area will be able to evacuate by the system and save their lives from the debris flow disasters.

10. 4 Operation and Maintenance

10. 4. 1. Operation and Maintenance of Seismic Reinforcement of Buildings

Reinforcement of buildings is not a single event project but it requires constant observation and maintenance. Because of weathering or fatigue of materials of buildings, the strength of buildings deteriorate with time.

Therefore, it is necessary to carry out periodical observation by using rapid visual screening method for every building. The owner of the building is responsible for the maintenance of the structure.

It is proposed to carry out periodical rapid visual screening for every building every 30 years after construction.

10. 4. 2. Operation and Maintenance of Early Warning and Evacuation

Maintenance of equipments

It is necessary to maintain and operate the equipments, such as rainfall gauging system , water level staff gauges and weir sensor system. The maintenance of rainfall gauging system and weir sensor system shall be done by the owner of the system, the Ministry of Environment and Natural Resources. The water level staff gauges shall be maintained by the community.

The maintenance of rainfall gauging system include payment of telephone bill for data transmission, payment of electricity to operate the receiving computer and change of batteries for rainfall date sending device.

Periodical inspection and maintenance is required for every electrical and mechanical part of the system. Periodical replacement of parts is also required to keep the good condition of the machines.

Operation of Institutional System

In order to activate the early warning and evacuation system as a whole in an emergency when the system is really needed, it is necessary to practice the activity of the system. The Metropolitan Civil Protection is responsible for such kind of practice, namely periodical drill.

It is proposed to do such kind of drill in two levels. One is a desk top exercise and the other one is real field drill.

The desk top exercise will be carried out by the representatives of each organization involved, such as the Ministry of Environment, the Metropolitan Civil Protection, the Operation Control Center, the Municipality Civil Protection, the Central University of Venezuela and Community Organization. This drill on the desk is proposed to be carried out twice a year.

The field drill will be carried out mobilizing all personnel related to this system including residents who are supposed to evacuate. This drill is proposed to be carried out once a year at the end of rainy season, say November 1st.

10. 5 Cost Estimate

10. 5. 1. Cost Estimate of Seismic Reinforcement of Buildings

(1) Unit Cost of New Building Construction Work (Building Replacement Cost)

JICA Study Team investigated each cost of new building construction work otherwise building replacement cost as shown table 10.5.1.

The typical rough unit cost of building replacement work in Caracas as shown in Table 10.5.2.

(2) Total Cost of Replacement and Seismic Reinforcement of Existing Buildings

According to the building inventory data, JICA Study Team assumed and investigated the building numbers and total floor area for each uses, the cost of building replacement and seismic reinforcing work of existing buildings in study area. Through our seismic evaluation and reinforcement planning, we assumed and investigated required ratio for seismic evaluation and reinforcement work, and cost of seismic reinforcement per building replacement cost.

The total floor area, total cost of replacement and seismic reinforcement work of existing buildings in study area are shown in Table 10.5.3.

Number of Buildings in each area and uses are shown in Table 10.5.4.

Ratio of required seismic evaluation and reinforcement, and cost of seismic strengthening per replacement cost for each category of existing buildings are shown in Table10.5.5.

10. 5. 2 Cost Estimate of Early Warning and Evacuation

The cost is composed of four items as;

- Establishment of agreement among related organizations
- Installation and equipments
- Maintenance cost of equipments
- Capacity building of regional office

Cost of each item was calculated and the total cost for the project was estimated. (Table 10.5.6)

In the cost calculation, the following items are excluded as they are involved in other projects.

- Publication of hazard maps and risk maps
- Development and maintenance of disaster information system
- Construction and maintenance of an emergency command center

10. 6 Evaluation of Seismic Reinforcement of Buildings

10. 6. 1 Framework of Evaluation

The project was evaluated in the following criteria, taking into account the nature of the project:

- Economic aspect is evaluated with cost-benefit analysis;
- Financial aspect is studied to investment plan of this huge project comparing with the various budgets of governments;
- Technical aspect is studied to confirm the local technological level for reinforcement especially for non-engineering buildings, is evaluated;
- Institutional framework is evaluated in terms of legal framework, and other arrangement to promote reinforcement of buildings from rapid visual screening to reinforcement work; and
- Community aspect is studied on how community will contribute to promotion of reinforcement of buildings

10. 6. 2. Economic Feasibility

Frame of economic evaluation

Benefit of the reinforcement of buildings is conceived as reduction of cost caused by earthquake disaster. Cost of natural disasters can be categorized into three; economic cost, human cost including loss of life and personal injuries, and ecological cost among other damage to ecosystem. Economic cost can be expressed in monetary terms, yet the other effects are difficult to quantify.

Economic loss caused by natural disaster can be categorized into three items: direct loss, indirect loss and secondary effect of the disaster. Figure 10.6.1 shows the links of those damage items. Direct cost relates to physical damage to capital assets, including buildings, infrastructure, industrial plants, and inventories of finished, intermediate and raw materials destroyed or damaged by the disaster.[1]

[1] Paul K. Freedman et al., "Catastrophes and Development Integrating Natural Catastrophes into Development Planning," *Disaster Risk Management Working Paper Series No. 4* (The World Bank, 2002).

Indirect cost includes output that come from damaged or destroyed assets and infrastructure and loss of earnings due to damage to infrastructure such as roads and airports. Secondary and macroeconomic effects take into account the short and long-term impacts of a disaster on aggregate economic variables.

Besides such economic activities, indirect cost related to rescue and medical activities, recovery activities are also reduced by the project.

Accordingly, in this analysis, quantitative limitation and data limitation, not all losses can be evaluated in monetary terms.

Benefits

In this disaster prevention study, *benefit* is conceived as reduction of damage by the project. Accordingly, based on the damage link, reduction of direct damage, indirect damage and secondary damage are calculated or estimated as much as possible, under the limited available data.

The damages caused by the 1967 earthquake scenario is used as the damage for economic analysis. Thus, reduction of the damage is difference between the damage caused by the 1967 earthquake scenario in case without project implementation and in case with project implementation.

The damage or cost of the following items are calculated in this study.

- Direct damage: Damage to buildings assets
- Indirect and secondary damage: Economic damage to Caracas and outside Caracas
- Rescue operation and medical cost: Cost for rescue operation and medical treatment
- Recovery cost: Cost for debris clearance and temporary houses construction

Total reduction of costs that are quantified in this study are shown in Table 10.6.1, summarized as follows (see Supporting Report 27 for detail):

- Direct damage: Reduced 375.4 million US $ from 439.6 milllion US$ to 64.2 million US$
- Indirect and secondary damage: Reduced 165.3 million US $ from 281.6 milllion US$ to 116.3 million US$
- Rescue and Recovery Cost: Reduced 42.2 million US $ from 49.0 milllion US$ to 6.8 million US$

- Total: Reduced 582.9 million US $ from 770.2 milllion US$ to 187.4 million US$

Costs

For the cost for the economic analysis, the cost that directly accrue the benefit, namely only the cost exclusive of tax for the reinforcement of the 10,020 heavily damaged buildings is employed for the economic analysis. The project of reinforcement of buildings starts with diagnosis of the necessity of reinforcement of buildings. As shown in Table 10.6.2, the total project cost is as follows:

- RVS fee: 0.38 million US$ (exclusive of IVA)

- Seismic Evaluation fee: 11.4 million US$ (exclusive of IVA)

- Seismic Design fee: 12.7 million US$ (exclusive of IVA)

- Construction Cost: 53.5 million US$ (exclusive of IVA)

- Total: 77.9 million US$ (exclusive of IVA)

Economic Evaluation

For economic evaluation, annual benefit accrued by the project is to be estimated. In this study, the annual benefit is estimated as follows:

Annual benefit = Total reduction of damage x annual probability of earthquake occurrence (1/return period).

It is said that the return period of earthquakes size of the 1967 is around 50 year to 100 years. However, the only concrete figure available about the return period of such earthquake is that by Fiedler G. He stated in “Resultados de Estudios Sismicos en Venezuela, precauciones prerenctivas, I. Simposimo, Nacional sobre Calamidadas Publicos, Instituto Sismologio, Caracas, 1962., that the return period of the earthquake in Caracas was 60 plus/minus 9.5 years. This means that an earthquake size of the1967 earthquake happens at return period of 50.9 year to 69.5 years. And although earthquakes smaller than this size may happen at shorter return period, they are not expected to cause damage to Caracas.

Accordingly in this study, the JICA Study Team employs the longest return period of 69.5 years for the 1967 earthquake scenario for the economic analysis.

The result of economic analysis is shown in Table 10.6.3. It shows that B/C = 0.99, and NPV = - 0.3 MUS$. Simply based on results calculated with the benefits that are estimated quantitatively, the project is slightly unfeasible from economic point of view. However, it should be taken into account that this is a disaster prevention project and reduces human casualty drastically, which is the major goal.

<u>Conclusions</u>

The project shows that the cost and benefit are almost even in economic terms.

The project contributes much to reduction of human casualty, that is the primary goal of the Master Plan.

In barrio areas, if the project will be implemented as self-help type work or with community people used as workers with governmental financial support, the reinforcement of buildings might contribute to local economy.

10. 6. 3. Financial Feasibility

<u>Public sector</u>

The total cost of reinforcement project, inclusive of IVA, is 2,598 MUS$. The annual cost of the project is shown in Table 10.6.4. Table 10.6.5 compares the project cost with GDP (2003), national budget (2003), Ministry of Infra (2003), AMDC budget (2003), and budget of newly established Ministry of Housing (2004). Total cost of the reinforcement of buildings (2,581 MUS$) accounts for 3 % of GDP in 2003, and 10% of the national budget of 2003. When the annual cost is compared with them, the cost is about 0.2 % of GDP and 0.7% of the national budget at most

<u>Individuals</u>

Based on the community pilot study in La Vega in barrio area and San Bernandino in urban area both in Libertador, when they understand the vulnerability against earthquake, they still have limited willingness to spend on reinforcement even though they would like to reinforce the buildings.

Urban community can spend some on reinforcement. On the contrary, barrio people have different tendency to invest on reinforcement. Barrio people with relatively much assets have intention to invest on reinforcement to protect their property while the people of the lowest strata cannot afford because their central concern is how to secure daily necessities rather than protecting their scarce property from earthquake. In either case, they need public support for reinforcement.

<u>Conclusion</u>

Comparing the project cost with national budget or other sources, the project has a large impact on public budget.

This shows the case where all the cost covered by the public sector. However, in reality, individual owners have to pay. The amount the government shoulders have to be discussed further.

The project's target and schedule should be further discussed, taking into account the both government and building owners financial limitation.

For barrio houses, the governmental financial support shall be need more than urban areas.

10. 6. 4. Technical Aspect

The project is technically feasible with local technical level. Even non-engineering buildings located in barrio areas can be reinforced with local technology, based on the field test of barrio house breaking, the study team conducted.

However, the project has to treat with a great number of buildings for RVS, seismic evaluation, design, and construction, which might cause a shortage of engineers and workers.

Table 10.6.6 summarizes the numbers of buildings to be screened, evaluated, and designed and reinforce until 2020. The project requires 100 engineers for RVS, 800 engineers for seismic evaluation, 640 engineers for reinforcement design. Number of buildings to reinforce is around 13 thousand annually for 14 years. Such a large number of engineers and construction workers are to be employed not only from Caracas but from the entire country or abroad.

10. 6. 5. Institutional Aspect

Institutional aspect of the project is summarized as follows:

Fist of all reinforcement of buildings is not a main agenda in disaster management in Caracas. Reinforcement of existing buildings is just stated in the seismic related COVENIN[2] but how to promote it has not been discussed and there has not been clear policy on that.

Many steps should be taken for promotion of reinforcement of buildings. However, starting with the seismic COVENIN, the institutional arrangement can be established, including roles of the central and local governments and institutions for promotional activities, financial support, technical support, and implementation.

[2] Norma Edificaciones Sismorresistentes COVENIN 1756-98 (Rev. 2001)

The recent establishment of Ministry of Housing is reflecting that the central government's emphasis on housing policies. Taking advantage of this, AMDC encourages national government to conceive the reinforcement of buildings as national project.

10. 6. 6. Community Aspect

To promote the project of reinforcement of buildings, enhancement of the awareness of people about the importance of the reinforcement of buildings is one of the most important factors because the most of the buildings are owned by individuals. Besides such individual awareness raising, people's willingness to reinforce their buildings is a key to the success of the project.

The social survey at an urban community of San Bernadino and a barrio communities of La Vega in Libertador[3] reveals that in barrio area, they are consolidated as unit and ready to take a collective action about reinforcement, as long as they can have a financial resource. The social survey also reveals that the higher stratum of the barrio society is likely to invest in reinforcement of their buildings while the lower strata of barrio has less affordability to spend on reinforcement. If governmental financial support will be realized they are willing to reinforce their houses.

On the other hand, in urban community, they understand the importance of the reinforcement of buildings. However, the community has strong distrust about the deed of the government. This distrust would hamper the promotion of the reinforcement of buildings as long as the project is promoted as governmental initiatives. Therefore, rapport-building between community and government would be one of the first steps that are mandate to promote reinforcement of buildings in urban area. With respect to financial aspect, the people in urban community have willingness to invest their own in reinforcement as long as the amount is affordable.[4]

10. 6. 7. Conclusions

- The project is judged is most effective to protect life of people from earthquake under the 1967 scenario case. The project of reinforcement of buildings aims primarily at protecting life of people. In this sense, this project is effective although the project cannot prevent 100% of human casualty.

[3] The Study Team conducted social survey at an urban community in San Bernandino and a barrio community in La Vega, both in Libertador municipality. to grasp the perception of people about reinforcement of buildings, the social survey were conducted in, both of which are estimated to suffer from higher rate of heavily damage buildings under the 1967 earthquake scenario (for detail, see Supporting Report S24)

[4] In the community workshop, as example, the following calculation was done: The price of one apartment building of four apartments per floor about 70 to 80 square meters each, with twelve floors, ranges between 90 to 140 million of bolívares. Divided by floors and apartments, the single apartment cost of reinforcement (using 10% of cost of building as reinforcement cost, according to broad estimates from JICA Study Team Experts) is about 9.8 million Bs. People's willingness to pay for this is negative at first however a simple calculation of monthly installment break-down, say some 20 thousand Bs per month per each family member, is acceptable by the community people.

- This project shows that the cost and benefit are almost even, with a slight economic unfeasibility.

- This project needs a huge investment in financial terms. Financial aspect is a key to implementation of the project even though this project has a huge contribution to damage reduction. Based on the social survey, people have willingness to invest in reinforcement at a certain level. To promote this project, the following should be further discussed within the related agencies.

- Incentives for building owners such as subsidy, tax cut, low interest loan, or insurance system, taking into account the financial limitation of both public and private sectors.

- Promotion of people's understanding about the importance of reinforcement.

- Institutional arrangement shall be started with putting the reinforcement of building as agenda. And the other institutional arrangement in financial and technical matters shall follow.

- Communities, once they understand their vulnerability to earthquake, are willing to reinforce buildings, but this again requires financial support from the government. However, the urban community has relatively distrust to the government, therefore governments have to build rapport or win trust from community that also is critical.

10. 7 Evaluation of Early Warning and Evacuation for Debris Flow Disaster Prevention

10. 7. 1. Framework of Evaluation

Early Warning System is a non-structural measure designed to protect people and other movables from debris flow, not aimed to protect unmovable assets such as buildings. The project covers the 47 quebrada areas north of Guaire river with 19,000 people. With the early warning system, people are expected to evacuate more effectively from debris flow.

Early warning system is a series of actions from collection and analysis of the relevant information,the resulting issue of early warning, and evacuation activities of affected people based on the eaarly warning. Variou technology are used, and wide ranges of actors are involved in the system and each actor has their own sub-system which are linked to make the entire early warning system. Accurate and timely data collection analaysis are required for functional system. Each actor should act as designed, through communitcation system among the actors.

The project aims to reduce human casualty and economic and financial analyses are judged unfit to evaluate this project. The following aspects are selected as evaluation criteria:

- Institutional aspect: Evaluate framework of laws and regulations, agency's capacity and coordination and communication among the relevant agencies and also community

- Technical aspect: Evaluate technical aspects to provide necessary warning based on accurate and timely data collection and analysis on hazard and risk

- Community aspect: Evaluate capacity to act according to early warning from the institute and evacuate effectively and timely.

10. 7. 2. Institutional Aspect

The early warning system is judged feasible from institutional aspect. The institutional linkage and coordination is prerequisite for successful system operation. Because the early warning has not been operated among the related agencies, the initial institutional arrangement is important. The study team proposed the draft agreement among the related agencies, and they have been discussing it for effective system operation. Starting with the existing institutional framework including creation of INAMEH which will start on the finish of VENEMET, it is judged that the related agencies with progressive improvement will be able to handle the early warning system.

The system would work, among others, realizing the following points at each level to overcome the limitation at present time.

(1) National level

- Promote VENEHMET project

- Establish and strengthen a regional branch of MARN to unite present rainfall monitoring system, update hazard map, and study hydrological features of Caracas.

- Formalize agreement for the early warning system, the JICA Study team proposed

(2) AMDC level

- Construct Emergency Operation Center to house Operation Control Center for disaster management of Caracas

- Develop (train) human resources in early warning

(3) Municipal level

- Issue the evacuation instruction to vulnerable community based on the information from AMDC and MARN

- Collaborate community in the planning and operation of the system

10. 7. 3. Technical Aspect

Among various information, a Critical Line (CL) is a key to issue a timely and proper early warning, though it is one of the technical difficulties of the system. In described in detail in Supporting Report 18, the Study Team preliminarily formulated a Critical Line with a limited available data to provide a threshold rainfall amount to assess a disaster situation and thereby decide on an issuance of evacuation. The CL shall be modified upon the accumulation of available information for model formation.

Even though a CL is granted as one of the information based on which the warning will be issued, with this preliminary CL as reference, the system would be started and will be improved gradually being operated.

10. 7. 4. Community Aspect

In the early warning system, because of the complexity, the operation within communities was thought to be rather difficult. However, the early warning system is judged as feasible from community aspect based on the results of the pilot study at communities in Caracas at 12 de Octobre, and Los Chorros in Sucre municipality.

In the early warning system, existing community organizations can be used as a core entity to play an important role in both urban and barrio communities. The communities are willing and responsive to the new system through the experience of the pilot study with the communities in urban and barrio areas.

The proposed early warning system shall provide openly to the community more accurate and timely information and instruction which the communities need.

A key is the relation between community and municipal agency like CP who has to have a close relationship with community and build up a rapport. In addition, when the system will be planned and designed, the communities shall participate actively so that they feel they are really a part of the system.

On such occasions and for enlightenment and improvement of the community in early warning system, the third party or intermediary groups will be utilized to act as a facilitator or mediator.

10. 7. 5. Conclusions

The Early Warning System will be feasible from institutional, technical, and community aspects. The following are important points in early warning system.

- In Venezuela, meteorological warning has been used as global, national, and regional warning, not for a local warning at this moment.

- However there is a program that can be a base for the system, such as VENEHMET. The system is expected to be operated based on the official agreement among the related governmental agencies, and communities in the near future.

- In respect to technical aspect, although more accumulation of necessary information and record of disaster are needed to establish more accurate analytical models, the system can be started with the provisional analytical models such as CL the JICA Study Team studied, even which requires further modification.

- Communities are willing and able to be part of the early warning system. They shall not be treated with passively in the system from the planning stage, but they shall be participating positively from beginning of the system establishment, thereby they shall feel they are part of the system. In order to enlightenment and improvement of community in the early warning system, intermediary groups, or external experts play an important role.

Table 10.2.1 Number of Buildings for Reinforcement by Area

	Urban	Barrio and Rural	Total
Total	83,499	231,158	314,657
RVS	62,620	184,900	247,500
Detail Seismic Evaluation	50,080	166,400	235,010
Seismic Reinforcement Design / Seismic Reinforcement Work	40,060	142,700	182,740

Table 10.2.2 Effect of Seismic Reinforcement of Buildings

Earthquake Case	Estimated Damage	Without Project	With Project
1967	Heavily Damaged Buildings	10,000	1,300
	Human Casualties	4,900	400
1812	Heavily Damaged Buildings	32,000	5,300
	Human Casualties	20,000	2,300

Table 10.5.1 Reference Price in Caracas as of February 2004

(1920Bs = 1US$)

A. Basic Materials: (+IVA)	
1. Ready mixed Concrete: Fc250	240,000 Bs/ m^3 + Labor cost
2. Concrete in site mixing	200,000 Bs/ m^3 + Labor cost
3. Reinforcing Bar: fy4,200 (12m length)	1,400 Bs/ Kg : 1 package: 2 tons
4. Steel fabric mesh	1,500 Bs/ m^2
5. Brick 15 cm in thickness	380 Bs/ No. 17 Nos./m^2
6. Concrete Block 15 cm in thickness	500 Bs/ No. 17 Nos./m^2
7. Cement	10,000 Bs/ package 42.5 Kg/ 1 package
8. Gravel/ Sand/ Plastering material	18,500/ 22,500/ 20,000 Bs/ m^3
9. Wooden form: Plate; 0.3m x 2.4m x 25mm Sheet; 1.2m x 0.6m x 25mm Square Bar; 50mm x 100mm	30,000 Bs/ m^2: for Beam & Column 10,000 Bs/ Bs: for Slab & Wall 3,000 Bs/ ml: for Support
10. Ceramic Tile: 33cm x 33cm	10,000 Bs/ m2 : 9 units/ 1m^2
B. Material and Labor: (+IVA)	
1. New Construction (Total Price)	500,000 ~ 600,000 Bs/ m^2
2. Structure and Masonry Wall (no finish)	280,000 Bs/ m^2
3. Labor cost of structure only	60,000 Bs/ m^2
4. Labor cost of wall only	4,000 Bs/ m^2
Wall + plastering both sides	12,000 Bs/ m^2
5. Paint finishing	8,000 Bs/ m^2
6. Asphalt Waterproofing 6mm thk.	12,000 Bs/ m^2
7. Installation of Ceramic Tiles w/ mortar	10,000 Bs/ m^2
8. Structural Steel Fabrication work	6,500 Bs/ kg
9. Square Steel Pipe	8,000 Bs/ kg
10. Base Plate	10,500 Bs/ kg
11. Anchor Bolt (A-32S)	16,500 Bs/ kg
C. Others: (+IVA)	C. Others: (+IVA)
1. Demolition by hand and disposal of Debris	6,000 Bs/ m^3
2. Excavation by Machine	5,000 Bs/ m^3
3. Excavation by Hand	7,000 Bs/ m^3
4. Electrical work (Cable 12mm)	45,000 Bs/ point : 6 points/ 50 m^2
5. Sanitary Plumbing (PVC)	30,000 Bs/ point : 2 points/ 50 m^2

Source: JICA Study Team

Table 10.5.2 Typical Rough Unit Cost of Building Replacement Work in Caracas

(As of February 2004, 1920Bs = 1US$)

1A. Dwelling Houses in Urban area	
1) Low class of dwelling (80-100 m^2) (100 m^2)	400,000 - 600,000 Bs/ m^2 50,000,000 Bs/ 1 House
2) Middle class of dwelling (100-200 m^2)	600,000 - 800,000 Bs/ m^2
(150 m^2)	105,000,000 Bs/ 1 House
1B. Dwelling Houses in Barrio area (70-100 m^2)	150,000 - 200,000 Bs/ m^2
(100 m^2)	17,500,000 Bs/ 1 House
Selling cost	300,000 Bs/ m^2
2A. Apartment Houses in Urban area	600,000 Bs/ m^2
(150 m^2)	90,000,000 Bs/ 1 Family
2B. Apartment Houses in Barrio area	300,000 - 400,000 Bs/ m^2
(100 m^2)	35,000,000 Bs/ 1 Family
3. Office Buildings	
1). Reinforced Concrete Buildings Architectural work Structural work Building Equipment work Electric work Plumbing work Air Conditioning work Elevator Total	 210,000 Bs/ m^2 (42%) 190,000 Bs/ m^2 (38%) 100,000 Bs/ m^2 (20%) 30,000 Bs/ m^2 20,000 Bs/ m^2 20,000 Bs/ m^2 30,000 Bs/ m^2 500,000 Bs/ m^2
2). Structural Steel Buildings Architectural work Structural work Building Equipment work Total	250,000 Bs/ m^2 (41.7%) 250,000 Bs/ m^2 (41.7%) 100,000 Bs/ m^2 (16.6%) 600,000 Bs/ m^2
3). Masonry Buildings (Existing Building) Architectural work Structural work Building Equipment work Total	 330,000 Bs/ m^2 (60%) 150,000 Bs/ m^2 (25%) 120,000 Bs/ m^2 (20%) 600,000 Bs/ m^2
4). Commercial Building (Excluding inside finishing)	500,000 Bs/ m^2
5). Hospital Buildings (Excluding Medical Equipments) Small Hospital (without Bed) Large Hospital (with Beds)	 600,000 Bs/ m^2 900,000 - 1,000,000 Bs/ m^2
6. School Buildings	400,000 Bs/ m^2
7. Factory Buildings (Steel structure with light roof)	200,000 Bs/ m^2

Source: JICA Study Team

Table 10.5.3 The Total Floor Area, Cost of Replacement and Seismic Reinforcement of Existing Buildings in Caracas

(As of Feb. 2004)

Area	Category: Type of Building	Category: Item	Total Floor Area (m^2)	Building Replacement Cost (M. Bs)	Seismic Reinforcement Cost (M. Bs)
Urban Area	Dwelling House	High Class	526,000	526,000	36,200
		Middle Class	3,244,000	2,271,000	156,500
		Low Class	3,507,000	1,754,000	120,900
		Sub Total	7,277,000	4,551,000	313,600
	Apartment	Low Rise: 1 ~ 3	2,404,000	1,442,000	99,400
		Middle Rise: 4 ~ 8	11,683,000	7,594,000	629,500
		High Rise: 9 ~	9,345,000	6,074,000	434,900
		Sub Total	23,432,000	15,110,000	1,163,800
	Office Building	Low Rise: 1 ~ 3	1,878,000	939,000	64,700
		Middle Rise: 4 ~ 8	7,511,000	4,131,000	342,500
		High Rise: 9 ~	7,510,000	4,506,000	322,600
		Sub Total	16,899,000	9,576,000	729,800
	Hospital and Governmental Office	with Beds	504,000	479,000	39,700
		without Bed	734,000	440,000	30,300
		Governmental Office	4,672,000	2,570,000	213,000
		Sub Total	5,910,000	3,489,000	283,000
	Other Important Building	Low Rise: 1 ~ 3	1,002,000	501,000	34,500
		Middle Rise: 4 ~ 8	2,004,000	1,102,000	91,400
		High Rise: 9 ~	1,500,000	900,000	64,400
		Sub Total	4,506,000	2,503,000	190,300
	Urban Area Total		58,024,000	35,229,000	2,680,500
Rural Area	Dwelling House	Slope ＞ 20degree	1,527,000	611,000	58,700
		Slope ≦ 20degree	9,639,000	816,000	173,000
Barrio Area	Dwelling House	Slope ＞ 20degree	13,424,000	2,349,000	300,700
		Slope ≦ 20degree	17,474,000	3,058,000	275,200
	Rural & Barrio Total		42,064,000	11,234,000	807,600
Ground Total			100,088,000	46,463,000	3,488,100
US$	(1920 Bs= 1US$)			24,200 M.US$	1,817 M.US$

Source: JICA Study Team

Table 10.5.4 Number of Buildings in Each Area and Uses

Area	Nos. of Bldg.	%	Category	Nos. of Bldg.	%	Class, Story	Nos. of Bldg.	%
Urban Area	83,449	100	Dwelling House	58,449	70	High C.	1,753	3
						Mid. C.	21,626	37
						Low C.	35,070	60
			Apartment House	6,680	8	1 ~ 3	2,004	30
						4 ~ 8	3,340	50
						9 -	1,336	20
			Office Building	12,526	15	1 ~ 3	3,758	30
						4 ~ 8	5,010	40
						9 -	3,758	30
			Hospital and Governmental O.	3,340	4	w/ Beds	84	2.5
						No Bed	918	27.5
						Govn. O.	2,338	70
			Other Important Building	2,504	3	1 ~ 3	1,002	40
						4 ~ 8	1,002	40
						9 -	500	20
			Urban Area Total	83,449	100		83,449	
Rural Area	25,175	10.9	Slope ＞20degree	10,182	40.4	---	---	
			Slope ≦ 20degree	14,993	59.6	---	---	
			Sub Total	25,175	100			
Barrio Area	205,983	89.1	Slope ＞ 20degree	89,491	43.4	---	---	
			Slope ≦ 20degree	116,492	56.6	---	---	
			Sub Total	205,983	100			
	231,158	100	Rural & Barrio Total	231,158	100			
	314,657		Grand Total	314,657	100			

Source: JICA Study Team

Table 10.5.5 Ratio of Required Seismic Evaluation and Reinforcement, and Cost of Seismic Reinforcement per Building Replacement Cost

Area	Category: Type	Category: Item	Category: Year Built	Ratio of Building Number	Ratio of Required Seismic Evaluation (Ratio of Seismic Reinforcement)	Cost of Seismic Reinforcement / Building Replacement Cost
	Type of Structure	R. C. Structure		82.1%		
		Steel Structure		3.7%		
		Masonry		14.2%		
	Year Built	Before 1967 *1		51.7%		15%
		1968 ~ 1982 *2		37.4%		10%
		After 1983		10.9%		5%
	Number of Story	Low Rise: 1 ~ 3	*1	44.1%	80%, (80%)	15%
Area			*2	30.4%	75%, (70%)	10%
			*3		70%, (60%)	5%
		Middle Rise: 4~8	*1	6.4%	90%, (90%)	15%
			*2	4.6%	80%, (80%)	10%
			*3		70%, (70%)	5%
		High Rise: 9 ~	*1	1.1%	95%, (70%)	15%
			*2	2.5%	90%, (60%)	10%
			*3		85%, (50%)	5%
Rural Area	Dwelling House	Slope＞20degree	---	40.4%	80%, (80%)	15%
		Slope≦20degree	---	54.6%	80%, (75%)	10%
Barrio Area	Dwelling House	Slope＞20degree	---	43.4%	80%, (80%)	20%
		Slope≦20degree	---	56.6^{oo}%	80%, (75%)	15%

Source: JICA Study Team

Table 10.5.6 Cost of Early Warning and Evacuation

Item	Cost (USD)
Establishment of Agreement	4,000
Installation of Equipments	100,000
Annual Maintenance Cost of Equipments	56,000
Capacity Building of Regional Office	300,000
Total	460,000

Table 10.6.1 Comparison of Damage Without and With Project

(unit: MUS$)

Item	Damage Without Project (A)	Damage With Project (B)	Benefit (A-B)
Direct cost	439.6	64.2	375.4
Heavily damaged building value	313.2	53.5	259.7
Human damage	126.4	10.7	115.7
Indirect & Secondary Economic loss	281.6	116.3	165.3
Loss to Caracas (study area) economy	230.8	95.4	135.5
Loss to National economy	50.8	21.0	29.8
Rescue & Recovery cost	49.0	6.8	42.2
Emergency + medical cost	6.9	1.2	5.6
Debris clearance	33.6	4.3	29.3
Temporary house cost	8.5	1.2	7.2
Total	770.2	187.4	582.9

Source: JICA Study Team

Table 10.6.2 Estimation of Engineering Fee for Seismic Evaluation and Seismic Reinforcement Design

	No. buildings	Cost for all the buildings in the study area		Cost for 10,020 buildings For economic analysis
		Cost (MUS$)	Cost less IVA (MUS$)	Cost less IVA (MUS$)
RVS	247,500	15.6	13.4	0.38
Seismic Evaluation	216,480	390.7	336.8	11.4
Seismic Design	182,760	357.3	308.0	12.7
Total Engineering fee	-	763.6	658.3	24.4
Construction cost	182,760	1,817	1,566	53.5
Grand Total		2,581	2,224	77.9

Source: JICA Study Team

Table 10.6.3 Flow of Cost and Benefit

(unit: MUS$)

	year	Cost					Expected benefit	Net Benefit
		RVS	Detailed Seismic Evaluation	Seismic Reinforcement Design	Reinforcement Work	Total Cost		
1	2005	0.05				0.1		-0.1
2	2006	0.11	0.8	0.4		1.3	0.0	-1.3
3	2007	0.11	0.8	0.8	3	5.0	0.0	-5.0
4	2008	0.05	0.8	0.8	3	4.9	0.6	-4.3
5	2009		0.8	0.8	3	4.9	1.2	-3.7
6	2010		0.8	0.8	3	4.9	1.8	-3.1
7	2011		0.8	0.8	3	4.9	2.4	-2.5
8	2012		0.8	0.8	3	4.9	3.0	-1.9
9	2013		0.8	0.8	3	4.9	3.6	-1.3
10	2014		0.8	0.8	3	4.9	4.2	-0.7
11	2015		0.8	0.8	3	4.9	4.8	-0.1
12	2016		0.8	0.8	3	4.9	5.4	0.5
13	2017		0.8	0.8	3	4.9	6.0	1.1
14	2018		0.8	0.8	3	4.9	6.6	1.7
15	2019			0.8	3	4.1	7.2	3.1
16	2020				3	3.3	7.8	4.5
17-50	2021 - 2054						8.4	8.4
	NPV					29.6	29.3	-0.3
	B/C							0.99

Source: JICA Study Team
Note: Earthquake return period is assumed as 69.5 years. Referring JICA project evaluation guideline, 50 years is employed as project life. 12 % is employed as discount rate as the World Bank uses in a project in Venezuela.

Table 10.6.4 Annual Cost for Reinforcement of Buildings

(unit: MUS$)

Year	RVS	Detailed Seismic Evaluation	Seismic Reinforcement Design	Reinforcement Work	Total
2005	2.6				2.6
2006	5.2	30.1	13.2		48.5
2007	5.2	30.1	26.5	129.8	191.5
2008	2.6	30.1	26.5	129.8	188.9
2009-2018		30.1	26.5	129.8	186.3
2019			26.5	129.8	156.3
2020				129.8	129.8
Total	16	391	357	1,817	2,581

Source: JICA Study Team
Note: inclusive of value added tax (IVA, 16%)

Table 10.6.5 Percentage of Project Cost to GDP and Various Budgets

Item	Project Cost	GDP (2003 est.)	National Budget (2003)	MINFRA Budget (2003)	MINFRA project budget (2003)	Min. of Housing (2004)	AMDC Budget (2003)
Year	(MUS$)	85,748 (MUS$)	25,968 (MUS$)	1,936 (MUS$)	884 (MUS$)	625 (MUS$)	600 (MUS$)
2005	2.6	0.0%	0.0%	0.1%	0.3%	0.4%	0.4%
2006	48.5	0.1%	0.2%	2.5%	5.5%	7.8%	8.1%
2007	191.5	0.2%	0.7%	9.9%	21.7%	30.6%	31.9%
2008	188.9	0.2%	0.7%	9.8%	21.4%	30.2%	31.5%
2009-2018	186.3	0.2%	0.7%	9.6%	21.1%	29.8%	31.1%
2019	156.3	0.2%	0.6%	8.1%	17.7%	25.0%	26.0%
2020	129.8	0.2%	0.5%	6.7%	14.7%	20.8%	21.6%
Total	2,580.6	3.0%	9.9%	133.3%	291.9%	412.9%	430.1%

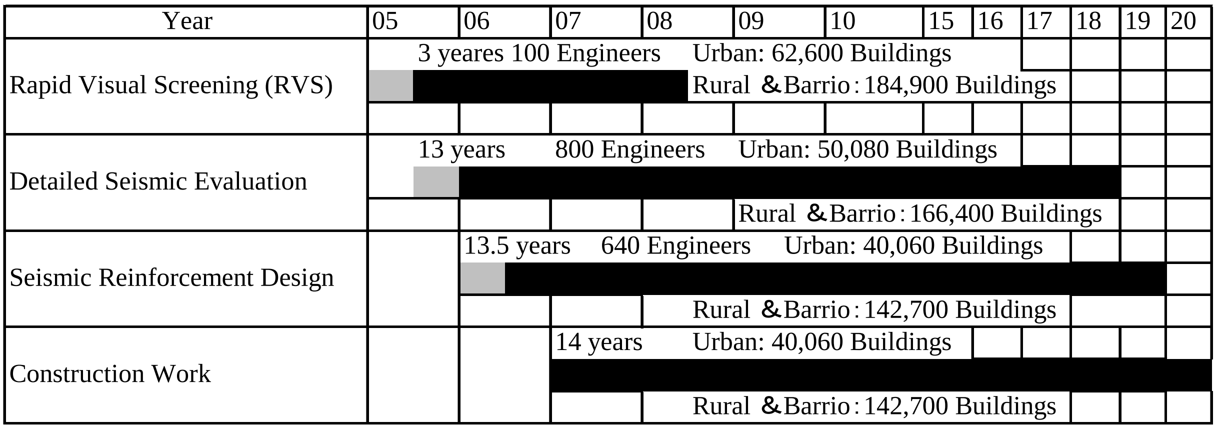
Source: GDP data from Central Bank (http://www.bcv.org.ve/EnglishVersion/Index.asp), National and MINFRA budget from "Resumen de la, LEY DE PRESUPUESTO 2003," Office of National Budget, (Oficina Nacional de Presupuesto) Ministry of Finance, AMDC budget from AMDC. For newly established Ministry of Housing news paper website "

Table 10.6.6 Annual Number of Buildings for Reinforcement Project

Year	RVS			Detailed Seismic Evaluation			Seismic Reinforcement Design			Reinforcement Work		
	Total	Urban	B+R	Total	Urban	B+R	Total	Urban	B+R	Total	Urban	B+R
Total Number	247,500	62,600	184,900	216,480	50,080	166,400	182,760	40,060	142,700	182,760	40,060	142,700
2005	41,250	10,433	30,817									
2006-2007	82,500	20,867	61,633	16,652	3,852	12,800						
2008	41,250	10,433	30,817	16,652	3,852	12,800	6,769	1,484	5,285	13,054	2,861	10,193
2009-2018				16,652	3,852	12,800	13,538	2,967	10,570	13,054	2,861	10,193
2019							13,538	2,967	10,570	13,054	2,861	10,193
2020										13,054	2,861	10,193

Source: JICA Study Team

Note: B+R denotes "barrio and rural."



Source: JICA Study Team

Figure 10.2.1 Project Implementation Schedule for Building Reinforcement

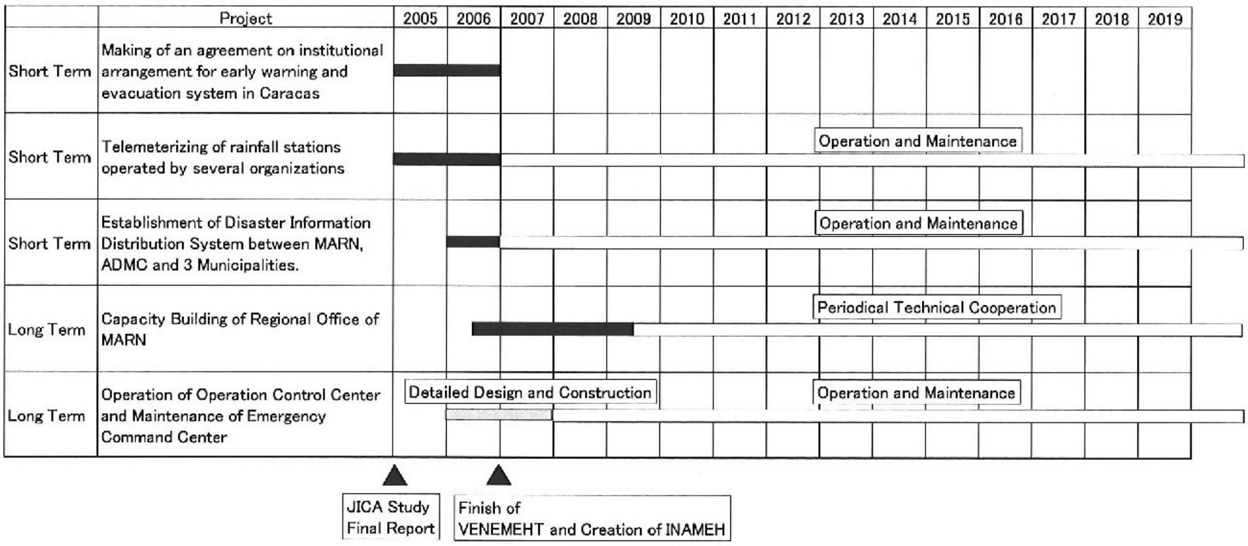
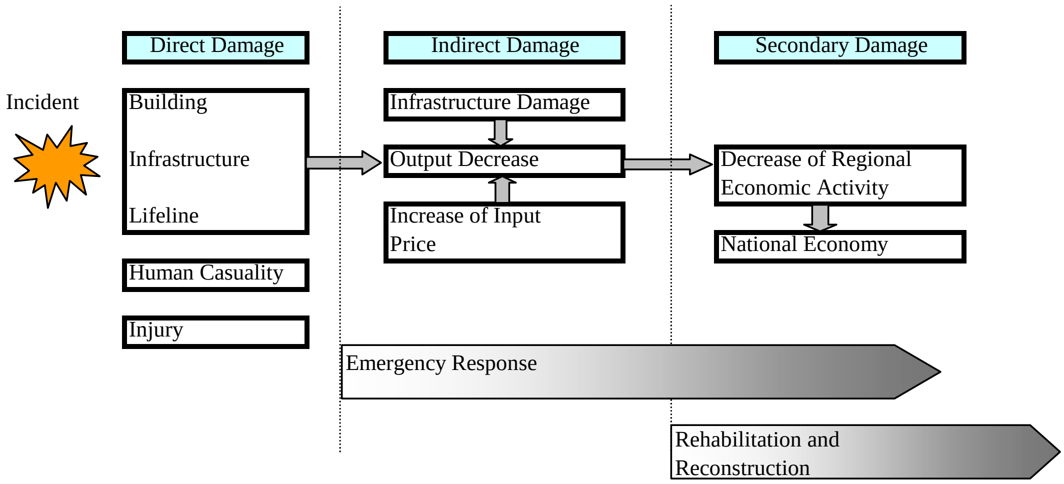


Figure 10.4.2 Project Implementation Schedule for Early Warning and Evacuation



Source: JICA Study Team based on Paul K. Freedman, et al., "Catastrophes and Development Integrating natural Catastrophes into Development Planning," Disaster Risk Management Working Paper Series No.4, World Bank, 202

Figure 10.6.1 Damage Link

CHAPTER 11

GEOGRAPHICAL INFORMATION SYSTEM (GIS) AND DATABASE SYSTEM

"Be part of the plan, help us to prevent natural disasters!"

Reinaldo Ollarves

CHAPTER 11. GEOGRAPHICAL INFORMATION SYSTEM (GIS) AND DATABASE SYSTEM

11. 1 Introduction

The study team has recompiled and prepared a large number of GIS maps and database. A base map in GIS format has been prepared in the scale of 1:25,000 and working map has been prepared in the scale of 1:5,000 for the urbanized area. Some parts of study area also have the working map in the scale of 1:1000. Digital image processing of satellite images (Aster and Landsat) has been carried out for getting the regional view of the study area. Aerial photographs in some parts of study area were orthorectified for the digital interpretation and overlaying with the existing maps.

Many GIS analysis have been done to create new layers. Digitization of paper map has been also carried out.

Database development has been done for population data and building inventory data based on census of 2001. Also database analysis has been carried out to develop physical and social vulnerabilities. Finally, the analysis of damage scenarios and damage estimation has been integrated to the GIS system.

11. 2 GIS System Design

The study team has prepared a basic GIS standard, data format, system platform to be used in the project. Based on the discussion with the counterpart team, these standards were finalized on the following aspects.

- System platform,
- Units of measure,
- Datums,
- Map projections,
- Terminology,
- Cross-platform data translation processes
- Available data sets
- Symbol sets,
- Data storage and naming convention

11. 3 Database System Design

The database design and structuring was based on the following principles.

- Understanding the requirements before beginning to build the solution.
- To follow the existing and accepted standards for the design.
- Writing code that is readable.
- Separate user interface and data management.
- Design for the most efficient use of the program by the user.
- Program codes that can be re-used.

11. 4 GIS System Developments

The collected data were converted to GIS system using the standard GIS design developed for the project. Following processes were applied to the data received from different institutions.

(1) The paper format maps were screen digitized by scanning and georeferencing the scanned images.

(2) All the digital maps received in CAD formats were checked and edited for respective topology and converted to GIS format topological models. Additionally, they were converted to La Canoa coordinate system by using the coordinate conversion routine developed by JICA Study Team.

(3) The received GIS format maps were checked for the topology and attribute accuracy as well as relevance. The coordinate conversion was done when applicable.

11. 4. 1. Base Map Preparation

The JICA Study Team uses the topographic map of 1994, scale 1:25000 developed by IGVSB as its base map for the study. Additionally working topographic maps in scale 1:5000 and scale 1:1000 (year 2000) are being used for the detail analysis. The working topographic map in scale 1:5000 covers the urbanized area of ADMC.

(1) Base map of Scale 1:25000

A base map in the scale of 1:25000 in CAD format is purchased from IGVSB. The base map is being used for the preparation of all the relevant maps. This base map is obtained from IGVSB in La Canoa coordinate system. This base map is already converted to GIS format and GIS compatible layers with attribute data. These layers has been edited and updated in the course of study period depending on the availability of the recent and more precise scale map and other information.

Table 11.4.1 shows the list of the GIS layers created from the base map.

(2) Working map of Scale 1:5000 and 1:1000

For the urbanized area, a working map of 1:5000 scale is obtained from Hidrocapital. Similarly working map of 1:1000 scale is obtained from Municipality of Sucre. These maps were originally in Loma Quintana system and were reprojected to La Canoa system using standard conversion routine developed by the study team.

(3) Digital Elevation Model (DEM)

DEM was prepared for the scale of 1:25000 and the scale of 1:5000 based on the corresponding contour maps. Further, a DEM of 2m pixel size (scale 1:2000) for the urbanized area was developed. The process of DEM development is given below.

11. 4. 2. Orthorectification of Aerial Photos

Aerial photos taken in March 2002 were purchased (in paper format) from IGVSB and scanned with high resolution (1200 dpi). Some of the aerial photos in barrio and rural areas were georeferenced and subsequently orthorectified using the DTM of scale 1:5000. These orthorectified aerial photos are used for interpretation of buildings and houses as well as expansion of the barrio area.

11. 4. 3. Digital Image Processing

Different satellite images spanning the different year were obtained for the study, the most important among them being Aster image and LandSat images. Aster image covering ADMC was obtained for April 2003 and LandSat images were obtained for the years 1986, 1990, 1992, 1997 and 2001.

11. 4. 4. Administrative Boundaries Definition

Several sources of data were received and the following procedure methodology was used to establish administrative units (Table 11.4.2).

11. 4. 5. Microzone

Microzone, by definition, is the spatial units which divides the Metropolitan area in some sort of sectorization and where database (like Building, Population, Open Spaces, Road Networks and other

Public Facilities) can be established. Further, these microzones could be used for presenting risk map as well as the results of damage scenarios. In future, these units can be used for planning purposes as well for evaluating the existing resources vs. degree of danger.

These units are the existing spatial divisions that exist in Caracas Metropolitan area with following sub units.

1. Urbanized Area
2. Barrio Area
3. Rural Area
4. Parks and Open Spaces

11. 5 Detail GIS System Design Procedure

11. 5. 1. System Platform

Several different GIS, CAD (Computer Aided Drafting), Image Analysis and DBMS (Data Base Management System) platform are currently used within different entities in metropolitan district to capture, edit, analyse and display spatial data.

The study team also observed that the most commonly used GIS software at present is ArcGIS, i.e. ARC/INFO and ArcView; with the mapping package MapInfo being used in some agencies as a display and query tool. Some of the MapInfo users, for example Hidrocapital, are planning to migrate to ArcGIS platform. Following this current trend of GIS system use, the study team and the counterpart team decided the use of following GIS software and system platform.

- GIS: ArcGIS, and its common extension, the Spatial Analyst

- CAD: AutoCad 2004 was selected for this purpose.

- Digital images (Satellite and aerial photographs) have been acquired and processed using basically two different softwares.

- DBMS: Oracle for Windows and MS Access

11. 5. 2. GIS and Attribute Data Development Phase

In the course of the project development, there would be three stages of data storage and conversion.

- Input Data: All the collected digital data will be kept inside this directory structure as they will be received. They are catalogued and saved as it was received.

- Temporary conversion data: The received input data will be analysed and the useful digital data will be converted to compatible file format and coordinate system.

- Final Output data: The processed and resulting data will be stored apart and the detail metadata will be created for this final product.

11. 5. 3. Scale

For the study purpose, all the maps will be produced in the scale of 1:25000 using base map of scale 1:25000 covering the whole study area.

Some parts of study area are being studied using the map of the scale of 1:1000 and 1:5000 depending on data availability.

11. 5. 4. Data Model in ArcGIS

The ArcGIS coverage will be the base of the GIS data. Every other format will be eventually converted to this topological format. Although, ESRI (the vendor of Arc/Info) has already launched the geodatabase model, it is not yet adopted by the national Venezuelan agencies. Topological model will be still in use for some time and, if required, they could be easily converted to new geodatabase model. All the ARC/INFO coverage will be subjected to *clean* to be acceptable under the most basic quality standards.

11. 5. 5. Metadata

Among the different version of metadata, the FGDC (Federal Geographic Data Committee) metadata format will be used. It is brought to the notice that the national cartographic institute has already developed the condensed version of the FGDC metadata.

11. 5. 6. Data Capture and Digitizing Standards

The digitizing is being done in the following software.

- AutoCAD
- Arc Info
- ArcView
- MicroStation
- Ilwis

The digitizing in Microstation software will use the existing digitizing manual developed in national cartographic institute. If done on other software, they will be checked for the followings.

- Preparation of the original material to be digitized
- Orientation of the map
- Layer definition for the elements
- Layer topology for each element
- Scale and coordinate system definition
- Control points
- GIS compatible node system
- GIS compatible attribute system

11. 5. 7. Methodology for GIS Data Preparation

The following will be basic steps for the GIS/database preparation.

- GIS/Database Collection
- GIS/Database Quality Checking
    - Attribute Database Quality
    - Spatial Database Quality
    - Relevance to Present Study

Revision and correction of GIS and Attribute Database

- Base Map Preparation
- Coordinate System definition
- Study area limit preparation for GIS
- Building and Population Database creation for Seismic Disaster
- Building and Population Database creation for Sediment Disaster
- Definition of Microzone for seismic disaster

11. 5. 8. Spatial and Database Analysis

Different spatial and database analysis have been carried out to evaluate the different damage scenario. Some of the examples of the damage scenarios are listed below.

- Building Damage Estimation and Human Casualty
- Property Damage (based on Real estate Value, if available)
- Sediment Damage Estimation
- Landslide Damage Estimation
- Regional evacuation places selection
- Damage to lifeline
- Damage to important buildings
- Evacuation route selection

11. 6 GIS and Database Maintenance

The creation of a GIS database has been a huge, expensive and time consuming task. The Study team expects that these GIS and Database system will be put into maintenance mode in order to retain its value. This is often only slightly less labor-intensive than the initial creation of the database and regains the benefit of the database.

Some data layers do not change and require little maintenance except when software versions are updated. Other layers such as parcel or ownership change on a daily basis and require constant attention. Usually the best course of action within the Counterpart team is to assign an "owner" to oversee to the maintenance on a regular basis. This person (or organizations) is responsible for obtaining updates of the information and transferring it to the digital version of the layer in order to make it available for general use.

Maintaining accurate, up to date and reliable GIS data is critical in a successful operational GIS. Data maintenance includes updates of, additions to, deletions from and conversion of the database. In order to maintain the GIS data integrity, these changes have to be performed in a very careful manner.

The basic policy of study team was followings.

- Data will be shared with all the counterpart team unless it is restricted.

- Acknowledgement of received data in the final report.

- Result will be published only with the agreement of C/P team.

The counterpart team may need to design the detail procedure and protocol for the continuity of the GIS database maintenance in the following aspects.

- Data use

- Data Update/ Modifications

- Data Security

- Data Analysis

- Result Publication

11. 7 Disaster Management Information (DMI) System

As mentioned before, the GIS system developed in the JICA project has been able to recompile a large number of data layers and has produced a lot of thematic maps required for planning and decision making for disaster related activities in the metropolitan area of Caracas.

During the discussion with counterpart members, it has been agreed that this GIS system should be maintained and used as one of the component of proposed Disaster Management Information System. Development of GIS system from the beginning is very costly; however, maintenance requires fewer resources than development.

11. 7. 1. Purpose, Objective and Goals

(1) Purpose

- Effective diagnosis and management of disaster cycles

- Aid to effective decision making during disaster

- Aid to Effective coordination

(2) Objective

To help disaster prevention and attention (management) in all of the disaster stages, namely before: Mitigation/Preparation; during: Response; and after: Recovery and Reconstruction.

(3) Goals

- Uniform and consistent Metropolitan Spatial Database
- Spatial data that is reliable/precise for the given time period and Scale
- Spatial Data infrastructure that can be used by legitimate user any time, all the time and from anywhere

11. 7. 2. Expected Results and Functions

(1) Expected Results

- GIS based disaster information management system in place
- Development of related data collection schemes
- Establishment of data interchange and data managements protocols
- Data analysis and use protocols
- Publication of hazard and risk maps for public use
- Distribution of scenario analysis among different agencies

(2) Expected Functions

- Real Time Data Analysis - Disaster Response, Early Warning, Disaster Scenario (15-20 Minutes)
- Short Term Data analysis - Forecasting (1-2 Days)
- Mid Term Data Analysis - Research and Diagnosis(Hazard and Risk map updating), Planning (Mitigation /Preparation)(1-2 Years)
- Long Term Data Analysis - Disasters Scenarios (Continuous)

11. 7. 3. Proposed DMI System

The proposed DMI system will have three sub systems.

- Integrated communication system
- Information management system (based on GIS and database system)

- Decision making and disseminating system

11. 7. 4. Pre-feasibility Study of DMI System

The study team reviewed four important aspects for the prefeasibility study for the implementation of DMI system.

- Legal aspect
- Institutional/ Organizational aspect
- Financial aspect
- Technical aspect

(1) Legal Aspects

Basically there are three main laws which regulate the disaster management activities and related information system. They are:

- The Law of National Organization of Civil Protection and Disaster Administration
- Decree with Legal Force of Firefighters Brigades and Administration of Emergency with Civil Character
- Citizen Security Law

Beside that, a National Cartographic Law regulates the production and representation of cartographic materials.

(2) Institutional/ Organizational Aspect

The JICA Study team realized different institutional visits and discussions with different organization to propose the organizational aspect of the DMI system. The database required for disaster related activities should come from different institutions. They are identified as in all level of government (national, regional and local as well as private companies).

Following institutions should take part in the DMI system database construction and maintenance.

- Metropolitan Protection Civil
- National Protection Civil

- IGVSB
- Funvisis
- Planning Secretary, ADMC
- Bomberos ADMC
- Protection Civil, Municipio Chacao
- HidroCapital
- INE
- Ingeomin
- Protection Civil, Municipio Libertador
- Protection Civil, Municipio Sucre
- CANTV
- CENAMB
- Electricity of Caracas
- IMF, UCV
- PDVSA GAS
- Inparques
- MARN
- Direccion Technolgico, ADMC
- Protection Civil, Municipio Baruta
- Protection Civil, Municipio El Hatillo

During these discussions, it was agreed that, the metropolitan protection civil is basically the institution responsible for implementation of this system in the metropolitan area of Caracas.

As metropolitan protection civil, at present, lacks specialized tools and knowledge of the GIS based system, the database and GIS part of this system should be placed in technological direction of metropolitan municipality. Some participating institutions (like metropolitan firefighters' office) already have GIS system. The maintenance and update of this system is the responsibility of all the organizations.

(3) Financial Aspect

To sustain the cost of operation, maintenance and future upgrades, there should be some mechanism of funding from national or municipal government. The budget required for the initial development of DMI system should be set aside. It is noteworthy to mention that there are two projects presented in the year 2003 (project cost 750 Million Bolivars) and 2004 (project cost 1400 Million Bolivars) to FIDES, jointly by secretary of infrastructure and technological direction, to modernize the physical infrastructure and technology of call center 171.

Beside the initial development fund, a provision for the maintenance and updating of the system should be separately earmarked. JICA study team identified the following sources as the fund provider.

- General public with insurance fee
- Municipal government
- Metropolitan government
- National government

(4) Technical Aspects

There are three alternatives proposed for the GIS based database system implementation.

Alternative 1

This is the simple implementation of interconnected GIS and database System. This system implementation involves the setting up the procedures (protocols) for communication between GIS and database System (Figure 11.7.1). The spatial unit of interconnection is parcel, manzana, microzone, parroquia and municipality.

The cost of implementation of the system would be approximately as follows.

System Cost:	US$ 50000
Initial Data Cost:	US$400000
Training Cost:	US$20000
Annual Maintenance cost:	US$100000
Total Cost:	US$600000

This cost does not include the cost of housing of the system and personnel.

Alternative 2

This alternative employs the scheme of the distributed system among national, regional and local government. This scheme may require certain data priviledge among different institutions as the data required by each institute is different.

The schematic representation distributed and interconnected GIS and Database System is given in Figure 11.7.2.

The cost of implementation of the system would be approximately as follows.

System Cost	US$500000
Initial Data Cost	US$500000
Training Cost	US$50000
Annual Maintenance cost	US$500000
Total Cost	US$ 1.5Millions

Alternative 3

This alternative employs the scheme of the distributed system among national, regional and local government interconnected with private companies/media and general public. This scheme requires separating the web based access to governmental agencies and general public. The schematic view of distributed and interconnected GIS and database system with participation of private Sector is given in Figure 11.7.3.

The cost of implementation of the system would be approximately as follows.

System Cost:	US$2.5 Millions
Initial Data Cost:	US$500000
Training Cost:	US$500000
Annual Maintenance cost:	US$100000
Total Cost:	US$3.6 Millions

11. 7. 5. Prototype System Implementation

The JICA Study Team together with the engineers from technological direction, Alcaldia Mayor (TDAM) has implemented a prototype system for accessing the GIS/database system by different users. This system is based on the virtual private network (VPN) scheme.

Basically, a VPN is a private network that uses a public network (usually the Internet) to connect remote sites or users together. Instead of using a dedicated, real-world connection such as leased line, a VPN uses "virtual" connections routed through the Internet from the company's private network to the remote site or employee.

The GIS/database developed in the project resides on the central server in TDAM. The system can be accessed using existing connection to internet. The minimum required infrastructure would be, a computer with P4 Processor and high speed internet connection (Aba or Other fiber optics connections).

Initially, twenty two institutions are selected to access the system. Additionally, these institutes can acquire the software de ArcView or ArcExplorer to run the application develop or visualize the content of the data. The ArcExplorer software is the free software for visualizing ArcView data.

The connection to the DMIS is configured by followings.

<u>a. Configuring the VPN network of Microsoft</u>

IP 200.44.181.190

Networking PPTP VPN

<u>b. Then the user can reach the central server by http or ftp.</u>

The IP of the HTTP/FTP Server is: 192.9.18.253

The user may switch to directory CARACAS ones the FTP is connected.

Free downloadable software ArcExplorer may be used for the visualizing data. ArcExplorer is the software that can be found in public domain. This software can be downloaded from the web site of ESRI (www.esri.com).

Use the following link for downloading.

http://www.esri.com/software/arcgis/arcreader/index.html

Following institutions were provided the user name and passwords to access the system. The technological direction (who hosts the GIS/database system) will create additional user name and password for the other institutions in future.

Table 11.4.1 GIS Layers Created from the Base Map

FILENAME	MAP LAYER
\Base_Map\Contour_Line\elevation_26_06.shp	Contour Lines
\Base_Map\Facilities\airport.shp	Airport
\Base_Map\Facilities\club.shp	Club
\Base_Map\Facilities\Fence.shp	Fence
\Base_Map\Facilities\Golf_Field.shp	Golf Field
\Base_Map\Facilities\Horse Track.shp	Horse Track
\Base_Map\Facilities\Metro Line.shp	Metro Line
\Base_Map\Facilities\School and Sport Buildings.shp	School and Sport Buildings
\Base_Map\Facilities\vegetation.shp	Croplands and Forest
\Base_Map\Hydrologic_Network\Channel.shp	Channel
\Base_Map\Hydrologic_Network\Check_Dam.shp	Check Dam
\Base_Map\Hydrologic_Network\Coast Line.shp	Coast Line
\Base_Map\Hydrologic_Network\Lagoon Of Seasonal Regimen.shp	Lagoon
\Base_Map\Hydrologic_Network\Reservoir.shp	Reservoir
\Base_Map\Hydrologic_Network\River Of Seasonal Regime.shp	River of Seasonal Regimen
\Base_Map\Hydrologic_Network\River.shp	River
\Base_Map\Life_Line\Gasoline Tank.shp	Tank
\Base_Map\Life_Line\High Tension Electric Line.shp	High Tension Electric Line
\Base_Map\Life_Line\Pipe Line.shp	Pipeline
\Base_Map\Road_Network\Path_Road.shp	Foot Path
\Base_Map\Road_Network\Paved_Road.shp	Highway, Paved Road and Street
\Base_Map\Road_Network\Secondary_Road.shp	Secondary Road
\Base_Map\Road_Network\Tunnel.shp	Tunnel
\Base_Map\Urban_Area\Buildings.shp	Building-polygon
\Base_Map\Urban_Area\buildings_line.shp	Building-line
\Base_Map\Urban_Area\Urban_Areas.shp	Urban Area

Table 11.4.2 Administrative Boundaries Source

Administrative Unit	Data Source	Comments
Municipal Limits	Interpretation of official gazette by Study Team	Revised by IGVSB
Parroquia Limits	Interpretation of official gazette by Study Team	Revised by IGVSB
Urbanization Limits	Secretary of Planning, ADMC	Converted to La Canoa System and topology generation by Study Team
Barrio Limits	Secretary of Planning, ADMC	Converted to La Canoa System and topology generation by Study Team
Manzana Limits	Secretary of Planning, ADMC	Converted to La Canoa System and topology generation by Study Team
Individual Houses	Working map 1:5000, Hidrocapital	Converted to La Canoa System and topology generation by Study Team, Additional interpretation was done for barrio houses and rural areas

Table 11.4.3 Area of different Administrative Boundaries

Municipality	Total Area (Has.)	Total Number of Microzone	Barrio		Urban		Rural		Park
			No.	Area (Has.)	No.	Area (Has.)	No.	Area (Has.)	No.
Libertador	47137.7	269	87	2285.95	162	9925.79	19	21316.8	1
Chacao	11906.1	34	9	1.727	24	1113.55	0	0	1
Sucre	32299.6	115	51	1062.38	53	2773.226	10	17368.3	1

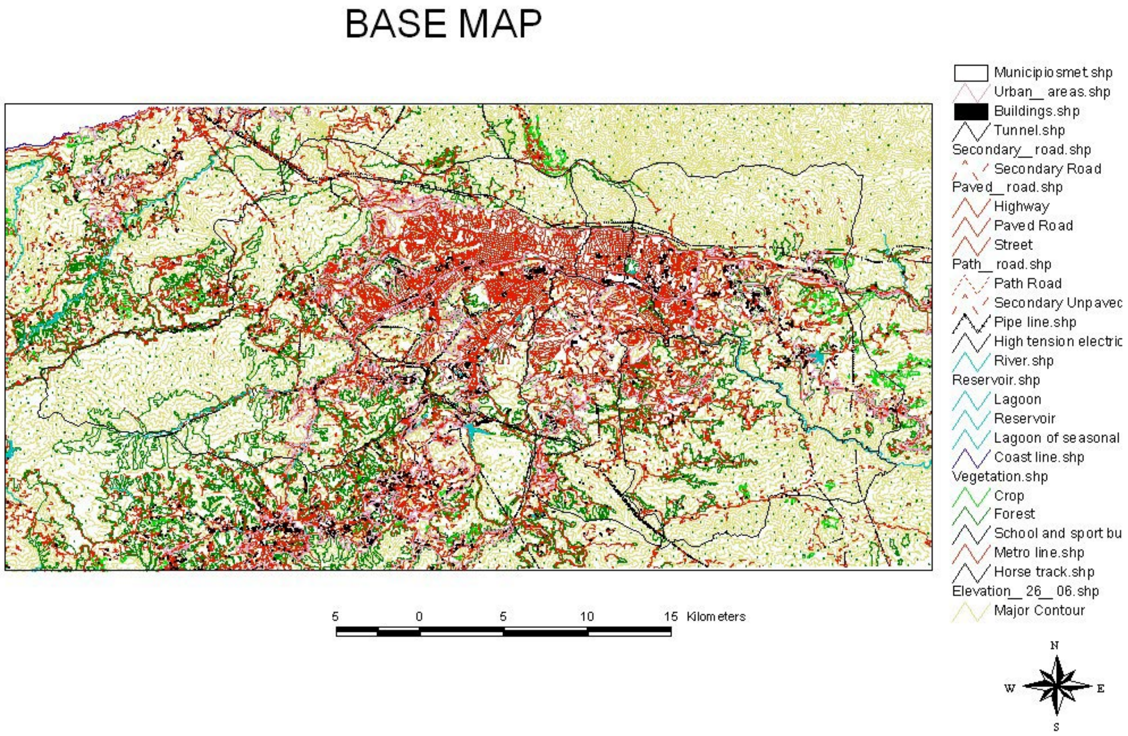


Figure 11.4.1(1) View of Base Map (1:25000)

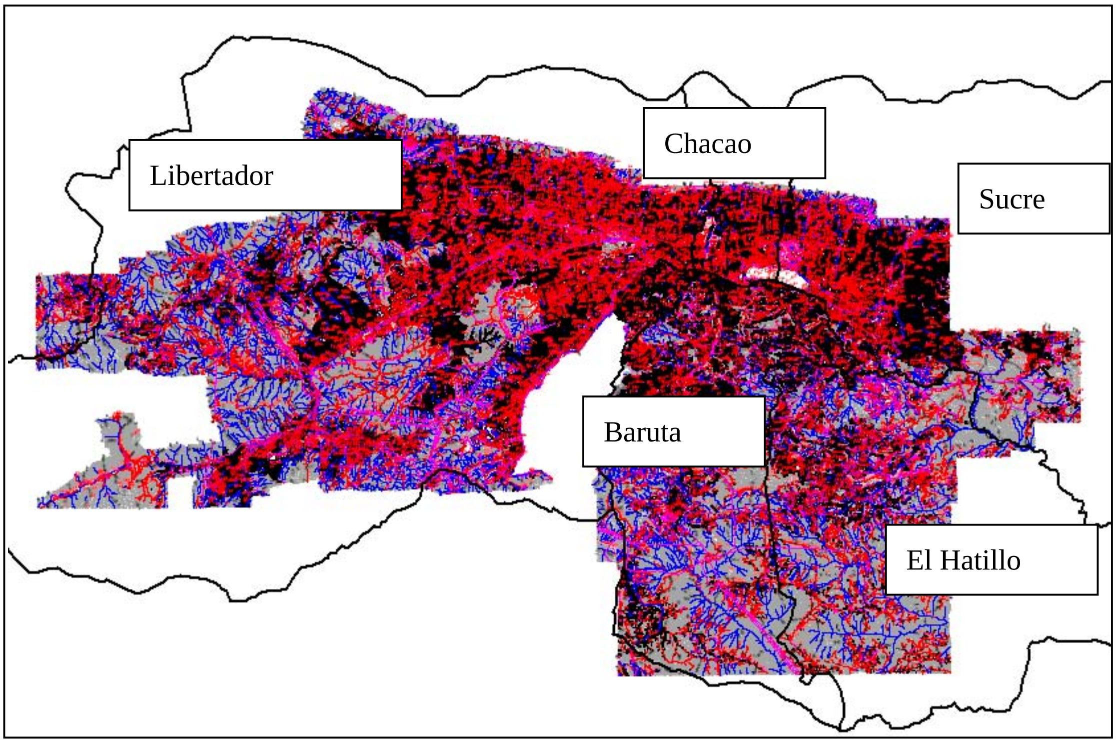


Figure 11.4.1(2) DTM Preparation

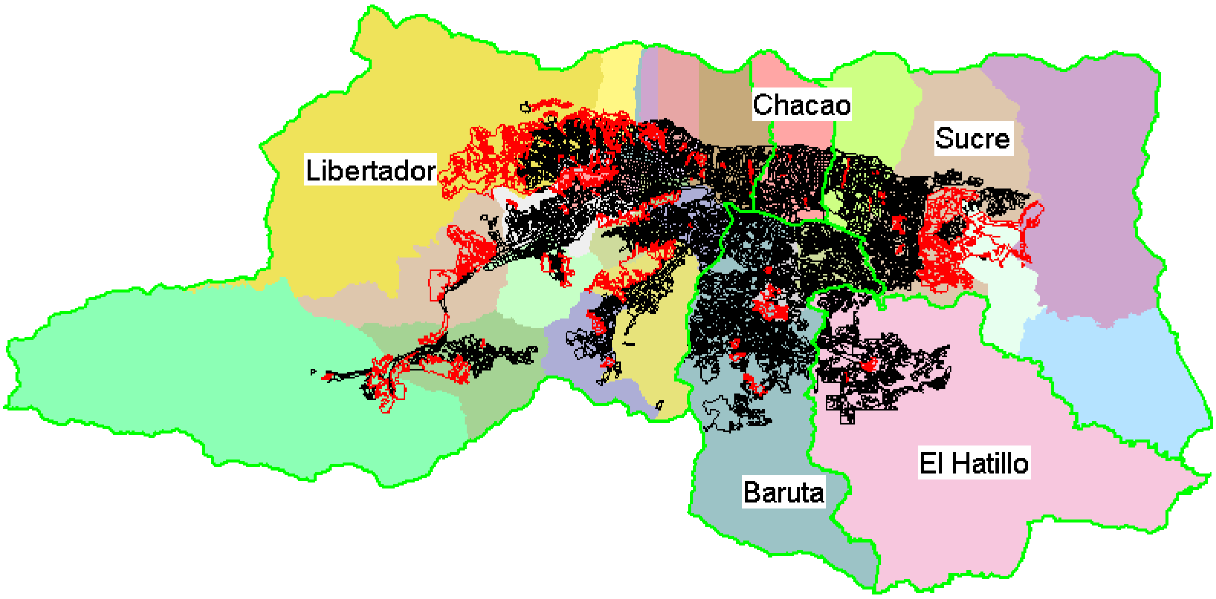


Figure 11.4.2 Administrative Boundaries (up to Manzana)

Figure 11.4.3 Administrative Boundary (upto individual houses)

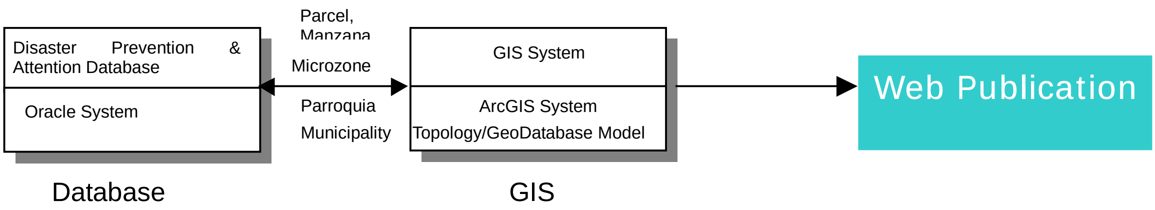


Figure 11.7.1 Simple Implementation of Interconnected GIS and Database System (Alternative 1)

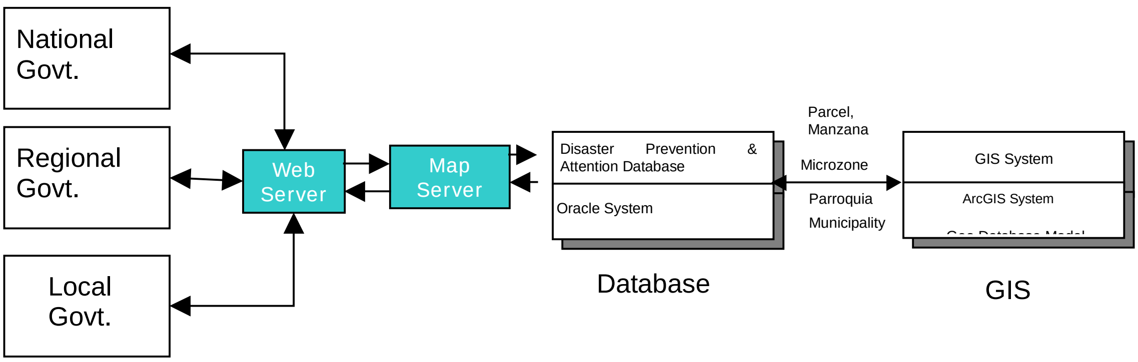


Figure 11.7.2 Distributed and Interconnected GIS System and Database System (Alternative 2)

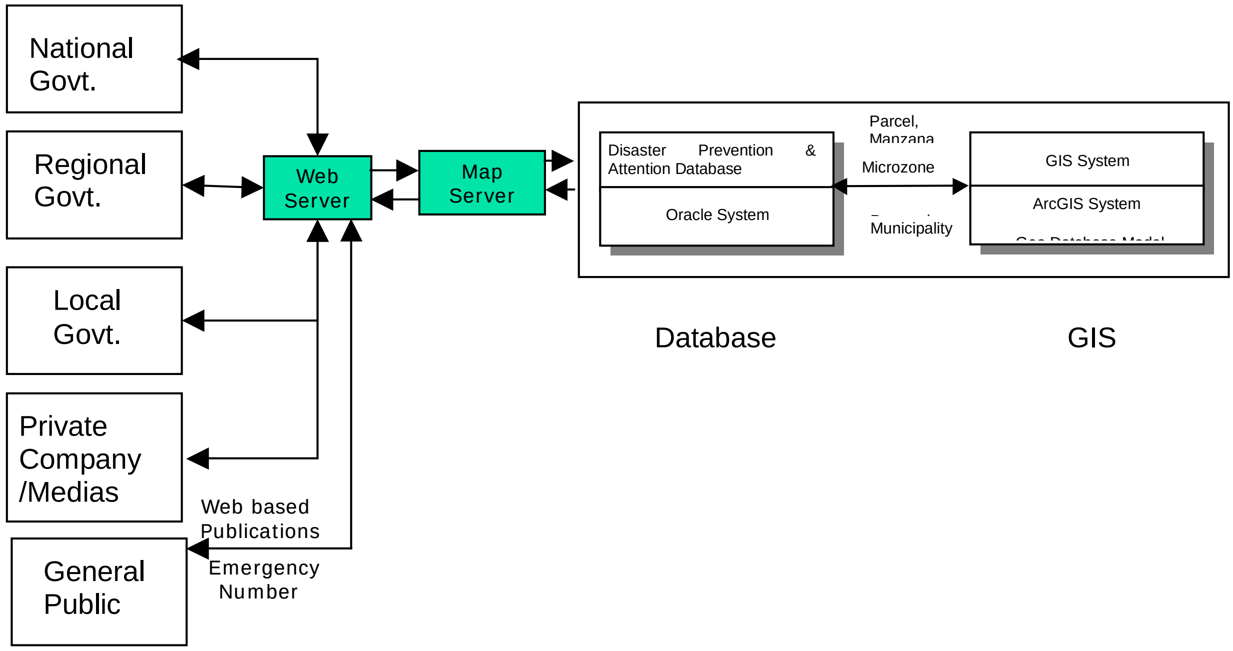


Figure 11.7.3 Distributed and Interconnected GIS System and Database System with Participation of Private Sector (Alternative 3)

CHAPTER 12

STUDY ON SEDIMENT DISASTER CAUSED BY HEAVY RAINFALL IN FEBRUARY 2005

"The worst of a tragedy,

is that never you know what to do. Prevent, get the information"

Francisco Layrisse

CHAPTER 12. STUDY ON SEDIMENT DISASTER CAUSED BY HEAVY RAINFALL IN FEBRUARY 2005

12. 1 Introduction

Between February 6th (Sunday) and February 10th (Thursday) in 2005, a large amount of rainfall occurred influenced by a developed cold front in the west coast and Andean mountain regions in Venezuela. Because of this heavy rainfall in dry season, 62 people died, 60 people are missing, 222,893 people were affected and 44,633 houses were damaged. (The figures were compiled by the Ministry of Interior and Justice by February 18th). There are reports road interruptions, road damage, breach of rive banks and flood damage from various parts of the country. After the disaster, Mr. Miura of the Study Team together with Mr. Jose Fra of the counterpart team and the JICA expert Mr. Nagata visited the sites of disaster in Caracas and in Vargas on 26th February, 2005. Consequently, the importance of the proposed Master Plan projects in the JICA Study targeting Caracas was recognized again.

12.2 Field Survey Result

The survey report will be prepared and will be handed over to the Venezuelan side as " Disaster Survey Report in February 2005" by the JICA expert Mr. Masaichi Nagata including the area other than the place of field visit on 26th February.

12.3 Relation with the JICA Study

According the to the survey of the disasters, the importance of the Disaster Prevention Basic Plan for the Metropolitan District of Caracas was recognized. Items for special note area as follows; (No corresponds to the Project Number proposed in the Plan.)

No.3: Debris Flow Control Structures

During the field survey, the Sabo dam constructed by Corpo Vargas on San Jose de Galipan River in Vargas was surveyed. The existing Sabo dam has stored the debris from upstream and the storage was full. The Sabo dam played a significant role to reduce the amount of sediment run-off downstream and at the same time, contributed to prevent further erosion of river side by making the rive bed slope milder. Thus, the effectiveness and the importance of debris flow control structures were recognized in Vargas. Therefore, it is expected that the proposed debris flow control structures be constructed as planed.

No.4 Slope Protection Works, No.5 Drainage Improvement in Barrios

Including the 19 de April area visited on February 26th, many steep slope failures occurred this time were caused by mal-drainage as well as incomplete sewerage. As proposed in the Plan, drainage improvement in barrio area is the most realistic and effective solution. The policy should be implemented by relevant authorities as soon as possible. When the slide is in a large scale or roads are protection targets, it is necessary to consider slope protection works proposed in the Plan.

No.6 Early Warning and Evacuation for Debris Flow Disaster Prevention

Fortunately, in this recent disaster, no death was reported by sediment disasters in Caracas. However, similar kind of sediment disasters will repeat themselves in future. Therefore, it is necessary to establish early warning and evacuation system as soon as possible and it will be implemented by MARN, ADMC Civil Protection, Municipal Civil Protection and communities.

No.7 Resettlement of People in Risky Areas

During this recent disaster no debris flow occurred in mountain streams in Caracas. However, larger rainfall in future will definitely cause debris flows in the same manner as in 1999. Therefore, it is necessary to implement the resettlement of people in risky area by the relevant authorities.

No.8 Land Use and Development Control in the Risky Area

The 19 de April area, where a large scale land slide occurred, had been damaged by the same kind of disaster in 1988. These kinds of area where land slide repeating should be designated as the restricted area and be converted to, for example, a park. By taking this opportunity, the government should imposed strict regulations in the area so that the land should not be used for housing construction again. It is expected that the local or the national governments acquire the land.

No. 10 Publication of Hazard Maps and Risk Maps, No.11 Education of People

The sediment disasters in Caracas this time , mainly “steep slope failures”, occurred in the risky slopes identified in the Study and described in the hazard maps. The importance of publication of hazard maps and risk maps of the area in order to draw attention of the residents was recognized again. At the same time, it is necessary to implement the education of people so that they will live away from risky area or they will be ready to evacuate from where live if they live in risky areas, when a disaster is anticipated.

No.12 Strengthening of Community Disaster Prevention Activities

In order to implement the early warning and evacuation system, strengthening of community disaster prevention activities is essential. On the other hand, sediment disasters in Caracas during this recent disaster occurred in many places at the same time and it is difficult for official rescue organizations such as fire fighters to cope with the situation. It is required to promote community activities for disaster prevention.

No.13 Emergency Command Centre

The importance of the emergency command centre proposed as the bases of disaster management administration before and after the disaster was recognized. Presently, the Metropolitan Civil Protection Office playing the role of the emergency command centre but the communication system is inadequate and the definition of their function is not clear. It is expected that the emergency command centre proposed in the Plan (equipped with the communication system, disaster management information system and it plays the role of bases for dispatching early warning and evacuation recommendation.), should be constructed as soon as possible.

12.4 Regional Disaster Prevention Plans for Other Regions

Through this recent disaster, risk of sediment disaster exists not only in Caracas or in Vargas State, but also in other states in the country. Although this JICA Study is limited to the Metropolitan District of Caracas for its target, the Disaster Prevention Basic Plan proposed in the Study can be applied for the other part of the country as a model plan. It is necessary to prepare other regional disaster prevention plans as soon as possible.

Photos

Existing Sabo Dam in San Jose de Galipan

Land Slide in 19 de Abril

Damaged House in 19 de Abril

Damaged House in Antimano

CHAPTER 13

CONCLUSION AND RECOMMENDATION

"The risk of our mountains and creeks belong to us,

Be prepared to prevent a disaster"

Maybelin Hernandez

CHAPTER 13. CONCLUSION AND RECOMMENDATION

13. 1 Conclusion of the Study

13. 1. 1. Hazard Feature of the Area

The Study Area has a history of earthquake disasters and sediment disasters.

Caracas City experienced some large earthquakes since 1500's when the history of the city began. The largest earthquake occurred is in 1812 when thousands of people died because of collapse of many buildings. The most recent earthquake in the Caracas history if 1967 earthquake when 275 people died. Considering these earthquake history, there is a possibility of occurrence of such scale of earthquakes as 1812 earthquake or 1967 earthquake.

The urban area of Caracas extending from the foot of El Avila to the Guaire River is a fluvial plane composed of debris flow from El Avila. The historical record of debris flow shows that in 1951, a large scale debris flow occurred in some mountain streams and caused damage. The most recent phenomenon is in 1999, when debris flow occurred along Catuche and Anauco mountain streams and some hundred people died. The mountains surrounding Caracas urban area have risky steep slopes or landslide mass. Strong intensity of rainfall in rainy season often causes landslides and steep slope failures in such areas.

13. 1. 2. Social Vulnerability and Social Capacity of the Place

Because of high concentration of population and assets, the risk of the city once a natural hazard occurs is high. Much more, the distribution of population in Caracas in terms of social vulnerability and social capacity against natural hazard is not uniform. About a half of the Caracas population live in so called barrio area and the social vulnerability is high according to the social survey.

Through this study, physical vulnerability distribution such as building damage ratio was developed on the GIS platform and at the same time social vulnerability/capacity distribution of the area was created from the result of social survey.

The physical vulnerability map and the social vulnerability/capacity map were superimposed. The result shows the risk distribution of the area taking into account the physical and social vulnerability. The map shows the uneven distribution of risk in the area.

13. 1. 3. Disaster Prevention Basic Plan

Disaster Prevention Basic Plan for the Metropolitan District of Caracas was formulated based on the analysis of the area in terms of natural hazard, human activity in the area, social vulnerability and social capacity. As the earthquake disaster scenarios, 1967 earthquake and 1812 earthquake were selected and damage were simulated. For sediment disaster scenario, rainfall amount with the probability of once in one hundred years was selected to simulate the damage.

The targets of the protection were defined as “human lives”, “property” and “function of the city”.

The master plan is composed of twenty projects and seven of them are major projects in order to attain the objectives of “making a safer Caracas” and “acting effectively in emergency”. The major six projects are “seismic reinforcement of buildings”, “seismic reinforcement of bridges”, “construction of debris flow control structures”, “resettlement of people from risky area”, “early warning and evacuation for debris flow disaster prevention”, “an emergency command center” and “strengthening community activities”.

The total project cost of the master plan was estimated as around US$ 2.8 billion by the target year 2020.

The master plan was evaluated from the viewpoint of economic aspect, financial aspect, social aspect, management aspect and environmental aspect. The master plan was evaluated as workable through good coordination of institutions in national, regional and municipality levels as well as community participation.

13. 1. 4. Feasibility Study on Priority Projects

Among the master plan projects, two priority projects were selected for feasibility study. The priority projects were selected based on the selection criteria of “significance”, “urgency”, “immediate consequences”, “technical feasibility”, “economic feasibility”, “the result of initial environmental examination”, “prospect of financial sources”, “social necessity” and “requests of the counterparts”.

As a result, “seismic reinforcement of buildings” was selected as a priority project for earthquake disaster prevention. For sediment disaster prevention, “early warning and evacuation for debris flow disaster prevention” was selected as a priority project.

According to the detail study including the field test on barrio houses reinforcement, the effect of the project became clearer.

In the case of 1967 earthquake scenario, the number of heavily dmaged building will be reduced from 10,000 to 1,300 and the number of human casualties will be reduced from 4,900 to 400 by the implementation of the seismic reinforcement of buildings. In the case of 1812 earthquake scenario, the number of heavily damaged building will be reduced from 32,000 to 5,300 and the number of human casualties will be reduced from 20,000 to 2,300 by the project.

By the implementation of the project of early warning and evacuation for debris flow disaster prevention, lives of 19,000 people, who live in the area where debris flow of various scales may attack , can be saved.

These two projects were evaluated from the viewpoint of economic aspect, financial aspect, social aspect, management aspect and environmental aspect. The feasibility of the two projects were verified through the study and strategy for promotion of the projects were formulated.

13. 2 Recommendation

Through this study, the disaster of the Metropolitan District of Caracas has been analyzed from the viewpoint of technological aspect, environmental aspect, social aspect, institutional aspect, legal aspect and community aspect by the Study Team with the close cooperation with the Venezuelan Counterpart.

The proposed disaster prevention basic plan is the product of repeated discussion among the Study Team members and the Counterpart team members.

Through this Study and preparation of the plan, the Study Team found some recommendations to the Venezuelan side.

Recommendation to the Metropolitan District of Caracas

(1) The ADMC should start to implement the projects proposed in the this Study in order to reduce the vulnerability and increase the capacity to cope with natural disasters which will attack this area,

(2) The ADMC should , referring the Supporting Report S1 of this Study, formulate and authorize the Basic Plan for Disaster Prevention of the Metropolitan District of Caracas including the five municipalities in the area, those are Libertador, Chacao, Sucre, Baruta and El Hatillo,

(3) The ADMC should hold discussion with the national civil protection to authorize the proposed Basic Plan for Disaster Prevention of the Metropolitan District of Caracas,

(4) The ADMC should promote coordination among the national government agencies, the Metropolitan government, the municipal governments and the communities in order to attain integrated disaster prevention for the Metropolitan District of Caracas, and

(5) The ADMC should lead the municipal governments to formulate their own regional disaster prevention plan referring the Basic Plan for Disaster Prevention of the Metropolitan District of Caracas.

<u>Recommendation to the Ministry of Interior and Justice</u>

(1) The national basic policy and the national plan of disaster prevention is the essential base of Venezuela. The national plan for disaster prevention should be formulated as soon as possible,

(2) The National Civil Protection should authorize the Basic Disaster Prevention Plan of the Metropolitan District of Caracas proposed by the ADMC after discussion with Metropolitan Civil Protection,

(3) The National Civil Protection should construct the National Emergency Command Center in order to act effectively in national emergency,

(4) The Metropolitan District of Caracas is the capital city of the country and the most important city in Venezuela. The national government should implement the project for disaster prevention in Caracas in order to save the lives of the people, the value of the assets and the function of the city, and

(5) The national government should promote coordination among the national government agencies, the Metropolitan government, the municipal governments and the communities in order to attain integrated disaster prevention for the Metropolitan District of Caracas.

<u>Recommendation to the Ministry of Housing</u>

(1) The Ministry of Housing should establish a policy on seismic reinforcement of buildings in the country,

(2) The Ministry of Housing should establish an institutional framework to promote seismic reinforcement of buildings in the country,

(3) The Ministry of Housing should take initiative in barrio houses seismic reinforcement project, and

(4) The Ministry of Housing should promote the project of drainage improvement of barrio area in order to reduce the risk of landslide and steep slope failure in the area.

Recommendation to the Ministry of Infrastructure

(1) The Ministry of Infrastructure should implement the project of seismic bridge reinforcement after detail seismic evaluation of the structures proposed in this plan.

Recommendation to the Ministry of Environment and Natural Resources

(1) The Ministry of Environment and Natural Resources should implement the project of debris flow control structures to protect Caracas,

(2) The Ministry of Environment and Natural Resources should establish a national policy on early warning and evacuation for sediment disaster prevention, and

(3) The Ministry of Environment and Natural Resources should establish a branch office in Caracas so that it will perform detail observation and study of the local meteorological and hydrological phenomena in the area of Caracas and Vargas.

Recommendation to the FUNVISIS

(1) FUNVISIS should establish a system to transmit the information on seismic events in the area to the ADMC when a significant level of earthquake hit the area,

(2) FUNVISIS should create a system to train engineers for the skill of Rapid Visual Screening as a part of the project of seismic reinforcement buildings, and

(3) FUNVISIS should promote and implement the study on seismic reinforcement of barrio houses.

Recommendation to the Institute of Fluid Mechanics, UCV

(1) IMF should continue research on debris flow phenomenon in Caracas Area,

(2) IMF should continue research on critical rainfall amount for the purpose of early warning and evacuation from debris flow disasters, and

(3) IMF should promote the early warning and evacuation system for debris flow disaster prevention collaborating with the related agencies with rainfall data in the area.

Recommendation to the Municipal Governments

(1) Each municipal government should prepare their own regional plan for disaster prevention referring to the Basic Plan for Disaster Prevention of the Metropolitan District of Caracas,

(2) Each municipality should coordinate and promote community organizations and community activities for the realization of disaster prevention policies in each municipalities, and

(3) Each municipal government should promote seismic reinforcement of buildings through their engineers' office.

Recommendation for citizens

(1) Every citizen of the Metropolitan District of Caracas should prepare for natural disasters in order to safeguard their lives and properties,

(2) Every citizen of the Metropolitan District of Caracas should formulate a community organization, where a disaster prevention is included as one of its purpose, and

(3) The community organization should coordinate with the municipality government in order to make their activity effective for disaster prevention.

APPENDIXES

Minutes of Meetings
On
Inception Report
For
The Study
On
The Disaster Prevention Basic Plan
In
The Metropolitan District of Caracas
In
The Bolivarian Republic of Venezuela

Agreed upon between
The Metropolitan District of Caracas
And
The Study Team of Japan International Cooperation Agency

Caracas, May 26, 2003

On behalf of the Government of the Metropolitan district of Caracas
Dr. Ramiro Molina
Secretary of Finance
Metropolitan District of Caracas

Mr. Mitsuo Miura
Leader
Study Team of Japan International Cooperation Agency

Witness
Mr. Yasuo Nakano
Chairman of the Advisory Committee
Japan International Cooperation Agency

The Study Team submitted the Inception Report of the Study (hereinafter referred to as "the Report") and explained the content of the Report to the Venezuelan side. The Venezuelan side accepted the Report in principle after discussion on the following items:

(1) Study Area

Study Area for Earthquake Disaster Prevention

The Study Area for earthquake disaster prevention covers the part of the Metropolitan District of Caracas as follows; El Libertador, Sucre and Chacao municipalities as shown in Annex1 in the Scope of Work signed between the Venezuelan side and the JICA Preparatory Study Team on March 21st, 2002 (hereinafter referred to as "the S/W").

Study Area for Sediment Disaster Prevention

The Study Area for sediment disaster prevention (composed of debris flow, landslide and steep slope failure) covers the area as shown in Annex 2 in the S/W. However, in terms of aerial photo analysis and topographic map analysis of landslides and steep slope failures, the Study covers the whole three municipalities of El Libertador, Sucre and Chacao.

(2) Map Scale

The scale of the hazard maps and the risk maps, which are the product of the Study in the Master Plan, is 1/25,000. However, the Study Team will utilize maps with more precise scales in the course of the Study when they are available.

(3) Existing Studies and Information

In order to avoid any duplication of the work, the Study Team will effectively make use of existing studies and information. The Venezuelan side will provide the Study Team with the information as much as possible under the three conditions as follows;

a. The Study Team is allowed to utilize it only for the purpose of the Study.
b. The names of the Venezuelan organizations which provided the information shall be mentioned in the Study reports.
c. When any of the table or the figures provided by the Venezuelan side is cited in the Study reports, the sources of information shall be mentioned with them.

(4) GIS Database Format

The Study Team will design the GIS database format for the creation of both of the hazard and the risk maps considering the existing GIS database format used in Venezuela.

When the Venezuelan side does not have its own standard or format, the Study Team will propose the format or standard to the Venezuelan side.

(5) Hazard Maps and Risk Maps

When the Study Team publicizes hazard and risk maps, consultation will be made with the Venezuelan side beforehand.

(6) Vulnerability Study

The Study pays attention to vulnerability from the viewpoint of social as well as physical aspect. The Study Team carefully takes social aspects into consideration for the effectiveness of the disaster prevention plan.

(7) Reports

The Study Team shall prepare and submit the following reports in English and Spanish to the Government of Venezuela.

a. Inception Report

Forty (40) copies in English and forty (40) copies in Spanish at the commencement of the Study in Venezuela.

b. Progress Report (1)

Forty (40) copies in English and forty (40) copies in Spanish at the end of the first work in Venezuela.

c. Progress Report (2)

Forty (40) copies in English and forty (40) copies in Spanish at the end of the second work in Venezuela.

d. Interim Report

Forty (40) copies in English and forty (40) copies in Spanish at the commencement of the forth work in Venezuela.

e. Draft Final Report

Forty (40) copies in English and forty (40) copies in Spanish at the end of the fifth work in Venezuela.

f. Final Report

Forty (40) copies in English and forty (40) copies in Spanish within one (1) month after JICA's receipt of the comments on the Draft Final Report.

Both the Venezuelan side and the Study Team agreed that English Version of the reports will prevail, when any discrepancy is found in the interpretation.

PARTICIPANT LIST

09-May-03

Name	Institution	Position	Remarks
Venezuelan Side			
Dr.Rosario Diaz Vilagut	Mayor's Office, International Cooperation	Director	Coordinator General
Mr. Jorge Molina	Firefighter's Department	Mayor, Gerente de Plade	Technical Committee Coordinator
Mr. Jesús Martinez	Mayor's Office, International Cooperation		
Ms. Ana Aguilar	Mayor's Office, International Cooperation		
Mr. Felipe Aranguren	Civil Protection		
Ms. Ketty Mendes	Simon Bolivar Geographical Institute of Venezuela (IGVSB)		
Mr. Brau Clemente	Mayor's Office	Director of Service	
Mr. Fernando Corvo	Mayor's Office	Director of Environment	Technical Committee on Env.
Ms. Alicia Moreau	Simon Bolivar Geographical Institute of Venezuela (IGVSB)	Secretary General	Technical Committee on Risk Map
Japanese Side			
Mr. Mitsuo Miura	JICA Study team	Project Manager/ Urban Disaster Prevention Planner	
Mr. Yoshitaka Yamazaki	JICA Study team	Earthquake Disaster Prevention Engineer/ Earthquake Engineer	
Mr. Kazunori Inoue	JICA Study team	Debris Flow Disaster Prevention Specialist	
Mr. Fumihiko Yokoo	JICA Study team	Topography/ Geology/ Aerial Photo Analysis/ Survey Specialist (1)	
Mr. Bishwa Pandey	JICA Study team	GIS System Design/ Data Base Expert	
Mr. Takeshi Hara	JICA Study team	Topography/ Geology/ Aerial Photo Analysis/ Survey Specialist (2)	
Ms.Hitomi Tomizawa	JICA Study team	Coordinator/ Education/ Peoples Organization Expert (2)	
Mr. Nobuhiko Yao	MIJ/DMC	JICA Expert	

PARTICIPANT LIST

12-May-03

Name	Institution	Position	Remarks
Venezuelan Side			
Dr. Rosario Diaz Vilagut	Mayor's Office, International Cooperation	Director	Coordinator General
Mr. Jorge Molina	Firefighter's Department	Mayor	Technical Committee Coordinator
Prof. Dr. Reinaldo Garcia	IMF-UCV	Professor	
Ms. Ketty Mendes	Simon Bolivar Geographical Institute of Venezuela (IGVSB)		
Mr. Fernando Corvo	Mayor's Office	Director of Environment	Technical Committee on Env.
Dr. Virginia Jiménez	Simon Bolivar Geographical Institute of Venezuela (IGVSB)	Chief of Risk Map Project	
Mr. Michael Schmitz	FUNVISIS	Researcher of Geophysics	
Japanese Side			
Mr. Mitsuo Miura	JICA Study team	Project Manager/ Urban Disaster Prevention Planner	
Mr. Yoshitaka Yamazaki	JICA Study team	Earthquake Disaster Prevention Engineer/ Earthquake Engineer	
Mr. Kazunori Inoue	JICA Study team	Debris Flow Disaster Prevention Specialist	
Mr. Fumihiko Yokoo	JICA Study team	Topography/ Geology/ Aerial Photo Analysis/ Survey Specialist (1)	
Mr. Bishwa Pandey	JICA Study team	GIS System Design/ Data Base Expert	
Mr. Takeshi Hara	JICA Study team	Topography/ Geology/ Aerial Photo Analysis/ Survey Specialist (2)	
Ms. Paulina Chaverri	JICA Study team	Education/ Peoples Organization Expert (1)	
Ms. Hitomi Tomizawa	JICA Study team	Coordinator/ Education/ Peoples Organization Expert (2)	
Mr. Nobuhiko Yao	MIJ/DMC	JICA Expert	

PARTICIPANT LIST

13-May-03

Name	Institution	Position	Remarks
Venezuelan Side			
Dr.Rosario Diaz Vilagut	Mayor's Office, International Cooperation	Director	Coordinator General
Mr. Jorge Molina	Firefighter's Department	Mayor	Technical Committee Coordinator
Mr. William Martinez			Technical Committee on EW-E
Ms.Beatriz Barrios	MPD-DGCIT	Director	
Mr. Faiber Castillo De Armas	Civil Protection, Libertador Municipality		
Mr. Carlos A. González	Aviation (Meteorology)		
Mr.St1 (AV) Marco Durán	Aviation (Meteorology)		
Mr.Leslie Ibarra	Municipal Services, Libertador Municipality		
Mr. Antonio Rivero	Civil Protection		
Mr. Nubis Báez	MPD-DGCIT		
Mr. Jose Luis Torres	MARN-DGPOA		
Mr. Gustavo Rodríguez	INPARQUES-DGSPN		
Gisele Croce	MARN-DGPOA		
Mr. Begoña Goicoechea	Planification Secretary		
Mr. Mauro Aponte	Civil Protection, Chacao Municipality		
Mr. Rafael Rodríguez	IMAPSAS		
Mr. Freddy Flores	FII-CPDI		
Dr. Virginia Jiménez	Simon Bolivar Geographical Institute of Venezuela (IGVSB)	Chief of Risk Map Project	

Mr. Brau Clemente	Infrastructure	Director of Service
Mr. Roberto Herrera	Consultant	
Mr. Luis Belmonte	Consultant	
Ms. Isabel Frontado	Metropolitan Town Council	

Japanese Side

Mr.Miura Mitso	JICA Study team	Project Manager/ Urban Disaster Prevention Planner
Mr. Yoshitaka Yamazaki	JICA Study team	Earthquake Disaster Prevention Engineer/ Earthquake Engineer
Mr.Kazunori Inoue	JICA Study team	Debris Flow Disaster Prevention Specialist
Mr.Bishwa Pandey	JICA Study team	GIS System Design/ Data Base Expert
Ms.Paulina Chaverri	JICA Study team	Education/ Peoples Organization Expert (1)
Ms.Hitomi Tomizawa	JICA Study team	Coordinator/ Education/ Peoples Organization Expert (2)
Mr. Akihiro Tsukamoto	MPD-JICA	JICA Expert
Mr. Nobuhiko Yao	MIJ/DMC	JICA Expert

PARTICIPANT LIST

16-May-03

Name	Institution	Position	Remarks
Venezuelan Side			
Mr. Jorge Molina	Firefighter's Department	Mayor	Technical Committee Coordinator
Mr. Fernando Corvo	Mayor's Office	Director of Environment	Technical Committee on Env.
Mr. Angel Herrera	Firefighter's Department	Assistant	
Mr. Brau Clemente	Infrastructure	Director of Service	
Mr. Jose Fra Rey	Civil Protection		
Japanese Side			
Mr. Mitsuo Miura	JICA Study team	Project Manager/ Urban Disaster Prevention Planner	
Mr. Yoshitaka Yamazaki	JICA Study team	Earthquake Disaster Prevention Engineer/ Earthquake Engineer	
Mr. Kazunori Inoue	JICA Study team	Debris Flow Disaster Prevention Specialist	
Mr. Fumihiko Yokoo	JICA Study team	Topography/ Geology/ Aerial Photo Analysis/ Survey Specialist (1)	
Mr. Bishwa Pandey	JICA Study team	GIS System Design/ Data Base Expert	
Mr. Takeshi Hara	JICA Study team	Topography/ Geology/ Aerial Photo Analysis/ Survey Specialist (2)	
Ms. Paulina Chaverri	JICA Study team	Education/ Peoples Organization Expert (1)	
Ms. Hitomi Tomizawa	JICA Study team	Coordinator/ Education/ Peoples Organization Expert (2)	
Mr. Nobuhiko Yao	MIJ/DMC	JICA Expert	

Minutes of Meetings
On
Progress Report (1)
For
The Study
On
The Disaster Prevention Basic Plan
In
The Metropolitan District of Caracas
In
The Bolivarian Republic of Venezuela

Agreed upon between
The Metropolitan District of Caracas
And
The Study Team of Japan International Cooperation Agency

Caracas, July 25, 2003

On behalf of the Government of the Metropolitan District of Caracas
Lt. Col. (B) William Martínez
General Director
Metropolitan Civil Protection
Metropolitan District of Caracas

Mr. Mitsuo Miura
Leader
Study Team of Japan International Cooperation Agency

(1) General

The Study Team submitted the draft of the Progress Report (1) of the Study (hereinafter referred as "Report") to the Venezuelan side. The Study Team and Venezuelan side worked together to improve the draft and thereafter, the revised version of the Report was prepared. The Venezuelan side accepted the content of the Report.

(2) Revision of the contents of the Report

The Study Team and the Venezuelan side agreed that the content of the Report will be explained to the JICA Advisory Committee in Japan and according to the result of the discussion in the JICA Advisory Committee, the content of the Report may be revised.

(3) Number of report copies

The Venezuelan side requested the change of the number of report copies as follows and the Study Team agreed to convey the request to JICA.

a. Progress Report (1)
   Five (5) copies in English and seventy five (75) copies in Spanish at the end of the first work period in Venezuela.

b. Progress Report (2)
   Five (5) copies in English and seventy five (75) copies in Spanish at the end of the second work period in Venezuela.

c. Interim Report
   Five (5) copies in English and seventy five (75) copies in Spanish at the commencement of the fourth work period in Venezuela.

d. Draft Final Report
   Five (5) copies in English and seventy five (75) copies in Spanish at the end of the fifth work period in Venezuela.

e. Final Report
   Five (5) copies in English and seventy five (75) copies in Spanish within about

two (2) months after JICA's receipt of the comments on the Draft Final Report.

(4) Role and Responsibility of Each Committee on the Venezuelan Side

The Study Team and the Venezuelan side held meetings to clarify the roles and the responsibilities of the Counterpart Team, the Technical Committee and the Steering Committee on the Venezuelan side in the Study.

The Venezuelan side proposed the member of the Counterpart Team, and the member of the Technical Committee and the Steering Committee as attached in Table 1 and Figure 1, respectively.

The clarification of role and responsibility is as follows:

Counterpart Team (Table 1)

The Counterpart Team will work with the Study Team on the Study. Each Counterpart Team member will coordinate with the relevant Study Team member on data collection, analysis, discussion and plan preparation.

The Study Team members will transfer technology to Counterpart Team members through daily work in the Study. The Study Team and the Counterpart Team will hold periodic formal meetings on the first and the third Tuesday every month during the Study in Venezuela. The Study Team and the Counterpart Team will work together and organize Workshops and Technology Transfer Seminars during the Study.

Technical Committee

The Technical Committee of the Study will hold technical discussions with the Study Team during each phase of the Study when necessary. The Technical Committee of the Study is responsible to report the progress of the Study to the Steering Committee and to get advice from the Steering Committee on the Study. The Technical Committee is also responsible to convey the advice of the Steering Committee to the Study Team.

The Study Team and the Counterpart team will invite the Technical Committee Chairpersons for Workshops and Technology Transfer Seminars during the Study.

Steering Committee

The Steering Committee of the Study can be called on by the Technical Committee Coordinator when the Technical Committee needs to report the progress of the Study and to get advice from the Steering Committee.

The Study Team and the Counterpart Team will invite the Steering Committee members for Workshops and Technology Transfer Seminars during the Study.

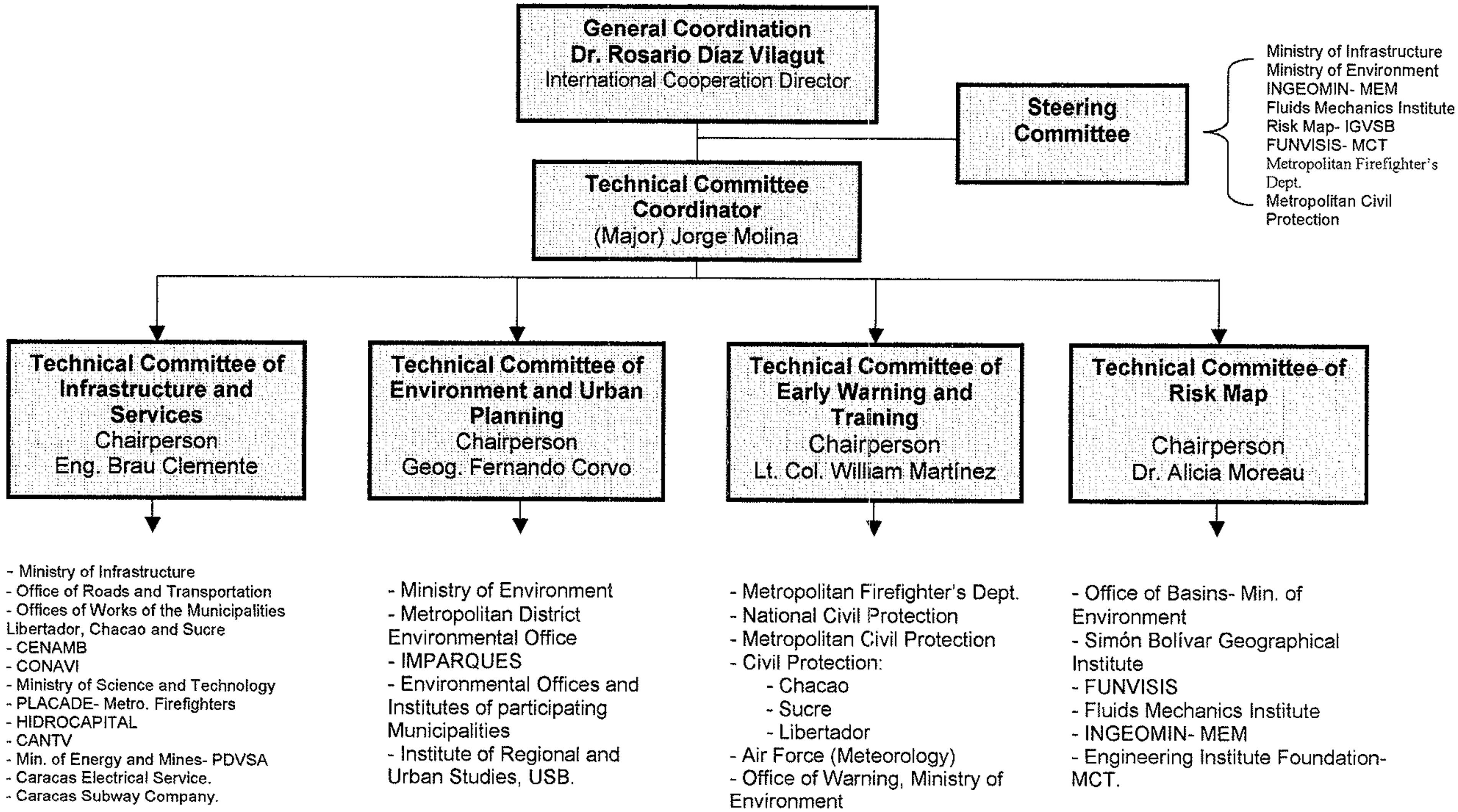
The Study Team agreed to covey the proposal to JICA.

Table 1 Counterpart Member List of Study on Disaster Prevention Basic Plan in the Metropolitan District of Caracas

Nº	NATIONAL MAIN COUNTERPART	INSTITUTION	JICA STUDY TEAM	AREA
1	Jorge Molina	Metropolitan Firefighters	M. Miura	Project Manager / Planner on urban disaster prevention
2	José Frá	Metropolitan Civil Protection Sec. Plan.and Urban.Ord., ADMC	T. Kudo	Project Joint Manager / Urban planner / socio-economical analyst / project assessor
3	Michael Schmitz	FUNVISIS	Y. Yamazaki	Eng. of earthquake disaster prevention / Earthquake engineer
4	Jesús Guerrero	INGEOMIN	I. Tanaka	Geotechnical Engineer
5	Jorge González	FUNVISIS	H. Kagawa	Seismic structure designer (1)
6	Mariana Lotuffo	FUNVISIS	K. Shono	Seismic structure designer (2)
7	Brau Clemente	Infrastructure, ADMC	T. Ueno	Infrastructure damage prevention designer
8	Luz Chacón	Cadastre - Sucre	K. Ito	Lifelines Expert / infrastructure
9	Reinaldo García Marielba Guillén	Fluids Mechanics Inst. Hydrology Office - MARN	K. Inoue	Specialist in debris flow disaster prevention
10	Marylin Manchego Luis Melo	INGEOMIN FUNVISIS	F. Yokoo	Specialist in topographical / geological studies / aerial photographical analysis
11	Annie Castañeda	Metropolitan Civil Protection, ADMC	T. Hara	Specialist in topographical / geological studies / aerial photographical analysis
12	José Pereira Giannina Paredes	Air Force-Meteorology Fluids Mechanics Inst.	Y. Uchikura	Specialist in hydrology / hydraulics / debris flow analysis / floods
13	Karen Jiménez	Infrastructure, ADMC	T. Kasahara	Expert in facilities design / cost estimation
14	Virginia Jiménez Giselle Croce Aldo Zamora	Risk Map-IGVSB MARN Metropolitan Firefighters	Bishwa Raj Pandey	Expert in GIS system design / database
15	Evelys España	National Civil Protection	Bruce P. Baird	Expert in disaster prevention administration / legislation
16	Clementina Massiani Fidel Frontén	Metrop. Civil Protection Metropolitan Firefighters	Paulina Chaverri	Expert in education / people organization (1)
17	Felipe Aranguren / Gerardo Rojas / Mauro Aponte	Metrop. Civil Protection Metropolitan firefighters Chacao Civil Protection	José Carlos Yamanija	Expert in rescue operations / health operations
18	Fernando Corvo	Environment Office, ADMC	Y. Muramatsu	Expert in environmental evaluation
19	Marianela Gómez	National Civil Protection	H. Tomizawa	Coordinator / expert in education / people organization (2)

Note:

ADMC: Alcardia (City) of Metropolitan District of Caracas
FUNVISIS: Foundation of Earthquake Research of Venezuela
MARN: Ministry of Environment and Natural Resources
INGEOMIN: Institute of Geology and Mines



Figurre 1 Member of Technical Committee and Steering Committee

Minutes of Meetings
On
Progress Report (2)
For
The Study
On
The Disaster Prevention Basic Plan
In
The Metropolitan District of Caracas
In
The Bolivarian Republic of Venezuela

Agreed upon between
The Metropolitan District of Caracas
And
The Study Team of Japan International Cooperation Agency

Caracas, February 13, 2004

On behalf of the Government of the Metropolitan District of Caracas
Dr. Ramiro Molina
Secretary of Finance
Metropolitan District of Caracas

Mr. Mitsuo Miura
Leader
Study Team of Japan International Cooperation Agency

The Study Team submitted the draft of the Progress Report (2) of the Study (hereinafter referred as "Report") to the Venezuelan side. The Study Team and Venezuelan side worked together to improve the draft and thereafter, the revised version of the Report was prepared. The Venezuelan side accepted the content of the Report.

Minutes of Meetings
On
Interim Report
For
The Study
On
The Disaster Prevention Basic Plan
In
The Metropolitan District of Caracas
In
The Bolivarian Republic of Venezuela

Agreed upon between
The Government of the Metropolitan District of Caracas
And
The Study Team of Japan International Cooperation Agency

Caracas, September 23, 2004

On behalf of the Government of the Metropolitan District of Caracas
Dr. Ramiro Molina
Secretary of Finance

三浦光夫
Mr. Mitsuo Miura
Leader
Study Team of Japan International Cooperation Agency
Agency

The Study Team submitted the Interim Report of the Study (hereinafter referred as "Report") to the Venezuelan side. The Venezuelan side accepted the contents of the Report including "draft master plan" and "selection of priority project", and submitted their comments on the Interim Report.

The Study Team agreed to review the comments and they will be reflected in the Draft Final Report, which will be prepared and submitted from the Study Team to the Venezuelan side in November 2004.

Minutes of Meetings
On
Draft Final Report
For
The Study
On
The Disaster Prevention Basic Plan
In
The Metropolitan District of Caracas
In
The Bolivarian Republic of Venezuela

Agreed upon between
The Government of the Metropolitan District of Caracas
And
The Study Team of Japan International Cooperation Agency

Caracas, November 12, 2004

REPUBLICA BOLIVARIANA DE VENEZUELA
SECRETARIA DE FINANZAS

On behalf of the Government of the Metropolitan District of Caracas
Dr. Ramiro Molina
Secretary of Metropolitan Finance

三浦光夫

Mr. Mitsuo Miura
Leader
Study Team of Japan International Cooperation Agency

1. Introduction:

JICA submitted the Draft Final Report (hereinafter referred to as DF/R) for the Study on "the Disaster Prevention Basic Plan in the Metropolitan District of Caracas" that had been conducted in accordance with the Scope of Work agreed and signed on March 21, 2002.

The discussion was made at the time of DF/R submission, and concluded the following main points. The list of the attendants is attached as Appendix.

2. Draft Final Report:

1) Acceptance of DFR:

The Venezuelan side has in principle accepted the DF/R that JICA study team submitted.

2) Comments on DFR

Japanese side requested to make the comments on DF/R, if any, and send them to the Embassy of Japan no later than December 12, 2004.

Venezuelan side requested to the due date January 20, 2005 instead of December 12, 2004 because of the change of the administration of ADMC.

Japanese side replied to convey the request of the Venezuelan side to JICA Tokyo.

3. Explanation of Final Report

Venezuelan side requested the Study Team to make presentation of Final Report to the new administration of ADMC when it is delivered next year.

Japanese side replied to convey the request of the Venezuelan side to JICA Tokyo.

Appendix:
List of attendants

Name	Organization
Venezuelan Side	
José Frá	Metropolitan Civil Protection / ADMC
Luz Chacón	Cadastre – Sucre Municipality
Marylin Manchego	INGEOMIN
Annie Castañeda	Metropolitan Civil Protection/ ADMC
Virginia Jiménez	National Cartographic Institute
Giselle Croce	MARN/ Planning Department
Rafael Hernández	MARN / Hydrographic Department
Aldo Zamora	Metropolitan Firefighters / AMDC
Evelys España	National Civil Protection
Clementina Massiani	Metropolitan Civil Protection/ ADMC
Mauro Aponte	Civil Protection Insitute / Chacao Municipality
Gila de Falcón	Environmental Management / ADMC
Marianela Gómez	National Civil Protection
Jesús Delgado	UCV / CENAMB
Francois Courtel	Mechanics Fluid Institute- UCV
Begoña, Goicoechea	Urban Planing and Environmental Management / ADMC
Erick Yonusg	Metropolitan Civil Protection/ ADMC
Antonio Aguilar	Metropolitan Civil Protection/ ADMC
Oscar Perozo	Metropolitan Civil Protection/ ADMC
Brau Clemente	Infrastructure Secretariat/ ADMC
Japanese Side	
Haruo Nishimoto	JICA Advisory Committee, Chairperson
Izuru Okawa	JICA Advisory Committee
Nozomu Yamashita	JICA Task Manager of the Study
Masaichi Nagata	JICA Expert
Mitsuo Miura	JICA Study Team, Leader
Toshiaki Kudo	JICA Study Team
Yoshitaka Yamazaki	JICA Study Team
Kazumori Inoue	JICA Study Team
Hitomi Tomizawa	JICA Study Team
Alejandro Linayo	JICA Study Team

Minutes of Meetings
On
Draft Final Report Comment
For
The Study
On
The Disaster Prevention Basic Plan
In
The Metropolitan District of Caracas
In
The Bolivarian Republic of Venezuela

Agreed upon between
The Metropolitan District of Caracas
And
The Study Team of Japan International Cooperation Agency

Caracas, March 2, 2005

On behalf of the Government of the Metropolitan District of Caracas
Mr. Héctor Sánchez
Director of International Cooperation
Metropolitan District of Caracas

Mr. Mitsuo Miura
Leader
Study Team of Japan International Cooperation Agency

On behalf of the Government of the Metropolitan District of Caracas
Mr. Cesar José Verde Martínez
General Director of Civil Protection
Metropolitan District of Caracas

On behalf of the Government of the Metropolitan District of Caracas
Mr. William Martínez Quintana
Second Commander of Fire Fighters' Department
Metropolitan District of Caracas

The Venezuelan side submitted their comments on the Draft Final Report of the Study on January 20th of 2005. Discussions were made between the JICA Study Team and the Venezuelan Counterpart Team on the comments on February 28th and March 1st of 2005. (Refer to the attendant list attached)

Based upon the discussions on February 28th and March 1st, JICA Study Team will revise the Draft Final Report and prepare the Final Report of the Study to submit it to JICA by March 25th of 2005. JICA will deliver the Final Report of the Study through the Embassy of Japan to the Venezuelan side by April 2005.

The Venezuelan after obtaining the Final Report of the Study will present the plan to the competent authorities for its approval and implementation.

Attendance List - Counterpart Meeting
Date: February 28, 2005

Last name	Name	Institution	Position
Venezuelan Counterpart			
Aguilar	Dodanin	Metropolitan Civil Protection, ADMC	Researcher
Aponte	Mauro	Chacao Municipality, Civil Protection Institute	Operation Manager
Aranguren	Felipe	Metropolitan Firefighters, ADMC	DIPRECON Assistant
Courtel	Francois	UCV / Mechanics Fluid Institute	Researcher
Croce	Gisele	MARN / POA	Planner IV
Escalante	Marina	Libertador Municipality	Chief Engineer
Fra Rey	José	Metropolitan Civil Protection , ADMC	Technical Chief
Fronten	Fidel	Metropolitan Firefighters, ADMC	Division Chief
Guillen	Marielba	MARN	Geologist
González	Maria Alejandra	Sucre Municipality / Cadastre	Division Chief
González	Ricardo	National Civil Protection	Legal Asesor
Manchego	Marylin	INGEOMIN	Geographist
Massiani	Clementina	Metropolitan Civil Protection / ADMC	Training Coordinator
Molina	Jorge	Metropolitan Firefighters, ADMC	Chief of DIPRECON
Nagata	Masaichi	Metropolitan Civil Protection, ADMC	Expert
Paredes	Giamnina	UCV / Mechanics Fluid Institute	Researcher
Romero	Tomás	Metropolitan Civil Protection, ADMC	Sub-Director
Rosales	Eulogio	Metropolitan Civil Protection, ADMC	Assistant
Santos	Rafael	National Civil Protection	Training Coordinator
Schmitz	Michael	Funvisis	Research
Seno	Ryuji	JICA	Expert
Torres	Marianela	Metropolitan Civil Protection , ADMC	Technical Coordinator of Education
Tugues	Inés	Libertador Municipality, ODEU	Chief of Planning Department
Vásquez	Ludmila	Libertador Municipality , ODEU	Planner
Zamora	Aldo	Metropolitan Firefighter's /ADMC	GIS Chief

Attendance List - Counterpart Meeting
Date: February 28, 2005

Last name	Name	Institution	Position
Japanese Side			
Miura	Mitsuo	JICA Study Team	Expert
Pandey	Bishwa	JICA Study Team	Expert
Toshiaki	Kudo	JICA Study Team	Expert
Uchikura	Yoshihiko	JICA Study Team	Expert
Yamazaki	Yoshitaka	JICA Study Team	Expert

Attendance List - Counterpart Meeting
Date: March 1st, 2005

Last name	Name	Institution	Position
Venezuelan Counterpart			
Aponte	Mauro	Chacao Municipality, Civil Protection Institute	Operation Manager
Aranguren	Felipe	Metropolitan Firefighters, ADMC	DIPRECON Assistant
Croce	Gisele	MARN / POA	Planner IV
D´Ascenso	Vitorio	Chacao Municipality, Civil Protection Institute	Training Department
Díaz	Luis E.	National Civil Protection	National Coordinator
Escalante	Marina	Libertador Municipality	Chief Engineer
Fra Rey	José	Metropolitan Civil Protection , ADMC	Technical Chief
Frontén	Fidel	Metropolitan Firefighters, ADMC	Division Chief
Guillén	Marielba	MARN	Geologist
Gómez	Marianela	National Civil Direction	Chief of Education
González	Maria Alejandra	Sucre Municipality / Cadastre	Division Chief
González	Ricardo	National Civil Protection	Legal Assessor
Massiani	Clementina	Metropolitan Civil Protection / ADMC	Training Coordinator
Martínez	Jesús	ADMC / International Cooperation	Unit Chief
Nagata	Masaichi	Metropolitan Civil Protection, ADMC	Expert
Olivares	Marina	Libertador Municipality	Chief Engineer
Paredes	Giamnina	UCV / Mechanics Fluid Institute	Research
Rojas	Gerardo	ADMC/ Firefighters	Chief Department
Segura	Senel	ADMC	Inspector
Torres	Marianela	Metropolitan Civil Protection , ADMC	Technical Coordinator of Education
Tugues	Inés	Libertador Municipality, ODEU	Chief of Planning Department
Vásquez	Omar	Nacional Civil Protection	Risk Engineer
Zamora	Aldo	Metropolitan Firefighter's /ADMC	GIS Chief
Japanese Side			
Miura	Mitsuo	JICA Study Team	Expert
Pandey	Bishwa	JICA Study Team	Expert
Toshiaki	Kudo	JICA Study Team	Expert
Uchikura	Yoshihiko	JICA Study Team	Expert
Yamazaki	Yoshitaka	JICA Study Team	Expert