2.7 Distribution of Building and Infrastructure/Lifeline

2.7.1 Distribution of Buildings

1) Buildings

(1) Building distribution

The building data used for the Study is from the cadastral data of both Bogotá City and the eight municipalities in Cundinamarca. Every item of information is collected separately because it is managed by different organizations. Cadastral data is collected for the property tax collection purposes and it is the most reliable data for building classification.

In the Study the building data have been classified based on the structure and number of stories of the buildings. According to the cadastral classifications, the buildings can be classified into four categorizes: wood, prefabricated, masonry and RC frame structures. The data also provide the number of stories of buildings.

Table 2.7.1. shows the distribution of buildings in the Study Area.

Table 2.7.1 Number of Buildings in the Study Area

Locality/ Municipality	Wood, Prefabricated	Masonry			RC Frame Building		Total Building for Analysis	Unknown	Total
	All Estrato	Estrato 1, 2	Estrato 3, 4	Estrato 5, 6	Upto 3 Stories	More than 3 stories			
Usaquén	1,722	7,595	18,077	7,817	1,904	2,936	40,051	4,615	44,666
Chapinero	921	2,708	3,492	3,748	2,433	2,806	16,108	2,937	19,045
Santa Fe	1,671	9,953	2,027	0	1,598	601	15,850	2,648	18,498
San Cristobal	2,912	44,371	6,231	0	470	172	54,156	1,094	55,250
Usme	4,026	31,081	194	0	133	8	35,442	11,942	47,384
Tunjuelito	427	12,708	4,556	0	621	97	18,409	2,003	20,412
Bosa	2,449	43,850	2,794	0	699	62	49,854	7,038	56,892
Kennedy	3,310	40,154	43,024	0	4,342	1,220	92,050	6,188	98,238
Fontibón	893	3,824	19,904	0	1,633	489	26,743	2,122	28,865
Engativá	1,689	15,652	61,130	0	3,531	1,201	83,203	5,986	89,189
Suba	4,334	41,262	27,367	7,782	3,097	1,744	85,586	3,409	88,995
Barrios Unidos	553	81	24,063	476	3,194	710	29,077	1,683	30,760
Teusaquillo	186	128	12,972	364	1,699	1,746	17,095	2,628	19,723
Mártires	488	1,041	10,758	0	2,667	678	15,632	934	16,566
Antonio Nariño	257	768	11,100	0	1,194	358	13,677	600	14,277
Puente Aranda	539	607	32,497	13	3,880	546	38,082	3,538	41,620
La Candelaria	507	1,540	369	0	338	110	2,864	986	3,850
Rafael Uribe	2,012	26,600	21,928	0	939	200	51,679	1,632	53,311
Ciudad Bolívar	6,996	57,066	1,685	15	634	109	66,505	14,384	80,889
Subtotal	***35,892***	***340,989***	***304,168***	***20,215***	***35,006***	***15,793***	***752,063***	***76,367***	***828,430***
Chia	2,388	2,542	12,527	323	315	16	18,111	0	***18,111***
Cota	988	2,086	1,355	20	165	17	4,631	0	***4,631***
Facatativa	1,864	3,663	9,038	35	185	32	14,817	0	***14,817***
Funza	1,239	2,293	5,453	50	195	16	9,246	0	***9,246***
La Calera	530	546	3,056	613	47	8	4,800	0	***4,800***
Madrid	1,361	3,749	4,356	438	333	12	10,249	0	***10,249***
Mosquera	897	2,921	3,529	166	262	2	7,777	0	***7,777***
Soacha	3,929	18,682	33,946	588	483	302	57,930	0	***57,930***
Subtotal	***13,196***	***36,482***	***73,260***	***2,233***	***1,985***	***405***	***127,561***	0	***127,561***
Total	**49,088**	**377,471**	**377,428**	**22,448**	**36,991**	**16,198**	**879,624**	**76,367**	**955,991**

The total number of buildings in the Study Area is 955,991 based on the cadastral data. There are 828,400 buildings in Bogotá City and 127,600 buildings in Cundinamarca's eight municipalities. Masonry structure buildings share 81.3% of the total buildings, while that of RC frame buildings is only 5.6%. The Study Team found that the "unknown" structure buildings are distributed in the southern part of Bogotá City. However, it was impossible to identify their structure type even though a field survey was conducted. . The discussion with the cadastral office in Bogotá City concluded that "unknown" structure buildings cannot be classified by cadastral classification. "Unknown" structure includes weak structure buildings, such as temporary housing, illegal housing etc. Therefore, "unknown" structure buildings are not included in the damage analysis.

For the distribution of housing stock, huge housing accumulation is found in Estrato 1 to 4, which account for 79% of the buildings in the Study Area. The most building accumulation is found in Kennedy of more than 98 thousand, or 10.3%, of total buildings, followed by Engativa, Suba and Ciudad Bolivar. Of the eight municipalities in Cundinamarca, Soacha has more than 57,000 buildings followed by Chia of 18,111.

(2) Housing unit distribution

The cadastral and IGAC data provide housing unit data. Housing unit is defined as a household unit and used only for residential purposes. The number of housing units in the Study Area is more than 1.3 million. The number of housing units in Bogotá City is 1.2 million and 129,000 in the eight municipalities. The distribution of residential buildings shows that the three localities of Suba, Engativa and Kennedy account for more than 10% of housing units. Of the eight municipalities, Soacha has more than 5% of housing units.

The summary of the housing unit data is shown in Table 2.7.2.

Table 2.7.2 Summary of Housing Units

Locality/ Municipality	Number of Building	Total Housing Unit	Distribution (%)
Usaquen	44,666	118,697	8.9%
Chapinero	19,045	51,142	3.8%
Santa Fe	18,498	24,234	1.8%
San Cristobal	55,250	60,336	4.5%
Usme	47,384	43,997	3.3%
Tunjuelito	20,412	27,566	2.1%
Bosa	56,892	59,945	4.5%
Kennedy	98,238	143,784	10.8%
Fontibon	28,865	48,792	3.7%
Engativa	89,189	143,973	10.8%
Suba	88,995	165,348	12.4%
Barrios Unidos	30,760	36,565	2.8%
Teusaquillo	19,723	41,852	3.1%
Los Martires	16,566	15,999	1.2%
Antonio Aranda	14,277	16,567	1.2%
Puente Aranda	41,620	48,324	3.6%
Candelaria	3,850	5,615	0.4%
Rafael Uribe	53,311	59,993	4.5%
Ciudad Bolibar	80,889	87,279	6.6%
Sub-Toatal	***828,430***	***1,200,008***	90.3%
Chia	18,111	15,228	1.1%
Cota	4,631	3,145	0.2%
Facatativa	14,817	14,182	1.1%
Funza	9,246	8,027	0.6%
La Calera	4,800	4,984	0.4%
Madrid	10,249	7,259	0.5%
Mosquera	7,777	5,651	0.4%
Soacha	57,930	70,208	5.3%
Sub-Toatal	***127,561***	***128,684***	9.7%
Total	**955,991**	**1,328,692**	100.0%

Source: JICA Study Team, from Cadastral and IGAC data

2.7.2 Distribution of Infrastructure

1) Infrastructure Conditions

(1) General

This Study includes infrastructures and lifeline facilities as exist in the Study Area. The infrastructure is classified into roads, bridges, airports and railways. Electricity supply facility, water supply facility, gas supply facility and telecommunication facility are included in the lifeline facility.

(2) Road facility conditions

A. Existing road network in the study area

a) Administrative institution of roads and bridges

National roads outside of Bogotá City are under the jurisdiction of the Ministry of Transport. The Instituto Nacional de Vías (INVIAS) under the ministry is responsible for the construction and the maintenance of these national roads. Municipal roads are under the jurisdiction of Bogotá City or each municipality. Prefectural or departmental, roads are under the jurisdiction of Cundinamarca.

All the roads in Bogotá City area are under the jurisdiction of Bogotá City. The Urban Development Institute (IDU) under Bogotá City is responsible for the construction and the maintenance of these city roads. The eight municipalities have responsibility of roads inside of their cities. Cundinamarca Prefecture has responsibility for the roads connecting to national roads and municipality roads. Table 2.7.3 shows the summary of administrative institution of roads and bridges.

Table 2.7.3 Administrative institution of Road and Bridges

Road Classification	Administrative Institution		
	Bogotá	Eight municipalities	
		Urban area	Rural area
National Road	-	-	INVIAS
Municipal Road	IDU	Each City	-
Prefectural Road	-	-	Cundinamarca

b) Road network in Bogotá City

The trunk road network in Colombia is formed by two longitudinal trunk roads and three lateral trunk roads. Two national trunk roads, No. 25 and No. 45A, connect to the center of Colombia as the longitudinal trunk road network from south and north. Three national trunk roads, No.40, No.50 and No.60, are located at the center of Colombia as the lateral trunk road network from east and west.

Four trunk roads that connect with Bogotá City make up the radial road network of Bogotá City. The four national roads connecting Bogotá City and other municipalities are as follows:

- National Road No. 55 (Bogotá City to Tunja/Cucuta/Venezuela).
- National Road No. 45A (Bogotá City to Tunja/Cucuta/Venezuela).
- National Road No.50 (Bogotá City to Manizales/Medellin/Cali).
- National Road No.40 (Bogotá City to Villavicencio).

The urbanized area of Bogotá City is 17 km of east-west direction by 35 km of south-north direction. Six principal roads go through Bogotá City as the major gateways from other municipalities in the Study Area. They are major supply routes between the Study Area and other municipalities. Especially, the gateways from Medellin and Cali in Western Colombia are important for transporting food supplies. (see Figure 2.7.1).

- Gateway from Northern Colombia: Autopista Norte Rd.-Tunja/Cucuta/Venezuela.
  Avenida La Calera Rd.-Tunja/Cucuta.
- Gateway from Western Colombia: Autopista Medellin Rd.-Manizales/Madellin.
  Avenida Centenario Rd.-Manizales/Medellín.
  Autopista Sur Rd.-Armenia/Cali.
- Gateway from Southern Colombia: Avenida Villavicencio Rd.-Villavicencio.

The principal road network in Bogotá City is formed by three (3) ring roads and seven (7) radial roads as shown Figure 2.7.1. The seven roads radiate outwards from city center and serve as distributor roads to each Barrio, and the three ring roads act as connector roads to each radial road. The ring roads and radial roads are as follows:

- Ring Roads:
  a) Avenida Ciudad de Quito.
  b) Avenida del Congreso
  c) Avenida Boyacá.
- Radial Roads:
  a) Autopista del Norte.
  b) Autopista del Sur.
  c) Avenida Villavicencio.
  d) Avenida del Américas.
  e) Autopista El Dorado.
  f) Autopista Medellín.
  g) Avenida Suba.

The secondary roads have been developing in accordance with the progress of housing and industrial developments. The secondary road network in the urbanized area of Bogotá City is served by a grid pattern.

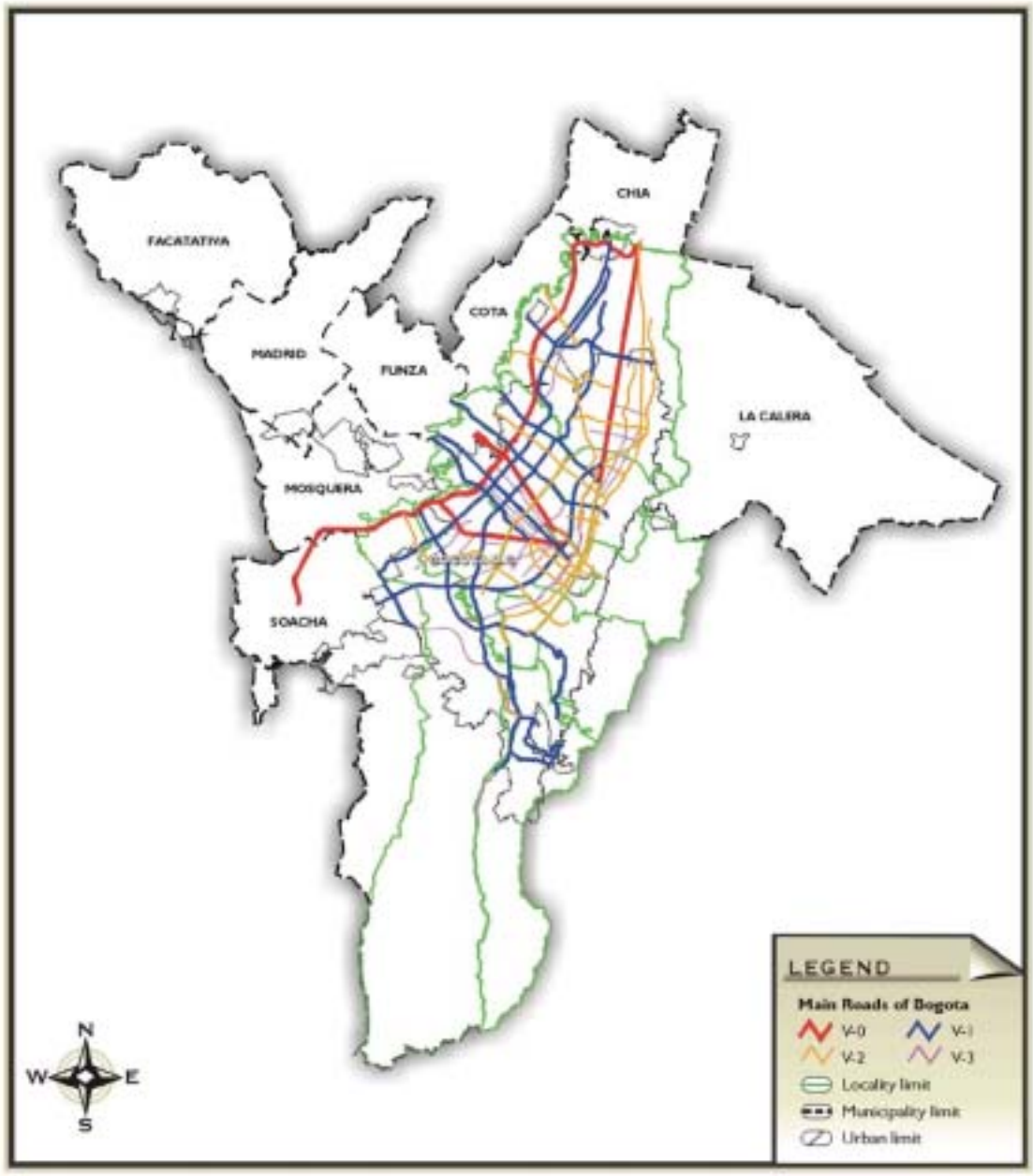


Figure 2.7.1 Principal Road Network in Bogotá City

c) Road network in eight municipalities

The conditions of the road network in the eight municipalities, which is shown in Figure 2.7.2, and described in Table 2.7.4.

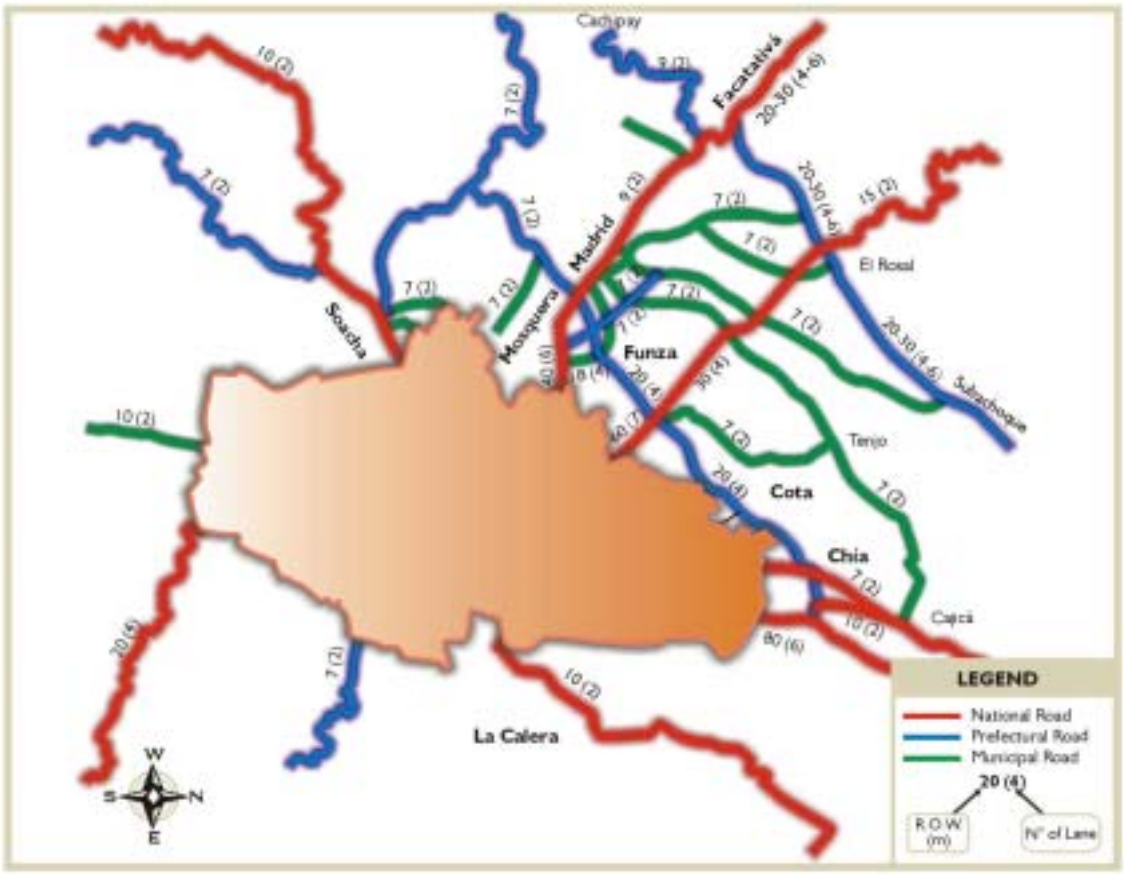


Figure 2.7.2 Inter-City Road Network of the Eight Municipalities Surrounding Bogotá City

Table 2.7.4 Principal Road Network Eight Municipalities

Municipality	Road Network
Chia	The road network in the municipality of Chia is formed by one ring road and four radial roads, which go outwards from the city center serving as main regional and principal roads. These roads are North-South Chia-Cajica Rd. and Chia-Suba Rd., East-West Chia-Cota Rd. and Mosquera Funza-Autopista Troncal Occidente Rd. They are main gateways of about 15-20 meters width entering into the city. Especially, the prefectural road of Mosquera Funza-Autopista Troncal Occidente Rd. is an important gateway connecting to Autopista Norte Rd. A ring road is formed by the complete links of about 20 meters width. Chia City is formed by adequate road network comparatively
Cota	Cota City is composed of the northern urban area and southern rural area. These areas of city are traversed from north to south by an arterial road of Mosquera Funza-Autopista Troncal Occidente Rd, which serves as main corridor for the city. This corridor is one of main gateway of about 20 meters width connecting to neighboring cities. Besides, another gateway, Cota –Suba Rd., goes through the central city from Bogotá City, and the southern rural area of the city is traversed by Autopista Medellin. Several principal roads of 20 meters width branch out from the main corridor. The role of road network in Cota City is not clear.
Facatativa	The corridor of Mosquera-Facatativa vía El Rosal Rd. (Avenida Centenario Rd.) traverses the Facatativa City from east to west as main gateway. Two radial roads form the road network of Facatativa City serve as other gateways. They are principal roads of about 20-25 meters wide connecting to a grid network pattern of local roads. The major radial road is a prefectural road between the cities of Facatativa and Subachoque. The road network in Facatativa City is orderly formed. The width of local roads is about 12-15 meters on average.
Funza	The road network in the municipality of Funza is formed by a ring road and two radial roads. The urban area of the city is bordered by the ring road and Fontibón-Mosquera-Facatativa Rd. (Avenida Centenario), and is served by a grid pattern of local roads. Two radial roads are major gateway of 27-28 meters width entering into the city. The average width of local roads ranges 17-20 meters wide. The road network in Funza is orderly formed
La Calera	The municipality of La Calera is traversed from north to south by an arterial road, which serves as main corridor for the city. The main corridor is the national road of Los Patios-La Calera-Briceño along the Rio Teusaca River. The La Calera road plays an important role of main gateway for the city. Four roads of about 6-7 meters width radiate outwards from the city center serving as main principal roads. The existing road network is poor; a few principal roads and many local roads form the road network of La Calera City..
Madrid	Facatativa-Madrid-Mosquera Rd. (Avenida Centenario Rd.) traverses the center of Madrid Municipality connecting to Facatativa from east to west. The road network in Madrid is formed by a ring road and four radial roads, three of which radiate from the main corridor of Avenida Centenario serving as main principal roads. The radial roads are North-South Madrid-Tenjo Rd. and Madrid-Subachoque Rd., East-West Madrid-Funza Rd. and Madrid-El Rosal Rd. These roads are main gateways of about 15-20 meters width entering into the city. The municipality of Madrid is formed by adequate road network comparatively
Mosquera	The central city of Mosquera is traversed from east to west by a corridor of Fontibon- Mosquera-Madrid Rd. (Avenida Centenario Rd.). Mosquera-Girardot Rd. and Mosquera Funza-Autopista Troncal Occidente Rd are gateways to the city center. Besides, branching out from this corridor to the city are seven principal roads, which are about 20-24 meters wide on the average. The road network in Mosquera is immature indicating unclear configuration.
Soacha	Autopista Sur traverses the municipality of Soacha from east to west. The road network in the municipality is formed by one ring road and three radial roads. Avenida Variente Longitudinal Rd. and Avenida Circunvalar Sur Rd., which form the ring road of the municipality, are principal roads of 45-60 meters width. The east side segments on the ring road have not been completed yet. Three radial roads of Avenida Terreros, Avenida Ciudad de Cali-Avenida Potrero Grande and Avenida Soacha-Avenida Indumil are linked to the Autopista Sur indiscriminately. These radial roads are about 45 meters wide. The road network in Soacha Municipality is very complex; it is necessary that road classification should be improved based on the role of each road, in order to become effective.

B. Functional road classification

a) Bogotá City

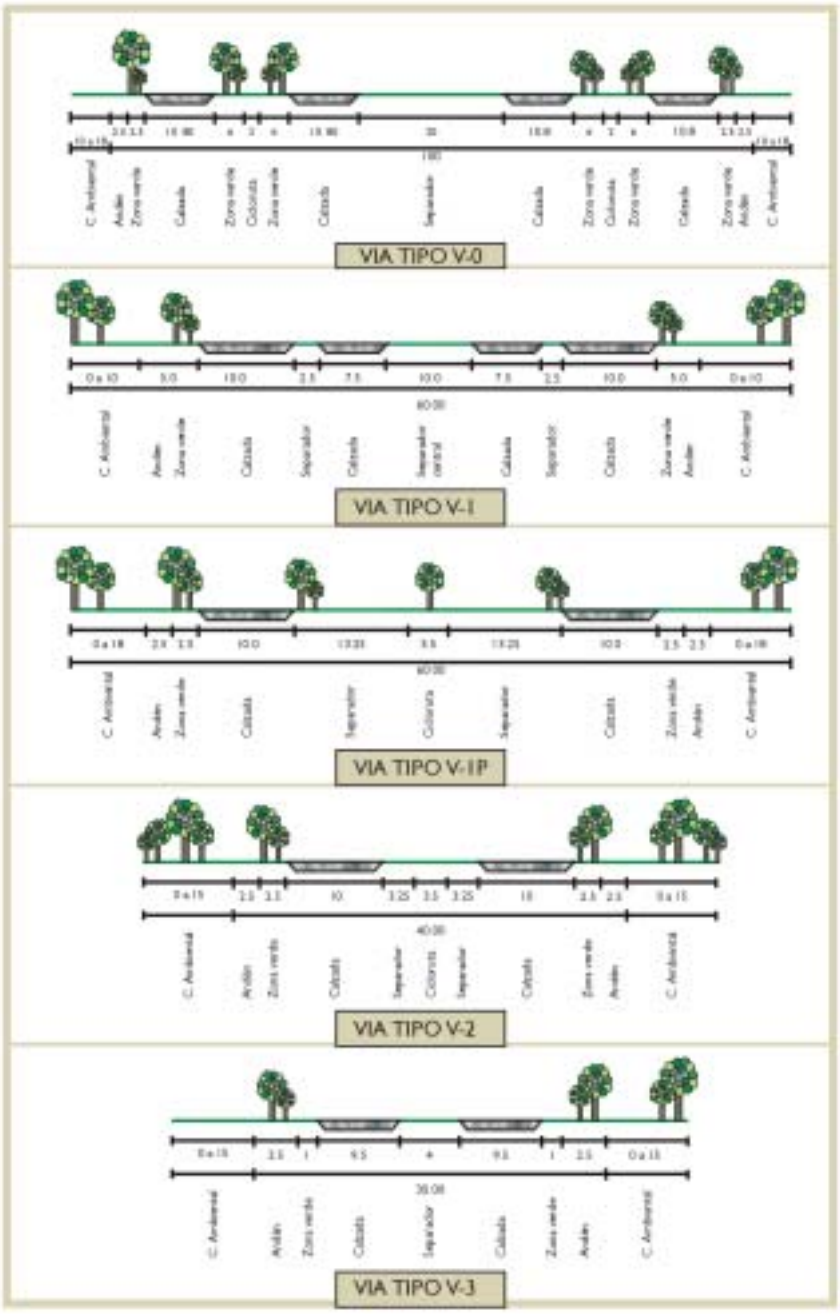
The functional road classification was stated in Acuerdo 2, 1980 of Bogotá City According to the Acuerdo, a road is classified into three types of roads as follows: principal roads, collector roads and local roads. The principal road is classified into four types of roads, the collector is classified into two types of roads, and the local road is classified into four types of roads. The width of the typical cross-section of each road type is shown in Table 2.7.5, and the typical cross-section of the arterial roads is illustrated in Figure 2.7.3.

The cross-section of V-0 and V-1 roads have the high-speed lane of 2 to 3 lanes and low-speed lanes of lanes, and V-2 and V-3 roads have 6 lanes dual carriage way with a 5- to 10-meter median divider.

Table 2.7.5 Functional Road Classification in Bogotá City.

Classification (Type of Road)		Right of Way (m)	Lane Width (m)	No. of Lanes (m)
Principal Road	V-0	100	3.50(H),3.50(L)	6(H)+6(L)=12
	V-1	60	3.75(H),3.33(L)	4(H)+6(L)=10
	V-1P	60	3.33(L)	6(L)=6
	V-2	40	3.33(L)	6(L)=6
	V-3	30	3.00(L)	6(L)=6
	V-3E	25	3.75(L)	4(L)=4
	V-3R	18	3.00(L)	4(L)=4
Collector	V-4	25	3.75(L)	4(L)=4
	V-4A	22	5.00(L)	2(L)=2
	V-5	18	5.00(L)	2(L)=2
Local Road	V-6	16	4.50(L)	2(L)=2
	V-7	13	3.50(L)	2(L)=2
	V-8	10	3.00(L)	2(L)=2
	V-9	8	3.00(L)	1(L)=1
	V-9E	6	2.00(L)	1(L)=1

Note, (H): High-speed lane, (L): Low-speed lane
Source: IDU, Bogota City.



Source: IDU, Bogotá City

Figure 2.7.3 Typical Road Cross-Section on Arterial Road in Bogotá City

b) Outside of Bogotá City.

National roads are classified into two types, namely, 4-lane road and 6-lane road, by the road design standards of INVIAS. The roads controlled by the Cundinamarca prefecture are almost similar to the Municipality's classification. With regard to the roads of the eight municipalities, the functional road classification is different by municipality. The road network of each

municipality generally comprises collector roads and local roads; the width by road type varies from V-0 to V-11.

C. Road bridge conditions

a) Number of bridges and their Locations

The existing road bridges are classified into three types: pedestrian bridges, vehicular flyover bridges and river bridges. Vehicular flyover bridges are constructed in various types such as diamond, semi-cloverleaf and full cloverleaf types as interchanges. Among them, the diamond-type interchange is the most popular.

During the Study a bridge site survey has been carried out in Bogotá City and in the eight municipalities for confirmation of IDU bridge inventory. The result showed that 13 of 134 pedestrian bridges and one of 103 vehicular flyover bridges in IDU inventory do not exist, but 26 pedestrian bridges 8 vehicular flyover bridges, and 68 vehicular bridges over rivers are newly found in the site survey in addition to IDU inventory. The number of bridges by type is shown in Table 2.7.6.

Table 2.7.6 Number of Bridges by Type

	Pedestrian Bridges	Vehicular Bridges			Total
		Flyover	River	Total	
Bogotá	146	108	69	177	323
Eight Municipalities	19	6	11	17	36
Total	165	114	80	194	359

Source: JICA Study Team

The location and structure of the bridge data collected from IDU have been clarified through the field investigation. It is found that the bridge inventory is accurate, except some bridge locations.

b) Bridge structure conditions

The existing conditions of the bridge structure classification such as type of girder, type of bearing, height of abutment/pier, material of abutment/pier and type of foundation, and seat width. Detailed conditions are described below:

Type of Girder

In the total pedestrian bridges, the share by girder type is as follows: simple of 2 or more spans at 56%, continuous of 2 or more spans at 26%, simple of 1 span at 14% and arch of one span at 4%. The girder type of simple/2 or more spans has a high share. The girder type with the highest share is single of 1 span at 51% followed by continuous of 2 or more span at 28% and simple of 2 or more span at 21%.

Type of Bearing

In the total pedestrian bridges, the share by different bearing types are as follows: normal type at 75% and fixed type at 25%. While in the vehicular bridges, normal type are approximately 96% and fixed type are only 4%. Therefore, most of the bearings of bridges are of the normal type.

Maximum Height of Abutment/Pier

In the total pedestrian bridges, the share by maximum height of abutment/pier is as follows: height of 5 to 10m at 82% and height of less than 5m at 18%. While in the total vehicular bridges, the shares of 5m to 10m, under 5m, and over 10m in height are 81%, 17%, and 2% respectively. Therefore, most of abutments/piers of bridges have a maximum height ranging from 5m to 10m.

Material of Abutment/Pier

In the total pedestrian bridges, the share by material type of abutment/pier are as follows: reinforced concrete at 84%, steel at 15% and masonry at 1%. While in the total vehicular bridges, the share of reinforced concrete is 74%, steel at 24% and masonry at 2%. Therefore, most of abutments/piers of bridges are made of reinforced concrete.

Type of Foundation

In the total pedestrian bridges, the share by foundation type is as follows: pile type at 57% and spread type at 43%. While in the vehicular bridges, the share of pile type is at 90%, and spread type is at 10%.

Seat Width

The seat width of the pedestrian bridges is in the range of 0.14 m to 0.65 m. On the other hand, in the vehicular bridges, the approximate seat width is between 0.25m to 2.0m. The seat width of existing bridges is small.

D. Railway conditions

a) Administrative institution of railway

The National Railway of Colombia (FNC) was dissolved and privatized by Law No. 21 of 1988. FNC was transformed to a new public entity in smaller size named *Empresa Colombiana de Vias Ferreos* (FERROVIAS) which manages infrastructure and facilities of the railway. Regarding private capital, two companies were newly established for the railway operation: *Sociedad Colombiana de Transporte Ferroviario* (STF) and *Sociedad Colombiana de Transporte Ferroviario de Occidente* (STFO). They have contracts annually with FERROVIAS to operate the assigned railway. Both of them are regarded as private companies. Another new entity, *Fundo Pasivo Social de Ferrocarriles* (FPSF), was founded to succeed to the FNC and manage its assets. This agency is also dealing with pensions and insurance of retired employees of FNC.

Railway system in Bogotá city is managed by the Central Regional Office, one of five Regional Offices of FERROVIAS and is operated by STF.

b) Present railway line in Bogotá City.

Location of the railway lines is shown in Figure 2.7.4. There are three railway lines: the west line starts from the central station called *Estacion de la Sabana* and runs westward while the north and south lines branch from the west line. The west and the north lines are operated for cargo, but the south lines are unused. Although maintenance of rail tracks is contracted to private companies, they are maintained in very bad conditions due to the shortage of budget. Because of poor maintenance, a train is forced to run at the speed of less than 15 km/hour. Presently, the operation of each line is very poor as follows:

- The west line operates one train a day each direction between Bogotá City and Santa Marta, transporting coal, salt, grain and steel to Bogotá City., but few cargos from Bogotá City.
- The north line operates one train in each direction everyday between Bogotá City and Belencito, transporting cement, iron ore, beverages, etc. In the weekend, a tourist train is operated from the Sabana station to Nemocon (60 km), with a steam locomotive by Tourist Train Company.
- The south line has already been discontinued, partly due to the reduction policy since 1980, and partly due to squatting.

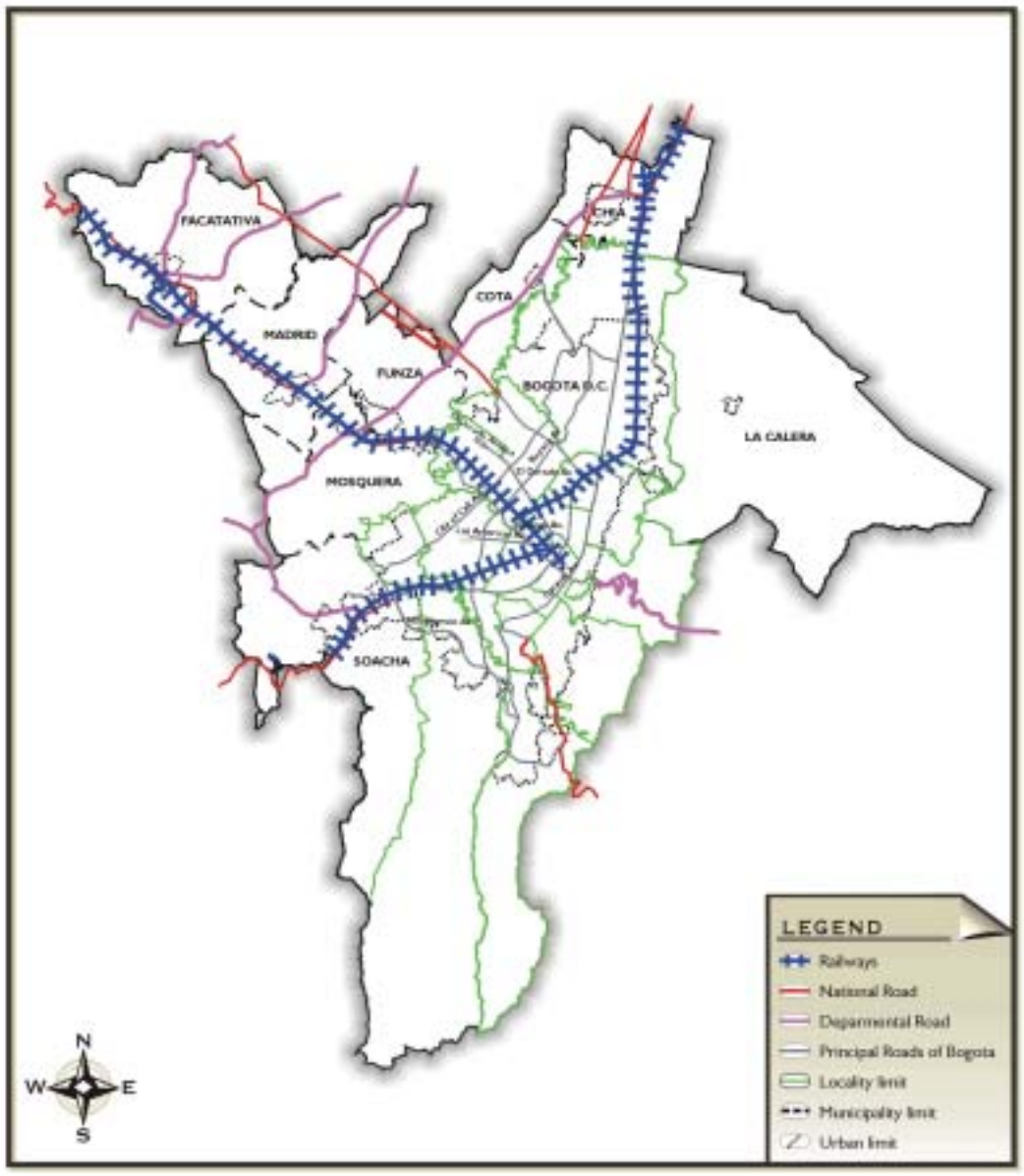


Figure 2.7.4 Location of Railway Lines in Bogotá City

(3) Lifeline conditions

A. Water supply and sewage system

a) Administrative institution of water supply and sewage system

EAAB-ESP, *Empresa de Acueducto y Alcantarillado de Bogotá*, is responsible for water supply, sewage and drainage services to Bogotá city, and for water supply to neighboring municipalities. ESP of EAAB-ESP is the Spanish acronym meaning Public Service Rendering Company, which keeps control over the resources and operation of its supply systems. EAAB is an Industrial and Commercial Company of the Capital District, rendering domiciliary public services, equipped

with legal identity, administrative autonomy and independent patrimony, according to Agreement 6 of 1993.

With regard to the eight municipalities, a public company in each municipality services water supply from wells and rivers, and manages their resources and supply facilities. However, EAAB supplies water to them to cover the shortage of water supply in each municipality. The amount supplied by EAAB to each municipality ranges widely between 10% and 100% of their water demand.

Table 2.7.7 Institution of Water Supply System

Plan	Facility in Charge	
	Bogotá	Eight municipalities
EAAB	Complete water supply system such as water reservoir, intake, purification plant, transport & supply pipeline, storage tank, pump station.	Service water supply for the shortage of consumption in each municipality
Public company in Eight Municipalities	-	Water supply system such as water reservoir, intake, purification plant, transport & supply pipeline, storage tank and pump station. But storage tank and pump station in some municipalities are insufficient in number.

b) Facility conditions of water supply and sewage system

Bogotá D.C.

1) Water Supply System

The distribution system is divided into matrix networks of tunnels, (as in the Chingaza system described below), or of big iron pipelines with diameter between 60 and 78 inches, which conducts the water from the sources to the purifying plants, and then to the main distribution networks with diameters between 12 and 36 inches. Detailed distribution network is composed of pipelines less than 12" in diameter. According to the brief description provided by EAAB, water for distribution is supplied through a 6,500-km long pipeline utilizing 65 operation stations composed of 31 pumping stations, 25 storage tanks and 9 control stations.

In order to supply water to high areas of Bogotá city, especially at the South part of Bogotá City., the company has pumping chains that is pumping stations located consecutively to guarantee the service to altitudes higher than 3,000 meters. The system is also composed of compensation and storage tanks, which are intended to decrease the pressure of the water that goes through the matrix network, thus making it easier to manage water for distribution. These storage/compensation tanks are located in the mountainous areas of Bogotá city (East and South), and there are two tanks in Suba hills with a total storage capacity of 6,000 m^3.

A special pumping station that receives water from Chingaza and Tibito systems is the one called *Planta de Rebombeo de Usaquen*. The plant water is pumped and distributed to approximately 70% of the city, and to the municipalities, Funza, Madrid and Mosquera, located on the west of Bogotá city. Table 2.7.8 shows how Bogotá City is divided water resources according to the main purifying plant or source that supply the respective areas. These zoning consists of 11 zones. Table 2.7.9 and Table 2.7.10 describes purifying plants (with the exception of Tibitóc system) and water sources managed by EAAB respectively.

Table 2.7.8 Zone System by Main Purifying Plant/Water

Zone	Laguna	Vitelma	Control Santafé	San Diego Sur	San Diego Norte	Paraiso	Chico	Zona Interme-dia	Zona baja sur	Zona Baja Norte	Soacha
Main Source	Laguna Purifying plant	Vitelma or San Diego Purifying plant	Usaquen pumping station	San Diego Purifying plant	San Diego Purifying plant	Wiesner Purifying plant	Wiesner Purifying plant	Usaquen pumping station	Usaquen pumping station	Usaquen pumping station	Usaquen pumping station
Area Aprox. of Bogotá (%)	8.3	10	4	3	1.5	2	3	1.5	15	45	7

Source: JICA Study Team, 2001.

Table 2.7.9 Purifying Plants Managed by EAAB

Plant	Capacity	Location	Structure Type	Use
Wiesner Purifying Plant	14 m^3 / sec.	Km 12 Via La Calera	CONCRETE	Drinkable water treatment
Vitelma Purifying Plant	1.5 m^3 /sec.	Circunvalar Road through 9th south street	CONCRETE	Drinkable Water treatment
La Laguna Purifying Plant	0.45 m^3 /sec.	East Side of the Usme Municipality	CONCRETE	Drinkable Water treatment
El Dorado Purifying Plant	1.6 m^3 /sec.	South Side of the new road to Villavicencio, next to the first tunnel	CONCRETE	Drinkable Water treatment
San Diego Purifying Plant	0.1 m^3 /sec.	Circunvalar Road No.2–03	CONCRETE	Drinkable Water treatment
Tibitoc Purofying plant	10.5 m^3 /sec.		CONCRETE	Drinkable Water treatment

Note) Tibitoc purifying plant is a concession one but supplies water to Bogotá City like EAAB plants.
Source: JICA Study Team, 2001

Table 2.7.10 Water Sources Managed by EAAB

Structure	Capacity	Location	Structure Type	Alert And Monitoring System0
Regadera Dam	Storage Volume 3,300,000 m^3	South of Usme, in the El Destino vereda	Dirty gravel clay nucleus	A monitoring by levels is carried out. Readings at 6 am, 12 am and 6 pm, in case of strong rains, the readings are done every half an hour and it's reported to the Office of Prevention and Attention of Emergencies. Instrumentation Monitoring: is carried
Chisaca Dam	7,700,000 m^3	South of the Usme Municipality El Hato vereda	Dirty gravel clay nucleus	A monitoring by levels is carried out. Readings at 6 am, 12 am and 6 pm, in case of strong rains, the readings are done every half an hour and it's reported to the Office of Prevention and Attention of Emergencies. Instrumentation Monitoring: a topograp
El Tambor Dam			A Dam of 59.50 m of maximum height located on the Teusaca River's valley constituted by homogeneous material, with a chimney's filter. The approximate volume of refilling is 2,75 hm^3.	Instrumentation Monitoring: (Piezometer reading, topographic control, and filtration measuring.
Chuza Dam	257,000,000 m^3	East of Bogotá City	Dirty gravel clay nucleus	A Monitoring by levels is carried out through readings every 24 hours. Instrumentation Monitoring: (Piezometer reading, topographic control, and filtration measuring.
San Rafael Dam	75,000,000 m^3	East of Bogotá City Within La Calera rural area	-	Instrumentation Monitoring: (Piezometer reading, topographic control, and filtration measuring.
Sisga Dam	102,000,000 m^3	North of Bogotá City	-	-
Tomine Dam	690,000,000 m^3	North of Bogotá City	-	-
Neusa Dam	102,000,000 m^3	North-West of Bogotá City	-	-

Source: JICA Study Team, 2001

EAAB has four sources or systems of water supply, which are shown in Table 2.7.11.

Table 2.7.11 EAAB Systems of Water Supply

System	Dam Composition	Storage Capacity Million m^3	Max. Supply Capacity m^3/seg	Tunnel Conduction (Km)	Pipeline Conduction (Km) / Diameter	Delivers water to
Chingaza	Chuza San Rafael	332	34	32	4.5 Km (60")	Wiesner Purifying Plant
Vitelma	La Regadera Chisaca Los Tunjos	11	1.35	No	(34") to Vitelma (20") to La Laguna	La Laguna or Vitelma Purifying plant
Tibitoc	Sisga Tominé Neusa Aposentos	894	10.5	No	(60")	Tibitoc Purifying plant and then to Usaquen pumping station
San Diego	San Francisco River	0.03	0.14	No	(14")	San Diego Purifying plant

Source: JICA Study Team, EAAB, 2001.

2) Sewage Service System

Bogotá City's sewage system consists of two kinds of networks as follows: one for storm water with a pipeline length of 1,654 km in total and 32,064 manholes, and another for wastewater that has a total length of 5,008 km and 85,110 manholes. Both networks are independent from each other for the most part but before the discharge points to the rivers the waters are mixed. Another problem is that even though the city networks are almost divided, the pipelines running in each house are not divided, so rainfall and wastewater coming from houses are combined and then discharged to the city wastewater network.

Eight Municipalities

The characteristics of water supply and sewage system in the eight municipalities are summarized in Appendix 2.7.1.

1) Water Supply System

The water supply system in each municipality has individual solutions; there are different systems such as the utilization of supply source, the function of supply facility and the service conditions. The method of water supply from source is generally classified into three types as follows:

- 100% coverage by well and river of each municipality.
- 100% coverage by EAAB supply.
- Mixed type by EAAB supply and each municipality's well/river.

About 75% of the eight municipalities combined are supplied with the mixed type of potable water by EAAB and wells/rivers of the municipalities. It is observed that the municipalities of Madrid, Mosquera and Soacha receive the highest share of EAAB supply in the range of 50% to 90%. Other municipalities of mixed type water supply have the following distribution: EAAB at

28% and river at 72% in La Calera, EAAB at 10% and well water at 90% in Funza. The municipalities of Cota and Facatativa are self-supporting with 100% of water supplied through their wells/rivers. While Chia is directly supplied 100% of water from EAAB by the purification plant of Tibitoc.

The supply facilities maintained for each municipality are mostly purification plants, supply pipelines, storage tanks and pumping stations. Number of purification plants in each municipality is about 1-3. The diameter of main pipelines network in each municipality varies between 6 and 40 inches, and the local network is composed of pipelines of less than 4" in diameter.

For the service conditions for each municipality, the service covers above 80% of the demand, however, storage volume capacity is not enough in the municipalities of La Calera, Chia, Madrid and Mosquera. The municipalities of Cota, Funza and Facatativa have enough in storage volume system.

2) Sewage Service System

At present, the sewage service system in each municipality consists of three kinds of sewer network as follows:

- Mixed type of rainfall/wastewater.
- Separated type.
- Mixed and/or separated type.

The municipalities of Chia, Facatativa and Soacha have the mixed type of rainfall and wastewater; La Calera, Cota and Funza, the separated type, and the municipalities of Madrid and Mosquera have the mixed and/or separated type. Especially, the system of La Calera is immature and complex. Regarding wastewater system in urban area, in Veredas Sector, individual solutions are made by a small group of people that do not have any control of the final disposition. In Los Molinos Sector, 80% of the population counts on a sewage system supplying four principal collectors; these supply the brooks that drain to the Los Molinos brook. Of the remaining 20%, 12% has a septic tank, and waste is discharged into the brook. The 8% has a secondary supply, superficial sewage systems that discharge to the Puente Piedra brook and the brook in the yard zone. A common problem among the system of other municipalities is sporadic flooding during rainfall seasons. All treatment plants with complementary facilities were constructed and managed by CAR (*Corporacion Autonoma Regional*). The capacity of treatment plants in each municipality varies widely at 60-160 LPS except the municipality of Cota.

(1) Electric system

A. Administrative institution of electricity system

The electricity supply in the study area is provided by several electricity supply companies such as EMGESA, EEB, CODENSA, AMBAS and ISA. EMGESA is in charge of the generation, EEB and ISA are in charge of the transmission at a districts and national level, respectively. CODENSA is in charge of distribution at a domiciliary level. Almost 100% of inhabitants are covered by electric supply. The generation and transmission network is not an isolated one, but is connected to the national electrical system through the National Transmission System. This means that Bogotá City and the other municipalities can be supplied from generation plants in other regions in Colombia or even from Venezuela or Ecuador. Interconexión Eléctrica S.A. Company or ISA are in charge of the most part of the national transmission network.

Before 1997 EEB (*Empresa de Energía de Bogotá*) was in complete control of the generation, transmission and distribution business around Bogotá Metropolitan Area, but in 1997 EEB sold approximately half of the stocks in the generation and distribution business to EMGESA and CODENSA companies respectively.

Figure 2.7.5 illustrates the stock participation in generation and distribution business before and after 1997, and Table 2.7.12 shows the institutions of electricity.

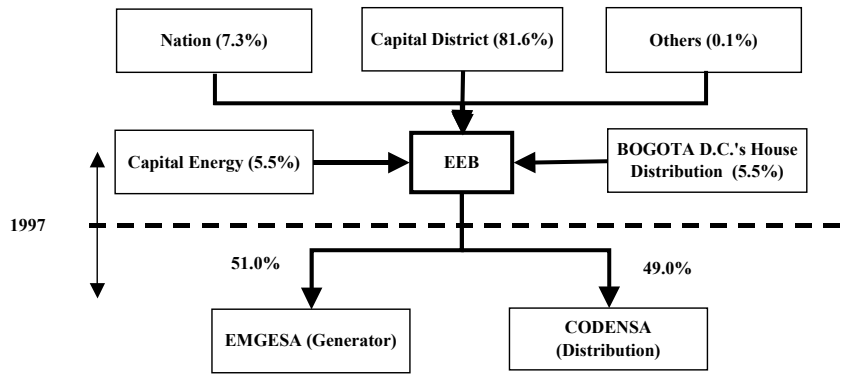


Figure 2.7.5 Stock Participation in Generation and Distribution Business Before and After 1997

Table 2.7.12 Institutions of Electricity

Company	Private or Public	Responsibility	Service Area	General Information
CODENSA	Mixed 51% Public (belongs to EEB) 49% Private	a. Expansion, maintenance and reparation of the distribution network (under 115 kV) and the facilities related with distribution (Sub-stations, posts, electrical transformers, etc). This work is performed by construction companies hired by CODENSA. b. Maintenance and reparation of the high voltage transmission lines (230 and 115 kV) within Bogotá. c. CODENSA personal is basically for administrative matters and there are around 600 people working at the company.	a. Bogotá, 8 municipalities in study (In Facatativa only one minor sector) and many other municipalities in Cundinamarca (a total of 96 municipalities)	a. EEB participation is only a monetary one. EEB Doesn't have administrative participation. b. Codensa S.A.-E.S.P. in its private part is the result of the capitalization of the Energy Company of Bogotá, carried out with contributions from three International Companies: Endesa (Spain) 55%, Enersis (Chile) 25.71% and Chilectra (Chile) 19.29%.
EEB	Public	a. Maintenance and reparation of a electrical circuit of high tension lines – 230 kV- (Transmission from the generation plants to Bogotá city)	a. Around Bogotá City	a. The personnel of EEB is minimum at the present time. Around 50 people.
EMGESA	Mixed 49% Public (belongs to EEB) 51% Private	a. Management, maintenance and reparation of electrical power plants (thermo-generation plants, Hydro-generation plants). b. Generation of energy for the national interconnected system (EMGESA produces energy not only for Bogotá but for the national system. This means, the national system gives energy to Bogotá too). c. EMGESA manages seven Hydro-electrical generation plants: Canoas, El Salto, Laguneta, Colegio, El Guavio, La Guaca y el Paraíso; Furthermore the company controls the thermo-electrical plant called Termozipa. A brief description of each one of the plants is included in this report.	a. Cundinamarca/Country (EMGESA participates in the electrical interconnected national system)	a. EEB participation is only a monetary one. EEB Doesn't have administrative participation. b. Emgesa S.A. E.S.P. is the largest and most important Generator Company of Electric Energy in Colombia. This company is the result of the capitalization of the Energy Company of Bogotá, carried out with contributions from two International Companies, leaders in the matter: Endesa Chile and Endesa Spain. In 1999 Emgesa generated 11.013 GWh, which approximately corresponds to the 20% of the total energy demanded in Colombia. b. Endesa is one of the largest private electrical. c. Groups in the world, with a total installed capacity of 36,994 MW, 153,264 GWh distributed capacity and more than 2 million customers in 12 countries.
AMBAS	-	a. Expansion, maintenance and reparation of the Distribution network. b. Distribution of under 115 KV voltage	a. Facatativa	-
ISA	Mixed ISA is a mixed-economy public utilities company ascribed to the Ministry of Mines and Energy	a. ISA owns and operates the largest high-voltage transmission network in Colombia: 1,449 km of 500-kV lines, 6,456 km of 230-kV lines, 7,372 MVA of transformation, 2,789 Mvar of reactive power compensation, six 500-kV substations and thirty-four 230-kV substations, all of which corresponds to 70% of the total National Transmission System. b. ISA has a 44% share in the connection business nationwide, which is served with 3,272 MVA of transformation capacity and 84 transformer bays	a. Colombia	a. Interconexión Eléctrica S.A. –(ISA)- is a Colombian corporate group with two power sector affiliate companies – Transelca and Interconexión Eléctrica from PERÚ, and Internexa from Colombia. b. The National Transmission System (NTS) provides a viable means of transaction between generators and traders. The transmission service is a natural monopoly that is regulated by the Energy and Gas Regulating Commission -CREG-. c. In Colombia there are eleven companies presently in charge of transmission activity, ISA being the largest with a partial ownership of more than 70% of the NTS network.

Facility Conditions of Electric System

- Distribution of Electricity

1) Service Area and Cable length in Bogotá City.

The distribution of electricity for houses in Bogotá city and the eight municipalities of Cundinamarca is maintained by CODENSA. Facatativa is served by CODENSA and AMBAS. CODENSA is generally in charge of expansion, maintenance and repair of the distribution network less than 115 kV, and the facilities related with distribution such as sub-stations, posts, electrical transformers, etc.

The service area of CODENSA is divided into three zones in Bogotá City as shown in Figure 2.7.6. The UN is the northern zone from Autopista El Dorado, UC is that between Autopista El Dorado and Avenida 1st de Mayo and US is the southern zone from Avenida 1st de Mayo. The total zonal cable length less than 50 kV is shown in Table 2.7.13. The total cable length in the City is 5,205 km, and the longest total length (of 1,994 km) is seen in US zone of southern city; the other zones have a cable length almost equivalent to about 1,600 km. The ratio of overhead cable and underground cable is significantly different according to the estrato. The areas of

estrato ranked from 1 to 3; high-income society, is equipped with overhead cable with a ratio in the range of 80%-100%. Meanwhile, areas ranked from 4 to 6, low-income society, show the ratio of 5%-20%.

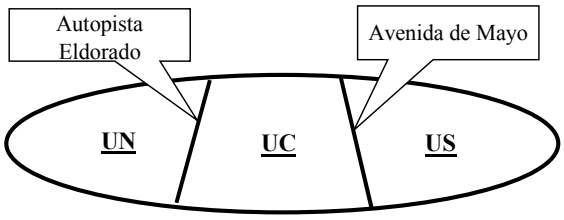


Figure 2.7.6 Definition of Zone for Electricity in Bogotá City

Table 2.7.13 Cable Length of Less Than 50 kV

Zone	Cable length (km)		
	Overhead	Underground	Total
UN	869	760	1,629
UC	681	901	1,582
US	1,574	420	1,994
Total	**3,124**	**2,081**	**5,205**

Source: CODENSA material; Circuitos de Media Tensión

The total length of 115 kV network is approximately 617.4km, while, the total length of 57.5 kV is approximately 80.4km.

2) Circuits Conditions Around Bogotá City.

The distribution of electric lines in and around Bogotá City is composed of 230 kV EEB, 115 kV CODENSA and 57.5 kV CODENSA. The high voltage lines of 230 kV are located outside Bogotá City bordered by Toroca, Noroeste, La Mesa, El Paraíso, Muña, Fusagasugá, Usme, Circo and Embalse San Rafael. At each boundary, there are eight main substations for transforming 230 kV into 115 kV, with a total of eight as it is shown below:

- Northern area outside Bogotá City.:
  1. A Chivor.
  2. Torca.
  3. Noroeste.
- Western area outside Bogotá City.:
  4. Balsillas.
- Southern area outside Bogotá City.:
  5. La Guaca.
  6. Tunal.
- Eastern area outside Bogotá City.:
  7. La Reforma.
  8. Circo.

The voltage lines of 57.5 kV are located at the central Bogotá. D.C. bordered by Concordia, San Facon, Salitre, Puente Bosa, Soacha, Veraguas and Calle 1a. There are three major substations for transforming 115 kV into 57.5 kV, namely, Salitre, Veraguas and Concordia.

Generation of Electricity

Power generation for Cundinamarca and the rest of the country is maintained by EMGESA. EMGESA is generally in charge of management, maintenance and repair of electric power plants. There are nine generation plants, which consist of a thermo-electric plant and eight hydro-electric plants.

- Thermo-electric Plant: 1. Termozipa.
- Hydro-electric Plant: 2. El Paraiso 6. Dario.
  3. Laguneta 7. Canoas.
  4. El Salto 8. Guavio.
  5. La Guaca 9. Muña.

These power plants generate 45MW -1,150 MW of electric power. The plants were constructed before 1992, and the oldest is the hydro-electric plant at Laguneta, which was constructed in 1957.

Transmission of Electricity

Power transmission for Cundinamarca and the rest of the country is maintained by EEB and ISA respectively.

1) EEB (Empresa de Energía de Bogotá)

EEB is generally in charge of maintenance and repair of an electrical circuit of high-tension lines – 230 kV (transmission from the generation plants to Bogotá City). Table 2.7.14 breaks down the total length of 230 kV transmission lines belonging to EEB.

Two of these generation plants located to the Southwest of Bogotá -La Guaca and Paraíso plants- are connected by a double transmission line of 7.5 km each, while La Guaca plant has connection only to the national system through 230 kV lines. Paraíso plant is connected to San Mateo and El Circo substations, which are located in South and East areas within Bogotá City respectively. It is necessary to clarify that the connection between La Guaca Plant and Bogotá City. City is made by lines lower than 230 kV. On the other hand, Guavio generation plant has a direct connection to the national network, and furthermore it is connected to the Bogotá City substations of El Circo and Tunal by two 230 kV lines.

Other three sub stations that receive 230 kV lines, but this time from ISA network, are Torca located at the North part of Bogotá, and Noroeste and Balsillas sub stations located at the

Northwest and West areas of Bogotá. These three sub stations are interconnected, with the Noroeste station functioning as a bridge between Balsillas and Torca.

Table 2.7.14 230 kV Transmission Lines of EEB

Origin	Destination	Owner of the Destiny facility	Total length (Km)
El Paraiso generation plant	San Mateo Substation	Codensa	33.9
	El Circo Sub Station	Codensa	50.0
	La Guaca generation plant	Emgesa	7.5
	La Guaca generation plant	Emgesa	7.5
La Guaca generation plant	La Mesa Substation	ISA	5.0
	La Mesa Substation	ISA	5.0
Guavio generation plant	El Circo Sub Station	Codensa	109.8
	El Circo Sub Station	Codensa	109.6
	Tunal Sub Station	Codensa	155.1
	La Reforma Substation	ISA	80.4
Tunal Sub Station	La Reforma Substation	ISA	74.7
	El Circo Sub Station	Codensa	29.8
	San Mateo Substation	Codensa	14.8
Total			683.1

Source: JICA Study Team, 2001.

2) ISA

ISA owns and operates the largest high-voltage transmission network in Colombia as follows: 1,449 km of 500 kV lines, 6,456 km of 230 kV lines, 7,372 MVA of transformation, 2,789 MVA of reactive power compensation, six 500 kV substations and thirty-four 230 kV substations, all of which corresponds to 70% of the total National Transmission System.

There is a unique interconnected network system in Colombia that links generation plants with electricity charge centres in the Andean region of the country, the Atlantic and Pacific seaboards and the Eastern plains. The national network managed by ISA is divided into five administrative centres or CTE (Spanish abbreviation of Energy Transport Centre) as shown in Table 2.7.15. ISA owns some of the 230 kV lines around Bogotá. A summary of them is shown in Table 2.7.16.

Table 2.7.15 National Network Managed By ISA

Name or CTN area	Network System
1. CTE North	a. This administration center is located in the town of Sabanalarga (Atlantico) and is the disembarkation point of a 500 thousand watt transmission system which links the electricity system in the Center of the country with the electricity system in the Northern region and passes through the departments (prefectures) of Antioquia, Cordoba, Sucre, Bolivar and Atlantico. b. From this center, 3 substations, located in Cerromatoso, Chinu and Sabanalarga, are served by a 500 thousand volt transmission system and 949 kilometers of lines. There is an associated transformation capacity of 1,950 MVA in these substations, represented by four transformer units of 150 MVA of a relation 500/150 kV located in Cerromatoso and Chinu and three banks of transformers in Sabanalarga with a relation 500/230 kV, each of 450 MVA.
2. CTE East	This administration center is located in the city of Bucaramanga and serves 9 substations and 1,126 kilometers of 230 thousand volts of network circuit. These installations include the circuits which allow the interconnection of the Eastern region of the country - the Santanderes, Boyaca and Arauca prefectures - with the central network of the
3. CTE North west	a. This administration center is located in the substation of Ancon Sur in the jurisdiction of La Estrella. This center serves 8 substations and 1206 kilometers of 500 thousand and 230 thousand volts of network circuit, making possible the integration of the large hydroelectric resources of the region (Antioquia) with the remainder of the country. b. This CTE is in charge of the most important substation in the Colombian electricity system, which is associated with the San Carlos hydroelectric center, and is the site where transmission systems of 500 thousand and 230 thousand volts join by means of three banks of transformers that total 900 MVA of capacity.
4. CTE Center	a. From this administration center, 8 substations and 1553 kilometers of 230 thousand volts of network circuit are served, allowing connection of important centers for the national electricity system such as Guavio and Chivor, with the largest consumer in the country, which is the capital of the republic - Santa Fe de Bogota. b. The total transformation capacity served is 834 MVA with transformer units in the substations of Torca and Balsillas, which allow the transformation of approximately one fourth of the energy required by Santa Fe de Bogota.
5. CTE Southwest	a. From there it attends 10 substations at 138, 230 and 500 kV, as well as 246.72 km of 500-kV transmission lines with 488 transmission towers; 1,125.63 km of 230-kV lines with 2,254 towers; 9.86 km of 138-kV lines with 30 towers which constitute the interconnection with Ecuador; and 77.15 km of 115-kV lines with 134 towers. b. Its influence area includes facilities in the prefecture of Caldas up to the region bordering Ecuador, where Panamericana Substation was inaugurated in 1998 becoming the starting point of the 138-kV interconnection with Ecuador power system.

Table 2.7.16 Network of 230 kV Around Bogotá City Belong to ISA

Origin	Destination	Owner of the Destiny facility	Total length (Km)
La Mesa Substation	Balsillas Sub Station	Codensa	27.0
	Noroeste Sub Station	Codensa	-
Noroeste Sub Station	Torca Substation	ISA	20.0
	Torca Substation	ISA	20.0
Torca Substation	Guavio generation plant	Emgesa	82.9
	Guavio generation plant	Emgesa	82.9
Total			232.8

Source: JICA Study Team, 2001.

C. Telecommunication system

a) Administrative institution of telecommunication system

The telecommunication supply in the Bogotá Metropolitan Area is provided by several telecommunication companies. In Bogotá City, there are three companies that render the service of local communication through fixed telephones. These are: *Empresa de Teléfonos de Bogotá* –ETB-, CAPITEL and *Empresas Públicas de Medellín en Bogotá* –EPM-Bogotá-. Except CAPITEL, the other companies render the long distance communication service too, using not

self-networks but one that belongs to TELECOM, which offers the long distance service for Bogotá and the local communication service in the eight municipalities. Local communication is performed by wire system while long distance is carried out by waves. Table 2.7.17 shows the institutions of telecommunication.

Table 2.7.17 Institution of Telecommunication

Company	Public or Private	Responsibility	Service Area	Remarks
ETB	Public a. The company is a society of stocks. The 99.93% of the stocks belong to the Capital District of Bogotá. The other shareholders are public entities of Bogotá D.C.	a. Management, construction, maintenance and reparation of Bogotá telephone network (this company has the biggest coverage in service) and the facilities related with it like Sub-stations, cabinets, poles, etc. Its main function was for local communication, but now has the long distance communication service. b. At the present time, ETB manage 1,900.00 telephone lines. c. There are around 4,500 employees at ETB. d. In 1999 ETB won $153.155 million pesos (66.5 million dollars).	a. Local network in Bogotá D.C.. b. Long distance communications	a. ETB controls the 26% of COMCEL Cellular company stocks.
CAPITEL	Public a. This is an industrial and commercial company of the state	a. Management, construction, maintenance and reparation of Bogota telephone network that belongs to Capital. Its main and unique function is for local communication.	a. Local network in Bogotá D.C.. b. Long distance communications	a. This company is a vice-presidency of Telecom
EPM-Bogotá	Public a. This is an industrial and commercial company of the state. Belongs to the Medellin governorship.	a. Management, construction, maintenance and reparation of telephone network that belongs to EPM-Bogotá. Its main and only function is for local communication, but it has the long distance service too. b. The company offers Internet service.	a. Local network in BogotáD.C.. b. Long distance communications.	a. In Bogotá D.C. EPM only has telephonic service. In Medellín city they manage all public services.
TELECOM	Public	a. Management, construction, maintenance and reparation of municipality telephone network. Its main national function was for long distance communication service (at national level) and local communication for small towns. b. Long distance communications, through micro waves transmission towers located at the top of some mountains. Telecom repairs, maintains and operates these towers, which are frequently damaged by terrorist attacks. c. The company offers Internet service. d. Gives the communication service to 800 municipalities in Colombia (total number of municipalities in Colombia is around 1100). e. TELECOM attend the service demand of 400 important companies in Colombia (Cash Machines, communication within banks, etc)	a. Local network in Eight Municipalities. b. Long distance communication in Bogotá	-

Source: JICA Study Team, 2001.

b) Facility conditions of telecommunication system

Distribution of Telecommunication

Until 1990 some public companies are in charge of the telephone service. TELECOM was one of them and it was in charge and had the monopoly of the national and international long distance communication, as well as the local service in some regions within the country. The other companies belonged to some municipalities or to some prefectures, and were in charge of local communication. Having those companies allowed them to have a monopoly of the communication business in their own areas; one company like this , and the biggest, is ETB.

For more than 110 years ETB had the monopoly of the telephone service in Bogotá City, but since 1995 this situation has changed. After Law 142 of 1994, the markets of local communication service were opened and some companies entered to compete with ETB for the market in Bogotá City. Therefore, at the beginning of 1996, TELECOM started to consolidate a project for local communications called CAPITEL, a company that made contracts with international companies

in order to install their network within Bogotá. Furthermore, at the beginning of 1997 another public company called *Empresas Públicas de Medellín* signed a contract with the multinational company Itochu to install around 95,000 lines. Table 2.7.18 shows the approximate number of lines projected and installed by each company in Bogotá City.

Table 2.7.18 Number of Projected and Present Telephone Lines in Bogotá D.C.

Company	Projected lines	Present lines
CAPITEL (TELECOM)	550,000	200,000
EPM	95,000	16,000
ETB	No available	1,900,000
Total	**645,000**	**2,116,000**

Source: ETB, 2001.

On the other hand, ETB owns 26% of the shares of COMCEL Company, the main operator in cellular telephone services in the country. Last year, COMCEL acquired 68.04% of the property shares and control over OCCEL Company, one of the two cellular operators in the western zone in the country.

In respect to long distance communication, in 1998 ETB received the license to compete in this field with TELECOM, as well as with Orbitel, which is a company put up basically by EPM and other shareholders.

ETB (Empresa de Teléfonos de Bogotá)

ETB has 37 local control centers and 4,500 cabinets in Bogotá City. The information is provided by GIS data. Furthermore, the information on cable length of main cables, cable length of local cables, percentage of overhead cable and number of pole were provided through interviews. The average length of main cables per cabinet is approximately 42,000m, and the average length of local cables per one cabinet is about 2,410m. The shares of overhead cable by type are as follows: main cables, 1%, local cables, 49%. Total number of poles is about 120,000. Table 2.7.19 shows average length of cables and percentage of overhead cable by type.

Table 2.7.19 Average Length of Cables and Percentage of Overhead Cables by Type

1. Average length of primary cables per cabinet	42,000 m
2. Average length of secondary cables per one cabinet	2,410m
3. Percentage of overhead cable of primary network	1%
4. Percentage of overhead cable of secondary network	49%
5. Total number of poles	120,000 Nos.

Source: ETB by interview survey of JICA Study Team. 2001

ETB has its main transmission network 100% digitized into optic fiber using the SDH technology; 83% of the commutation is digital. There are projects under the reposition execution of analog lines to achieve a digitalization of 100% in commutation in the year 2001.

CAPITEL

CAPITEL has a cable telephone network and mobile telephone network. The information of both networks is provided by well-organized GIS database, which contains mobile radio station, overhead cable network, underground cable network and telephone poles. The share of overhead cable is 58% and that of under ground cable is 42%. The total number of poles is 54,970and the number of radio stations is 98. Table 2.7.20 summarizes CAPITEL telecommunication network.

Table 2.7.20 Summary of CAPITEL Telecommunication Network

1. Total length of over head cables	1,618km
2. Total length of under ground cables	1,160km
3. Total number of poles	54,970 Poles
3. Total number of radio bases	98 Stations

Source: CAPITEL, 2001.

Table 2.7.21 shows location of local control centers and client attention centers owned by CAPITEL; the first part of the list is for local control centres and the last one for client attention. Unfortunately, the information given by the company does not include details like constructed area of each building.

Table 2.7.21 Location of Local Control Centers and Client Attention Centers

	Building	Address	No. of Story
Local Control Center	CENTRAL AUTOPISTA	Av.13 No. 135-20	2
	CENTRAL TOBERIN	Cra. 38 No. 167-06	1
	LA CABRERA	Cl.86A No. 13-33	5 + 1 cellar
	MORATO	TRANSV. 9 No. 105-84	1
	VILLA MARIA	Cr.107 No. 136B-16	2
	CENTRAL SALITRE	Cr.69 No. 43B-44	3 + 2 cellar
	PROGRESO	Cr.22 No. 3-2/286	2
	ASTURIAS	DIAG.42Bis.Sur x TRANSV.62A	1
	MARRUECOS	Cl.50A Sur No. 7-53/61	3
	SOACHA	Cr.4 No. 22-30	1+ 1 cellar
C.A.C. (Client Attention Center)	CENTRO SUBA	Cl.140 No.91-19 Loc.5-117/8/9	1
	CIENTO NUEVE	Diag. 109 No. 17-15	-
	COLGAS	Cl.36 No. 8-64	1
	CENTRO INTERNACIONAL	Kr.13 No. 26-49	1
	ALAMOS	Transv. 93 No. 62-92	1
	FONTIBON	Diag. 43 No. 95-89	1
	UNISUR (soacha)	Autop. Sur No. 29A-02	1
	SIBATE	Kr.8 No. 10-44	1

Source: TELECOM

D. TELECOM

TELECOM maintains and operates the local communication network in the eight municipalities. TELECOM also maintains the long distance communications through microwave transmission towers located at the summit of the hills. The tower height is in range between 8 and 40 meters; all towers are of the self-supported square section type.

E. Gas supply system

a) Administrative institution of gas supply system

The natural gas resource that comes to Bogotá is mainly extracted from Ballena offshore well (70% of the total amount of gas consumed in Colombia) which is managed by Texaco company and is located on the Atlantic Ocean, in the Guajira prefecture. The second source of natural gas comes from Apiay wells (25 % of the national consumption) located in the east part of Colombia and their manage is performed by ECOPETROL. After being extracted, natural gas is transported by conduction lines that are managed by a company called ECOGAS, which is a national public company. The maximum transport capacity of the North line is 30 million ft^3/day, while the maximum one of the East line is 17 million ft^3/day. The present demand in Bogotá city is around 25 million ft^3/day.

Around Bogotá there are two city gates: The first one is near a municipality called Cogua that is located North-west of the city and receives the coming gas from Ballena wells, while the second one is located in Usme (South of Bogotá) and receives the gas from Apiay area. A city gate is an installation where the gas that comes from a line is received and its pressure is regulated in order to reduce it to distribution values (from 1200 PSI to 250 PSI).

The principal pipelines from the city gates as well as the distribution networks are not controlled by ECOGAS but by Gas Natural Company. Table 2.7.22 shows institution of gas supply system.

Table 2.7.22 Institution of Gas Supply System

Company	Public or Private	Responsibility	Cover Area	Remarks
Gas Natural	Private a. The company is a group dedicated to the distribution of natural gas in Spain and Latin-American. 59% of the capital is international and the other one is national.	a. Management, maintenance and reparation of natural gas pipelines distribution network. b. Management, maintenance and reparation of natural gas pipelines distribution network.	Bogotá D.C., Soacha and Chia	a. This company recently won a bid to distribute natural gas to the municipalities studied in this project. In the future de control of these networks will belong to gas Natural company. There are around 500 employees
Ecogas	Public a. This company was created in August 20th of 1997. Before Ecogas was founded, Ecopetrol controlled the transportation of natural gas.	a. Management, construction, operation, planning and commercial exploitation of the natural gas transportation systems. This work is performed by other companies that are hired by Ecogas. This is the reason why there are not many workers. b. The company is in charge (through other companies like Texaco, BP, ECP) of the gas production areas located in the north and in the plain land of Colombia; some areas of the main transmission network (pipelines) are in concession as well. This means this company is not so important for this study, because the main transmission line for Bogotá and the other municipalities is managed by Gas natural	Transmission lines in Colombia.	In total there are 50 employees

Source: Gas Natural, JICA Study Team, 2001

b) Facility conditions of gas supply system

Distribution of Gas Supply

- ECOGAS

As described before, the natural gas transmission network from Ballenas and Apiay to the cities is managed by ECOGAS. The distribution of the network and the main pipe length by pipe diameter is shown in Figure 2.7.7.

This national network is composed by iron pipes and there is a shut down valve every 25 Km on the lines; the design of the lines were done based on international codes as API and ANSI. The North coastal system was constructed around 15 years ago, while the rest of the net was put in service since 1996. The calculated reserves of natural gas in Colombia are enough for 15-20 years. The average consumption per family is calculated in 30 ft^3/day. The construction of the line Monterrey-La Belleza has two main reasons: The first one is because Cusiana wells have a big reserve of natural gas, even though the exploitation of this resource is relegated to a second plane by now, because the principal resource of this area is oil. The second one is that the transport line from Apiay to Bogotá has already fulfilled its maximum transmission capacity (17 millions of ft^3/day) and further availability is required for the future.

Figure 2.7.7 Distribution of Network and Main Pipe Length by Diameter

c) Gas natural company

The current extension of the primary and distribution network covers about 90 % of the urban area in Bogotá City. For the capital city, the network attends 751,734 users (houses or apartments) and is in capacity to attend a total of 1,140,080 users; the same numbers for Soacha are 91,122 and 306,556, and for Chia are 4,160 and 21,042 respectively. Even though the service is rendered at the present time only to the mentioned municipalities, Gas Natural Company recently won a

public bid to distribute the resource to all municipalities studied in this project. In the future control of these networks will belong to Gas Natural Company.

The principal or high pressure network consists of some kind of distribution rings within the city, in such way that if a track of pipe is broken or damaged, the gas service to the affected area can be supplied from other different branch. This redundant system is not for all Bogotá City and the presence or not of it depends on the city area where the damage might occur.

A transmission line or a pipeline for gas is installed from a supply source or sources towards one or more distribution centers. They are different from the main distribution lines, which operate with higher pressures. The total length of gas supply pipes is shown in Table 2.7.23, while the Figure 2.7.8 shows the distribution iron network within Bogotá City.

Table 2.7.23 Total Length of Gas Supply Pipes In Bogotá City

Area	Length (km)
Bogotá	8,023.0
Soacha	584.0
Total	8,607.0

Source: Gas Natural Company, 2001.

Figure 2.7.8 Network of Main Gas Line in Bogotá City

d) Valve stations for control and attention of emergencies

In order to receive information of problems or emergencies in the gas natural network, the company has two different systems: the first one is through the dispatch center where the main

network is monitoring in real time at some valves by the measurement of gas volume, temperature, pressure, smell and calorific value. This valve stations are constructed underground, and there are instruments that monitoring the well functioning of the measurement gauges. The communication from this points to the central building is done or transmitted by CDP, which is a communication system similar to the one used by cellular phones.

There is one monitoring gauge in each city gate and five additional ones located on the iron network within the city. According to the recommendations suggested by Los Andes University study of Seismic Vulnerability, Gas Natural Company is installing other 15 points of valves; this processes have been finished by the end of October in 2001.

The second information system is the Urgency Center where phone calls from the users are received in aspects related to distribution and gas usage. All phone calls are introduced to a computerized system to follow the progress of the emergency, and to categorize the level of problem: Leakage and gas smelling reports have priority over lack of gas.

2.7.3 Public Facilities

The Study Team collected a wide range of public facilities data within the Study Area. These data can be used for identification of the command center, emergency response center, evacuation site, storage places and others. The information is also useful to identify where to set up emergency response centers and disaster management centers and prioritize the seismic reinforcement required. The data include the following items:

- Name of facility and main functions.
- Size of land and building coverage.
- Structure type, age of building and number of stories.
- Capability of the facility (staff and equipment).

The public facilities data items collected in this study are as follows:

- Fire fighting station.
- Civil defense.
- Red cross.
- Police station.
- Military station.
- Public and private hospital.
- Government facilities.
- Educational facilities (kindergarten, primary school, intermediate school).
- Parks and open space.
- Emergency goods storage center.
- Food Storage center.

- Transportation Facilities (Airport and Bus Terminal).

The information is collected from each organization responsible for the facilities in Bogotá City. In eight municipalities, the local governments do not compile this kind of information, so that the Study Team had a field survey undertaken by a team of local consultants.

The list of the public facilities in the Study Area is shown as follows:

Table 2.7.24 List of Public Facilities

Locality	Government		Disaster Organization						Transportation		Storage Places		Evacuation Facilities		
	Locality Offices	Minintries	Police	Civil Defense	Fire Fighting	Red Cross	Hospitals & Clinics	Army	Airport	Bus Terminal	Goods Storage	Food Storage	Public Schools (Primary/Secondary)	Kindergartens	Parks & Open Sapces
WITHIN BOGOTA CITY :															
1 - Usaquén	1		1		1		9	2					32	7	246
2 - Chapinero	1		2	1	1		9						11	3	133
3 - Santa Fé	1	5	4	1			2						18		71
4 - San Cristóbal	1		1	1	1		7	1					64	3	194
5 - Usme	1		1		1								64	11	154
6 - Tunjuelito	1		1		1		2	1					24	5	58
7 - Bosa	1		1		1		1						34	12	187
8 - Kennedy	1		1		1		3					1	70	8	494
9 - Fontibón	1	1	2	1	1		1		1	1			19	1	132
10 - Engativá	1		2	6	2	2	3						61	3	508
11 - Suba	1		1	1	2		1						42	10	319
12 - Barrios Unidos	1		1										26	4	109
13 - Teusaquillo	1	4	3	3			9	1			1		4		119
14 - Los Mártires	1		1	2	1		4						15	1	47
15 - Antonio Nariño	1	3	1		1		1						12		54
16 - Puente Aranda	1		2	2	1	1		2					33	3	284
17 - La Candelaria	2	7	1	1	1								7		15
18 - Rafael Uribe	1		1	1			2						53	5	212
19 - Ciudad Bolívar	1*		1				1						69	10	263
SUBTOTALS	***20***	***20***	***28***	***20***	***16***	***3***	***55***	***7***	***1***	***1***	***1***	***1***	***658***	***86***	***3,599***
WITHIN EIGHT MUNICIPALITIES :															
Chía	1		1		1	2	7						29		17
Cota	1		1				1						9		
La Calera	1		1	1			1						9		
Facatativá	1		1	1	1	2	7						17		18
Funza	2		1	1	1		3						15		20
Madrid	1		2				4	1					25		29
Mosquera	1		1		1		3						19		26
Soacha	2		6	1	1	1	13						32		12
SUBTOTALS	***10***		***14***	***4***	***5***	***5***	***39***	***1***					***155***		***122***
TOTALS STUDY AREA	***30***	***20***	***42***	***24***	***21***	***8***	***94***	***8***	***1***	***1***	***1***	***1***	***813***	***86***	***3,721***

Source: JICA Study Team

The details of each facility is summarized below:

1) Fire Fighting Station

The Fire Fighting department is under the national government specifically the Ministry of Interior, yet it is under the Command of the Bogotá City Government. The fire fighting office in Bogotá City prepared the data for the office, but for eight municipalities in Cundinamarca, data were collected by the consultant team on field survey. There are 21 fire fighting stations with a collective staff of 330 and 57 volunteers, including those of eight municipalities. The vehicles for the fire fighting activities are 42 in total.

2) Civil Defense

There are 24 Civil Defense buildings in the Study Area. The Civil Defense office, Bogotá Direction, provides the data about capability of the institution and building information of each branch. The Civil Defense in the Study Area has a staff of 224 and 491 volunteers in total. The headquarters of Civil Defense in Bogotá City is in Teusaquillo locality, while the one in Cundinamarca prefecture is located in Puente Aranda locality.

3) Red Cross

In the Study Area, there are eight rescue force centers of the Red Cross with a personnel complement of 538 and 690 volunteers. Apart from those facilities, the Red Cross has health and emergency medical care centers in Engativá locality in Bogotá City and in Chia, Facatativa and Soacha municipalities. Information for Bogotá headquarters was provided by the National Red Cross. For eight municipalities in Cundinamarca, the information was collected by the field survey carried out by the consultant team.

4) Police Station

The police stations are identified in each locality and municipality in the Study Area. The information was collected through the Constructions and Maintenance Group from the National Police Institution that provides the Study Team with the data about staffing, capability and structure of the buildings. For Cundinamarca, information on police stations was collected during the field survey by the consultant team. Nine specialized police stations are distributed in Bogotá City as follows:

Table 2.7.25 Distribution of Police Stations

Locality	Functions
Santa Fé	Perseverance station with 30 policemen for policewomen station La Estanzuela station with 700 policemen to support other stations in any case Carabineros National Park stations with 70 policemen.
Chapinero	Chicó station with 200 policemen for Embassies' security
Fontibon	Modelia station with 50 policemen, same as La Estanzuela station
Engativá	Airport station with 70 policemen for narcotics and related issues
Teusaquillo	Bus terminal station with 12 policemen Judicial station with 200 policemen
Puente Aranda	Traffic police station with 600 policemen

Source: JICA Study Team

It is found that 27 police stations, or 64%, of the total police stations were constructed before 1984, which could be categorized as weak seismic resistant structures; 16 masonry structure stations were also found to have weak seismic resistant structures.

5) Military Station

Seven major military bases and Commanding Center are strategically located in the north, west, south and center of Bogotá City. The General Secretary of the Ministry of Defense provided the information on the military buildings. Regarding the eight municipalities, in Madrid there are some facilities for the Air Force, mainly for maintenance and training.

The number of military personnel is around 20,000 in the Study Area. Almost all buildings were constructed before '84, yet the data cannot be verified due to security reasons.

6) Public and Private Hospital

The Secretary of Health in Bogotá City and each municipality in the Cundinamarca government prepare the data of the public and private hospitals. However, the Cundinamarca data are not so reliable. The consultant team went on field to visit each facility and also checked 55 of the hospitals in Bogotá.

Ninety-four (94) hospitals are identified in the Study Area, of which 54 hospitals are public and 40 are private.

7) Government Facilities

The information was collected from each one of the offices in Bogotá, including information from ministries, but those of eight municipalities were collected during the field survey by the consultant team as well. The information on government facilities is important to determine the location of command center for the national, regional and local level.

8) Educational Facilities

The educational buildings such as primary and secondary schools are distributed in the whole Study Area. The Study Team collected the data for public schools in Bogotá and for public and part of private schools within eight municipalities in the whole Study Area. The source of the information is the Secretary of Education in Bogotá City and a field survey carried out by the consultant team in Cundinamarca prefecture. Reliability of the information is very good for Bogotá as well as for Cundinamarca municipalities.

Educational facilities are important after the earthquake for community level evacuation places. Bogotá City carried out the seismic resistance investigation for the public school facilities in the last 3 years due to the expedition of the Seismic Resistance Code NSR-98. As the results of the investigation, all public schools have undergone a diagnostic study but less than 1% has improved its structure because of the lack of resources.

In addition, information of kindergartens and community centers was provided by the Administrative Department of Social Welfare (DABS) that includes information about the buildings and staff.

9) Parks and Open Space

The information on open space is collected from the District Institution of Sports and Recreation (IDRD). IDRD has responsibility for the maintenance and rehabilitation of the parks. The parks in the Study Area have six stratification based on the size of the park: metropolitan, urban, regional, barrio parks, pocket parks and zonal parks. Based on the information provided by IDRD, the Study Team visited some of the parks and open space to verify the area and facilities. The parks and open space is used for the evacuation places, after the disaster has happened.

10) Emergency Goods Storage Center

For materials and goods storage place, the exhibition center “Corferias” was selected for this purpose due to its size, location and storage capability. The information was obtained from the administrative department regarding structural data and areas in general.

11) Food Storage Center

For emergency food supply, it was necessary to identify a storage place for food.. The biggest food storage place in Bogotá is “Corabastos,” which provides to the Study Team the information about its facilities.

12) Transportation Facilities

Aerocivil was provided the information regarding passenger and cargo terminals within the International Airport “El Dorado” in Bogotá. Besides, bus terminal information was collected from the Transportation Terminal of Bogotá that includes the structural data only.

2.8 Emergency Health and Medical Service System

Laws and regulations, administrative systems, on-going plans, health facilities and personnel as medical resources available in case of a disaster are reviewed here.

2.8.1 Laws and Regulations

Medical response in case of a disaster is not prescribed especially in laws and regulations, which are often in the form of government decrees and resolutions. Among them the following regulations are important for planning of mitigation measures and medical response:

- Decree 1283 in 1996, Resolution 4252 in 1997.
- *Normas Colombianas de Diseño y Construcción sismo Resistente NSR-98.*
- Decree 93 in 1998 (*Plan Nacional para la Prevención y Atención de Desastres*).
- Decree 03019 in 1998 (*Sistema Departamental para Prevención y Atención de Emergencias y Desastres de Cundinamarca*).
- Decree 723 in 1999 (*Sistema Distrital de Prevención y Atención de Emergencias*).
- Many government decrees have been issued especially after the Quindío Earthquake occurred in 1999. Refer to the chapter on "Law and Organization" for further details.

2.8.2 Organizational System

The agencies, which plan and carry out disaster medical response, and their roles and responsibilities, are given below.

1) National Level

Fundamental frame: Sistema Nacional para la Prevención y Atención de Desastres.

Core agency for activity: Subdirección de Urgencias, Emergencias y Desastres, Dirección General para el Desarrollo de Servicios de Salud, Ministerio de Salud

Responsibility: Formulation of policy, Coordination of roles among agencies concerned, Supervision of emergency services by municipalities and prefectures, Command and coordination of agencies in a disaster

Staff: 8 in total, including Medico-2, Bacteriologist-1, Dentist-1

2) Regional (Cundinamarca) Level

Fundamental frame: Sistema Departamental de Prevención y Atención de Emergencias y Desastres (DPAE)

Core agency for activity: Centro Regulador de Urgencias, Cundinamarca (CRUC), Dirección General para el Desarrollo de Servicios de Salud, Secretaria de Salud.

Responsibility: Formulation of policy on emergency service, Operation of emergency information system. Coordination of roles among agencies concerned, Supervision of emergency services, Command and coordination of agencies in a disaster,

Staff: 19 in total, including Medico-4, Nurse-1, Radio operator-12, Emergency technician-1

3) District (Bogotá D.C) Level

Fundamental frame: Sistema Distrital de Prevención y Atención de Emergencias.

Core agency for activity: Area de Emergencias y Desastres, Dirección de Desarrollo de Servicios de Salud, Secretaria de Salud

Responsibility: Formulation of plan for preparedness, Coordination of roles among agencies concerned before and after a disaster, Stockpile of medicines, etc.

Centro Regulador de Urgencias (CRU) will play a role in Formulation of plan, Provision of common emergency service, and Operation of emergency information system, etc.; it will also actively participate in relief effort, in close cooperation with Area de Emergencias y Desastres, when a big disaster occurs.

Staff: 3 (originally 5) in total, including Medico-2.

4) Local Level

In Cundinamarca, some *municipios* which have a population of less than 100,000 form an association to plan and implement measures against disasters. However, information about the system and activities of the associations has not been obtained yet.

2.8.3 Health and Medical Response Plans

The progress and outline of the medical response plan, which has been already prepared at each level, are as follows.

1) National Level

There does not seem to be any plan on the emergency disaster medical response or any guideline to prepare it at the national level.

2) Regional (Cundinamarca) Level

It is the responsibility of municipalities to settle on a plan of measures against disasters. Except for Soacha, the present population of each municipality in Cundinamarca is small with less than 100,000. And the kind of disasters anticipated varies according to the location of each municipality. Therefore, the government of Cundinamarca leads municipalities that have a small population, to form an association for the purpose of devising an emergency plan. The association membership of eight municipalities in the metropolitan area is given below:

- La Calera belongs to an association consisting of several municipalities adjoining the metropolitan area.
- Chia and Cota are just two of 11 municipalities comprising 'Sabana Centro' association.
- The municipalities of Funza, Madrid, Facatativa and Mosquera have formed their own group.
- Soacha has its own association.
- Sabana Centro association, which includes Chia and Cota has already completed its plan preparation, and others are reported to be still in preparation. But even the plan of Sabana Centro does not show the emergency plan concretely though the health sector program is said to be partial in every comprehensive prevention plan.

3) District (Bogotá D.C.) Level

Bogotá City is the only city in Colombia where the plan for the medical response in case of a disaster has already been settled. *Area de Emergencias y Desastres* in charge has officially announced 15 plans in total since 1999 (see Table 2.8.1). The plan divides the causes of disasters into two categories: natural threats and man-made threats (see Table 2.8.2).

Table 2.8.1 Disaster Threats in Bogotá

Type of Threats	Threats
Natural Threats	Earthquake, Landslide, Flood, Gale
Man-made Threats	Technological, Epidemiological, Organizational and Chemical

Table 2.8.2 List and Outline of Emergency Plan by the Health Department in Bogotá

	Title	Outline
1	Frame of health sector plan	Medical response system at a disaster in Bogotá and a communication network by telephone are explained. CRU is placed as the center of command and is given parts such as coordination of related agencies, arrangement for free beds and preparation of blood transfusion.
2	Threats in Bogotá	Potential threat in Bogotá is explained.
3	Methodological guide for elaboration of Hospital Plan of Emergency	It is a kind of a guideline for a hospital to make an emergency plan (PHE). It contains 14 kinds of forms, in which condition of facilities, personnel alarm system, etc are to be filled out.
4	Link of telephones	This is the attached document to 1 above, to show a link by phone network within the Health Secretariat in an emergency. A communication network is to be decided at the following two Phases. Phase- 1: Impact Phase- 2: Interinstitutional total activation
5	Rationing of water	It shows the way for a hospital to secure the necessary amount daily, because public hospitals usually have poor capacity of water storage. It suggests the necessity to reduce the number of patient admissions in the worst-case scenario. Among all 40 hospitals, 23 hospitals fall below the necessary capacity of water storage that is calculated from the number of beds.
6	Rationing of energy/electricity	There are 3 steps given to save on electric consumption, because hospitals have low electric capacity as well as low water capacity. It shows that service has already been restricted in several hospitals.
7	Evacuation Plan	Omit
8	Management of shelters	Items of infrastructure, environment and items of minimum sanitary condition are shown for health personnel in charge to evaluate a refuge.
9	Massive poisoning	The way to cope with a break out of massive poisoning is shown by three steps.
10	Floods-Landslides	Investigation forms to assess the inhabitants in the danger area from the health side, before and during a disaster, is shown. An activity process before and during a disaster is proposed briefly

Among the 15 volumes in total, general countermeasures are described in the 1st volume to the 8th, and the medical response plan against specific disasters is explained in the 9th volume to the 15th.

The plan takes up the disasters, which are expected to occur more frequently, for example, riots or social unrest as threats by human activity and the 'El Nino' phenomenon or flooding as natural threats (see Table 2.8.2). Therefore, a response plan against a potential massive earthquake is not contained there. It is possible, however, to develop the target plan from the existing plans. This can be pointed out as a clear difference with Cundinamarca, who has yet to prepare its own response plan..

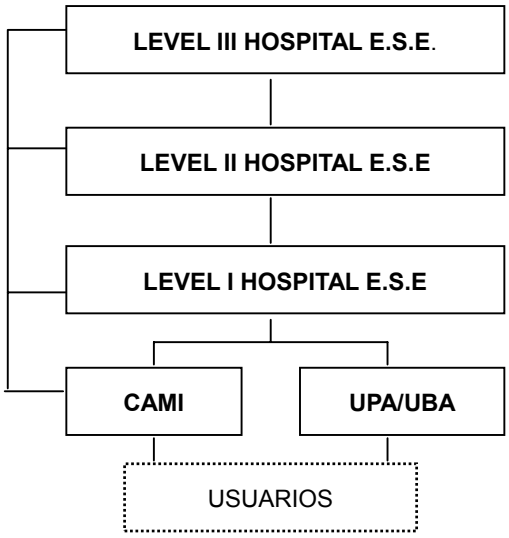
Since the target plan is still underway, *Area de Emergencias y Desastres* is soliciting opinions from concerned persons in order to improve the plan.

2.8.4 Medical and Health Service System

1) Health Delivery System in Bogotá Metropolitan Area

(1) Public health service system

Public health institutions are categorized into the following three levels (Figure 2.8.1). Patients can freely choose a hospital regardless of its level without being penalized.



- **LEVEL III:** furnish several subspecialties and an Intensive Care Unit (ICU), other than Internal Medicine, Surgery, Ob/Gyn, and Pediatrics.
- **LEVEL II:** furnish inpatient wards for Internal Medicine, Surgery, Ob/Gyn, and Pediatrics.
- **LEVEL I:** Small hospitals and affiliated health centers, CAMI, with basic treatment, dental care, disease prevention activity and observation beds.

E.S.E.: Empresa Social del Estado
CAMI: Centro de Atención Medica Inmediata
UPA: Unidad Primaria de Atención
UBA: Unidad Básica de Atención

Figure 2.8.1 Health Service System

(2) Net of services

The Health Department divides a city area into four health service zones, and arranges one level III hospital in each zone. And in each *localidad* one level I hospital is allocated, at least. (Figure 2.8.2).

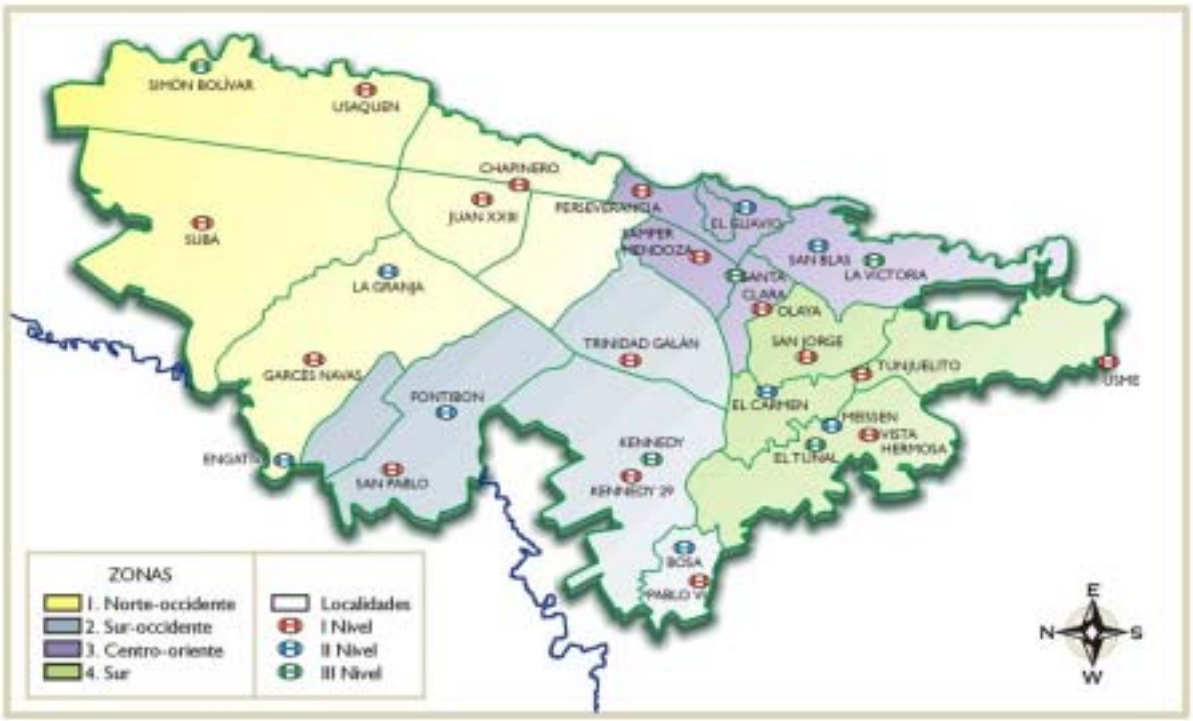


Figure 2.8.2 Four Zones and Hospital Allocations in the Health System

Such a network of zones has just been adopted from 2001 by the change of health administration system. This system corresponds to the idea of the service zone of the 2nd level. It becomes possible that a balance of medical demand and supply is examined by service zone.

(3) Public hospitals by level

The number of public hospitals E.S.E in the Bogotá Metropolitan Area is 39, and the number of beds is 2,189 excluding emergency beds (see Table 2.8.3). There are 13 hospitals of level IIand level II furnished with 921beds in total. These 13 hospitals are expected to become the bases to provide in-hospital care in times of disaster. The hospitals of level III in Bogotá are functioning as Top Referral Hospitals not only for Bogotá City but also for Cundinamarca. The usage of beds in public hospitals is very high at 80-85% BOR, compared with 60% of private clinics.

And "Fusion" of the hospital name shows that it is a complex of a hospital and CAMI and/or UPA/UBA affiliated to it. This is also a newly established system by the reform in 2001.

Table 2.8.3 Number of Public Hospitals E.S.E and their Beds by Level and Area (Year: 2001)

Area		Level III		Level II		Level I*	
		No.	Beds	No.	Beds	No.	Beds
Bogotá	North	1	328	3	160	6	116
	South-West	1	245	3	141	5	82
	Center-East	2	339	3	323	4	13
	South	1	165	3	157	7	120
Bogotá Total (a)		5	1,077	12	781	22	331
8 municipalities in Cundinamarca (b)				1	140	7	190
Bogotá Metoropolitan Area (a) + (b)		5	1,077	13	921	29	521
Cundinamarca Total (d)		1	258	9	1,530	67	1,271

Name of Public Hospitals E.S.E

Area		Level III	Level II
Bogotá	North	Simon Bolivar: 328 (ICU: 24 beds)	Engativa: 17 Granja: 51 Fusión Engativá: 92
	South-West	Kennedy III: 245 (ICU: 23 beds)	Fontibon: 36 Fusión Fontibón: 46 Bosa: 59
	Center-East	La Victoria: 161 Santa Clara: 178 (ICU: 15 beds)	Guavio: 52 Fusión Centro Oriente: 59 San Blás: 212
	South	Tunal: 165 (ICU: 18 beds)	Carmen: 20 Fusión Tunjuelito: 44 Meissen: 93

Note: *mark shows that Health Centers are included in both numbers.

(4) Private clinics and other public hospitals

All private clinics in Bogotá are classified as Level II and/or Level III; they number 37 and have 6,521 beds in total (Table 2.8.4). This capacity is equivalent to 2 times in number of facilities and 3.5 times in beds in comparison with those of public hospitals at the same levels. Moreover, there are many comparatively bigger hospitals in terms of admission capacity. In addition to clinics, number of private practitioners comes up to 12,565.

It is clear from these figures that the role of the private sector in health and medical activities in case of a disaster is not to be ignored.

Table 2.8.4 Number of Private Clinics, Other Public Hospitals and their Beds by Level

Area	Level III		Level II	
	No.	Beds	No.	Beds
Bogotá	31	6,153	6	368
Eight municipalities in Cundinamarca (b)	-	-	3	364
Bogotá Metropolitan Area (a) + (b)	31	6,153	9	732

Note: * Not including beds for emergency purpose .Year 2000)

(5) Health personnel

In 1997, the number of medical doctors amounted to 4,253 (including 756 engaged in emergency service), which was double the number of nurses that same year (Table 2.8.5). In addition to this, there were over 10,000 private practitioners. Therefore, it could be said that the number of doctors reached an almost excessive level. It could also be pointed out that there were far fewer nurses compared to the number of doctors contrarily.

Table 2.8.5 Health Personnel by Level and Area in Bogotá (Year:1997)

	Level			Total
	I	II	III	
Medical Doctor	413	1,628	2,212	4,253
Nurse	153	489	1,251	1,893
Auxiliary	377	1,750	4,223	6,350

Note: * Includes personnel for emergency services.

Private sector occupies the most part of health facilities. Therefore, as for the number of doctors, private sector accounts for 89% of specialists and 80% of general practitioners.

2) Emergency Medical Service Network

(1) Facility services

Hospitals of level II and III, regardless of whether they are public or private, provide 24-hour emergency medical service. Even in the number of observation beds for emergency patients, the private sector has a capacity over three times, compared with that of the public sector (Table 2.8.6). Moreover, *Servicio de Atención Medical de Urgencia* (SAMU) of the Red Cross has 3 observation beds and 10 ambulances. Thus, SAMU plays a big part in emergency service in the metropolitan area.

Table 2.8.6 Hospitals with Emergency Services by Level in Bogotá (Year:2000)

Sector	Level	Service Hours		Hospitals	
		24h	12h	Nos.	Nos. of beds
Public	III	all		5	114
	II	all		12	67
	I	CAMI only	all	23	9
	Total			40	181
Private	III	all		31	581
	II	all		6	27
	Total			37	608

Note: Hospitals in Cundinamarca are not included.

(2) Information and communication network system

The information and communication center for emergency medical service is CRU in Bogotá and CRU Cundinamarca (CRUC). With regard to their information centers, both are located in the

center of Bogotá independently, with a staff of 23 for CRU and 12 for CRUC working 24 hours by 3-shift system.

Moreover, there are medical doctors who are stationed to give medical directions and consultations on the telephone. The radio-communication system, which covers the whole city area through two relay points with huge tower antennas, is almost completed in Bogotá City. Furthermore, the latest facilities of CRU will function as a control tower at the time of a massive disaster; therefore, it is furnished with a room where the responsible persons in charge can gather at this crucial time. There are no such facilities in CRUC.

It should be noted that there is no direct radio contact between CRU and CRUC. But rather the radio system of SAMU is connected with all the organizations directly. It means that SAMU occupies the important position (Figure 2.8.3) in terms of covering the metropolitan area as a whole.

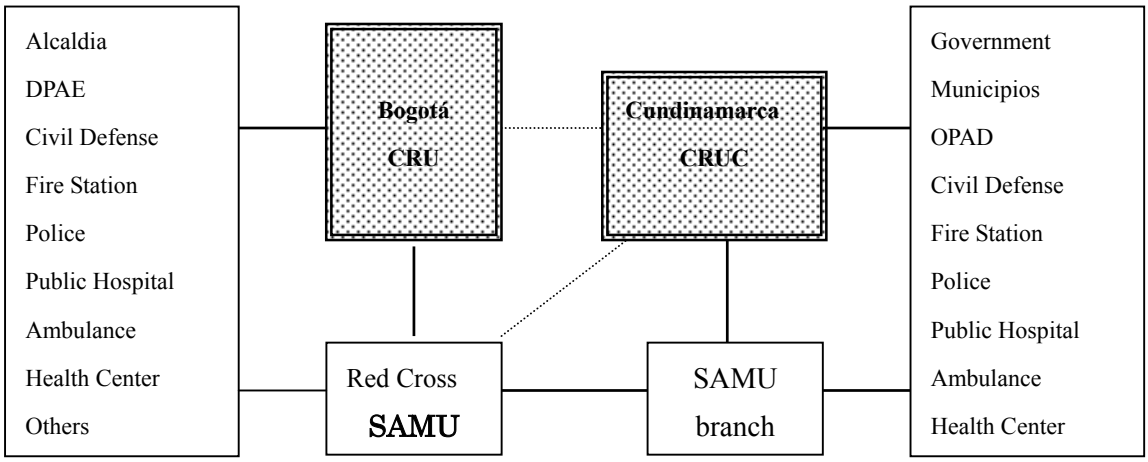


Figure 2.8.3 Radio Communication Network in Bogotá Metropolitan Area

(3) Ambulance arrangement system

There are 28 units of ambulances, which CRU can use at any time. On the other hand, CRUC can only use several units even if units contracted with a private company are included. (Table 2.8.7) CRU arranges, by contract, a team consisting of a doctor, an assistant nurse and a driver to every 15 TAMs out of 28 units for 24 hours.

However, it is uncertain how many ambulances under control of public hospitals and municipalities CRUC could actually use, although a government decree prescribes that the health authority can use any ambulance regardless of its ownership in times of urgency.

Table 2.8.7 Allocation and Arrangement of Ambulances

Bogotá	Public hospitals – **60** cars CRU – allows **28** cars by contract among 60 to arrange at Strategic Points like fire stations. Private ambulance – 180 cars (including 10 of Red Cross')
Cundinamarca	Public hospitals and municipalities – **260** cars. 8 municipalities have **18** cars among them. CRUC –owns **2** cars only, then contracts with a private company. Other public agencies like Police have 7 cars. No information about private ambulances.

2.8.5 Preparedness

1) Progress situation of preparing a plan for disasters

Government Decree 619 in 2000 places main municipalities under an obligation to settle on a medical response plan against disasters. Though the essential plan already mentioned is prepared, Bogotá does not have a plan for a big earthquake completed yet. Furthermore, the eight municipalities in Cundinamarca have not set a time frame for preparing even a fundamental one.

2) Education on disaster medicine

A. Ministry of Health

A study is made of 35 medical doctors in charge of emergency services on Disaster Administration in 8 courses (2 years) in Valle University and Antioquia University respectively. Another 2 courses will be added in 2001.

B. Bogotá City

- *Centro de Estudios sobre Desastres y Riesgos Naturales* (CEDERI) of Los Andes University was entrusted to study the risk analysis of disasters of natural and man-made origins in 1999.
- The textbook titled "*Capacitación en Manejo y Administración de Emergencias y Desastres*" was made in cooperation with Bosque University in 1999. It is used for educational purpose for people involved in the measures against disasters, including health personnel.

Apart from the academic and comprehensive education mentioned above, several health entities like *Secretaria de Salud* in Bogotá are providing health personnel with educational courses. Targets of these educational courses and the executing agencies, shown in Table 2.8.8, are characterized as follows:

- There is no subject on disaster medicine in the undergraduate and postgraduate courses.
- Training courses by health authorities are carried out actively, but they are very low-key in Cundinamarca.

Table 2.8.8 Agencies In-Charge of Training and Enlightenment Activity on Disaster Health Care

Executing Agencies \ Education Targets	1.Undergraduate: Medical Students	2.Postgraduate Education	3.Professional Health Personnel	4.Community Health Volunteers	5.Community People	6.School Students
1. Ministerio de Salud			○			
2. Secretaria de Salud, Bogotá			○	○	○	○
3. Alcaldia Localidades, Bogotá			○	○	○	○
4. Secretaria de Salud, Cundinamarca			○	○		
5. Alcaldia Municipios, Cundinamarca						
6. Cruz Roja			○	○	○	○
7. University or other agencies	○	○	○			

Frequency of holding training courses is about once a year. Consequently, the number of participants is quite large (Table 2.8.9).

Table 2.8.9 Frequency and Cost to Carry Out Disaster Health Training/Education by Secretaría de Salud in Bogotá

Target	Frequency and cost
Professional Health Personnel	Target: Doctors of public and private hospitals, Frequency: 2-day course for 250 participants, once a year Budget: $68,000 a person, Bogotá hired a consulting firm to design the curricula and recruited lecturers.
Community Health Volunteers	Frequency: 2-day course for 600 participants, once a year Budget: $70,000 a person Bogotá conducted the course in 1998, 1999, & 2000, but Bogotá hired a consultant to do it.
Relief Personnel (Civil Defense, etc.)	These relief agencies provide training by themselves
Community People	Frequency: 15 to 20 times a year, 6-hour course for 40 participants Budget: $ 15,000-20,000 a person, Target: 1,000 participants a year CRU staff themselves become lecturers
School Students	Included in community people

3) Building Reinforcement of Public Hospitals against Earthquake

There is a law prescribing completion of reinforcement work on buildings within six years from the date of the law's effectiveness. However, it is only Kennedy Hospital (Level Ⅲ) which has started reinforcement work, and it is still ongoing. Budget for the reinforcement works is shown in Table 2.8.10.

Table 2.8.10 Budget to Reinforce Buildings of Public Hospitals E.S.E

	Level III		Level II	
	No. of facilities	Budget	No. of facilities	Budget
Bogotá City	5	US$20,000,000	8	US$25,000,000
Cundinamarca	0		27*	1,400 million pesos

*Note: Consists of 18 level-I and 9 level-2 hospitals.

4) Stockpile of Medical Necessities

- Ministry of Health: Medical supplies and materials for 10,000 patients are stored in Bogotá.
- *Area Emergencias y Desastres*: 21 packs (1 pack can meet the needs of 150 patients) of medicines and materials for the hospital are stockpiled in the Central Storage.
- CRU: It has a plan to stockpile the blankets, materials and medicines for medical teams on site in the storage located at the underground of the centers.
- Cundinamarca: Medical supplies and materials for 200 patients are stored in CRUC. There is a plan to set up a warehouse in four strategic places in the Department.

2.8.6 Some Major Problems Recognized to be Solved

As for the emergency medical system and its response plan against a disaster, even Alcaldía Mayor Bogotá, the lead agency for such preparation, has not made a plan for a massive earthquake yet. The Study Team, the Health Department of Cundinamarca, and the Health Department of Bogotá, have discussed on-going plans and came to an understanding that the following seven problems were indispensable for phase 2 of the Study.

The Study Team and *Area De Emergencias y Desastres* of Bogotá made the remarks written under each problem.

1) Cundinamarca is far behind with preparing the plan, compared with Bogotá.

- Cundinamarca covers so wide an area for emergency service that it is more difficult to provide the corresponding resources to urgent requirements.
- There is a big gap in the budget scale, the number of staff and so on between both governments, and this has an enormous influence on planning too.

2) The role of private sector is hardly being taken into consideration in the plan.

- Bogotá considers that the private sector is involved in the disaster medical services to a certain extent, because it participates in the disaster training.
- Private clinics are not actually being taken into consideration when the capacity of beds for the injured is examined.
- A dialog with owners of private clinics has started on the diagnosis of building resistance against an earthquake, which is to take place in a year's time.

3) Necessity of formulating a coordination system, which unifies all agencies of Central-Cundinamarca-Bogotá and the Private Sector, is not being considered.

- Ministry of Health does not have much scope to elaborate such system, because the Ministry has to take care of many departments and municipalities all over the country.

4) A quantitative countermeasure based on the damage prediction is not planned. The resource, which can be inputted at the time of a big disaster, is not grasped quantitatively.

- Bed occupancy rate of public hospitals in Bogotá is 80%-85 %, and it would not be able to admit serious patients, even in the case of the lightest damages estimated by INGEOMINAS.
- Human damage estimated in the microzoning system: Number of beds which can be available need to be calculated corresponding to the medical needs in order to check the balance of supply and demand.

5) The radio communication system of CRU and CRUC does not synchronize. Therefore, neither one can communicate directly any more once their telephone lines are interrupted.

6) Stockpile of medical supplies for disasters is not sufficient.

7) It is necessary to test if the emergency response plan, which each hospital has, is actually effective.

2.9 Existing Communication and Information System

2.9.1 DPAE System

1) General

The communication system of DPAE is the vertebral column type, which has been chosen for its functionality. It connects all the personnel in DPAE as well as 15 different entities subscribed in the *Red Distrital de Emergencia* (District Emergency Network).

The communication system of DPAE actually falls under the "Operation Coordination". It consists of basically two systems: the old analog system, in operation at present, and the new digital system in implementation for future.

2) Objective of the Unit

The objectives of the information system in DPAE are:

- To coordinate and administrate the communication network installed in DPAE and other places; and
- To serve as PBX of DPAE outside the office hours of DPAE.

3) Technical Specifications

The communication system can be divided into two broad categories, namely, analog system and digital system, based on the installation type. The present analog system is at the moment in operation but will be shortly replaced by new digital system. The digital system should be the information system in DPAE. The following section explains the digital system, which will be for future use.

The new digital system consists of "Smart Trunk" of Motorola. In total there are six repeaters, three of which are inside the installation of DPAE and three more repeaters are located in the southern part of Bogotá. The "Smart Trunk" technology lets the base unit continuously communicate with the repeaters in the southern part of Bogotá. Also all the verbal communications generated can be saved through one CPU in digital format.

4) Frequency and Channel

The communication is carried in VHF (Very High Frequency) and presently has two channels in operation.

- Channel 1 or Administrative Channel.
- Channel 2 or Emergency Channel.

Channel 1 is for only the personnel of DPAE (CLE, EQT etc.) and for the communication among the personnel of DPAE. There are about 120 users for this channel.

Channel 2 is for all the 15 institutions subscribed to the District Emergency Network. The institutes subscribed to this network are the following: Secretary of Health (District), Secretary of Traffic, Water Supply and Sewage, Energy, Natural Gas, Telephone Service, CISPROQUIM, Fire Fighting Office, Red Cross, Civil Defense, Police, 13th Army Brigade, DNPAD (National Directorate of Emergency Attention), *Transmilenio* (Public Transport System) and DPAE. All these entities have one base unit in their installations and use channel 2 to communicate with each other.

Another channel, Channel 3, is also being tested for the communication between point to point or mobile unit to mobile unit directly. This might optimize the traffic to the base unit.

Also, there is a plan to connect the present network in such a way that it can communicate with other communication systems such as normal telephone, cellular etc.

5) Coverage

The location of antenna and repeaters in DPAE and the southern part of Bogotá City allows the DPAE to communicate with almost all localities of Bogotá. Part of the localities of Santa Fe and USME is not covered. Also the Region of Sumapaz is not covered.

6) Functionality

The communication unit in DPAE operates 24 hours a day, all year around. It has four operators. Three operators rotate on eight-hour shifts: 6:00 – 14:00, 14:00- 22:00 and 22:00- 6:00. The fourth one is the backup when someone takes a leave.

(1) Normal emergency management

When no major disaster event happens, it is defined as normal emergency management. Under normal emergency management, the operator listens to the communication of different institutes and makes a note of the events in the database system developed in Excel. This database system covers type of event, victims, locality, barrio, address, responsible institution and action taken. The database has been registered since 1998 and is saved as Excel files. Actually, this database is used in DPAE for future planning of actions.

(2) Disaster management

Under emergency situation (landslide, flood, forest fire etc.), the operator takes a pro-active role. The operators are not only listening to the communication but facilitating the people in charge of emergency to locate materials, other people etc. The operator, in emergency situation, may use conventional communication system such as telephone and cellular to contact the institute or person not connected with this network.

7) Installation

Three antennas and three repeaters are installed in the building of DPAE (located in Diag. 47 # 77b 09). Another three antennas and three repeaters are located in Sierra Morena in the southern part of Bogotá City.

2.9.2 The Information System for Risk Management and Attention of Emergency (SIRE)

1) Mission

Sistema de Informacion para la gestion de Riesgos y Atencion de Emergencia de Bogotá: (SIRE) was created by the Inter administrative agreement 006 of 1998 between FOPAE and INGEOMINAS. The mission of the organization is to facilitate the risk management by capturing, organizing, processing, and supplying available information rapidly.

2) Vision

The vision of SIRE is to be an integrated system that can be converted into the pillar of risk management at the national level

3) Objective

The objectives of SIRE are summarized as follows:

- Store, integrate, and maintain adequately the information related with the risk management;
- Facilitate the access or the query of existing and future information in the most rapid way;
- To help the promotion of the disaster prevention culture; and
- To guarantee the security, integrity, recuperation and privacy of the information for all types of events.

SIRE contain basically two types of information system, namely, generated information or product information, and locally structured information.

- Product Information: The product information is information generated by third party (studies, maps, reports and others) that cannot be modified by the users in any of the risk management stage. This type of data will be entered in the system with meta-data and geographic coverage.
- Locally structured Information: This information is generated during the risk management stages and organized with relational tables.

4) Component of the System

This system is composed to work under two environments; public environment under internet service having domain under www.sire.gov.co, and restricted environment under intranet and internet with user name and password.

Under the public environment, users are permitted to access to the product information by using the data warehouse (library) or to the maps by using a geographical information system for internet (GIS-Web). The users are asked to download a free plug-in for these data visualization.

Under the restricted environment, it is depended on the several modules, each of which has the user profiles. The main modules of the system are: administration, security, metadata entry, data warehouse, requests, reports, projects, boring survey, directories, inventories, emergencies, and geographic information systems.

The fundamental characteristics of the main modules are described as follows:

- Data warehouse: This is permitted to all the users and allows to search by using the data warehouse. Users are allowed to search a document by key words, such as title, author, or by the type of product. Once the document is found, a small summary of the content (metadata) is displayed, and permits to access to the digital document on-line based on the user request.
- Requests: This is not permitted to the public. This module allows to organize and allocate the appropriate personnel to answer for the requested questionnaires by citizen or the public employee of the other entity. All the questions are controlled digitally for information.
- Reports: Controls the elaboration in a standard manner and approval of reports which respond to the different requests. This is captured and stored digitally for the purpose of anytime consulting.
- Boring Survey: Allows access to the boring survey profile and tests realized in the study as well as access to the meta-data of the study. Detailed maps of the surveyed area are available based on the request. The data entrance module is not for public, though the questions and the reports are fully accessible for the public.
- Directories: Entry and consulting of structured information in the form of directories (Ex. Directory of Entities on risk management, Directory of Academic Programs related with risk management, Directory of Education Centers etc.) with geological reference. With new need, new directories can be created.
- Inventories: Inventories are structured similar to directories. The difference lies in the fact that the inventories store information related with the accumulated quantity of the elements (Ex. Inventory of Human Resources, Inventory of Resource Materials). This module has

interface with SUMA program (System of Human Inventory Preparation) that is used often for the preparation emergency control.

- Emergencies: One of the most complete and complex module of the system. This module helps the functions related with the attention of Emergency, with which information on emergency procedures is generated as well as the necessities, and the mobilized resources. This module is complemented with directories, inventories, data warehouse, and geographic module.
- Geographical Module: This is based on the geographical information system for WEB, and transversal to the system and can be utilized by different modules simultaneously. The information is stored in a Geographic Information System, possesses a geographic location with coordinates, and can display maps, geographic queries and geographic codification. This is also related to the land database which is officially provided by DACC. The data has more than 40 layers of different information and the users are available to access to different geo-statistical information. Any geographic element could be questioned through the direct navigation or address, because this system has official information of Census Bureau.

  In addition, users are not required to download the plug-in files, because it had developed in Java.

5) Technical Infrastructure

SIRE is a system based on Intranet. It develops the major part of the processing in a central server and through the communication infrastructure supply information to clients.

The hardware necessary for implementing SIRE is composed of:

- Server with local domain.
- Proxy Server or the Internet.
- Application server.
- Database server.
- Clients.
- Accessories.

The software necessary for operation of the system is Oracle8i, MapXtreme Java, communication and productivity software.

6) Advantages of the System

SIRE, as an information provider, offers the following advantages:

- Easy access to information in all the stages of risk management thus speeding up the decisions making.
- Generates standard documentation.

- Covers the major part of the culture of disaster prevention by supplying the public the general information related to risk management.
- Improves the coordination of the activities to concentrate and integrate different sources of information.
- Allows the consolidation of the information related to emergency and disaster; and
- Facilitates the planning and control of public investment, optimization of human, physical, and logical resources, although this is not the principal objective of SIRE.

7) General Restrictions

- The goal of SIRE is to provide the information, and thus SIRE in itself does not do the risk management and it is just a tool to facilitate the risk management, stated as the provider.
- SIRE is not the best system for simulation modeling for risk management, because it was not designed for this kind of purpose. It is rather strong for the data distribution.
- It is not robust enough to connect with the Internet in case of emergency.

8) Projection of the System

DPAE and INGEOMINAS are the institutions that can update the new version of SIRE. These institutions can perform thematic and functional amplification as well as summon other institutes for the system's improvement and use.

SIRE can be implemented in other geographic places. The system allows the application of new technology and utilization. Moreover, SIRE makes possible the adoption of changes in risk management models.

2.9.3 Cundinamarca Government

1) General

Since 1995, all the agencies of Cundinamarca in charge of emergency attention and relief-provision are concentrated in Cra. 58 with calle 10 in Puente Aranda.

2) Communication Unit of Government of Cundinamarca

The communication system of Cundinamarca government serves to establish a link with all the 116 municipalities of prefecture. It connects all the municipalities through the network of 16 repeaters.

This communication system actually falls under the "Secretary of Government." It consists of one independent analog system. Adjacent to this communication unit there is a smaller unit handled by one person from the national army.

3) Objective of the Unit

The objective of the unit is to coordinate and administrate the communication network installed in base unit and other 116 municipalities

4) Technical Specifications

The communication system consists of an analog system based on the Motorola technology, which serves basically three types of users.

- Officials of Government of Cundinamarca.
- 116 Municipalities of Cundinamarca and their officials.
- Provincial units (CAPS) of Cundinamarca.

In total, there are sixteen repeaters located in different parts in Cundinamarca.

5) Frequency and Channel

The communication is carried in the following frequencies: VHF (Very high Frequency) high, VHF low and UHF.

The majority of the municipalities does not have a communication base installed and work point to point basis. Following is the status of the communication system installed in the municipalities. Further check on the status should done in each municipality.

Table 2.9.1 Communication System in Eight Municipalities

Municipality	Communication base installed
Chía	Yes
Cota	No
Facatativá	Yes
Funza	No
La Calera	Yes
Madrid	No
Mosquera	No
Soacha	No

Source: JICA Study Team

All the municipalities that do not have communication base installation communicate point-to-point basis. Also, there is an emergency 9800 number that any person can use to report an emergency and there are operators to handle such calls.

6) Coverage

The location of 16 antennas and repeaters all over Cundinamarca gives an almost complete coverage of the Prefecture of Cundinamarca. Although actual number of users is not known it is estimated that users of this system may exceed 1,000.

7) Functionality

The communication unit of Cundinamarca functions 24 hours per day. Like the units of other institutions, it operates under two modalities:

- A normal situation is when there is no major disaster events, like forest fire, landslide, flood etc. Under normal situation, the operator listens to the communication of different municipalities and takes note of the events in the register book.
- Under emergency situation such as landslide, flood, forest fire etc., the operator takes a pro-active role. The operator is not only listening to the communication but facilitating the people in charge of emergency to locate materials, other people etc. The operator, in emergency situation, may use conventional communication system such as telephone and cellular to contact the institute or person not connected with this network.

The Cundinamarca government also has two mobile repeaters, which can be installed on the emergency spot when needed.

8) Installation

Sixteen antennas and sixteen repeaters are installed all around Cundinamarca.

9) Workshop of Communication Unit

The workshop is the unit for the maintenance of the equipment and the network. It has three people working in it. The people in this unit offer services to base unit in Cundinamarca and all the other municipalities. Often they provide the services to adjacent agencies like Civil Defense.

The personnel in the workshop have deep knowledge of the installation and equipment, especially of the Motorola Technology. According to the person interviewed, 90 percent of the communication system consists of Motorola Technology.

2.10 Education and Training

2.10.1 Existing Situation

1) Background

In case of disaster, it is inevitable that concerned governmental organizations are required to implement the systematic and integrated rescue works with private sector. In addition to this, communities should be able to carry out disaster relief effort by themselves in cooperation with related agencies. More important are preventive measures to mitigate the damages in case of disaster. Therefore, in normal condition, people should be aware of disaster prevention and attention and prepare to act effectively in case of emergency. In order to make the prepared condition among government agencies, private sector and communities, necessary information should be distributed; coordination among relevant entities and capacity building are indispensable through education and training on disaster prevention and emergency responses.

2) Present Conditions

(1) Organizations in charge of education and training for prevention and attention of disaster

Major organizations that plan and implement education and training on prevention and attention of disaster are summarized below with their responsibilities. Organizations are categorized by level and type as shown in Table 2.10.1.

Table 2.10.1 Organizations Related to Education and Training for Prevention and Attention of Disaster

Level	Educational Organization	Special Organization for Disaster Management	Coordinator	Cooperating Institution	Private Sector
National	Ministry of Education	- National Committee -National Advisory Commissions - SNPAD	DNPAD	- Ministry of Health - National System of Fire Fighters - National Police - Colombian Civil Defense	Red Cross Colombia
Regional (Cundina-marca)	-Secretariat of Education -Board of Education	- CREPAD - CLOPAD	OPAD	- Secretary of Health -Corps of Fire Services - Metropolitan Police - CAR - Civil Defense	Red Cross
District (Bogotá City)	Secretariat of Education	- SDPAE - District Committee	DPAE	- Secretary of Health - Fire Men Official Body - Metropolitan Police - Civil Defense	Red Cross

A. Educational organization

a) Ministry of Education

At national level, Ministry of Education is included as a member of National Advisory Commissions (*Comisiones Nacionales Asesoras*) and an integral party of the National System for the Prevention and Attention of Disasters (SNPAD). Decree 9129 (1989) articulates the Ministry's function as preparing the community on issues related to prevention, attention and rehabilitation of disasters.

b) Secretary of Education

At regional and district levels, there are Secretaries of Education. Since there is no specific staff in charge of prevention and attention of disaster and budget for the topic, Secretaries of Education have cooperated and coordinated mainly with OPAD and DPAE, and have also established some relation with Firemen Official Body, Police and Red Cross. At locality level, there are CADELs in Bogotá (Coordinator of the Local Education Administrative Center) that can touch base with communities but any specific activities related to prevention and attention of disasters have not been done yet.

B. Special organization on preparedness and attention of disaster

a) Education Commission in CREPAD

Under CREPAD, Education Commission was established based on the Decree No. 3019 in 1998 in parallel with Technical and Operation Commissions in Cundinamarca. Education Commission is coordinated by Secretary of Education. Significant areas covered by the Commission are a) Training of community and institutions, b) School plan and c) Public information and its dissemination.

b) Education Commission in CLOPAD

CLOPAD also has an Education Commission, whose objectives are:

- To coordinate training activities and training directed to CLOPAD.
- To define training programs for communities with high risk.
- To implement School Emergency Plan with the conformation of Brigades in schools, and
- To elaborate instructions, bulletins, and official statements for popularization of preventive measures for emergencies.

c) District System of Prevention and Attention of Emergencies in Bogotá (SDPAE)

SDPAE is organized in order to generate and establish discussion, arrangement and sectoral and institutional commitment spaces and process, in such a way as to strengthen the coordination, management and execution capacity of district entities on the issues of prevention and attention of emergencies, as well as on rehabilitation and reconstruction.

d) District Education Committee in Bogotá

Under the District Committee of Prevention and Attention of Emergencies of Bogotá, three committees (Operation, Technical and Education Committees) were organized in 1999. The objectives of Education Committee are to involve and integrate the theme of prevention and attention of disaster/emergency into the culture of local community through planning and implementing of policy, strategy, projects, and methodology in cooperation with concerned organizations. Secretary of Education coordinates this committee and the role of the members. Activities and roles of each committee member are not defined clearly. They are not coordinated regularly and do not function as preventive organizations.

e) Local Committee on Prevention and Attention of Emergencies 19 Localities of Bogotá (CLE)

Each locality of Bogotá establishes CLE as an inter-organizational coordinating body in order to cope with disaster in each locality through formulating emergency plan, planning and promoting projects of emergency prevention and attention issues by way of incorporating the projects into the local investment plan and budget. The number of committee members is basically 19 but the

additional members such as community organizations and leaders are available in order to deal with specific theme in the locality. The members and condition of each CLE are various as shown in Appendices 2.10.1 and 2.10.2. DPAE supports CLE in the way of close cooperation of consultants and staff with community. Inside CLE, there is also an internal education commission for the performance of its duties and the development of the topic.

C. Coordinator

a) OPAD

In OPAD, there are 3 sections:

- Coordination of Technique and Planning.
- Coordination of Education and Public Information.
- Coordination of Operation and Emergency.

Each section has one professional staff and the total number of staff is 7, which is very limited. The Section of Coordination of Education and Public Information is responsible for the following: a) Training for community and institution and b) School plan and curriculum. Its target groups are CLOPAD, municipal operation organizations such as Firemen Official Body, Police, Army, Red Cross, Civil Defense, Community Brigades, etc., schools, and vulnerable communities living in zones of high risk as well. OPAD concluded an agreement with the Red Cross for financial support to build the Prevention and Attention Training Center in Cundinamarca, which is already in operation.

b) DPAE

The number of staff of DPAE in each section including assistants and secretaries is shown in Table 2.10.2

Table 2.10.2 Staff of DPAE

	Section	No. of Staff
1	General Direction	3
2	Planning	1
3	Administrative and Financing	20
4	Juridical Area	6
5	Dissemination and Press	1
6	Inter-institutional Coordination - Technical Coordination - Operation Coordination - Education Coordination	 2 17 1
7	Risk Analysis	17
8	Local Management	12
9	SIRE	4
	Total	**84**

Source: DPAE

There is one coordinator each in charge of education and information in Dissemination and Press and Education Coordination who plans and implements all activities related to education, training, workshop, publication, and other public relations activities. It is clear that the number of staff is not enough and the staff allocation to cover all necessary work is not appropriate. The length of their existing services in DPAE is rather short and experienced administrators are not included. Most of them are employed on contract basis, which means essentially that they hold unstable positions. There is no motivation to become devoted to their work because of the absence of a long-term prospect. Many aspects of the work required have been subcontracted with local consultants and private companies. These include planning, implementation and even evaluation of workshop, seminar, training, and materials to be used for staff activities. The staff sometimes have not monitored and supervised and evaluated sub-contracted works carefully due to lack of time. It is likely that information and the activities at local level have not been systematically compiled and understood. Without feed back from past work, the expertise is often lost partly in the offices because of frequent personnel relocation, thus future work is not improved. It is a pressing need that the existing staff should be provided with stable positions and trained continuously. Also, additional permanent or long-term experts who are experienced administrators with capacity of planning, monitoring and evaluation of the plan should be hired.

DPAE spent 653 million pesos from FOPAE for training/empowerment in 1998-2000, which targeted mainly on educational staff (365,171 million pesos mainly to the educational personnel), community in general (181,383 million pesos) and local institutions (106,830 million pesos). As for the dissemination activities, guidebooks, videos, pamphlets, posters, other publication, etc. were produced with 462 million pesos from FOPAE. DPAE also organized several seminars, workshops, talks, forums, etc. As Enforcement of District System of Presentation and Attention of Emergency, more than 1,200 government officials in different institutions were trained. They are from Firemen Official Body, Secretary of Health, Metropolitan Police, Civil Defense, Red Cross, and NGOs.

D. Cooperating Institution

a) CAR

CAR attends to activities relating to forest fire, that is, forest fire prevention through training and rehabilitation of the affected areas. The officers in regional area are in charge of promoting the establishment and advancement of CLOPAD, as well as the accompanying plans and programs, planning and advise addressed to the prevention and control of forest fires, being part of PMU (*Puesto de Mando Unificado*: Unified Command Post) and of the operation protocol. CAR is part of the Forest Fire Commission of Cundinamarca (*Comision de Incendios Forestables de Cundinamarca*), as well as CREPAD, which follows the guidelines of the Office for the

Advancement of Forest Fire Prevention and Control (*Oficina de Gestion para la Prevencion y Control de Incendios Forestables*) of the Ministry of Environment.

b) Firemen official body

There are six fire stations among eight municipalities in Cundinamarca. Since the two municipalities of La Calera and Madrid have no fire stations, a supporting system from neighboring municipalities has been established. Besides professional staff, there are some volunteers working for the stations.

An academy of the Firemen Official Body of Bogotá has a mission of the internal training of firemen and emergency brigades at national and local levels. Also, the Academy has trained external institutes and communities. Furthermore, 16 fire stations in Bogotá play an important role of touching base with general citizens through education and training of schools and communities.

c) Civil Defense

Civil Defense is structured with two components, Administrative and Control by national budget under the Ministry of Defense, and Volunteers by private system. In Cundinamarca, 5 public employees and 2,000 volunteers work for Civil Defense. In Bogotá, there are 6 public employees and 3,579 volunteers. Volunteers consist of 2 groups: a) *Civil Defense Board* (the general citizens) and b) Supporting groups (experts). Therefore, activities of Civil Defense rely heavily on the volunteers. A Training School opened in 2001 in Funza (Cundinamarca). The courses and programs are formulated with technical support of National University.

E. Private sector

a) Red Cross

Red Cross covering both of Cundinamarca and Bogotá has Sections of Education/Training and Volunteer as related section to prevention and attention of disaster. Volunteers are consisted of 3 groups as shown in Appendix 2.10.3. Training Center for Prevention and Attention of Disasters is constructed in financial cooperation with Cundinamarca and land is supplied by Tabio City. The expenditure to education and training had a 13% share of the total expenditure in year 2000. The Training Center opened in June 2001 and already started to offer its services, whose costs vary according to the town requesting the services.

F. Community level

In communities of Cundinamarca and Bogotá, there are community-based organizations of JAC (*Juntas de Action Communal*: Community Action Board) and administrative organization of JAL (*Juntas de Administracion Local*: Local Administrative Board). JAC is a beneficiary group, organized at neighborhood (*barrio*) level and its operation is related to management level of

neighborhood processes. JAL is a local administrative body; it decides priority assignment of budget and approval of local agreements and decrees in local mayoralty. Although JAL represents the community in local government, it is not directly a community organization. In municipalities of Cundinamarca, there has been 533 JAC organized in 2001; Bogotá had 1,500 JAC in 1999. The representatives of JAC organize Association of Juntas. The President of the Association can exchange information with CLE. JAL is consisted of 7 councilors (*edils*). Some members of JAL can participate in CLE. In addition to these, there are many traditional informal community organizations and NGOs such as women, mothers, youth, the elderly, environment, and community self-guard groups. They are engaged in activities for development and improvement of areas and members with their group's respective topics of interest. Prevention and attention of disasters are not covered directly in their topics, but some groups may touch on them indirectly.

(2) Regulation and plan of education on prevention and attention of disaster

A. National level

Law of General Education 115 (1994) includes instructions and flexibility for elaboration and inclusion of topics pertaining to prevention and attention of disaster in school curriculum. The National Plan for Prevention and Attention of Disasters addresses education, training and community participation. The plan points out that the private sector should play an important role in disaster management and calls for the involvement of non-governmental organizations to participate in the implementation of the plan. In the plan, there is a strategy on "Socialization of Disaster Prevention and Mitigation". The programs are listed as follows:

- Public information for adequate prevention and response by the community in case of disaster.
- Incorporation of concepts of disaster prevention and environmental protection in formal education.
- Development of national system of training of government staff and community leaders.
- Development of activities with organizations of civil society responsibility.

Also, directive No. 13 (1992) of Ministry of Education gives the following guidelines.

- Incorporation of disaster prevention subjects in education and create an environmental conscience
  - a) Analyze the curricular contents.
  - b) Formation of professional group to present disasters
  - c) Teachers' training.
- School Program of Disaster Prevention.
  - a) Disaster prevention plans in educational establishments.

- Make the necessary changes in educational facilities under the General Direction School construction of Ministry of Education and physical plant of the Secretarial of Education
- Emergency Plans in Sporting Events.
- Inter-institutional Coordination.

Resolution 7550 (1994) regulates the performances of the National Education System as to the Prevention of Emergency and Disasters. The resolution requests educational establishments to create and develop a project on the prevention and attention of emergencies and disasters, in accordance with the guidelines issued by Ministry of Education, which will be an integral part of the Institutional Educational Project. This project shall cover at least the following aspects:

- Creation of a school committee for the prevention and attention of emergencies and disasters, as well as school brigades,
- School risk analysis,
- Action plan, and
- School simulation for potential threats.

B. Regional level

Department Decree 2653 (1995) establishes actions within the Education System for prevention and attention of emergency and disaster in the Prefecture of Cundinamarca. The public and private establishments should be responsible for preparing a detailed balance of the potential risks that may exist in each educational institution, on the basis of studies and investigations they may perform together with different institutions such as the Red Cross, and related to the participation of directors, teachers and students. Cundinamarca Decree No. 3019 (1998) directs that prevention and attention of disaster should be incorporated into the school curriculum.

C. District level

Resolution No. 3459 (1994) of the District Secretarial of Education regulates the responsibilities of the Educational System in Bogotá for the prevention of disaster. All the educational establishments in Bogotá should adopt an Emergency and Disaster Prevention Plan that as a minimum will include the following aspects.

- Creation of school brigades.
- Risk school analysis.
- School vulnerability.
- Evacuation plan.
- School simulation.

General Plan for Prevention and Attention of Disaster in Bogotá covers: a) Risk analysis and construction of risk scenario, b) Reduction of threat, c) Reduction of vulnerability, d) Preparation for emergency, and e) Rehabilitation. As for the vulnerability, the Plan has many objections:

institutional, educational community reinforcement and community involvement. In the new Development Plan of the City (2001-2004), as non-structural preparation, education of local people at every level is emphasized.

D. Locality level

CLE of each locality in Bogotá should make a Contingency Plan based on the new POT. Five localities have already prepared the plan, 5 others have prepared the plan for countermeasures and the rest (9 localities) have not done anything yet. In this plan, policy and target of education and training will be included.

(3) Activities of organizations related to prevention and attention of disaster

A. Education system

a) School education

National Education System

The system covers 9 areas in the primary, medium and higher levels, which are:

- Natural science and environment.
- Social science (history, geography, political system, democracy, etc).
- Artistic education.
- Ethnic, and human values.
- Physical education and recreation/sports.
- Religion.
- Humanity and languages.
- Mathematics.
- Technology and information theory.

Educational institutes are obliged to achieve 70% of the formal curriculum and the remaining 30% corresponds to programs whose contents are dependent on each school. In this case, the school can come up with an institutional educational project that includes the topic of prevention and attention of disaster. The system applies for Bogotá.

b) Curriculum

There are 7,610 teachers and 180,711 students in Cundinamarca as of 2001. In Bogotá, there were 73,868 teachers (22,891 for public and 56,977 for private schools) and 1,307,636 students (570,574 for public and 737,062 for private) in 1999. In the Secretary of Education in Bogotá, there is no specific budget allocated for education on prevention and attention of disaster. However, this topic is being socialized in locality. The Secretary of Education with Cooperation of CADELES and CLE, the amount of 24 billion pesos is allocated for reinforcement of physical structure against seismic vulnerability.

As for curriculum of the school, regardless of the existing regulations, there is no mechanism for implementation. The Secretary of Education has not any information of the present condition whether the school curriculum includes prevention and attention of disaster or not because its implementation ways vary depending on the school level of interest and budget. It is likely that only big schools can afford to have contracts with specific organizations such as Civil Defense, Red Cross and DPAE to do training of prevention and attention of disaster. With the exception of official Firefighters and DPAE, other organizations require high fee for their assistance.

DPAE designed a special program for teachers, which is being promoted at the universities, with the objective of producing experts to design programs and projects for disaster prevention. Also, its official implementation (enactment of regulation at national level) is suggested. Actually, DPAE is promoting the university Francisco Jose de Caldas and the Gran Colombia University. The course covers all the subjects relates to the context of the city development, legislative aspects and the territorial ordering, disaster prevention, a pedagogical focus for the disaster prevention, among others.

B. Seminar and workshop

a) DPAE

DPAE organized many seminars, workshops, talks, forum, etc. mainly about seismic threat and preparation for emergencies, among which about 900 persons participated in 3 seminars during 1998 to 2000. All localities in Bogotá participated at these workshops organized by DPAE in 2000, and total participants reached nearly 23,000 as shown in Appendix 2.10.4. Also, DPAE staff visited universities to provide talks regarding the topic. "The 1st Encounter of District CLE in October 2000" was organized to discuss how to integrate and re-feed organizations and people in districts and local aspects for Prevention and Attention of emergencies. Other seminars conducted were as follows: Seismic Zoning and its Effects in the Infrastructure and Urban Planning in March 2000, Experiences of Seismic Vulnerability Evaluation and Reinforcement in September 2000, Reduction of Structural Vulnerability in Clinics, Private and National Hospitals in November 2000, and Reduction of Structural Vulnerabilities in Private Schools in January 2001.

"Reduction of Seismic Vulnerability on Essential Buildings" was organized using FONADE with support of DPAE in April 2001. This is the 3rd seminar on earthquake in series following the 1st and 2nd ones on seismic risks for university engineering students. Thirty (30) participants, who are directors and heads of related organizations such as hospitals, health service, universities and other government institutions, discussed seismic hazard and risks on Bogotá and Colombia, different mechanisms to reduce seismic vulnerability and energy mechanism. In the following months in 2001, other seminars were held for experts such as members of engineering society.

b) CAR

Fifteen (15) officers have been trained and they work both at central and regional levels; they are in charge of the management of the forest fires program. In addition, there have been 7 workshops, covering 65 municipalities in Cundinamarca with participation of about 350 people. These seminars are given at a central level, by those who compose the fires prevention team, supported by audiovisual aids, publications and other material that might have a positive contribution for such purpose. Target participants are the officers assigned by the corresponding regional direction, who will serve as multipliers taking this information to each one of the municipalities, activating the creation and start-up of CLOPAD as it is ordered in Decree 919 of 1998. These entities will be supported by CREPAD. The goal is to capacitate CLOPAD for forest fires and equipment handling. Topics to be treated in the capacity building workshops are as follows:

- Operation protocol.
- Generalities about forest fires.
- Fire behavior.
- Control techniques of forest fires.
- Tools and equipment for the control and extinction of forest fire.
- Water use in control and extinction of forest fire.
- Operation and maintenance of motor engines.
- Personal security in control and extinction of forest fire.
- Demonstration and practice in tools and equipment use.

c) Firemen official body in Bogotá

Seminars have targets of public institutions especially prison and police, and private sector. Major topics are:

- Management of car accidents.
- Communication system.
- Trainers' training.
- Experts training, and
- Diving.

Workshops are organized on fire fighters technique.

d) Community level

The level of organization and participation of workshops/seminars on disaster prevention differs from one district to another. It depends on the interest and awareness of chief of the locality. In Bosa locality, for example, where there are possibilities for inundation, fire and earthquake, its own budget is used for disaster prevention project with contract with a private company providing

training. The training started initially as a 2-month project. One course takes 4 hours and total hours during the project are 32. The target groups of the training are general inhabitants for basic education and experts related to disaster prevention for specific technique. The participants with over 80% of total attendance can be awarded certificates. The program of the workshop is shown below.

Table 2.10.3 Example Course of Workshop in Bosa Locality

No.	Topics	Contents
1	Earthquake	- Understanding of threat and vulnerability - Prevention, occurrence and rehabilitation
2	Inundation	- Sewerage and waste treatment - Structural change for drainage, sewerage and waste treatment
3	Fire	- Cause of fire - Threat - Handling of extinguishers
4	Evacuation	- When is the time for evacuation? - Observe the symptom - Evacuation routes
5	Various Information	- Weather information - Participation of workshop - Communication among organizations in the community
6	Local Committee	- Assistance from members of locality assembly

Source: Bosa Locality

C. Training

a) DPAE

Teachers

A 5-hour training course for school teachers on risk management and disaster prevention was provided to 1,500 teachers for methodologies of the School Plan for disaster prevention and 600 teachers for curriculum in 2000 (about 5,000 teachers during 1998-2000) using training manuals produced by DPAE as shown in Appendix 2.10.5. Methodology course is intended to target teachers and counselors in general in order to generate in the community knowledge of high risks for the people that are exposed, with the objective of formation of the process to reduce their risks and eliminate an emergency situation. Contents of methodology course are a) Diagnosis and analysis of school risks, b) Identification of preventive measures, c) Identification of response measures in an event (evacuation and practice), and d) Organizational strategies. Major materials used are “Teachers Guide I (Conceptual aspects for the risk management) and II (Methodological aspects)” and “Students Guide”. The curriculum course focuses on teachers of social science, natural science and preschool education in order to incorporate in the basic education curriculum the knowledge, attitudes and values about risk management and disaster prevention, depending on the age and level of students. The contents are: a) Threat conceptualization, vulnerability, risk, disasters, emergency, b) Pedagogical approach to the natural phenomenon and its relation with the

risk and disaster situations, c) View of Bogotá risks with emphasis on seismic threat, d) Natural, social and construction environment of the buildings in Bogotá and in general the social-spatial transformations that generate imbalance in the relations between man and the environment, e) Personal security and self-protection, f) POT and the development plans as tools for the risk management, and g) Institutional aspects. The training is developed in an interactive way, in pedagogical perspectives, and uses videos as supportive material. There are also supporting materials produced by DPAE that are given, such as: a) Guide I (Pre-school and 3rd Grade), b) Guide II (4th to 6th Grade), and c) Guide III (7th to 9th Grade). Those teachers are expected to teach their students using methodologies they learned, and the follow-up activities have begun in 2001.

Initial evaluation was carried out, with six educational institutions in which 16 students participated, for a total 90 students.

School Children

On 15-30 November 1998, about 10,700 students joined a vacation training on general topics (see Appendix 2.10.6. DPAE considers that it is necessary to educate children on disaster prevention and attention, especially at ages between 5 to 12 years when they are more vulnerable to emergency cases. Also, at these ages, they have more potential for learning and they can be future advocates of the advancement of disaster prevention.

Community

DPAE provided training during 1998 to 2000 to communities covering 10,497 persons, touching on 6 topics, namely, a) Seismic threat and preparedness, b) Town plan, c) Risk management, d) Flood threat, e) Threat from mass events, and f) Threat of technological risk.

Institutions

DPAE provided training to CLE covering 1,017 persons in 2000 and collaborated with Civil Defense for training of 29 persons. Besides there are other institutions trained as shown in Table 2.10.4 below.

Table 2.10.4 Organizations Trained by DPAE in 2000

No.	Entity	No. of Participants
1	Secretary of Education	18
2	Ministry of Health	38
3	Civil Defense	29
4	Controllers of Budget Users	1
5	Firemen official Body	5
6	Controllers of Health	4
7	Ministry of Mines	59
8	Commission of Regulating Energy and Gas	13
9	Special Medicine Producers	17
10	Catholic University	68
Total		**252**

Source: DPAE

Additionally, the major topics and the number of participants to DPAE training are shown in Table 2.10.5.

Table 2.10.5 Topics and Participants in DPAE Training

No.	Topics	No. of Participants
1	Fire management and evacuation from buildings	60
2	Qualification in prevention and emergency attention	32
3	PEGR (School Plan for Risk Management)	40
4	Usage and maintenance of specialized equipment	28
5	Forest fire	68
6	Collapsed structure	50
7	Institution for instructors of disaster prevention and attention	25
8	First aid	125

Source: DPAE

It is regrettable that most of these activities are transient and not continuous. Lack of budget may stop the activities halfway, which can result in loss of motivation of the people toward disaster prevention.

b) Secretary of Health

Training and education for disaster prevention provided by the Secretary of Health of Bogotá target employees of the Secretary of Health, Metropolitan Police, and community leaders (community organizations, teachers, and religious organizations). One course is 16 hours for 2 days with 35 participants in average. The programs of the courses are as follows.

- Conceptual aspects of disaster.
- Organizational strategies.
- Possible threats in Bogotá.
- How to manage emergency with institution.
- Contingency and Emergency Plan

As the target group of employees of the Secretary of Health, 600 have been trained and the second group of community leaders has had 700 participants for the last 3 years. For the hospitals, the Secretary provides drills on fire, bomb threat and earthquake but no drills have been conducted for community. Future training plan is to cover the following:

- Secretary of Health for general contents: 200 people,
- Community leaders for general contents: 100 people, and
- Governmental institutions: 400 people.

c) Fire Department in Bogotá

There are 3 kinds of training courses provided by Centro Académico (internal, external and special ones) as listed below and 6,800 participants so far have attended one of them.

Table 2.10.6 Training Courses Provided by Centro Académico in 2000

Type	No. of Courses	No. of Modules	Total No. of Participants	Total No. of Hours
Internal Training	19	0	475	1,306
External Training	0	362	6,037	1,105
Special Course for Other Institutes	13	0	337	308
Total	**32**	**362**	**6,849**	**2,719**

Source: Centro Académico de Bomberos

The training structure is presented in Appendix 2.10.7.

Internal Training

Table 2.10.7 Training for Internal Staff of Firemen Official Body

No.	Name of Course	No. of Courses	Hours per Course	Total Hours	Total No. of Participants
1	Human Relationship	2	8	16	60
2	Management of Personnel and Leadership	2	8	16	60
3	Retaining	1	30	30	20
4	Inspection of Risks	1	16	6	42
5	Forest Fire	2	24	48	52
6	Basic Swimming	4	40	80	52
7	Machine Operation – SENA- Diving Technique	4	40	160	35
8	Basic Course for Firemen (1)	4	140	560	108
9	Basic Course for Firemen (2)	1	380	380	46
Total		**19**	**686**	**1,306**	**475**

Source: Centro Académico de Bomberos

Basic courses for firemen differ in time and target. Major topics are as follows:

- Basic concept of fire department.
- Management of chemicals.
- Forest fire.
- Emergency handling of victims.
- Rescue from high building.
- Massive events.
- Cartography.

Courses for government staff at national level focus on police and public prosecutors in jail and justice. In mid-June 2001, 65 volunteer officials at national level will be provided with training by contract with U.K. The topics are as follows:

- Hazardous materials.
- Breathalyser.
- Vehicular accident.
- Incident command system, etc.

External Training

Table 2.10.8 External Training by Centro Académico

Description	No. of Entities	Total No. of Modules	Total No. of Participants
Public	21	83	1,343
Private	46	152	2,607
Military	5	28	482
National Police	9	97	1,605
National Army	1	1	16
Civil Defense	1	1	11
Total	**81**	**362**	**6,037**

Source: Centro Académico de Bomberos

JAC and 500 schools are targeted at community level with a) Plan of emergency, b) Theory, c) Evacuation, and d) Conformation of brigades.

Special Training

Table 2.10.9 Special Training for Other Entities

No.	Name of Courses	No. of Courses	Hours per Course	Total Hours	Total No. of Participants
1	Volunteer Firefighters Training	1	30	30	15
2	Courses to Carabineers Academy	1	24	24	40
3	National Course for Firefighters	1	36	36	34
4	Rescue	4	16	64	120
5	District Brigade	1	100	200	17
6	Red Cross of Colombia	3	10	30	60
7	National Police-Policemen Club	1	12	12	21
8	National Army	1	2	12	30
Total		**13**	**210**	**308**	**337**

Source: Centro Académico de Bomberos

Module

The courses modules are shown in Appendix 2.10.8. Applicants of the modules should be registered. Enterprise brigades can also take 13 modules.

d) Civil Defense

Civil Defense provides many kinds of education and training in order to produce a lot of volunteers for their activities. The targets are general citizens and special technical staff, and 5-15 year-old children in community as future volunteers as well. Instructor courses are also included. In order to be registered as volunteers of Civil Defense, applicants should take training courses organized by Civil Defense and are obliged to carry out 500 hours of social service after training and then serve at the Civil Defense for 2 years. The courses are: a) General Information (2 hours),

b) Level I (Basic, 58 hours), c) Level II (Specialized), d) Level III (Integral), and e) Level IV (Technical).

e) CAR

CAR officers, government entities, NGOs and the community in general are involved. They get training in the technical and practical parts. At its end, they will be able to get technical and operational support, as well as learn how to handle equipment and tools.

f) Red Cross

In Tabio Municipality of Cundinamarca, training center for prevention and attention of disaster was opened on June 2, 2001. This center can play a role of piloting activities. Sixteen (16) various courses are provided to cope with 18 situations and topics of disaster and emergency, for technical experts, school children and ordinary community. However, all courses and materials are provided with rather high fee. For example, a 3-day course takes 30 hours with 2-3 million pesos per course. The Red Cross has projects in cooperation with other institutions (Civil Defense, Official Firefighter Squad, Health Department and DPAE) and also a trainer's training (see Appendix 2.10.9).

g) CLE (Bogotá)

CLE promotes the implementation of the Contingency Plan, which envisages all the actions to be performed at community and institutional training levels, as well as the necessary mitigation actions. In some localities, where the local mayor has a strong interest in the topic, CLE has achieved the formation of neighborhood emergency brigades that are working on prevention and attention of emergency. The neighborhood emergency brigades have no connection with JAL but JAC. Some of them are fortified by the efforts of different entities that comprise CLE. The training topics, for example, are:

- First Aid and Search and Rescue.
- Risk Administration.
- Seismic Hazard and Flood Hazard.
- Motor Pumps Management.
- Basic Security and Others.

D. Training materials and information

Some organizations have produced many materials for training, workshop, dissemination of information of their activities and related topics, etc. The other organizations have published only a few materials or none because of the lack of budget and technical staff. Though the focal points of the materials are different by organization, they generally cover system of disaster outbreak, behavior in case of emergency and for disaster prevention, in technical and easy ways, etc. Once

the materials are produced, however, they are left as they are and efforts of dissemination and development are not made. Even among the concerned organizations, they do not know what kind of materials is produced because of lack of information exchange.

a) Secretary of Education

The Secretary has a budget of 5 billion pesos for educational materials produced by the official institutions. Since this amount does not include specific allotment of prevention and attention of disaster, the usage depends on institutions. The situation has not been investigated.

b) OPAD

The number of materials produced by OPAD is not large. OPAD had an agreement with the Red Cross and the training manual to be used especially for CLOPAD members was produced by the Red Cross. A "chick" mascot is used, and other cartoon characters are imprinted on other materials (sticker, pen, T-shirts, etc.), which make the contents more familiar. CLOPAD is the target organization for capacity improvement under the regulation in Cundinamarca.

c) DPAE

Materials produced by DPAE are listed in Appendix 2.10.10. All materials are available to any persons at their request. DPAE made videos and guidebooks on earthquake, landslide, and flood for local mass media. For inundation and landslide, signboards are produced and put up to warn people in the high-risk areas. Massive events and accompanying instructions are informed by video clip, radio advertisement, posters and pamphlets. Information on fireproof structure is produced and disseminated to local mass media. Forest fire is informed by radio and video clip. Guide on house reinforcement, guidebook on construction in the landslide area (possible area), guidebook on regulations and procedures to apply for licenses and permits for construction are prepared by DPAE. All materials are considered as technically satisfactory. The problem is dissemination. For example, video coverage is good but has not been often presented in public. Also, pamphlets and guidebooks introducing activities of DPAE have not been distributed enough and well publicized. Public relation activities have not been organized and mass media such as radio, TV and newspaper are not utilized effectively. Teacher's Guides have not been evaluated and the teachers' activities at their schools have not been followed-up.

d) Firemen Official Body

The Firemen Official Body produced materials not only for internal but also external use. For schools, 16 fire stations in Bogotá have 60 slides and guidebooks to utilize in presentations.

e) Civil Defense

Civil Defense produced many materials for their own volunteers, the community in general, and the children, which are made in order to increase a sense of voluntarism and cultivate future

volunteers. Also, a quarterly magazine, *Defensa Civil Colombiana*, is issued regularly to introduce their activities and related events. The magazine can be obtained at the government offices and Civil Defense.

f) Red Cross

The Red Cross also produced a variety of materials, covering from prevention to rescue for general community, educational staff and technical trainers.

g) Media in municipalities of Cundinamarca and localities of Bogotá

In order to disseminate information related to prevention and attention of emergency and disaster, some segment of mass media is used. In Cundinamarca, all 8 municipalities use radio programs for dissemination of the topic and in Bogotá newspapers and magazines are more useful.

(4) Activities of communities and NGOs related to disaster prevention

Disaster prevention activities at community level are closely linked to the occurrence level of dangerous events. This means that in the localities in which occur more events are more likely to organize and prepare themselves than in which a lower number of events. In that same way the level of compromise of the mayors can be observed. Such is the case for the localities of San Cristobal, Bosa and Ciudad Bolivar. On the other hand, Teusaquillo, Martines, Candelaria, etc. are not vitalized yet as shown in Appendix 2.10.11. Local mayors do not have high interest in disaster prevention partly because the possibility of a disaster or inundation occurring is nil or low. However, some measures have been considered; educational activities for disaster prevention such as training, workshop and drill, and discussions are in progress.

Among NGOs working for the community development and poverty alleviation, some play an indirect role of prevention and mitigation of disaster. For example, the project *Sur con Bogotá*, under the international assistance of KfW (Bank for the German Development), targets environment protection in the 3 districts (San Cristobal, Usme and Rafael Uribe), which includes the activities of relocation and disaster mitigation in the communities located in the high risk areas.

(5) Public awareness of prevention and attention of disaster

A. The Quindio Earthquake

The January 25, 1999 earthquake occurred in the cities of Armenia and Pereira, almost 4 years after the 1995 Calima-Darich earthquake. “The earthquake certainly helped to raise the seismic awareness of the city and, unlike the city of Armenia, Pereira had made significant advances in a number of areas that helped them deal with the earthquake’s effects through the implementation of the Seismic Risk Mitigation Project for Pereira. Specific achievements, though still in the beginning stage, had been made in the areas of assessment of regional seismic hazard, the

influence of local effects on seismic hazard; physical, institutional and social vulnerability; preparatory plans for emergency response, and the formulation of earthquake safety and mitigation measures." (Source: Special Report, Effects of January 25, 1999 Colombian Earthquake; As viewed by Authorities in Pereira Geo Hazard International)

On the other hand, "although Pereira learned many valuable lessons from the 1995 earthquake, by most accounts the city was not fully prepared to deal with the effects of the 1999 event. Problems of organization, communication, and coordination typically arise in response to any disaster, and their factors definitely complicated the situation in January of 1999." a) Lack of coordination amongst working groups: Volunteers were many, but organization was poor. b) Lack of communication amongst institutions and on different organizational levels: Few people are aware of the magnitude of the problem as a whole. The public, in general, was not well-informed. People were referred to many different organizations and locations. c) Lack of participation by the community in the reconstruction phase: The people do not know how to reach the state and the state does not know how to let itself be reached with regard to this issue. According to the case of Armenia/Pereira, it may be said that the lessons from the disaster can increase awareness and prepare against disaster at some level but it takes time to reach the level of actual responses and functions.

B. Analysis of public awareness survey for disaster prevention

Survey on Public Awareness on Prevention and Attention of Disaster was carried out by staff and coordinators working for DPAE in 15 districts in Bogotá during 24-31 May 2001. Since the sample number is very limited, the findings from the survey summarized below cannot be generalized as the sentiments of local people. However, some ideas can be drawn from the results as the input for the disaster prevention plan.

a) Awareness of disaster prevention

- People who have been affected by disaster or who live near dangerous places such as slopes and rivers or on slopes are fearful of the possibility of disaster but do not have measures of protection and evacuation. Though some respondents even recognize an important level of risk, they would prefer or have to continue living in the dangerous places for economic reason. Also, they do not have enough information about the danger in the places where they are living. Among those who answered living in a safe place, some deem that disaster could not happen in future.
- All interviewees think that measures to prevent floods and landslide are necessary. These measures include the following: to prohibit living in risk areas, to institute land use control, and to create a brochure showing places where it is not possible to live.
- People who have lived in dangerous places for many years are often reluctant to leave even in case of emergency. They can evacuate their places only when the danger is very

imminent. However, the majority would evacuate immediately in case of emergency, where previous emergencies have created some degree of consciousness of danger.

- The people consider that information is most important and needed against disaster. If they have enough knowledge of hazards, they can prevent them accurately. Most of the interviewees who have awareness of disaster have been affected by disaster before, but they are not sure of what to do in case of an emergency.

b) Tools of communication and necessary information in normal and emergency conditions

- In normal condition, the best way to inform people about disaster in the area where they live is through community organizations, announcement from a roving car for public information and TV news. These responses indicate that people are conscious of the importance of community organizations for disaster prevention. The best media of communication to utilize in case of emergency are television and community organizations, followed by radio and roving car on streets. Cundinamarca mentioned roles played by fire station and local government, which could have been more efficient in previous emergencies than other media in Cundinamarca.
- The most relevant information needed in normal condition is the presage and the history of disaster occurrence, dangerous places, a map showing areas of high possibility of occurrence, and guidance of what to do during/after disaster including evacuation routes and communication media. These answers indicate that the people do not have enough knowledge of locations appropriate for living and the difference between safe and unsafe places. These answers show that they prefer to know curative actions instead of preventive actions when they think under imminent danger. The necessary information in case of emergency is dangerous places, their conditions, communication media for help and evacuation routes as well.

c) Training and workshop

- Majority of interviewees in Bogotá has participated in trainings or workshops about disaster prevention. The respondents who have participated in training and workshops before think that the prevention and attention is important work in the community, which means that training raise the level of consciousness of the people.
- The reasons for participation are that they have had experiences of disaster and have a sense of danger. Additionally, they were informed of workshops by the government or community members. The reasons for not participating in the training/workshops are a lack of time and absence of information of the workshop. This represents a necessity of more information dissemination of these events.

- The topics of training and workshop required are first aid and prevention of emergency in general.

d) Necessity of voluntary groups in the community

- All interviewees believe that voluntary disaster response groups are necessary and many of them want to participate in such groups. Most of them consider such groups can be formed by themselves soon or after meeting or discussion among the community with support of the local government, which shows they understand its importance and the importance of working in community.
- Half of interviewees have discussed about disaster prevention among the community and for this reason they also think that it is possible to act as community members in case of emergencies. Many of them think that rescue and evacuation activities can be done in cooperation with community. However, the problem is in implementation because they do not have enough information and techniques for disaster.

e) The support from the government to the voluntary groups for disaster

The supply of equipment and tools needed in case of emergency to voluntary groups are not so homogeneous. However, majority think that groups must be prepared with equipment and tools with subsidy of the local government and some community contribution, and the rest thinks local government must provide all of them. Sometimes people affected by disaster, are displaced or poverty stricken expect that governments supply all their necessities without any contribution by the people. These characteristics vary according to locality, location and living condition.

C. Analysis of workshops and seminars

a) Stakeholder meeting

Among the points raised during discussion by the participants, five subjects mainly were focused and various aspects to be strengthened were recognized. They are: a) Infrastructure strengthening, b) Organizational and institutional strengthening, c) People and community strengthening, d) Mass media usage, and e) Information distribution system strengthening. Opinions among the participants are summarized in Appendix 2.10.12. Among them, the following three are related to education and training:

<u>People and Community Strengthening</u>

- Inter-community information network strengthening.
- Informing the related legislation and decrees.
- Community integration to the prevention plans.
- Campaign to the community for massive information.
- Education.

Mass Media Usage

- Mass media towards the disaster prevention, for spreading the information
- Introduction of international experience

Information Distribution System Strengthening

- Strengthening the method to spread information on the risks and threats.

b) PCM workshop

The participants consider the community or local level as the most important target groups for the disaster prevention. The major possible approaches to solve the problems for these target groups could mainly be categorized into three, which are: a) Institutional strengthening, b) Public awareness strengthening, and c) Capacity building. The following table shows approaches related to community and education and training.

Table 2.10.10 Possible Approaches Drawn by the Objective Analysis

No	Target Group	Core Problem	Main Objectives	Possible Approaches
1	Community Organizations	Indifference to disaster prevention problems, because of - technical limitations - ignorance of the topic - economic limitations - inadequate proceeding of the community	Cultivate interest in disaster prevention	-Disaster prevention technical information -Disaster prevention and awareness improvement -Community strengthening
2	Community	Ignorance of what to do in case of an emergency, because of - insufficient programs at local level for training - poorly spread program	Awareness of what to do in case of an emergency	-Capacity building - Enlightening activities
3	General Planning Organizations	Staff is not aware of their vulnerability, because of -inefficient education mechanisms -unawareness in prevention and attention of disaster topics - deficiency of prevention and attention of disaster policies and strategies	Staff is aware of their vulnerability	-Educational system introduction -Disaster prevention and attention improvement -Disaster prevention organization strengthening

The team attempted to apply some of these approaches to the project design matrix (PDM), as three examples such as 1) Disaster Prevention and Awareness Improvement Project, 2) Project for Disaster Prevention Institution Strengthening in Colombia, and 3) Project for Capacity Building on Disaster Management.

c) Workshop on contribution of education in disaster prevention

The teachers who participated in the workshop discussed the strategy for the education of disaster prevention in three sectors, namely, government, educational institute and educational staff. Based on the strength, opportunities, weakness and constraints of these three sectors, the participants came to the following conclusions:

Government responsibility

- Cooperation with different agencies.
- Training for the educational personnel.
- Exploitation of the governmental roles for educational awareness of disaster prevention.
- Active participation of regional, district and local committees.
- Development of curriculum guideline including the topic.
- Budget allocation.
- Continuation of projects for education on disaster prevention.
- Support NGOs and private sector.

Educational Institutions

- Preparation of their own policy.
- Coordination among institutions.
- Network of educative institutions to exchange information and experiences.
- Development facilities and equipment in physical and structural safety.
- Cooperation with community.
- Implementation of the prevention project included in the study plan.
- Risk evaluation of the institutions.
- Preparation of risk map.
- Design and implementation of drill and training.

Educational Staff

- Training, drills and research for the prevention subject.
- Increase of awareness and change of attitudes.
- Development of leadership.
- Continuous efforts and educational projects on the topic.
- Experience of multidisciplinary fields.

d) Workshop on community safety map

Based on the observation in 2 communities, the participants were fully involved into the activities for formulating community safety maps. By walking around the community and then drawing a map based on the discussion among themselves, the participants, began to recognize their places and risks of disaster as a whole. Indeed this activity increased their awareness of disaster

prevention. However, this is merely a starting point of the community disaster management and should be followed by prevention countermeasures and activities for prevention and responses, which can also be undertaken by the inhabitants with government support. Also, this activity can be applied to other communities (fortunately, already done in some communities in Cundinamarca), and the methodology should be developed in an appropriate way for this region.

D. Findings

The outputs and observation of the workshops may be concluded as follows:

- Presentation of stories of victims' experience impacted to the participants because their lessons from the disaster have not been shared before.
- Participants were well aware of the lack of coordination and information dissemination among different entities and strongly recognized that a lot of effort should be extended toward this in future. However, some of the participants still acted as though they were outsiders, not being cognizant of the fact that they are the concerned persons regarding this topic of disaster prevention and attention.
- The activities to be implemented by the participants should cost less and be easy to understand.
- Community coordinators and community leaders should be utilized for the activities with initiative of government staff.
- The level of understanding varies from one community to community. Therefore, having a good grasp of the condition of the community is indispensable.
- In the community with many unemployed, students and women, their active involvement can be considered.

2.10.2 Issues, Constraints, Potentials and Measures

Based on the above information and the results of the survey and the workshop, the present issues, constraints and potentials can be summarized from the viewpoints of education and training as shown in Appendix 2.10.13. The most important issues related to education to be addressed are considered as follows:

- Coordination among concerned entities is not enough for planning and implementation of the educational activities.
- Distribution of the related information is not well organized, not shared among the entities, and distributed to the appropriate persons. Additionally, duplication can be found in many places.
- Training and workshop are not organized continuously nor controlled. There is no systematic planning about training policy and no analysis of the training necessities from different target groups and demands. None of the organizations has done their evaluation and follow-up activities. Topics of the training are almost the same in the different

agencies. The target number of participants covered by each organization is still limited because of insufficient financial and human resources. Topics are sometimes very thematic and some of them are not specialty of the organizations.

- Educational and training materials for disaster have not been produced taking into consideration the target groups, objectives and the present situation. The evaluation of the materials has never been implemented and most of them have different terminology, generating conceptual confusion in the people who use the materials.
- Awareness of prevention and attention of disaster in the community is generally low. The efforts to increase their awareness have not been done enough.
- In spite of many regulations on education instructing the incorporation of prevention and attention of disaster into school education, the way of implementation and operation have not been clarified at national level and not achieved at the field level.
- The opinions and ideas of the local people, especially inhabitants with high possibility of disaster, have not been collected and analyzed for the planning.

On the other hand, there are some potential capacities that can be utilized for education and training on disaster prevention and attention. Those with the most potential are as follows:

- There are many organizations already established for the topics.
- Various training and workshops have been organized by different agencies to various target groups using many materials.
- There are some agencies that have been working with communities, private sector and NGOs.

2.11 Institution and Organization for Residential Housing

2.11.1 Public Housing

1) Demand

Number of housing units by income levels in Colombia are shown in Table 2.11.1. The Colombian government has struggled to cope with the housing problem, but it has never caught up with the ever-increasing demand. Only 44,958 units of socialized housing (VIS - *Vivienda de Interés Social*) were delivered in 1999.

In the case of Bogotá, it is estimated that about 80 % of the total households belong to the income levels below 4 SMLM (4 times of the monthly legal minimum salary). Though there is a need of 456,000 VIS houses (in 2,000), 14,773 housing units were provided in 1998[2-11-1].

Table 2.11.1 Number of Housing Units by Income levels in Colombia

Income per Household (SMLM)	Total Number of Households	Number of Households with Deficit of Dwellings	Percentage (%)
0 – 1	1,151,721	224,371	17.8
1 – 2	1,759,059	204,203	16.2
2 – 3	1,225,776	378,154	30.0
3 – 4	801,858	235,716	18.7
(Subtotal 1 – 4)	(4,938,414)	(1,042,444)	(82.7)
4 – 5	571,957	88,236	7.0
5 – 7	671,223	61,765	4.9
7 – 10	476,631	44,118	3.5
more than 10	503,775	23,950	1.9
Total Colombia	**7,162,000**	**1,260,513**	**100**

SMLM: Monthly Minimum Legal Salary
Source: National Development Plan 1998-2002

2) National System of Public Housing

(1) National system of VIS

The housing policy of Colombia is mainly producing low-cost housings, the so-called VIS (*Vivienda de Interés Social*) or housing of social interest. The target group of income levels are households with income levels of 4 SMLM or lower than 4 SMLM. The main entity to handle the housing needs is the Ministry of Economic Development. The housing policy is promoted to execute the Territory Ordering Plan (POT, Law 388/1997, Decree 2620/2000). Under the ministry the National System of Social Housing (*Sistema Nacional de Vivienda de Interés Social*, Law 3/1991) has been organized to involve public and private entities. On the other hand, apart

[2-11-1] Source: Metrovivienda.

from the national system, there are other low-cost housing projects promoted by the Social Solidarity Network (RSS - *Red de Solidaridad Social*) for people displaced by conflicts of guerrillas and violence.

The organizations of the National System of Social Housing are as follows:

- Organizations of Subsidies:
  a) INURBE (National Institute of Social Interest Housing and Urban Reform), promoting.
  b) CPVM (Fund of Military Housing).
  c) Family Compensation Funds.
- Organizations of Loans:
  a) FNA (National Fund of Savings).
  b) Private Funds of Unemployment.
  c) FINDETER (Financial Society of Territorial Development).
  d) Municipal Funds of Social Interest Housing.
  e) Family Compensation Funds.
  f) Corporations of Saving and Housing.
  g) Commercial Banks, and
  h) Agricultural Bank of Colombia.
- Organizations of Technical Assistance:
  a) SENA (National Service of Vocational Training).
  b) IGAC.
  c) Center of Construction and Regional and Urban Development Study and
  d) Universities.
- Coordinating Organizations:
  a) Organizations of Prefectures and Municipalities.
  b) ONG.
  c) OVPs (Popular Housing Organizations).
- Constructors:
  a) Public.
  b) Private and.
  c) ONG Constructors.
- Beneficiaries' Organizations:
  a) Postulants' Groups.
  b) OVPs.

(2) Organizations of subsidy

A. INURBE (*Instituto Nacional de Vivienda de Interés Social y Reforma Urbana)*

INURBE is a Public Establishment of the Ministry of Economic Development, which manages national subsidies to invest in the housings of social interest (Lay 3/1991). It was established in 1991–the reborn ICT (Institute of Territorial Credit).

The subsidies were given for 19,424 cases in 1999 with the total amount of investments of $113,353 million pesos for the following:

- Acquisition of houses.
- Construction of houses in proper sites and.
- Improvement of houses.

30 % of the total subsidies were in Bogotá.

In the case of the acquisition of houses, the sums of subsidy are shown Table 2.11.2.

Table 2.11.2 Subsidy for Acquisition of VIS

Type	Limit Price of House	Sum of Subsidy
1	30 SMLM (8,580,000 pesos)	25 SMLM (7,150,000 pesos)
2	50 SMLM (14,300,000 pesos)	25 SMLM (7,150,000 pesos)
3	70 SMLM (20,020,000 pesos)	25 SMLM (7,150,000 pesos)
4	100 SMLM (28,600,000 pesos)	20 SMLM (5,720,000 pesos)
5	120 SMLM (34,320,000 pesos)	20 SMLM (5,720,000 pesos)
6	135 SMLM (38,610,000 pesos)	20 SMLM (5,720,000 pesos)

Decree 2342/2001

SMLM: Monthly Minimum Legal Salary, 1 SMLM = 286,000 pesos (2001)

In the case of type 2), construction of houses in proper sites, the sums of subsidy are half of the above sums. In the case of type 3) improvement of houses, the sum of subsidy is 15 SMLM (4,290,000 pesos) each.

The most commonly authorized subsidy of acquisition is type 3: house price until 70 SMLM (20,020,000 pesos) with subsidy of 20 SMLM (5,720,000 pesos).

The subsidy for improvement of houses is limited up to 10% of total investment budget by regulation (Art.21, Decree 2620/2000). Besides there is a contradiction in the subsidy system, that is, the requirement of construction licenses which the defective houses in general do not have. So, actually, very few cases of housing improvements were authorized. Furthermore, improvements for seismic resistance are even lesser as the subsidies would have been applied to the cases of a) structural defect, b) lack of sewerage, c) lack of toilet or kitchen, d) an earth floor, e) temporary material, and f) over-inhabited dwelling.

a) Popular Housing Organizations (OPV)

INURBE is promoting the formation of Popular Housing Organizations (OPV – *Organizaciones Populares de Vivienda*) to execute VIS projects with the participation of the communities. OPVs are groups of persons who intend to advance housing programs by way of self-effort and mutual collaboration for the benefit of the popular sector. INURBE responds to the necessities of these groups by way of social and technical assistance to help them in forming autonomous and juridical recognized bodies, so as to achieve their objectives of constructions of VIS.

B. Family Compensation Funds (CCF)

CCF offers family welfare services such as family allowance, educational support, housing subsidy, loans, support for cultural, recreational, tourism and vacation activities. All of the enterprises have to join with CCF and the employers have to contribute 4% of their basic salary as membership fees. There are 55 such funds in the country, a membership of about 70,000 companies and 3,400,000 workers and a total budget amounting to 1,200,000 million pesos. The system was established in 1962.

The Funds are obligated to establish a VIS Fund (FOVIS - *Fondo para el Subsidio Familiar de Vivienda de Interés Social*), to invest 16% of their budgets for family subsidy of housing according to the national policy of VIS（Art.81, Decree 2620/2000). The funds are controlled by the Superintendent of Family Subsidy.

A total of 20,374 subsidy applications were approved in 1999 with total investment of 98,907 million pesos for 1) acquisition of houses, 2) construction of houses in proper sites and 3) improvement of houses.

The system, the objects and the sums of subsidy are the same as those of INURBE.

The following are principal Family Compensation Funds: Compensar, Colsubsidio, CAFAM, Comfenalco, Comfandi, Comfama, Comfamilia, Afidro, Comfacundi, Indufamiliar, Caja de Compensación Familiar Campesina.

C. Promoting Fund of Military Housing (CPVM)

CPVM is an Industrial and Commercial Company of the Ministry of National Defense.

Subsidies for 5,150 cases were given in 1999 for military VIS housings with total investment of $45,578 million pesos.

(3) Organizations of loan

FNA (*Fondo Nacional de Ahorro* or National Saving Fund), an Industrial and Commercial Company of the State, is a VIS loan organization. It processed 10,515 housing loans with a total

amount of $213,972 million pesos in 1999, but this was mainly for national government employees.

Corporations of Saving and Housing are banks that offer housing loans and savings service with unit of adjustment (UVR - *Unidad de Valor Real*) to the index of consumer prices (IPC). In this system of VIS subsidy, the Corporations offer to deposit the down payment (more than 10% of the house value) and give a loan to the subsidy beneficiaries amounting to the balance of payment on mortgage of the house to purchase.

In the common cases other than VIS subsidies, Corporations offer loans until 70% of value of the house to purchase on mortgage of the house. In these cases, corporations do not inspect the houses especially their seismic resistance; they only examine the economic value and physical condition of the houses.

Corporations do not give loans only for the cost of construction.

(4) Organizations of Bogotá City government

Bogotá D.C. Government has the following housing and urban development entities: as public establishments: IDU (Urban Development Institute), FAVIDI (Fund of Saving and Housing of the District), Fund of Popular Housing; as industrial and commercial companies: Metrovivienda Company, Urban Renovation Company.

IDU constructs city roads and manages them. FAVIDI supplies VIS houses to the city government's employees utilizing their resources of unemployment compensation and pension. Fund of Popular Housing supplies VIS houses for relocation of houses occupying public space and houses located in high-risk areas of disaster. Metrovivienda supplies building lots to VIS housing constructors. Urban Renovation Company manages renovation projects in the central areas.

There is no organization dealing with improvement of existing defective buildings and guiding and controlling of buildings planned/constructed by the owners themselves.

2.11.2 Common Housing

1) Housing of Low-income People

Beneficiaries of subsidy of Family Compensation Funds are contractual laborers with relatively stable income comparing with those of INURBE who are mainly non-contractual laborers with less income.

The majority does not have much luck in making use of the subsidy system, or does not qualify for public assistance.

Low-income people construct houses step by step in the processes of building the basement, structure, wall, floor, interior and exterior by contracting workers or by themselves. In many cases, there are no design plans nor construction licenses.

2) Self-Construction

For the poorer people who do not qualify for subsidies and loans, or do not have stable and enough income, so-called Self-Construction is very common in the areas of *estrato* 1 and 2 mainly located in the south of Bogotá. Though there is no statistical information, it is estimated that more than half of the buildings are self-constructed in the poorest areas of the city. People construct their houses by themselves little by little when they have time and money. Many of the people are construction workers and sometimes they construct 3 or 4 story buildings. However, almost all of them do not have construction licenses and their work are not subjected to any technical check; thus many of their constructions have structural problems. There are a few technical guides for self-construction; however, the technique is very far from what is commonly known and used.

There are no countermeasures carried out for guiding and controlling Self-Construction, nor supporting for improvement of existing buildings constructed in such a manner.

2.11.3 Organization of Control

1) Construction Guard Office

Authorizing and controlling licenses of urban development and building construction are responsibility of municipalities. Checking of seismic resistance should be included in the examination for construction license (Art.13, Decree 1052/1998).

Municipalities with more than 100,000 inhabitants should have *Curadurías Urbanas* decentralizing the jurisdiction of municipal planning offices (Art.49, Decree 2150/1995).

The *Curadurías Urbanas* are entrusted to issue licenses and execute necessary studies for the license issuance. Their responsibility is public (Art.36, Decree 1052/1998), but their business form is private (Art.35, Decree 1052/1998). They are independent economically and financially from the Municipal Government.

Municipal mayor has a duty to check and control construction guards in observance of regulations of their business (No.7, Art.101, Law 388/1997). The Ministry of Economic Development supports and orients the construction guards in their adequate implantation of local administration by way of Inspecting Commissions（No.6, Art.101, Law 388/1997; *Comisiones de Veeduría*, Art.74, 75, 76, 77, Decree 1052/1998).

Observance of the law on construction licenses should be enforced directly by the office of the mayor or indirectly by the municipal authority of construction and planning（Art.61 Decree

2150/1995). In the case of Bogotá D.C., the locality sends inspectors to check the observance of this law.

For the actions of development or construction without licenses or violation of authorized matters, the municipal mayor, the local mayor in the case of Bogotá, can oblige to stop and seal the actions (Art.103, Law 388/1997), punish the responsible person with a fine (No. 1, 2, 3, 4, Art.104, Law 388/1997), or oblige to demolish partially or totally the construction (No.5, Art.104, Law 388/1997).

2) Number of Construction Licenses

About 5,000 construction licenses are likely issued annually by the five *Curadurías Urbanas*, but a large part of the new buildings are to be constructed yearly without any construction licenses, because annual new building constructions are estimated to be 20,000 to 30,000 in the city.

The latest public selection of Guards was held in November of 2001. Five Guards were selected for January 2002 to December 2006 without changing the total number.

3) Distribution of Curadurías Urbanas

In Bogotá there are five *Curadurías Urbanas* Offices, four of which are located in the Chapinero locality in the northern part of the city, and one in Santa Fe. The distribution is inclined to the north, and the other 17 localities do not have any Guard Office.

4) License Fee

An application fee is necessary for Construction License. The rate formula is determined by the Ministry of Economic Development (No.4, Art.101, Law 388/1997; Art.57, Decree 1052/1998) and each municipality will set every year coefficients to calculate the fees (Art.68, Decree 1052/1998). Fees are usually based on the area of economic *estrato* and types of use. Fee for housing is cheaper than that for commercial use.[2-11-2]

2.11.4 Issues for Private House

1) Increase of Defective Buildings without Control

There are 20,000 to 30,000 new constructions of houses and buildings annually in Bogotá, but only 5,000 have construction licenses. There exist in the Study Area about 400,000 defective houses and buildings of little seismic resistance made of brick masonry, most of which are located in the areas of economic and social *estrato* 1 and 2 in the south of Bogotá. Almost none of them

[2-11-2] For example, in the case of housing in the area of *estrato* 1 or 2 with 50 m^2 of construction the application charge will be 175,924 pesos (2001) included 16% of IVA (Value Added Tax, Law 635/2000). There is discounted fee applicable to VIS, which costs 44,234 pesos equivalent to 4 SMDV (Daily Minimum Salary, Art.65, Decree 1052/1998). VIS fee is applicable to housing: 1) up to 90 SMLM (25,740,000 pesos) of value, 2) up to 50 m^2 of construction, and 3) of authorized VIS project. An interview consultation will be charged 22,117 pesos per hour.

have construction licenses or checks for seismic resistance. The background of this situation is supposed as follows:

- The owners do not know or disregard construction license.
- The fee of construction license is not economical for the owners of *estrato* 1 and 2.
- The capacity and number of Construction Guard Offices are not enough, and the location is inclined to the north of the city.

2) Backlog to the Demand of Low-Cost Housings

About 45,000 VIS houses were built in 1999 by the subsidy system of INURBE and Family Compensation Funds, about one third of which were in Bogotá. All the licenses are checked in the case of VIS housing.

The common low-cost housing projects other than VIS are not very well checked in seismic resistance.

3) Disregarding Seismic Resistance for Existing Defective Buildings

At this moment there is no project of reinforcement for 400,000 existing defective buildings by DPAE-FOPAE or other organizations of housing, urban development and prevention of disasters. There are subsidies for improvement of houses by way of INURBE and Family Compensation Funds; but actually they are not effective for improvement of seismic resistance because of system nature and lack of resources.

These defective houses and buildings are actually left alone and unattended.

4) Cost and Benefit for Reducing Human Casualties

It is important to gain more benefit in reducing human casualties by prevention projects utilizing limited financial resources. There is a question whether the present projects of DPAE-FOPAE are really effective or not from the above-mentioned aspect. But the more important question should be how many lives can be saved against expected risk of disaster with the same unitary cost.

It is recommended that prevention projects should be shifted and concentrated 1) to produce more seismic-resistant buildings and 2) to reinforce the existing 400,000 defective buildings.

5) No Reserved Budget for Immediate Response

Any of the following organizations studied in this project are not reserving a budget for immediate response to disasters except for FOPAE: National Calamity Fund, Calamity Fund of Cundinamarca, 8 municipal governments, road management organizations such as INVIAS, Cundinamarca Secretariat of Public Works, IDU, Lifeline Service Enterprises such as EAAB, TELECOM, ETB, Natural Gas Company, and so on.

Most of these organizations will divert budget urgently to response use; however, the availability will be uncertain and immediate disbursement will be difficult.

It is impossible for insurance companies to offer insurance of immediate cash-payment as they are always investing in money markets.

6) Reserved Budget of FOPAE

FOPAE is the only organization that has a reserved budget for immediate response to any urgent necessity after a disaster (Art.68, Decree 1148/2000), in the sum of 5,000 million pesos (2001 budget No.7240).

However, this amount cannot be carried forward to the next fiscal year; it should be diverted to other use until the end of the year because of actual budget regulations.

The 5,000 million pesos is just a little for 6 million inhabitants at 833 pesos per person.

7) Establishment of Organization for Reconstruction

In Colombia, each time after a large disaster a special organization for reconstruction was established. They are, for example, Corporation of Cauca after the earthquake of Popayán, Corporation of Nasa Ki We after the Paez River avalanche by an earthquake in 1994, FOREC after the Quindío earthquake, San Cayetano Fund after the landslide of the village, and so on. In the case of Quindio, FOREC was established only 5 days after the disaster together with a decree of additional national budget.

However, if a large seismic disaster occurs in Bogotá, a much bigger organization will be needed than those mentioned above. Some preparatory study will be needed for it.

8) Legislation

In the case of Quindío, 10 Municipal Decrees were issued within a week after the earthquake and 12 National Decrees within a month. The rush of legislations was not successful and did not really register in the people's minds; there were alterations and abolitions during a short period. Some of them were not so effective for lack of preparation and deliberation.

9) Disaster Insurance for Public Organizations

Not all of Colombian public organizations including Lifeline Service Enterprises have disaster insurances, though they are obliged to have some insurance against disaster damages (Art.101 and 107, Law 42/1993; Art.6, Resolution 5145/2000 of the General Board of Audit).

10) Disaster Insurance for the Private Sector

Disaster insurances are not yet common for private houses and buildings in Colombia. In Bogotá earthquake insurances occupy only 9% of all the damage insurances. (1,004.254 million pesos in 2000.

Law of Joint Ownership obligates joint owners to have Disaster and Fire Insurances to protect common properties. There will be a need to promote this law because it is very new (August of 2001) and no sanction is imposed for non-compliance of this law.

Also it is necessary to study the possibility to introduce the 1 % contribution system of paid insurance fees to disaster funds, referring the case of National Fire Fighting Fund receiving 1 % of paid fee insurance (National Fund of Fire Fighting, Art. 2, 3, Decree 2211/1997).

2.12 GIS and Database System

2.12.1 Introduction

In this study, attribute and GIS database creation has an important role not only to integrate the large number of data collected during the study period but also to aid and enhance the future decision making process. Keeping this in mind, the collected database is put under standard database design so that the future use is more straightforward.

To achieve this goal, the database received from different institutions were carefully analyzed and validated against standard database structure. Following can be assumed from the database construction.

1) Data Source and Compilation

- A large number of existing data and database were collected from different institutions for the study purpose. Basically, three ways were employed to get hold of them: data and information provided by each institution (past studies conducted by them form the information provided by these institutions), studies and observation carried out by JICA study team, and studies subcontracted by JICA team for the study purpose.
- The analysis of collected data revealed that a large number of data received are not consistent in quality, scale, and time period in which they had been collected. Furthermore, the data are not organized in a structured manner to be used directly for the study purpose. Many of the collected map data were not in GIS format. A great deal of the effort was put to organize and systematize the data as well as data correction.

2) Database Analysis and Modeling

- Database analysis and modeling was done by using standard querying language SQL. Following database components were completely analyzed through SQL routines.
  a) Building Database creation.
  b) Population Estimation for the year 2000.
  c) Housing Units Distribution.
  d) Building Damage Estimation and Human Casualty.
  e) Debris Generation.
  f) Property Damage (based on Cadastral Value).
  g) Flood Damage Estimation.
  h) Landslide Damage Estimation.
  i) Fire break out ratio from Chemical Industries.
- The GIS system was structured around Arc/Info topological model. The latest Arc/Info data model is geo-database. The geo-database model offers better solution than conventional topological model and enhances data validation rules inside the GIS system.

In some form, the geo-database model homogenizes the existing difference between GIS system and Database system leading to better interchange and compatibility between these two systems. This model, however, is not implemented in the present study, considering the fact that it is not backward compatible. The counterpart agencies do not have latest Arc/Info software to read the geo-database model. That means this model cannot be correctly interpreted by existing software available in DPAE and Government of Cundinamarca. They need to procure new Arc/Info release so as to interpret this geo-database model. Also, all the information received from the counterpart agencies are in Arc/Info topological model, so converting these data to geo-database require a huge task.

- The database system was finally integrated with GIS system with the common spatial units (connectors). These spatial units to connect Oracle and Access database systems are Manzana, Microzone, Locality and Municipality.

2.12.2 Database Construction

1) Information Provided by the Entities

Following entities provided GIS and non-GIS database for the study.

- DPAE
- Planning departments of eight Municipalities
- Cadastral Department, Bogotá
- Secretary of Education, Bogotá
- Parks and Open Spaces, Bogotá
- Planning Department of Bogotá
- Government of Cundinamarca
- IDU
- Water Supply Company, Bogotá (EAAB)
- Telecommunication Companies (CAPITEL, ETB)
- Natural Gas Company
- DABS
- Electricity Supply Company (CODENSA)
- Ecopetrol
- Ingeominas

2) Database Quality Checking

The collected databases were checked for their present structure, level of detail, quality, consistency, time period in which data were collected and relevance of them to this study. Mainly database quality checking was done for three aspects.

- Attribute database quality.
- Spatial database quality.
- Relevance to present study.

A summary of the attribute and GIS database quality checking for major database received is given below. Mainly following information were rigorously checked:

1) Base map collected from Government of Cundinamarca.
2) POT data and map collected from municipalities.
3) Cadastral database.
4) Seismic Microzoning Study carried out by Los Andes University and Ingeominas.
5) DPAE's GIS database.

2.12.3 Revision and Correction of GIS and Attribute Database

1) Base Map Preparation

The study team established GIS base map for the study area through sub contracting to the Colombian firm. The existing data base and maps are constructed Bogotá City and Cundinamarca separately. Within the study, integrated map for the study area was established.

2) Coordinate System

There are two types of Coordinate System in use in the Study Area. Almost all the information received for Bogotá has its local Coordinate system. Similarly, all the national entities including eight municipalities use the Bogotá national coordinate system.

Finally, for this study the JICA team chose the Bogotá National system as a unique coordinate system for the following reasons.

- The Bogotá local system can be transformed to Bogotá National system with less error in coordinate transformation as the data from Bogotá were prepared in major scales.
- The tendency is to work in a unique system so as to facilitate easy interchange of data.

2.12.4 Design and Structuring of Database and System

1) Introduction

The fundamental points for the design of database for the present study were:

- 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.

The database design process consists of the following steps:

(1) Requirements collection and analysis

The study requires setting up microzones, setting a database for existing buildings (both for residential and other use) and setting up the population data in these microzones.

(2) Conceptual database and GIS design

The goal of this stage is to analyze the application and do a conceptual design on the application to provide a description of reality. The figure below shows the flow of the information from different entities and their organizations.

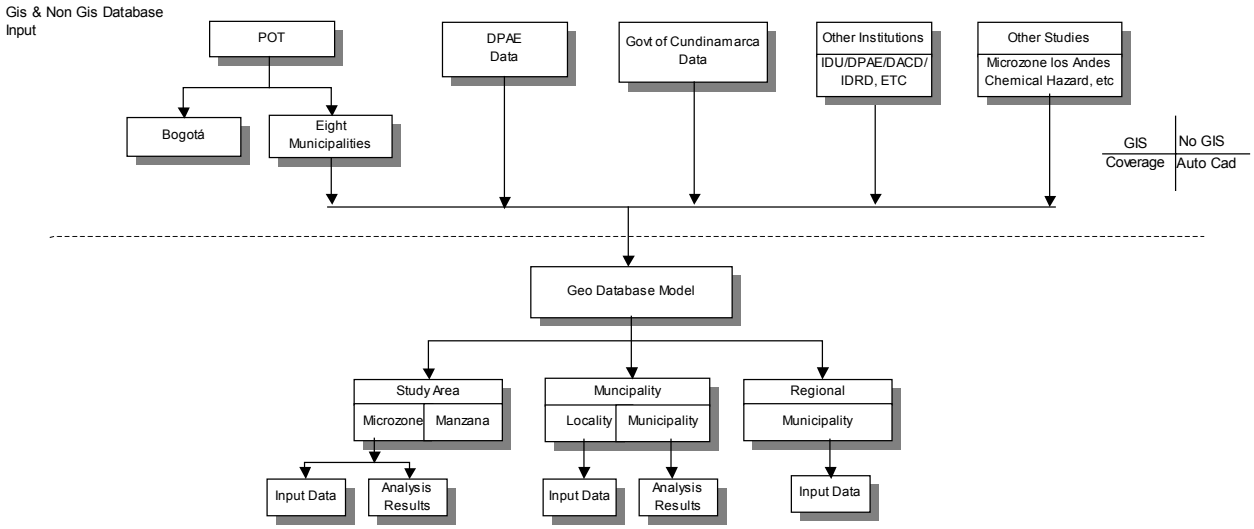


Figure 2.12.1 Organizational Design of Database

A conceptual design should reflect all the components of the designed database. The flow chart in the next page shows the different components and subcomponents of the constructed database and its hierarchical order.

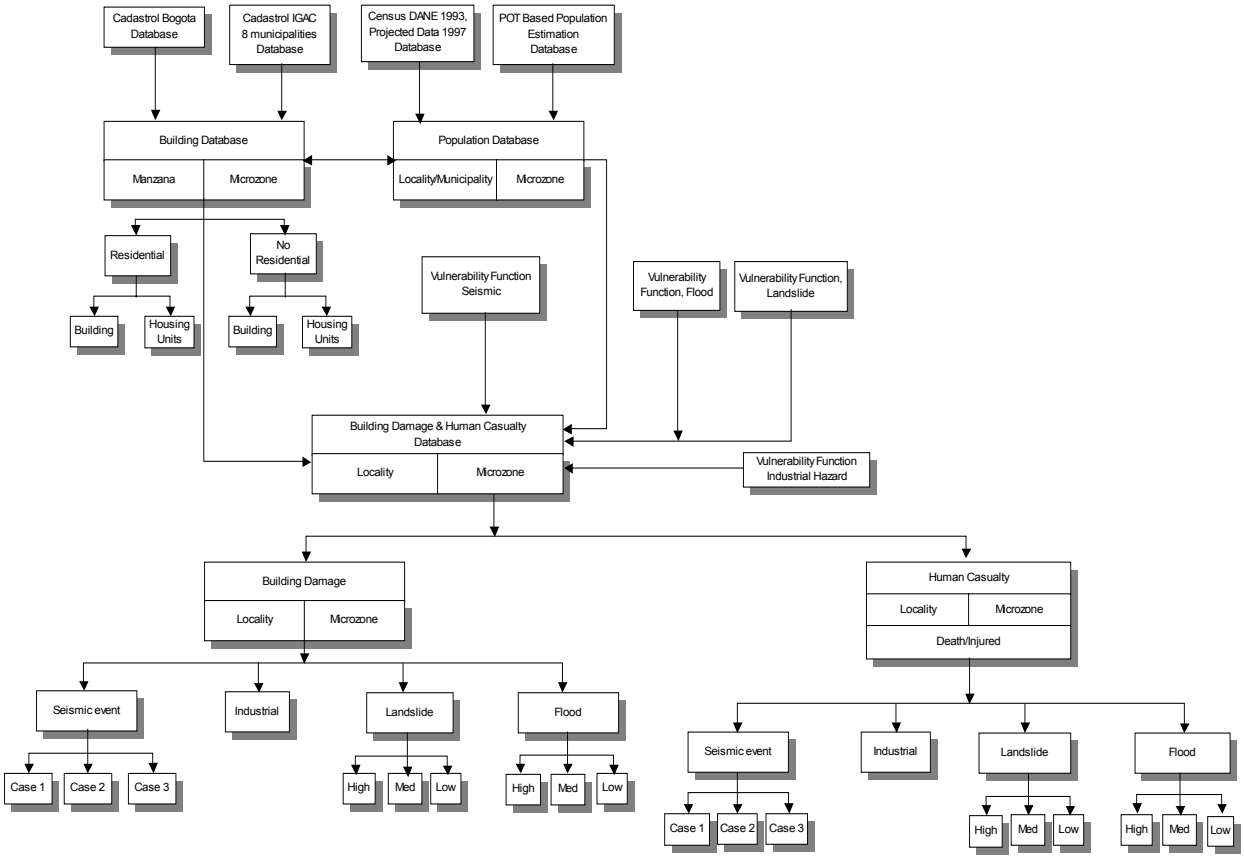


Figure 2.12.2 Components of the Database

(3) Choice of a DBMS and GIS

A decision was made to choose Personal Oracle database system to be used as the desktop database. This has all the features of a Server database but could be used in only one computer at a time. This gave an excellent solution to the need of power, flexibility and scalability of server database at very low cost.

For the Geographic Information System, ArcGIS (new version of Arc/Info family) is chosen as it is versatile, reliable and widely used GIS system. Further, most of the data collected in Bogotá are already in Arc/Info coverage while GIS data from the municipalities are in Arc/View shape file. Almost all of the entities using GIS has either Arc/Info or Arc/View software.

(4) Database and GIS system implementation

The database system implementation involves the setting up of procedures for communication between the Database System and GIS system. Through proper communication system and suitable spatial and attribute connectors, the GIS and Database system can interact with each other. Four spatial units (common connectors) were defined so that the attribute and spatial database could communicate with each other. These spatial units can be modified or deleted at any time in

the database making it flexible for database aggregation and changes. Equally, new connectors can be added to both attribute and GIS database.

- Manzana.
- Microzone.
- Locality.
- Municipality.

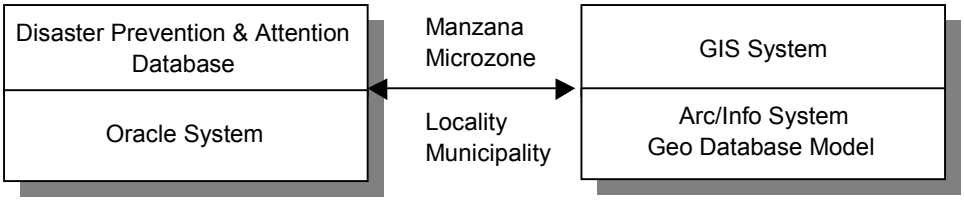


Figure 2.12.3 Relationship between Database and GIS System through Common Connectors

2.13 Summary of Donor Activities

2.13.1 UNDP

In the mid 1980s, the Colombian government started a disaster management project with cooperation with the United Nation Development Program (UNDP). The study done by UNDP proposed to establish the disaster management system in Colombia. The project recommended establishing a National level organization to deal with disasters as well as local level organizations. The Colombian government has established the national level organization and the four local level organizations, i.e. Cali, Bogotá, Ibague and Tumaco, for high risk areas. Since then, UNDP has given assistance to the Colombian Government on this field.

UNDP has assisted rehabilitation of the Choco province, which was hit by an earthquake in 1992. The project has focused on five municipalities of Vigia de Fuerte, Carmen de Atrato, Bojaya, Murindo and Medio Atrato, and implemented the relocation of people as well as the development of agriculture. It will continue to develop community level organizations with participation of the people.

2.13.2 GTZ and KfW

GTZ has carried out the feasibility study on the Bogotá Metropolitan Area. As the results of the feasibility study, the Government of Germany, through KFW (Bank for the German Development), gives the financial assistance to the Bogotá City. The project calls "Project to Improvement of Neighborhoods SUR with Bogotá". The project intends to develop community level planning, coordination, and administrative capacity through participation.

2.13.3 On-going Project

The disaster management project is relatively new area in Colombia and there are four disaster management projects in Colombia in 2001. The list of the projects is shown as follows:

Table 2.13.1 Summary of the Donor Activities for Disaster Management Projects in Colombia

Name	Counter Part Organization	Objectives
Program for Prevention and Mitigation of the Risks in the Andean Region	Andean Region	Formulation of national and sectoral policies on prevention and mitigation
The recovery of earthquake damaged area in the Atrato Medio	Direction General of Prevention and Attention of Disasters	Rehabilitation and reconstruction of the earthquake damaged area
Disaster prevention in the Bogotá Metropolitan Area	Direction of Prevention and Attention of Disasters	Formulation of disaster prevention master plan in the Bogotá City.
Donation of Medical equipment for four hospitals in Quindio Prefecture	Ministry of Health	Renewal of medical equipment in the earthquake damaged area

2.13.4 Emergency Assistance

1) Armenian Earthquake

The Colombian government received assistance from various organizations for rehabilitation of the coffee-growing region. The Inter-American Development Bank (IDB) would provide about US$ 180 million and other donors (USAID, the Government of Italy and Spain) would provide US$ 70 million. The World Bank provided US$ 225 million for the various projects. The projects are consists of the five groups: 1) shelter assistance, 2) rehabilitation and retrofitting of social infrastructure, 3) rehabilitation of public infrastructure, 4) capacity building for natural disaster management, 5) social capital restoration and 6) project management.

To rehabilitate Armenian area, the Colombian government established a new organization, Fondo para la Reconstrucción y Desarrollo Social del Eje Cafetero (FOREC), to finance, execute, and coordinate the economic, social and ecological reconstruction of the disaster affected region[2-12-1]. The organization is just for reconstruction of the coffee growing area and only limited to three years. FOREC organizes 32 Non-Governmental Organization (NGO) to reconstruct the areas. It is estimated that the more than 90 percent of the funds is invested to the reconstruction of the area.

2) Summary of the Donor Activities

The summary of the donor activities in the coffee growing area is shown as follows:

[2-12-1] Project Appraisal Document on A Proposed Loan in the Amount of US$225.0 million to Forec Guaranteed by the Republic of Colombia for An earthquake Recovery Project, February 25, 2000

Table 2.13.2 Summary of Donor Activities in the Coffee Growing Area

Name of the Project (Project Location)	Activities	Beneficiary	Project Costs	Implementation organization
Alimentary assistance of emergency to the affected population by the earthquake in the coffee area of the Colombian west center (12 municipalities of the Quindio Prefecture)	Cleaning of rubbish Opening and rehabilitation of access roads Reconstruction of destroyed housing Reconstruction of basic services Reconstruction of productive infrastructure	115,000 people in total	US$ 1.5 million From PMA	PMA
Emergency Program	Mental treatment for affected children Reconstruction of portable water system Public awareness camping Return to school	10,000 children in the area 90,000 inhabitant	US$ 1.2 million From UNICEF	UNICEF
Technical Assistance for the Rehabilitation and Reconstruction of the municipalities in the coffee zone, affected by the earthquake in January 25th , 1999	Recruitment of specialized technical personnel to advice the local and prefecture authorities Organization and promotion of thematic meetings Co-financing of other UN system	Regional and Local Emergency Committee 1 million of people	US$ 113 thousand	UNDP is co-financing other 13 project within the UN system
Support to the Alimentary Safety for the Affected Communities project	Promotion of mixed families orchards Training to government officials Acquisition of seeds and agricultural inputs	5,000 farmers	225 million pesos	FAO
Support to the Housing Construction and Rehabilitation	Technical support of damaged housing	10,000 inhabitants	US$ 504 thousand	GTZ
Reestablishing of Health Services in the Quindío Prefecture.	Endowment of medical-surgical equipments	Four hospitals in different municipalities	9,917 million pesos	Government of Japan