(3) Discussion

Generally, it is well known that deformation of linear structures such as pipelines is generated by ground deformation during an earthquake. Many cases of heavy damage, such as broken pipes, caused by past earthquakes have been reported due to liquefaction and / or slope failure.

In the Boumerdes Earthquake, no damage associated with the sewerage system was reported. However, the pipelines located in the "high risk" and "relatively high risk" areas have the highest priority to be assessed for seismic vulnerability if an aseismic assessment for the sewerage pipeline is undertaken.

6-3-6 Electric Power Supply Cable

Electric power supply cables are classified into 3 types by distribution voltage, these being high voltage (220,000V or 60,000V), medium voltage (30,000V for rural areas or 10,000V for urbanized areas) and low voltage (others) cables as described in the section 4-2-7.

The high voltage cables are supported by power pylons or buried underground. The design of these installations included aseismic considerations and therefore, there have been only a few records of damage due to past earthquakes. Hence, vulnerability of the high voltage cables for the scenario earthquake was evaluated qualitatively by overlaying the cable locations on the geo-hazard maps.

The medium voltage cables will suffer damage due to the scenario earthquake, which will be influenced by various activities. The electric power supply cables in Japan are 6,600V, which is similar to the medium voltage cables in Algiers. Some damage estimation methods for the cables are recommended in Japan.

The low voltage cables in the Wilaya of Algiers are very complicated and are distributed generally along the buildings. Damage to these cables due to the scenario earthquake is estimated as being comparable to building damage. Hence, the damage estimation of the cables is beyond the scope of this section.

(1) Medium Voltage Cables

1) Damage Function

The basic concept of the damage function is based on the Disaster Prevention Council of the Tokyo Metropolitan Area in 1997. The concept recommends 2 damage function curves in which one is for the aerial cables and the other is for underground cables. In this study, the damage functions applied were examined with the counterpart, and then we applied the following damage function curve shown in Figure 6-46.

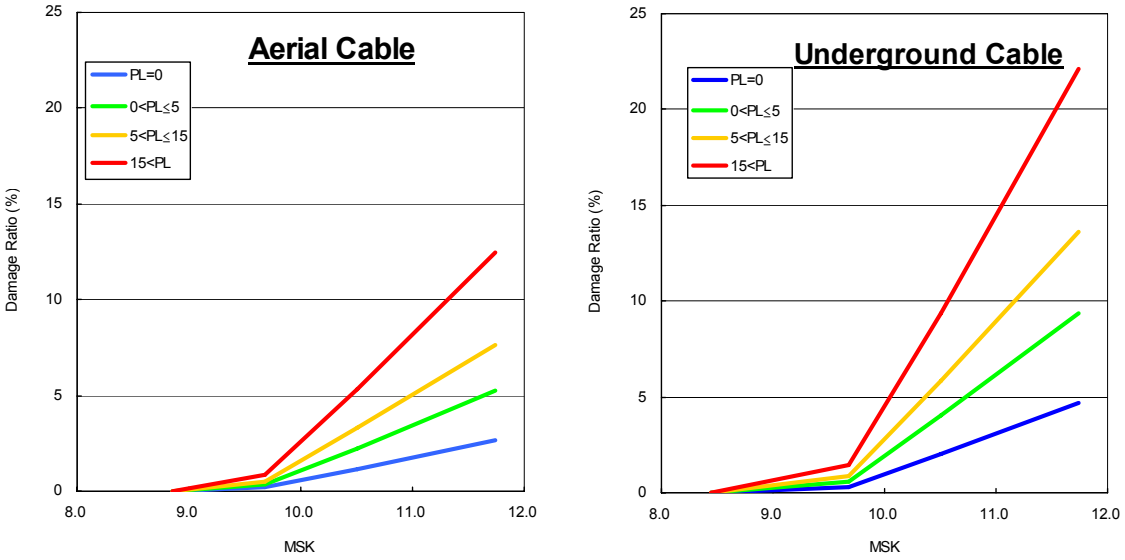


Figure 6-46 Damage Function Curve for Medium Voltage Cables

In each grid sector, the damage function gives the damage ratio corresponding with an MSK value, and that ratio multiplied by the total length of pipe is the damage cable length.

2) Results and Discussion

As a result, the length of damage in each 250 m grid zone was calculated by the damage ratio multiplied by the total length of the cables.

Figure 6-47 to Figure 6-48 shows the result of the damage estimation for medium voltage cable by 250 m grid zone. The damage length will be concentrated in the central part of the study area for the Khair al Din scenario and eastern part of the study area for the Zemmouri scenario.

Table 6-30 shows the tabulation of damage points by commune.

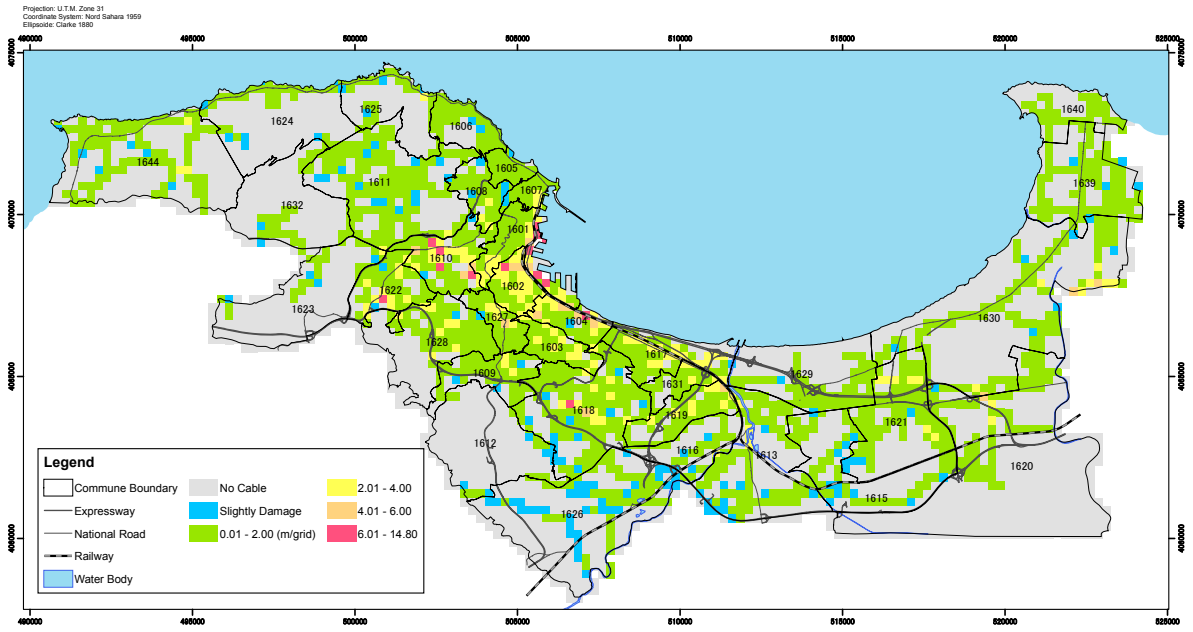


Figure 6-47 Damage Length of Medium Voltage Cable: Khair al Din

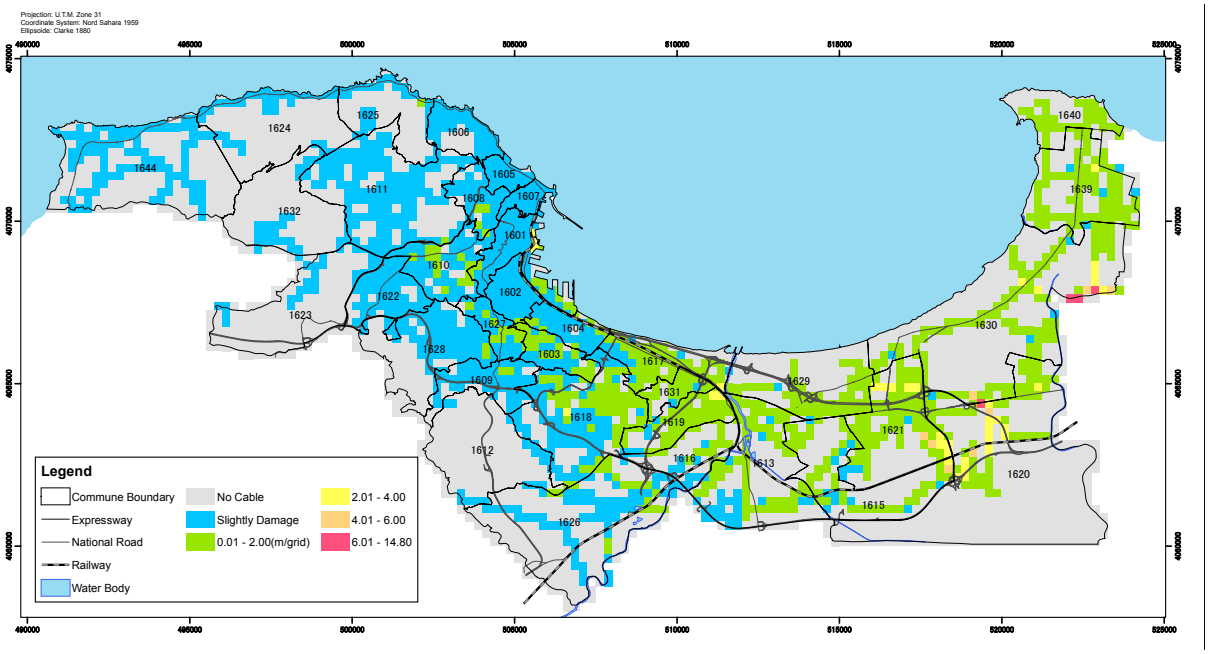
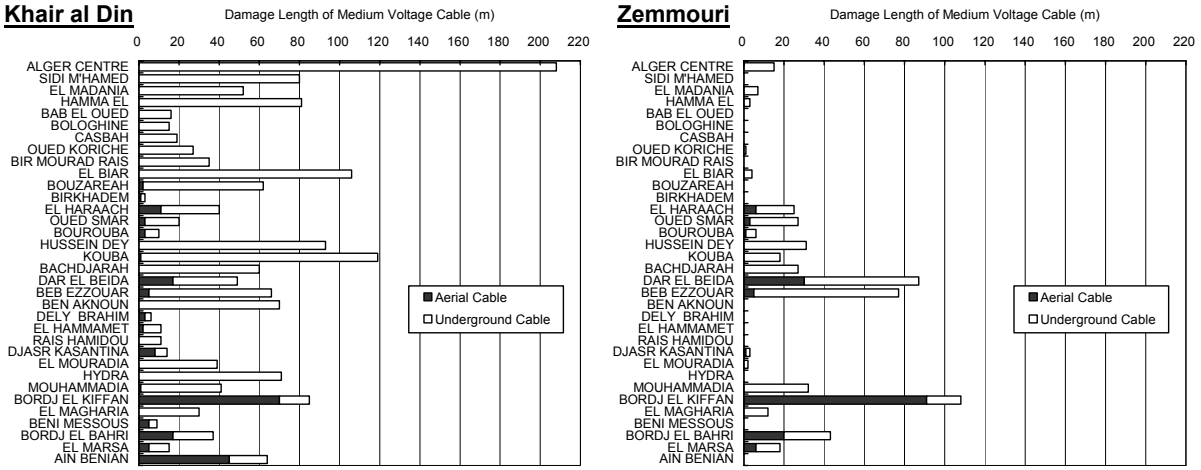


Figure 6-48 Damage Length of Medium Voltage Cable: Zemmouri

Table 6-30 Summary of Damage Length of Medium Voltage Cable by Commune

Commune	Length			Damage Length (m)					
	(m)		(km)	Khair al Din			Zemmouri		
	Aerial	Under-ground	Total	Aerial	Under-ground	Total	Aerial	Under-ground	Total
ALGER CENTRE	-	59,806	59.8	-	208	208	-	15	15
SIDI M'HAMED	-	40,903	40.9	-	80	80	-	0	0
EL MADANIA	-	22,833	22.8	-	52	52	-	7	7
HAMMA EL ANNASSER	-	42,397	42.4	-	81	81	-	3	3
BAB EL OUED	-	10,843	10.8	-	16	16	-	0	0
BOLOGHINE IBNOU ZIRI	728	10,339	11.1	0	15	15	0	0	0
CASBAH	-	12,956	13.0	-	19	19	-	0	0
OUED KORICHE	-	14,017	14.0	-	27	27	-	1	1
BIR MOURAD RAIS	-	22,798	22.8	-	35	35	-	0	0
EL BIAR	-	33,051	33.1	-	106	106	-	4	4
BOUZAREAH	5,994	39,432	45.4	2	60	62	0	0	0
BIRKHADEM	2,057	2,230	4.3	1	2	3	0	0	0
EL HARRACH	13,151	11,516	24.7	11	29	40	6	19	25
OUED SMAR	3,284	8,468	11.8	3	17	20	3	24	27
BOUROUBA	2,230	2,553	4.8	3	7	10	1	5	6
HUSSEIN DEY	-	38,585	38.6	-	93	93	-	31	31
KOUBA	1,914	68,190	70.1	1	118	119	0	18	18
BACHDJARAH	-	30,683	30.7	-	60	60	-	27	27
DAR EL BEIDA	8,652	11,509	20.2	17	32	49	30	57	87
BEB EZZOUAR	4,751	21,997	26.7	5	61	66	5	72	77
BEN AKNOUN	-	35,025	35.0	-	70	70	-	0	0
DELY BRAHIM	3,617	1,789	5.4	3	3	6	0	0	0
EL HAMMAMET	1,908	5,795	7.7	2	9	11	0	0	0
RAIS HAMIDOU	34	6,241	6.3	0	11	11	0	0	0
DJASR KASANTINA	15,646	3,578	19.2	8	6	14	1	2	3
EL MOURADIA	-	17,339	17.3	-	39	39	-	2	2
HYDRA	-	39,170	39.2	-	71	71	-	0	0
MOUHAMMADIA	520	15,526	16.0	1	40	41	0	32	32
BORDJ EL KIFFAN	21,617	4,479	26.1	70	15	85	91	17	108
EL MAGHARIA	-	12,780	12.8	-	30	30	-	12	12
BENI MESSOUS	4,298	2,949	7.2	5	4	9	0	0	0
BORDJ EL BAHRI	14,515	8,639	23.2	17	20	37	20	23	43
EL MARSA	3,295	4,976	8.3	5	10	15	6	12	18
AIN BENIAN	15,588	7,936	23.5	45	19	64	0	0	0
Total	123,797	671,326	795.2	199	1,465	1,664	163	383	546



The commune that is projected to suffer the most damage is Alger Center for the Khair al Din case and Bordj El Kiffan for the Zemmouri case.

In the most recent Boumerdes Earthquake, damage to the electric facilities was reported, while there were no reports about damage to the medium voltage cables.

It is estimated On the basis of the above mentioned past damage records it is projected that the damage to the medium voltage cable may not be very extensive. The result of the damage estimation also shows that the damage length is not very great (1,664 m for Khair al Din, 546 m for Zemmouri) and the damage ratio is not very high (0.21 % for Khair al Din, 0.056 % for Zemmouri). However, it is necessary to prepare for any possible energy emergencies due to a huge earthquake, and the locality feature can be utilized effectively for deciding the priorities to strengthen the cable network system against seismic damage.

(2) High Voltage Cables

1) Evaluation of Vulnerability

Vulnerability of the high voltage cables and substations for the scenario earthquakes was evaluated qualitatively by overlaying the locations of both the aerial and underground high voltage cables and their substations on the geo-hazard map (defined by the section 6-3-4).

2) Results

Figure 6-49 and Figure 6-50 shows the results of the vulnerability evaluation for the Khair al Din and the Zemmouri scenarios, respectively.

Table 6-31 and Table 6-32 show a summary of the results for the Khair al Din and the Zemmouri scenarios, respectively.

Table 6-31 Areas Evaluated as Relatively High Risk and High Risk for the High Voltage Cables and Substations: Khair al Din

High Voltage		Evaluated Relatively High and High Risk Area		
		PGA	PGA + Liquefaction Potential	PGA + Slope Failure Risk
Cable	Aerial	Ain Benian Oued Smar South part of Bordj El Kiffan	South part of Ain Benian	Ain Benian Center part of Dely Brahim
	Underground	East part of Bab Ezzouar	Coastal line in Alger Centre, Sidi M' Hamed, Hamma El Annasser and Hussein Dey	Bir Mourad Rais Kouba
Substations		Ain Benian El Marsa Mouhammadia	Alger Center	Hydra Bachdjarah

Table 6-32 Areas Evaluated as Relatively High Risk and High Risk for the High Voltage Cables and Substations: Zemmouri

High Voltage		Evaluated Relatively High and High Risk Area		
		PGA	PGA + Liquefaction Potential	PGA + Slope Failure Risk
Cable	Aerial	South part of Bordj El Kiffan	-	-
	Underground	East part of Bab Ezzouar	-	-
Substations		El Marsa	-	-

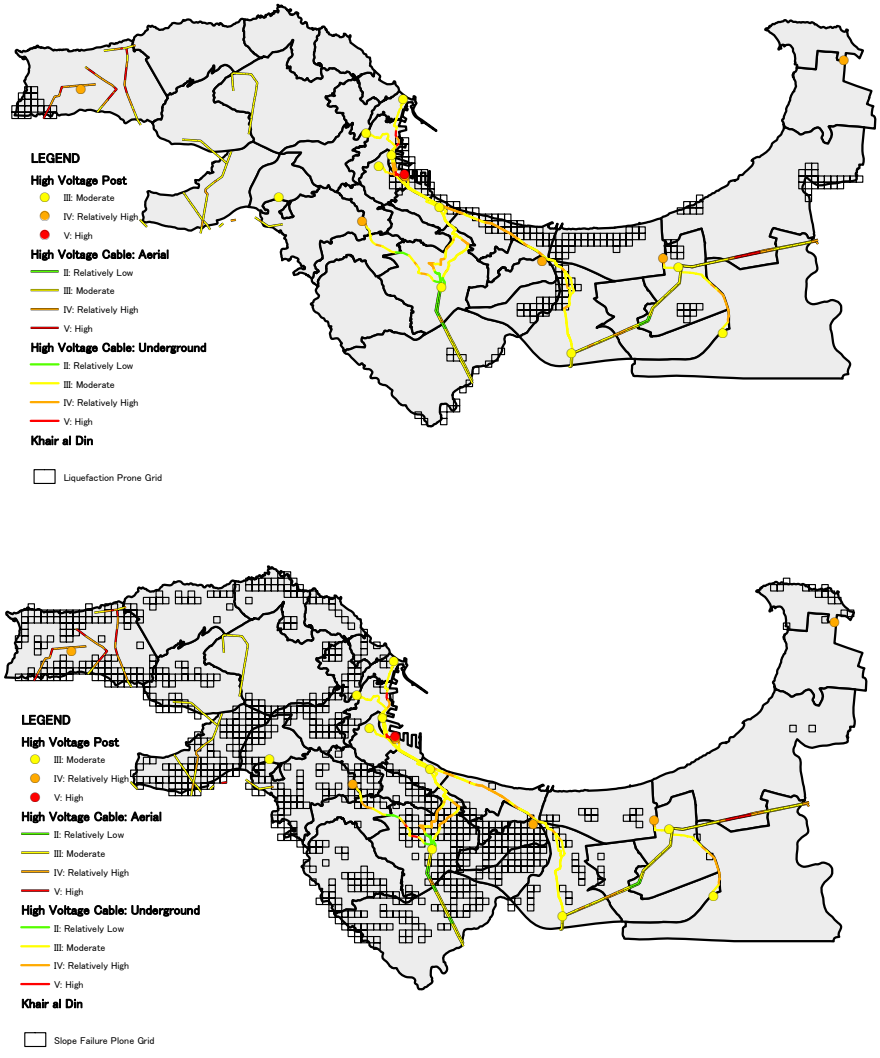


Figure 6-49 Qualitative Damage Estimation for the High Voltage Cables and Substations: Khair al Din

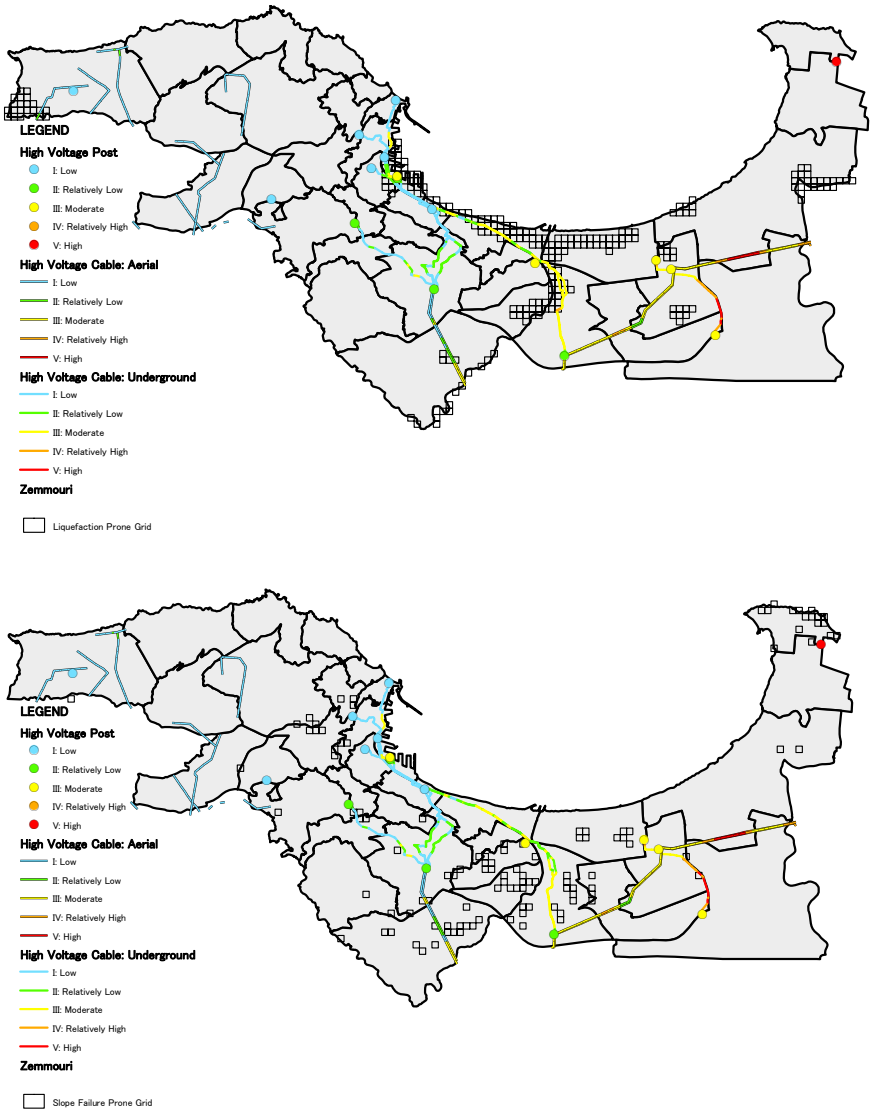


Figure 6-50 Qualitative Damage Estimation for the High Voltage Cables and Substations: Zemmouri

3) Discussion

In the Boumerdes Earthquake, no damage was reported associated with the high voltage cables, while damage to the post (transformers) was reported as follows.

Table 6-33 Summary of Damage Condition of Electric Facilities from the Boumerdes Earthquake

Location / Facility	Damage Condition
Ras Djinet: power plant	Shut down
Boumerdes Station	Damaged two transformers
Si Mustapha Station	Damaged two transformers
Reghaia Station	Damaged a transformer
Boudouaou Station	Damaged two 220 / 60 kV transformers

Hence, the cables / post located in the "high risk" and "relatively high risk" areas have a high priority for seismic assessment if an aseismic assessment for the high voltage network systems is executed.

6-3-7 Gas Supply Pipelines

The high pressure gas pipelines are based on aseismic design and are buried underground. There are few damage records as a result of past earthquakes, including the Boumerdes Earthquake. Hence, vulnerability of the high pressure gas pipelines for the scenario earthquakes was evaluated qualitatively by overlaying the pipeline network on the geo-hazard map.

Sonelgaz is replacing the low pressure gas pipelines with medium pressure pipelines in the Wilaya of Algiers. Hence, in this study the low pressure gas pipelines are analysed as though they were medium pressure gas pipelines.

(1) Medium Pressure Gas Pipelines

1) Damage Function

The empirical approach for damage estimation of the medium pressure gas pipelines is applicable to the low and medium pressure gas pipelines. The structure of these latter pipelines in the Wilaya of Algiers is similar to those in Japan. Consequently, the following damage function based on damage conditions due to past earthquakes, including the Kobe Earthquake in 1995, is used for the damage estimation. The basic concept is based on the damage ratio established by Kubo and Katayama (1975) as it was for the water supply pipelines, refer to section 6-3-4).

In this study, the applied damage functions were examined with the counterpart, and then the mean values of the coefficients were applied as follows:

$R_{fm} = R_f * C_g * (C_p * C_d)$

$R_f = 1.7 * A^{6.1} * 10^{-16}$ ---------- (maximum $R_f = 2.0$)

where

R_{fm} : Damage ratio (points/km)

R_f : Standard damage ratio (points/km)

A : PGA (Peak Ground Acceleration)

C_g : Modification coefficient for ground type with liquefaction potential (P_L)

Ground Type	P_L	C_g
Hill / Plateau	-	0.50
Alluvial Soil	$P_L = 0$	1.00
Soft Ground	$0 < P_L \leq 5$	2.00
	$0 < P_L \leq 5$	2.90
	$15 < P_L$	4.70

$C_p * C_d$: Modification coefficient for pipeline material and diameter

Pipe Material	$C_p * C_d$
Steel	0.10
Polyethylene	0.05
Copper	2.00

Figure 6-51 shows the applied damage function curve according to the above mentioned equation and coefficients.

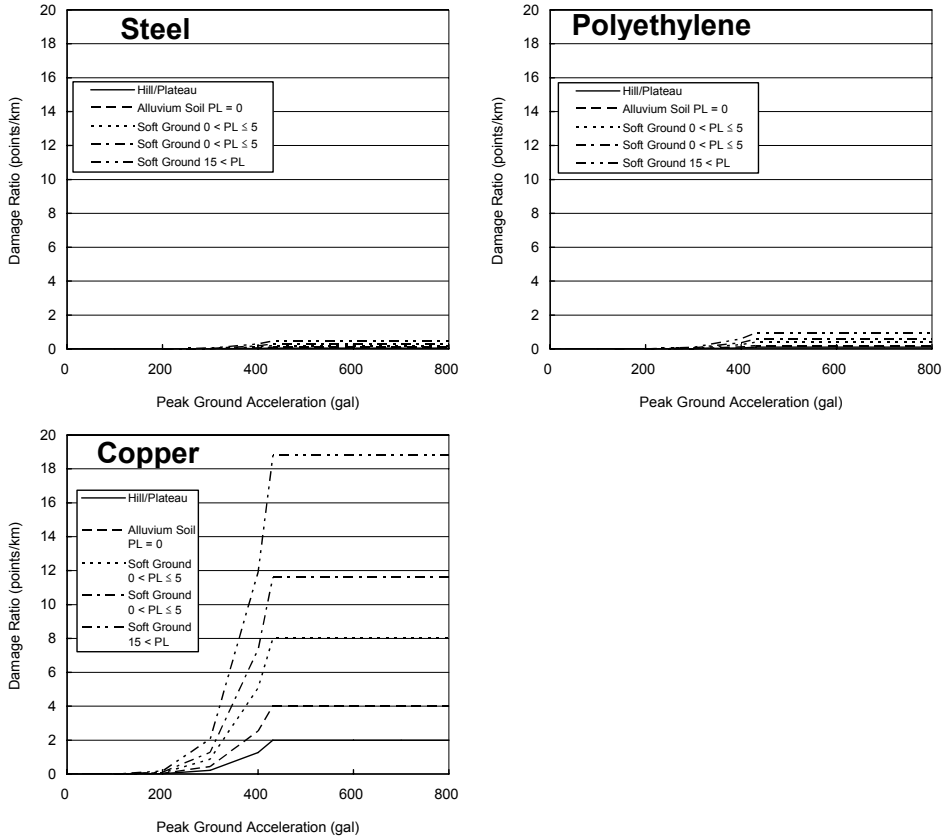


Figure 6-51 Damage Function Curve for Gas Supply Pipelines by each Material

2) Results and Discussion

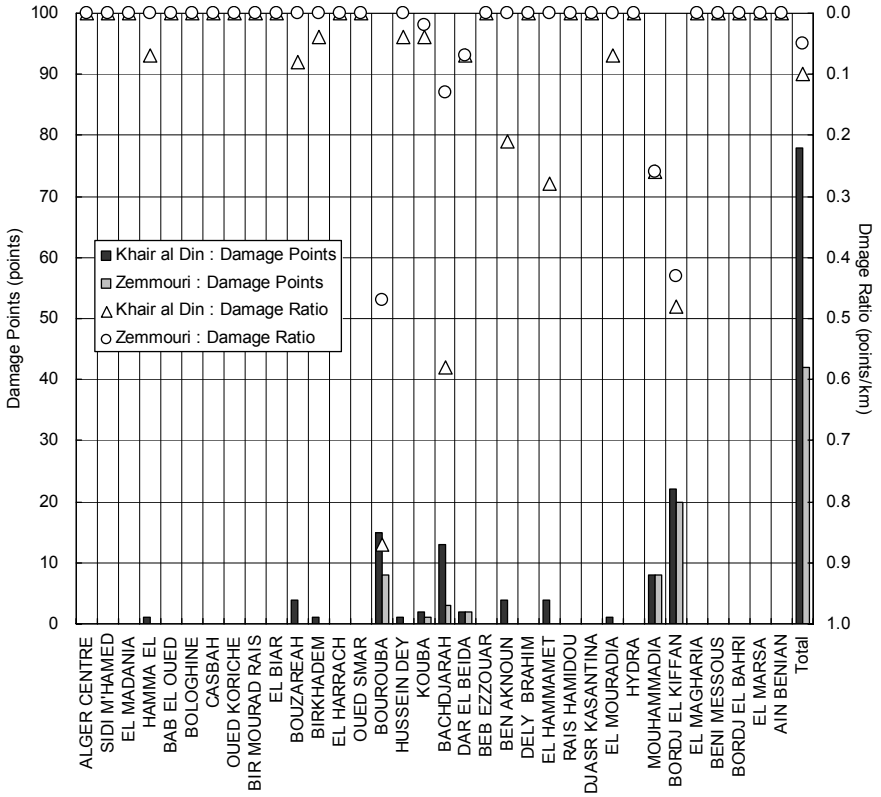
As a result, the number of damage points in each 250 m grid zone was calculated as the damage ratio multiplied by the total length of the pipelines.

Figure 6-52 to Figure 6-53 shows the result of the damage estimation for gas supply pipelines by 250 m grid zone. The damage points will be concentrated around the administrative boundary of Bachdjarah and Bourouba, and the west part of Bordj El Kiffan for both the Khair al Din and Zemmouri scenarios.

Table 6-34 and Table 6-35 shows the tabulation of damage points by commune and by pipe material, respectively.

Table 6-34 Summary of Damage Points of Gas Supply Pipeline by Commune

Commune	Length (km)	Khair al Din		Zemmouri	
		Damage Points	Damage Ratio (points/km)	Damage Points	Damage Ratio (points/km)
ALGER CENTRE	12.0	0	0	0	0
SIDI M'HAMED	9.7	0	0	0	0
EL MADANIA	15.2	0	0	0	0
HAMMA EL ANNASSER	15.1	1	0.07	0	0
BAB EL OUED	11.0	0	0	0	0
BOLOGHINE IBNOU ZIRI	23.6	0	0	0	0
CASBAH	7.7	0	0	0	0
OUED KORICHE	13.9	0	0	0	0
BIR MOURAD RAIS	28.6	0	0	0	0
EL BIAR	17.7	0	0	0	0
BOUZAREAH	52.3	4	0.08	0	0
BIRKHADEM	27.9	1	0.04	0	0
EL HARRACH	34.8	0	0	0	0
OUED SMAR	30.1	0	0	0	0
BOUROUBA	17.2	15	0.87	8	0.47
HUSSEIN DEY	27.3	1	0.04	0	0
KOUBA	53.9	2	0.04	1	0.02
BACHDJARAH	22.3	13	0.58	3	0.13
DAR EL BEIDA	28.6	2	0.07	2	0.07
BEB EZZOUAR	23.4	0	0	0	0
BEN AKNOUN	19.5	4	0.21	0	0
DELY BRAHIM	18.3	0	0	0	0
EL HAMMAMET	14.3	4	0.28	0	0
RAIS HAMIDOU	15.7	0	0	0	0
DJASR KASANTINA	21.2	0	0	0	0
EL MOURADIA	13.8	1	0.07	0	0
HYDRA	29.1	0	0	0	0
MOUHAMMADIA	30.4	8	0.26	8	0.26
BORDJ EL KIFFAN	46.0	22	0.48	20	0.43
EL MAGHARIA	12.0	0	0	0	0
BENI MESSOUS	16.5	0	0	0	0
BORDJ EL BAHRI	29.9	0	0	0	0
EL MARSA	12.4	0	0	0	0
AIN BENIAN	25.4	0	0	0	0
Total	776.8	78	0.10	42	0.05



The commune that is projected to suffer the most damage points will be BORDJ EL KIFFAN for both scenarios (Khair al Din and Zemmouri), and the commune that will suffer the highest damage ratio (points/km) will be Bourouba for both scenarios.

Table 6-35 Summary of Damage Points of the Gas Supply Pipelines by Pipe Material

Material	Length (km)	Khair al Din		Zemmouri	
		Damage Points	Damage Ratio (points/km)	Damage Points	Damage Ratio (points/km)
Steel	379.0	0	0	0	0
Polyethylene	372.3	0	0	0	0
Copper	25.5	78	3.06	42	1.65
Total	776.8	78	0.10	42	0.05

As a result, it is estimated that the copper pipelines will suffer the heaviest damage, and the pipelines of other materials will suffer less damage

The copper pipelines are mainly distributed in Bordj El Kiffan, Bachdjarah, Bourouba and Mouhammadia; hence, these areas will suffer much more damage in comparison with other communes as shown in Table 6-34.

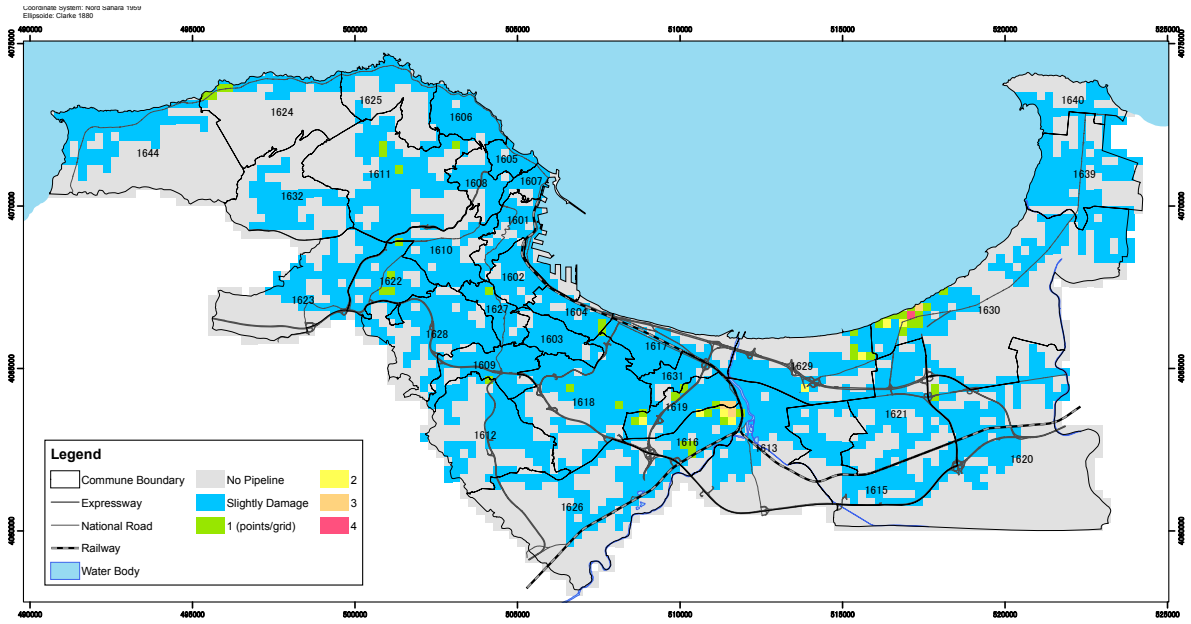


Figure 6-52 Damage Points of the Gas Supply Pipeline: Khair al Din

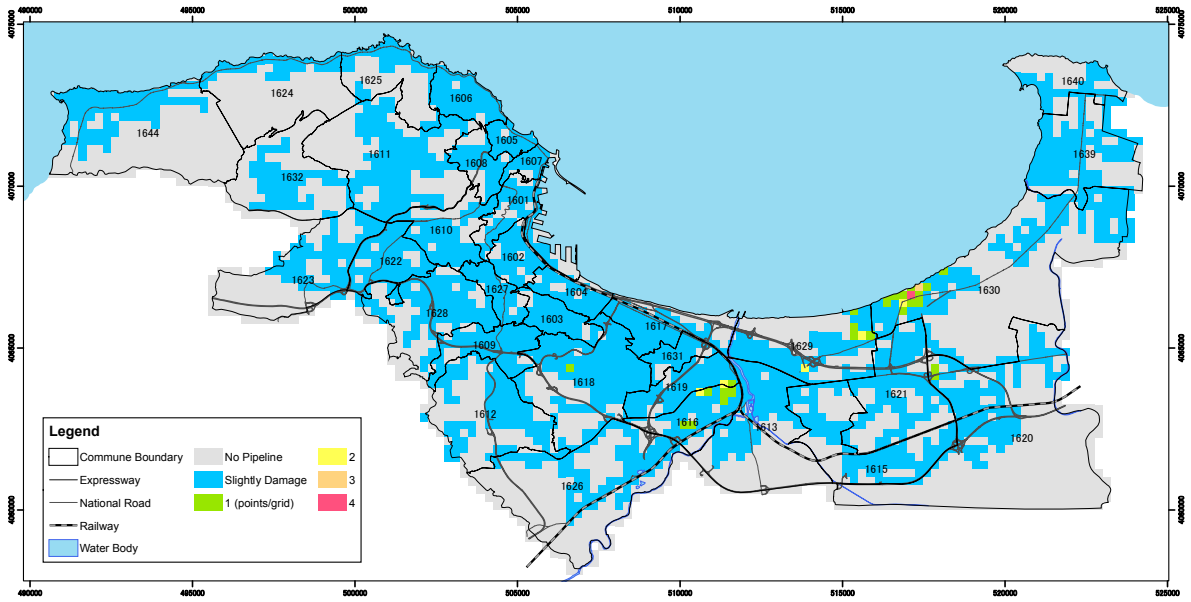


Figure 6-53 Damage Points of the Gas Supply Pipeline: Zemmouri

(2) High Pressure Gas Pipelines

1) Evaluation of Vulnerability

Vulnerability of the high pressure gas pipelines and substations for the scenario earthquakes was evaluated qualitatively by overlaying the locations of the pipelines and their substations on the geo-hazard map (defined by the section 6-3-4).

2) Results

Figure 6-54 and Figure 6-55 show the results of the vulnerability estimation for the Khair al Din and the Zemmouri scenarios, respectively.

Table 6-36 and Table 6-37 show a summary of the results for the Khair al Din and the Zemmouri scenarios, respectively.

Table 6-36 Areas Evaluated as Relatively High Risk and High Risk for the High Pressure Gas Pipelines and Substations: Khair al Din

High Pressure Gas	Areas Evaluated Relatively High and High Risk		
	PGA	PGA + Liquefaction Potential	PGA + Slope Failure Risk
Pipeline	Center part of Ain Benian South part of Bordj El Kiffan East part of Dar El Beida	Along the coast in Hussein Dey	South part of Ain Benian Dely Brahim Kouba Djasr Kasantina
Substation	-	Hamma El Annasser	Ain Benian Rais Hamidou Kouba Bachd Jarah

Table 6-37 Areas Evaluated as Relatively High Risk and High Risk for the High Pressure Gas Pipelines and Substations: Zemmouri

High Pressure Gas	Areas Evaluated Relatively High and High Risk		
	PGA	PGA + Liquefaction Potential	PGA + Slope Failure Risk
Pipeline	South part of Bordj El Kiffan East part of Dar El Beida	North part of Beb Ezzouar	-
Substation	-	-	-

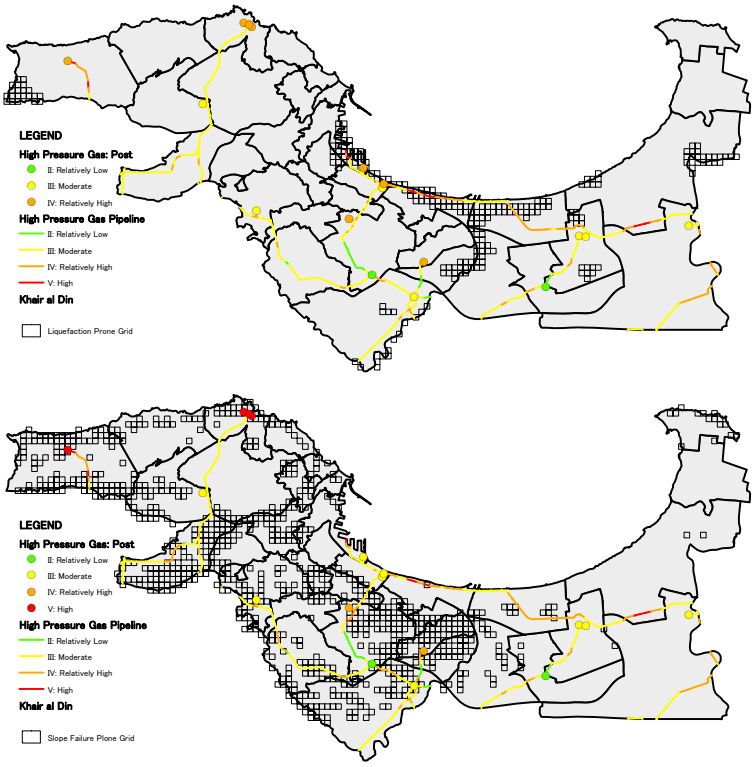


Figure 6-54 Qualitative Damage Estimation of High Pressure Gas Pipelines and Substations: Khair al Din

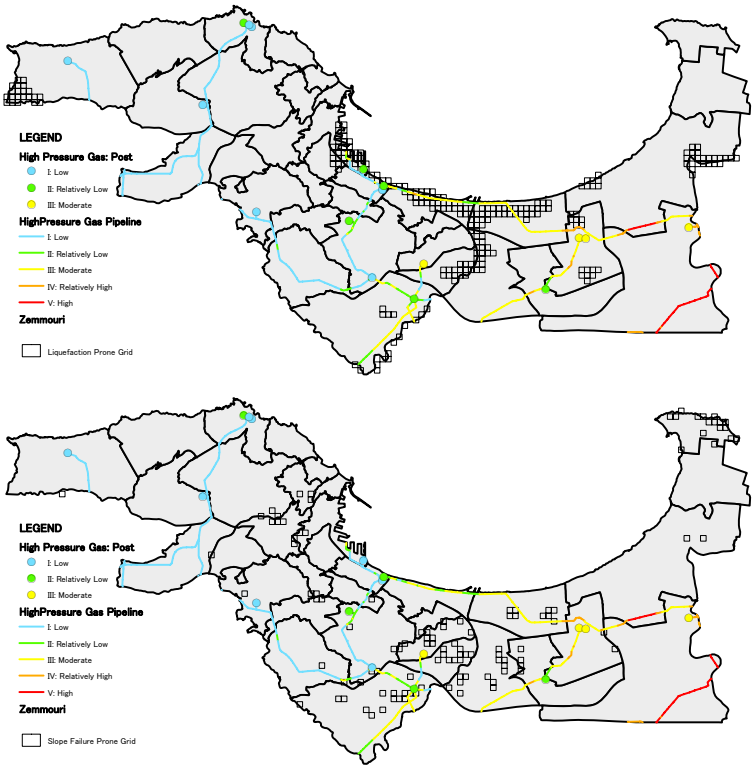


Figure 6-55 Qualitative Damage Estimation of High Pressure Gas Pipelines and Substations: Zemmouri

3) Discussion

In the Boumerdes Earthquake, no damage associated with the high pressure gas pipelines was reported.

However, the pipelines / substations located in the “high risk” and “relatively high risk” areas have a high priority for seismic assessment if an aseismic assessment for the high pressure gas pipeline network systems is executed.

6-3-8 Telecommunications

The telecommunication optic fiber cables are almost all buried underground. This is similar to the underground electric cables (medium voltage). Hence, the damage function curve of the electric cables can be used for the damage estimation of the optic fiber cables (refer to section 6-3-6).

Figure 6-56 and Figure 6-57 shows the distribution of the damage ratio due to the ground motion and the liquefaction potential for the Khair al Din case and the Zemmouri case, respectively.

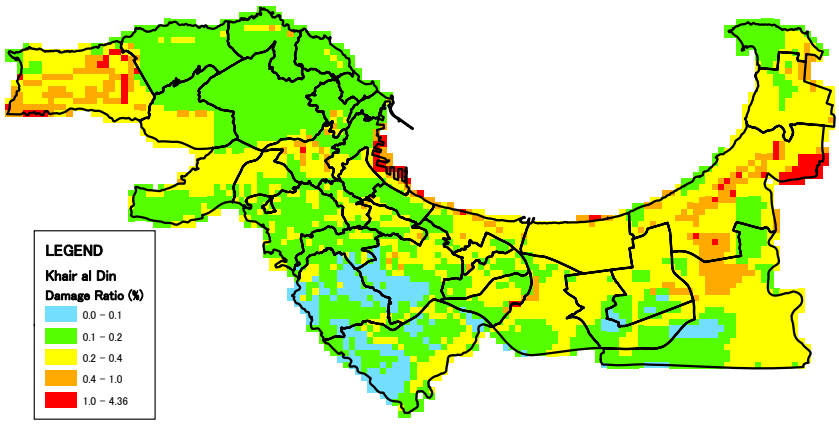


Figure 6-56 Distribution of Damage Ratio for Damage Estimation for the Optic Fiber Cables: Khair al Din

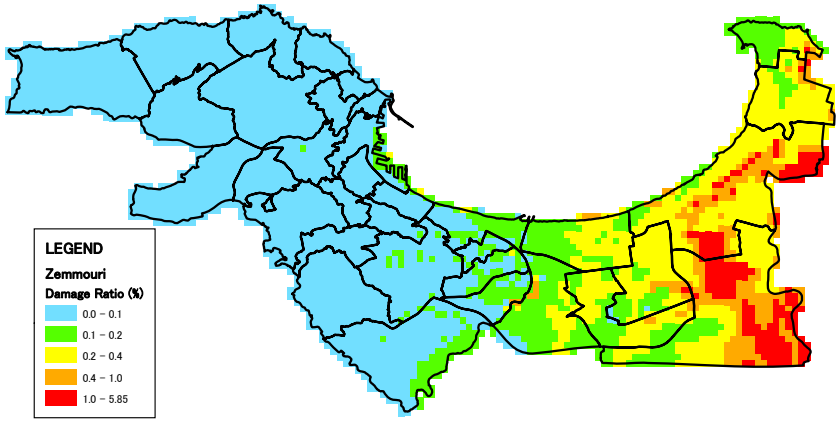


Figure 6-57 Distribution of Damage Ratio for Damage Estimation for the Optic Fiber Cables: Zemmouri

If an optic fiber cable is in a high damage ratio area (shown orange or red in the above), there is a high probability that the cable will suffer damage.

In the Boumerdes Earthquake, while there were no reports of damage to the cables in land, damage to the telecommunication facilities was reported as follows:

Table 6-38 Summary of Damage Condition of Telecommunication Facilities

Location / Facility	Damage Condition
El Harrach, Zemmouri and Tidjelabine: communication centers (Argerie Telecom)	Collapsed completely
Tizi Ouzou: mobile antennae	Damaged
El Djamila to Palma (Spain), and to Marseille: offshore cable	Cut off

The damage estimation for the telecommunication facilities refers to the results of building damage estimation.

6-4 Summary of Damages Immediately after the Scenario Earthquakes

In this chapter, damage to buildings, people, infrastructure and lifelines that are projected to be caused by either of two possible future scenario earthquakes are studied and estimated. The damage estimation was conducted using a 250 m grid system and the amounts of damage were estimated for each grid cell. However, in order to express the probable damage situation, the damage for all the cells within a commune were summed and the results shown for the commune as a whole. Table 6-39 summarize the result of the damage estimation in each commune as well as existing conditions of buildings, population infrastructure and lifelines. Using these figures, analysis of urban vulnerability was conducted as shown in the following chapters.

Table 6-39 (a) Summary of Damage in Each Commune

Items				Unit	Total of 34 Communes	1601 ALGER CENTRE	1602 SIDI M'HAMED	1603 EL MADANIA	1604 HAMMA EL ANNASSER	1605 BAB EL OUED	1606 BOLOGHINE	1607 CASBAH	1608 OUED KORICHE	1609 BIR MOURAD RAIS
A. Basic Information	1. Area of Commune			ha	23,083.9	375.5	214.9	220.9	216.8	121.6	274.4	111.8	234.8	358.6
	2. Population	2.1 Population (1998 Census)		nos	1,803,258	96,330	90,454	51,405	59,248	87,557	43,284	50,453	53,378	43,255
		2.2 Population Density		person/ha	78.1	256.5	420.9	232.7	273.3	720.3	157.7	451.5	227.3	120.6
	3. Building	3.1 Number of Building		nos	154,315	3,836	2,388	2,752	2,317	1,900	2,965	2,467	2,528	4,654
		3.2 Number of Building by Grid		nos	154,032	3,396	2,206	3,124	2,169	1,884	2,933	2,739	2,585	4,696
			Ratio of Old Brick Masonry (at CASBAH	%	1.0	0.0	0.0	0.0	0.0	0.0	0.0	35.7	0.0	0.0
			Ratio of Stone and Brick Masonry	%	33.6	77.4	66.0	72.4	12.5	75.5	37.5	64.3	46.7	25.0
			Ratio of RC Frame Pre-code	%	40.6	20.8	30.0	13.8	75.0	18.4	50.0	0.0	53.3	41.7
			Ratio of RC Frame Low-code	%	10.0	0.0	4.0	3.4	12.5	4.1	8.3	0.0	0.0	4.2
			Ratio of RC Frame Medium-code	%	1.7	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2
			Ratio of RC Frame High-code	%	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Ratio of Steel	%	0.9	0.0	0.0	0.0	0.0	2.0	4.2	0.0	0.0	0.0
			Ratio of RC Wall	%	11.9	0.0	0.0	10.3	0.0	0.0	0.0	0.0	0.0	25.0
		3.3 Number of Household		nos	300,438	17,888	15,469	8,283	9,807	14,160	7,341	9,326	9,138	7,296
	4. Road Network	4.1 Road Length		km	2,640.21	71.52	38.96	37.91	44.97	28.08	36.13	16.20	40.59	59.95
			Ratio of less than 4m width	%	-	6.1	7.8	4.7	17.1	6.6	18.1	5.9	25.8	11.9
			Ratio of 4-6m width	%	-	27.3	28.4	33.9	29.0	23.5	36.4	12.7	32.8	26.9
			Ratio of 6- 8m width	%	-	20.9	25.8	30.2	20.5	39.8	27.0	30.1	14.5	34.1
			Ratio of 8- 12m width	%	-	35.2	24.5	20.5	30.7	25.9	18.3	37.3	22.0	26.2
			Ratio of over 12m width	%	-	10.5	13.5	10.7	2.7	4.2	0.2	14.0	4.9	0.9
		4.2 Road Density		km/ha	-	0.19	0.18	0.17	0.21	0.23	0.13	0.14	0.17	0.17
		4.3 Bridges		nos	147	11	4	1	1	0	7	1	1	3
	5. Water Supply Pipeline Length by Grid			km	2,148.2	83.6	61.2	55.1	50.4	37.9	45.8	36.7	36.7	69.0
	6. Electric Power Supply Cable (High, Medium Voltage) Length by Grid			km	795.2	59.8	40.9	22.8	42.4	10.8	11.1	13.0	14.0	22.8
	7. Gas Supply Pipeline (Medium Pressure) Length by Grid			km	776.8	12.0	9.7	15.2	15.1	11.0	23.6	7.7	13.9	28.6
	8. Open space (public parks and open-air sports fields)	8.1 Number		nos	250	17	5	5	2	14	8	6	6	10
		8.2 Area		ha	356	27.4	3.2	1.8	3.6	9.4	1.8	2.9	2.0	5.7
		8.3 Area per Resident		m^2/person	2.0	2.8	0.4	0.4	0.6	1.1	0.4	0.6	0.4	1.3
B. Estimated Earthquake Motions and Related Hazard	1. PGA (Max./Min.)		1.1 Khair al Din	(gal)	1200/295	970/424	596/431	748/412	861/416	441/435	610/429	535/435	784/426	655/364
			1.2 Zemmouri	(gal)	1141/122	508/188	282/198	422/210	486/221	219/201	276/188	270/202	348/188	328/181
	2. Seismic Intensity (Max./Min.)		2.1 Khair al Din	(MSK)	9.8/7.9	9.5/8.4	8.9/8.4	9.2/8.4	9.4/8.4	8.5/8.5	8.9/8.4	8.7/8.5	9.3/8.4	9.0/8.2
			2.2 Zemmouri	(MSK)	9.8/6.7	8.7/7.3	7.9/7.4	8.4/7.5	8.6/7.5	7.5/7.4	7.8/7.3	7.8/7.4	8.2/7.3	8.1/7.3
	3. High Liquefaction Potential		3.1 Khair al Din	%	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			3.2 Zemmouri	%	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	4. High Slope Failure Potential		4.1 Khair al Din	%	0.3	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0
			4.2 Zemmouri	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. Summary of Estimated Damage	1. Heavily Damaged/Collapsed Building		1.1 Khair al Din	nos	55,817	1,395	922	1,435	834	616	899	1,067	978	1,249
			1.2 Zemmouri	nos	29,176	379	235	492	265	155	212	282	246	331
	2. Heavily Damaged/Collapsed Total Floor Area		2.1 Khair al Din	1000 m^2	10,681	429	289	194	223	135	115	170	141	166
			2.2 Zemmouri	1000 m^2	6,250	128	74	68	70	34	27	47	35	44
	3. Debris of Heavily Damaged/Collapsed Building		3.1 Khair al Din	1000 ton	49,010	2,556	1,765	907	1,123	922	483	774	616	756
			3.2 Zemmouri	1000 ton	28,128	763	450	316	350	231	115	212	154	199
	4. Human Death		4.1 Khair al Din	nos	12,011	875	752	502	398	541	218	492	403	190
				%	0.67	0.91	0.83	0.98	0.67	0.62	0.50	0.97	0.75	0.44
			4.2 Zemmouri	nos	4,568	185	138	125	78	82	0	78	47	0
				%	0.25	0.19	0.15	0.24	0.13	0.09	0.00	0.15	0.09	0.00
	5. Heavy/Slightly Injury		5.1 Khair al Din	nos	54,742	3,061	2,775	2,138	1,841	2,242	1,244	2,108	1,854	1,136
				%	3.0	3.2	3.1	4.2	3.1	2.6	2.9	4.2	3.5	2.6
			5.2 Zemmouri	nos	25,158	1,116	916	858	641	665	0	640	464	0
				%	1.4	1.2	1.0	1.7	1.1	0.8	0.0	1.3	0.9	0.0
	6. Homeless Victims		6.1 Khair al Din	nos	642,088	38,820	37,129	23,093	22,351	28,083	13,026	19,133	19,755	11,294
				%	36	40	41	45	38	32	30	38	37	26
			6.2 Zemmouri	nos	311,121	10,532	9,490	7,974	7,184	7,126	3,122	5,150	5,058	3,046
				%	17	11	10	16	12	8	7	10	9	7
	7. Possibility of Bridge Fall Down (High+Medium)		7.1 Khair al Din	nos	22	1	3	0	0	0	0	0	0	0
				%	15.0%	9.1%	75.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
			7.2 Zemmouri	nos	11	0	0	0	0	0	0	0	0	0
				%	7.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	8. Damage of Water Supply Pipeline		7.1 Khair al Din	points	3,965	92	91	50	82	53	71	42	50	65
			7.2 Zemmouri	points	1,636	2	0	1	3	0	0	0	0	0
	9. Damage of Electric Power Cable (Medium Voltage)		8.1 Khair al Din	m	1,664	208	80	52	81	16	15	19	27	35
			8.2 Zemmouri	m	546	15	0	7	3	0	0	0	1	0
	10. Damage of Gas Supply Pipeline (Medium Pressure)		9.1 Khair al Din	points	78	0	0	0	1	0	0	0	0	0
			9.2 Zemmouri	points	42	0	0	0	0	0	0	0	0	0

Table 6-39 (b) Summary of Damage in Each Commune

Items				Unit	Total of 34 Communes	1610 EL BIAR	1611 BOUZAREAH	1612 BIRKHADEM	1613 EL HARRACH	1615 OUED SMAR	1616 BOUROUBA	1617 HUSSEIN DEY	1618 KOUBA	1619 BACH DJERAH
A. Basic Information	1. Area of Commune			ha	23,083.9	418.9	1,260.3	891.7	971.7	806.3	355.3	428.9	1,011.1	335.5
	2. Population	2.1 Population (1998 Census)		nos	1,803,258	52,584	69,152	55,083	48,167	21,396	77,496	49,921	105,253	90,073
		2.2 Population Density		person/ha	78.1	125.5	54.9	61.8	49.6	26.5	218.1	116.4	104.1	268.5
	3. Building	3.1 Number of Building		nos	154,315	7,606	9,578	6,348	4,442	3,193	5,222	4,326	9,573	5,337
		3.2 Number of Building by Grid		nos	154,032	7,408	9,804	6,459	4,560	3,455	4,808	4,630	8,940	6,041
			Ratio of Old Brick Masonry (at CASBAH	%	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Ratio of Stone and Brick Masonry	%	33.6	33.3	15.8	31.3	55.6	0.0	25.6	46.4	25.0	18.0
			Ratio of RC Frame Pre-code	%	40.6	56.7	68.4	65.6	37.0	91.7	62.8	39.3	35.7	48.0
			Ratio of RC Frame Low-code	%	10.0	6.7	2.6	0.0	0.0	8.3	4.7	3.6	10.7	12.0
			Ratio of RC Frame Medium-code	%	1.7	0.0	2.6	0.0	3.7	0.0	4.7	0.0	0.0	0.0
			Ratio of RC Frame High-code	%	0.4	0.0	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0
			Ratio of Steel	%	0.9	0.0	0.0	0.0	0.0	0.0	0.0	3.6	1.8	0.0
			Ratio of RC Wall	%	11.9	3.3	10.5	3.1	3.7	0.0	2.3	3.6	26.8	22.0
		3.3 Number of Household		nos	300,438	9,182	11,362	8,833	7,645	3,309	12,291	8,139	18,095	14,408
	4. Road Network	4.1 Road Length		km	2,640.21	76.17	154.07	111.21	97.39	74.02	31.92	57.02	126.10	46.99
			Ratio of less than 4m width	%	-	8.3	14.2	13.9	4.0	7.1	0.2	1.7	4.8	10.5
			Ratio of 4-6m width	%	-	45.6	34.8	33.0	29.2	17.7	18.7	21.8	35.6	28.7
			Ratio of 6- 8m width	%	-	22.5	24.0	22.5	24.5	14.5	32.6	22.2	32.6	27.7
			Ratio of 8- 12m width	%	-	22.4	24.7	27.4	32.2	29.3	35.7	50.5	23.6	27.0
			Ratio of over 12m width	%	-	1.2	2.3	3.2	10.1	31.4	12.8	3.8	3.4	6.1
		4.2 Road Density		km/ha	-	0.18	0.12	0.12	0.10	0.09	0.09	0.13	0.12	0.14
		4.3 Bridges		nos	147	0	1	4	16	3	2	17	9	5
	5. Water Supply Pipeline Length by Grid			km	2,148.2	81.7	126.0	103.3	70.8	31.4	51.7	54.5	147.5	58.1
	6. Electric Power Supply Cable (High, Medium Voltage) Length by Grid			km	795.2	33.1	45.4	4.3	24.7	11.8	4.8	38.6	70.1	30.7
	7. Gas Supply Pipeline (Medium Pressure) Length by Grid			km	776.8	17.7	52.3	27.9	34.8	30.1	17.2	27.3	53.9	22.3
	8. Open space (public parks and open-air sports fields)	8.1 Number		nos	250	11	6	2	8	5	2	11	16	3
		8.2 Area		ha	356	5.0	3.0	2.0	8.2	5.8	11.9	10.6	12.4	4.5
		8.3 Area per Resident		m^2/person	2.0	0.9	0.4	0.4	1.7	2.7	1.5	2.1	1.2	0.5
B. Estimated Earthquake Motions and Related Hazard	1. PGA (Max./Min.)		1.1 Khair al Din	(gal)	1200/295	989/434	849/426	677/328	691/371	726/359	666/377	978/417	766/330	674/390
			1.2 Zemmouri	(gal)	1141/122	411/185	358/157	382/174	610/326	871/372	500/264	581/238	438/191	516/264
	2. Seismic Intensity (Max./Min.)		2.1 Khair al Din	(MSK)	9.8/7.9	9.6/8.5	9.4/8.4	9.1/8.1	9.1/8.2	9.2/8.2	9.0/8.3	9.6/8.4	9.2/8.1	9.1/8.3
			2.2 Zemmouri	(MSK)	9.8/6.7	8.4/7.3	8.2/7.1	8.3/7.2	8.9/7.2	9.4/8.2	8.6/7.8	8.9/7.7	8.5/7.4	8.7/7.8
	3. High Liquefaction Potential		3.1 Khair al Din	%	0.2	0.0	0.0	0.0	3.0	0.0	1.8	0.0	0.0	0.0
			3.2 Zemmouri	%	0.2	0.0	0.0	0.0	3.0	0.0	1.8	0.0	0.0	0.0
	4. High Slope Failure Potential		4.1 Khair al Din	%	0.3	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			4.2 Zemmouri	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. Summary of Estimated Damage	1. Heavily Damaged/Collapsed Building		1.1 Khair al Din	nos	55,817	3,393	2,633	1,852	2,076	1,339	1,892	2,155	2,884	1,895
			1.2 Zemmouri	nos	29,176	820	454	617	1,555	1,352	1,259	1,024	1,195	1,119
	2. Heavily Damaged/Collapsed Total Floor Area		2.1 Khair al Din	1000 m^2	10,681	414	386	356	562	438	262	457	458	275
			2.2 Zemmouri	1000 m^2	6,250	100	67	118	430	474	173	212	186	163
	3. Debris of Heavily Damaged/Collapsed Building		3.1 Khair al Din	1000 ton	49,010	1,867	1,612	1,451	2,449	1,849	1,107	2,172	2,207	1,240
			3.2 Zemmouri	1000 ton	28,128	453	278	481	1,872	2,001	731	1,009	897	734
	4. Human Death		4.1 Khair al Din	nos	12,011	489	352	273	401	99	453	459	658	599
				%	0.67	0.93	0.51	0.50	0.83	0.46	0.58	0.92	0.63	0.67
			4.2 Zemmouri	nos	4,568	64	2	43	282	100	278	180	231	325
				%	0.25	0.12	0.00	0.08	0.59	0.47	0.36	0.36	0.22	0.36
	5. Heavy/Slightly Injury		5.1 Khair al Din	nos	54,742	2,102	1,696	1,438	1,848	747	1,999	2,014	2,545	2,397
				%	3.0	4.0	2.5	2.6	3.8	3.5	2.6	4.0	2.4	2.7
			5.2 Zemmouri	nos	25,158	564	61	436	1,470	755	1,455	1,094	1,289	1,610
				%	1.4	1.1	0.1	0.8	3.1	3.5	1.9	2.2	1.2	1.8
	6. Homeless Victims		6.1 Khair al Din	nos	642,088	23,570	18,178	15,489	21,489	8,214	30,008	22,747	33,329	27,670
				%	36	45	26	28	45	38	39	46	32	31
			6.2 Zemmouri	nos	311,121	5,785	3,206	5,248	16,106	8,290	19,979	10,838	13,812	16,319
				%	17	11	5	10	33	39	26	22	13	18
	7. Possibility of Bridge Fall Down (High+Medium)		7.1 Khair al Din	nos	22	0	0	0	4	0	1	8	0	0
				%	15.0%	0.0%	0.0%	0.0%	25.0%	0.0%	50.0%	47.1%	0.0%	0.0%
			7.2 Zemmouri	nos	11	0	0	0	4	0	1	1	0	0
				%	7.5%	0.0%	0.0%	0.0%	25.0%	0.0%	50.0%	5.9%	0.0%	0.0%
	8. Damage of Water Supply Pipeline		7.1 Khair al Din	points	3,965	202	77	84	136	57	113	241	347	137
			7.2 Zemmouri	points	1,636	13	0	2	120	59	76	91	68	50
	9. Damage of Electric Power Cable (Medium Voltage)		8.1 Khair al Din	m	1,664	106	62	3	40	20	10	93	119	60
			8.2 Zemmouri	m	546	4	0	0	25	27	6	31	18	27
	10. Damage of Gas Supply Pipeline (Medium Pressure)		9.1 Khair al Din	points	78	0	4	1	0	0	15	1	2	13
			9.2 Zemmouri	points	42	0	0	0	0	0	8	0	1	3

Table 6-39 (c) Summary of Damage in Each Commune

Items				Unit	Total of 34 Communes	1620 DAR EL BEIDA	1621 BAB EZZOUAR	1622 BEN AKNOUN	1623 DELY BRAHIM	1624 HAMMAMET	1625 RAIS HAMIDOU	1626 DJASR KACENTINA	1627 EL MOURADIA	1628 HYDRA
A. Basic Information	1. Area of Commune			ha	23,083.9	2,357.4	816.6	369.4	838.4	860.4	499.6	1,443.8	191.1	743.5
	2. Population	2.1 Population (1998 Census)		nos	1,803,258	44,752	92,158	19,406	30,577	19,650	21,517	82,730	29,503	35,727
		2.2 Population Density		person/ha	78.1	19.0	112.9	52.5	36.5	22.8	43.1	57.3	154.4	48.0
	3. Building	3.1 Number of Building		nos	154,315	8,366	5,519	3,136	3,877	2,179	3,410	3,427	3,253	7,135
		3.2 Number of Building by Grid		nos	154,032	8,094	5,138	3,299	3,813	2,223	3,364	3,458	3,277	6,980
			Ratio of Old Brick Masonry (at CASBAH	%	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Ratio of Stone and Brick Masonry	%	33.6	0.0	3.9	9.1	0.0	18.2	41.7	10.9	84.8	0.0
			Ratio of RC Frame Pre-code	%	40.6	44.0	21.6	54.5	82.4	81.8	41.7	37.0	6.1	75.0
			Ratio of RC Frame Low-code	%	10.0	32.0	15.7	0.0	5.9	0.0	0.0	10.9	0.0	0.0
			Ratio of RC Frame Medium-code	%	1.7	0.0	7.8	0.0	0.0	0.0	0.0	0.0	0.0	5.0
			Ratio of RC Frame High-code	%	0.4	0.0	2.0	0.0	11.8	0.0	0.0	0.0	0.0	0.0
			Ratio of Steel	%	0.9	8.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0
			Ratio of RC Wall	%	11.9	16.0	49.0	36.4	0.0	0.0	16.7	39.1	9.1	20.0
		3.3 Number of Household		nos	300,438	7,025	15,370	3,371	4,992	3,406	3,556	13,446	5,176	6,429
	4. Road Network	4.1 Road Length		km	2,640.21	181.02	106.93	41.39	85.24	106.31	76.25	125.63	35.78	96.67
			Ratio of less than 4m width	%	-	3.8	13.5	2.5	4.5	19.6	32.3	13.9	8.8	8.9
			Ratio of 4-6m width	%	-	21.2	24.4	31.3	20.5	42.3	28.7	26.3	47.0	29.3
			Ratio of 6- 8m width	%	-	25.4	29.6	23.9	35.4	20.0	19.4	16.8	20.3	41.5
			Ratio of 8- 12m width	%	-	38.2	29.3	40.3	33.9	17.0	18.4	29.3	22.0	18.9
			Ratio of over 12m width	%	-	11.4	3.2	2.0	5.7	1.1	1.2	13.7	1.9	1.4
		4.2 Road Density		km/ha	-	0.08	0.13	0.11	0.10	0.12	0.15	0.09	0.19	0.13
		4.3 Bridges		nos	147	14	6	5	3	0	6	8	0	6
	5. Water Supply Pipeline Length by Grid			km	2,148.2	65.1	55.5	41.0	92.0	29.1	38.8	129.1	55.3	77.8
	6. Electric Power Supply Cable (High, Medium Voltage) Length by Grid			km	795.2	20.2	26.7	35.0	5.4	7.7	6.3	19.2	17.3	39.2
	7. Gas Supply Pipeline (Medium Pressure) Length by Grid			km	776.8	28.6	23.4	19.5	18.3	14.3	15.7	21.2	13.8	29.1
	8. Open space (public parks and open-air sports fields)	8.1 Number		nos	250	5	9	10	10	3	5	2	1	6
		8.2 Area		ha	356	6.5	24.9	31.2	75.1	0.8	1.2	9.3	0.4	5.3
		8.3 Area per Resident		m^2/person	2.0	1.5	2.7	16.1	24.5	0.4	0.5	1.1	0.1	1.5
B. Estimated Earthquake Motions and Related Hazard	1. PGA (Max./Min.)		1.1 Khair al Din	(gal)	1200/295	854/356	795/367	645/460	741/424	839/427	835/429	668/295	758/416	696/387
			1.2 Zemmouri	(gal)	1141/122	1050/417	938/373	247/183	269/156	278/144	340/169	469/209	366/201	317/178
	2. Seismic Intensity (Max./Min.)		2.1 Khair al Din	(MSK)	9.8/7.9	9.4/8.2	9.3/8.2	9.0/8.5	9.2/8.4	9.3/8.4	9.3/8.4	9.0/7.9	9.2/8.4	9.1/8.3
			2.2 Zemmouri	(MSK)	9.8/6.7	9.6/8.4	9.5/8.3	7.7/7.3	7.8/7.1	7.9/7.0	8.1/7.2	8.6/7.5	8.2/7.4	8.0/7.3
	3. High Liquefaction Potential		3.1 Khair al Din	%	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			3.2 Zemmouri	%	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	4. High Slope Failure Potential		4.1 Khair al Din	%	0.3	0.0	0.0	0.0	0.0	2.7	6.7	0.0	0.0	0.0
			4.2 Zemmouri	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. Summary of Estimated Damage	1. Heavily Damaged/Collapsed Building		1.1 Khair al Din	nos	55,817	2,941	1,490	1,009	1,309	687	1,047	785	1,675	1,967
			1.2 Zemmouri	nos	29,176	3,848	1,531	166	198	98	200	424	512	417
	2. Heavily Damaged/Collapsed Total Floor Area		2.1 Khair al Din	1000 m^2	10,681	652	321	151	258	111	148	342	238	212
			2.2 Zemmouri	1000 m^2	6,250	860	334	25	39	16	28	190	72	46
	3. Debris of Heavily Damaged/Collapsed Building		3.1 Khair al Din	1000 ton	49,010	2,795	1,800	707	1,185	495	626	1,694	1,013	983
			3.2 Zemmouri	1000 ton	28,128	3,687	1,872	115	180	70	120	941	306	213
	4. Human Death		4.1 Khair al Din	nos	12,011	244	487	76	150	73	69	337	293	172
				%	0.67	0.54	0.53	0.39	0.49	0.37	0.32	0.41	0.99	0.48
			4.2 Zemmouri	nos	4,568	340	502	0	0	0	0	149	40	0
				%	0.25	0.76	0.54	0.00	0.00	0.00	0.00	0.18	0.13	0.00
	5. Heavy/Slightly Injury		5.1 Khair al Din	nos	54,742	1,333	2,094	631	964	615	592	1,647	1,509	1,059
				%	3.0	3.0	2.3	3.3	3.2	3.1	2.8	2.0	5.1	3.0
			5.2 Zemmouri	nos	25,158	1,660	2,138	0	0	0	0	961	415	0
				%	1.4	3.7	2.3	0.0	0.0	0.0	0.0	1.2	1.4	0.0
	6. Homeless Victims		6.1 Khair al Din	nos	642,088	15,990	26,219	5,885	10,347	6,032	6,662	18,408	14,754	9,885
				%	36	36	28	30	34	31	31	22	50	28
			6.2 Zemmouri	nos	311,121	20,895	26,943	978	1,585	866	1,277	9,988	4,597	2,133
				%	17	47	29	5	5	4	6	12	16	6
	7. Possibility of Bridge Fall Down (High+Medium)		7.1 Khair al Din	nos	22	0	0	0	0	0	0	1	0	0
				%	15.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	12.5%	0.0%	0.0%
			7.2 Zemmouri	nos	11	1	0	0	0	0	0	0	0	0
				%	7.5%	7.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	8. Damage of Water Supply Pipeline		7.1 Khair al Din	points	3,965	184	151	31	64	16	48	191	66	99
			7.2 Zemmouri	points	1,636	185	154	0	0	0	1	24	3	0
	9. Damage of Electric Power Cable (Medium Voltage)		8.1 Khair al Din	m	1,664	49	66	70	6	11	11	14	39	71
			8.2 Zemmouri	m	546	87	77	0	0	0	0	3	2	0
	10. Damage of Gas Supply Pipeline (Medium Pressure)		9.1 Khair al Din	points	78	2	0	4	0	4	0	0	1	0
			9.2 Zemmouri	points	42	2	0	0	0	0	0	0	0	0

Table 6-39 (d) Summary of Damage in Each Commune

Items				Unit	Total of 34 Communes	1629 MOHAMMADIA	1630 BORDJ EL KIFFAN	1631 EL MAGHARIA	1632 BENI MESSOUS	1639 BORDJ EL BAHRI	1640 EL MARSA	1644 AIN BENIAN
A. Basic Information	1. Area of Commune			ha	23,083.9	793.6	2,107.1	159.0	772.4	758.6	378.0	1,386.1
	2. Population	2.1 Population (1998 Census)		nos	1,803,258	42,079	103,690	30,459	17,489	27,905	8,782	52,345
		2.2 Population Density		person/ha	78.1	53.0	49.2	191.6	22.6	36.8	23.2	37.8
	3. Building	3.1 Number of Building		nos	154,315	4,148	11,010	2,727	2,286	4,797	1,273	6,340
		3.2 Number of Building by Grid		nos	154,032	4,321	10,915	2,643	2,254	4,724	1,330	6,362
			Ratio of Old Brick Masonry (at CASBAH	%	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Ratio of Stone and Brick Masonry	%	33.6	13.0	15.3	11.8	10.0	13.3	20.0	24.1
			Ratio of RC Frame Pre-code	%	40.6	34.8	18.6	58.8	50.0	66.7	80.0	44.8
			Ratio of RC Frame Low-code	%	10.0	30.4	49.2	5.9	30.0	13.3	0.0	24.1
			Ratio of RC Frame Medium-code	%	1.7	0.0	10.2	0.0	0.0	0.0	0.0	0.0
			Ratio of RC Frame High-code	%	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Ratio of Steel	%	0.9	0.0	3.4	0.0	0.0	0.0	0.0	0.0
			Ratio of RC Wall	%	11.9	21.7	3.4	23.5	10.0	6.7	0.0	6.9
		3.3 Number of Household		nos	300,438	6,928	16,136	5,055	2,895	4,465	1,470	8,746
	4. Road Network	4.1 Road Length		km	2,640.21	98.29	193.39	20.06	85.85	79.89	33.37	124.94
			Ratio of less than 4m width	%	-	9.6	18.7	8.2	18.2	17.6	4.2	12.5
			Ratio of 4-6m width	%	-	24.8	30.0	39.3	29.8	24.1	15.6	31.2
			Ratio of 6- 8m width	%	-	30.0	20.7	17.9	24.5	19.0	23.4	22.9
			Ratio of 8- 12m width	%	-	29.9	19.0	30.9	23.2	22.8	31.2	28.4
			Ratio of over 12m width	%	-	5.7	11.6	3.7	4.3	16.5	25.6	5.0
		4.2 Road Density		km/ha	-	0.12	0.09	0.13	0.11	0.11	0.09	0.09
		4.3 Bridges		nos	147	7	2	2	0	0	0	2
	5. Water Supply Pipeline Length by Grid			km	2,148.2	37.8	108.5	23.3	36.0	54.7	24.5	78.3
	6. Electric Power Supply Cable (High, Medium Voltage) Length by Grid			km	795.2	16.0	26.1	12.8	7.2	23.2	8.3	23.5
	7. Gas Supply Pipeline (Medium Pressure) Length by Grid			km	776.8	30.4	46.0	12.0	16.5	29.9	12.4	25.4
	8. Open space (public parks and open-air sports fields)	8.1 Number		nos	250	11	24	2	7	8	1	9
		8.2 Area		ha	356	17.5	25.9	3.7	3.7	18.5	0.7	10.1
		8.3 Area per Resident		m^2/person	2.0	4.2	2.5	1.2	2.1	6.6	0.8	1.9
B. Estimated Earthquake Motions and Related Hazard	1. PGA (Max./Min.)		1.1 Khair al Din	(gal)	1200/295	961/489	1047/431	776/454	796/434	867/435	848/435	1200/434
			1.2 Zemmouri	(gal)	1141/122	777/372	1141/390	510/300	282/146	922/463	902/463	340/122
	2. Seismic Intensity (Max./Min.)		2.1 Khair al Din	(MSK)	9.8/7.9	9.5/8.6	9.6/8.5	9.2/8.5	9.3/8.5	9.4/8.5	9.4/8.5	9.8/8.5
			2.2 Zemmouri	(MSK)	9.8/6.7	9.2/8.2	9.8/8.3	8.7/8.0	7.9/7.0	9.5/8.5	9.4/8.5	8.1/6.7
	3. High Liquefaction Potential		3.1 Khair al Din	%	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0
			3.2 Zemmouri	%	0.2	0.0	0.5	0.0	0.0	0.0	0.0	0.0
	4. High Slope Failure Potential		4.1 Khair al Din	%	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			4.2 Zemmouri	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. Summary of Estimated Damage	1. Heavily Damaged/Collapsed Building		1.1 Khair al Din	nos	55,817	1,671	4,637	974	821	1,799	504	2,986
			1.2 Zemmouri	nos	29,176	1,304	4,911	493	125	2,022	556	385
	2. Heavily Damaged/Collapsed Total Floor Area		2.1 Khair al Din	1000 m^2	10,681	409	1,136	151	204	347	108	423
			2.2 Zemmouri	1000 m^2	6,250	319	1,200	77	31	390	120	53
	3. Debris of Heavily Damaged/Collapsed Building		3.1 Khair al Din	1000 ton	49,010	1,900	4,858	631	816	1,420	440	1,791
			3.2 Zemmouri	1000 ton	28,128	1,482	5,131	325	124	1,599	491	226
	4. Human Death		4.1 Khair al Din	nos	12,011	300	796	167	65	147	3	479
				%	0.67	0.71	0.77	0.55	0.37	0.53	0.03	0.91
			4.2 Zemmouri	nos	4,568	218	847	49	0	173	10	0
				%	0.25	0.52	0.82	0.16	0.00	0.62	0.11	0.00
	5. Heavy/Slightly Injury		5.1 Khair al Din	nos	54,742	1,532	2,881	1,039	568	953	69	2,072
				%	3.0	3.6	2.8	3.4	3.2	3.4	0.8	4.0
			5.2 Zemmouri	nos	25,158	1,243	2,998	475	0	1,066	169	0
				%	1.4	3.0	2.9	1.6	0.0	3.8	1.9	0.0
	6. Homeless Victims		6.1 Khair al Din	nos	642,088	15,938	43,340	11,043	6,338	10,480	3,329	24,061
				%	36	38	42	36	36	38	38	46
			6.2 Zemmouri	nos	311,121	12,449	45,916	5,667	973	11,754	3,672	3,166
				%	17	30	44	19	6	42	42	6
	7. Possibility of Bridge Fall Down (High+Medium)		7.1 Khair al Din	nos	22	3	1	0	0	0	0	0
				%	15.0%	42.9%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%
			7.2 Zemmouri	nos	11	3	1	0	0	0	0	0
				%	7.5%	42.9%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	8. Damage of Water Supply Pipeline		7.1 Khair al Din	points	3,965	94	378	84	29	206	80	254
			7.2 Zemmouri	points	1,636	89	374	35	0	206	80	0
	9. Damage of Electric Power Cable (Medium Voltage)		8.1 Khair al Din	m	1,664	41	85	30	9	37	15	64
			8.2 Zemmouri	m	546	32	108	12	0	43	18	0
	10. Damage of Gas Supply Pipeline (Medium Pressure)		9.1 Khair al Din	points	78	8	22	0	0	0	0	0
			9.2 Zemmouri	points	42	8	20	0	0	0	0	0

CHAPTER 7
EXISTING SOCIAL CONDITIONS

Chapter 7. Existing Social Conditions

7-1 Population and Households

7-1-1 Demography of Algiers

(1) General population growth

The population of Algiers decreased significantly when nearly 400,000 French citizens left at the time of independence (1962). This led to a major exodus of people from rural areas to the rich coastal plains and cities in the north, as shown in Figure 7-1[1]. Following independence, the Algerian population grew at a rate of 3.48% per annum, which is justifiably referred to as a "demographic explosion".

Population growth was then restored to previous levels in 1997. The results of the censuses (RGPH[2]) in 1987 and 1998 confirmed that tendency, with annual growth rates declining to 3.1% and 2.15%, respectively.

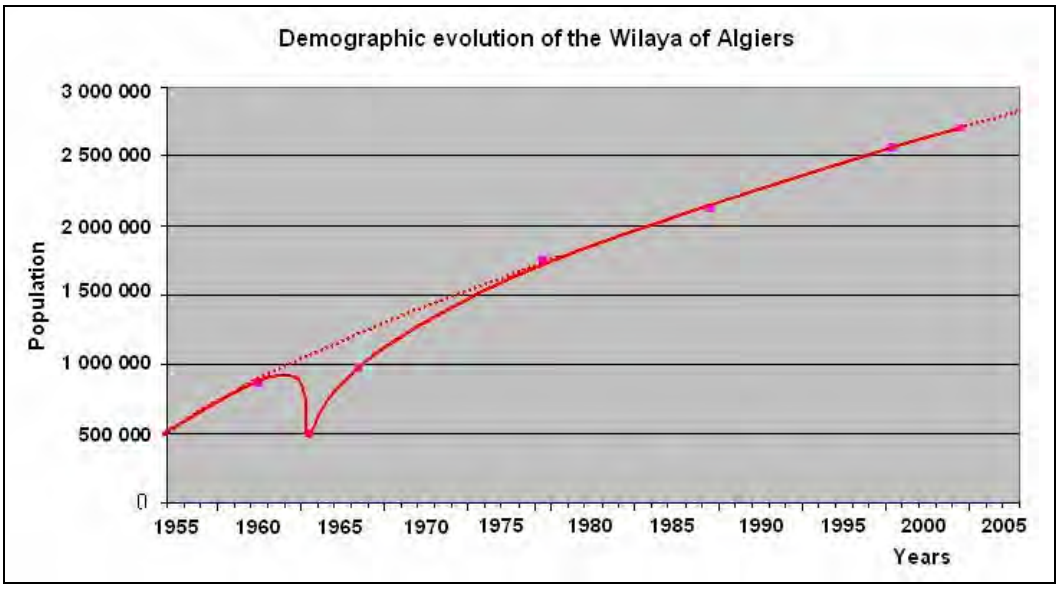


Figure 7-1 Population of the Wilaya of Algiers over the Past 50 Years

The total population of the Wilaya of Algiers was 2,562,424 at the time of the General Population and Housing Census of 1998. By 31 December 2002, it was estimated to be 2,700,449[3] with a density of 3,337 inhabitants per square kilometer.

During the period between the last two censuses (1987-1998) the population increased at an average annual rate of 1.6%, which is lower than the national rate of 2.5%. The high population density mentioned above is seen particularly in the center of Algiers, and has resulted in the overloading of various sectors such as education, transportation, housing,

1 That curve is not perfectly accurate since the territory of Algiers taken into account changed along with the administrative divisions of each of the reference periods.

2 RGPH: General Population and Housing Census.

3 Source: Statistical Yearbook of Algiers Wilaya (2003)

potable water supply, etc. For example, Kouba Commune, which occupies a surface area of 1.2% of the total area of the Wilaya accounts for 3.7% of the total population.

(2) The actual situation

The estimated figures for the population of the Wilaya of Algiers as of the end of 2002 are shown in Table 7-1.

Table 7-1 Estimate of the Population of Algiers Wilaya as of December 31, 2002

COMMUNES	Superficie en Km²	Population au 31.12.2002	Densité (Hab/Km²)
Bab El Oued	1,21	90.499	74.792
Bologhine	2,76	44.976	16.295
Casbah	1,08	52.170	48.305
Oued Koriche	2,24	55.435	24.748
Rais Hamidou	4,94	22.408	4.536
S / TOTAL	**12,23**	**265.488**	**21.708**
Baraki	32,15	100.613	3.129
Eucalyptus	30,32	102.622	3.385
Sidi Moussa	43,27	28.744	664
S / TOTAL	**105,74**	**231.979**	**2.194**
Bir Mourad Rais	4,15	45.243	10.902
Birkhadem	8,89	58.302	6.558
Gué de Constantine	14,54	90.851	6.248
Hydra	6,12	37.220	6.082
Saoula	25,00	33.087	1.323
S / TOTAL	**58,70**	**264.703**	**4.509**
Birtouta	27,01	23.402	866
Ouled Chebel	29,30	17.241	588
Tessala El Merdja	20,51	11.548	563
S / TOTAL	**76,82**	**52.191**	**679**
Bouzaréah	12,44	72.446	5.824
Ben Aknoun	3,83	20.342	5.311
Beni Messous	7,91	18.694	2.363
El Biar	4,08	54.542	13.368
S / TOTAL	**28,26**	**166.024**	**5.875**
Cheraga	36	64.865	1.802
Ain Benian	16	55.467	3.467
Dely Brahim	7,72	32.260	4.179
Hammamet	8,54	20.955	2.454
Ouled Fayet	25	16.378	655
S / TOTAL	**93,26**	**189.925**	**2.036**
Dar El Beida	33.29	49.455	1.486
Ain Taya	9,55	31.202	3.267
Bab Ezzouar	8,23	98.662	11.988
Bordj El Bahri	7,48	29.582	3.955
Bordj El Kiffan	21,70	111.009	5.116
El Marsa	3,88	9.252	2.384
Mohammadia	7,99	44.519	5.572
S / TOTAL	**92,12**	**373.681**	**4.056**

COMMUNES	Superficie en Km²	Population au 31.12.2002	Densité (Hab/Km²
Drarıa	14	25.215	1.801
Baba Hacène	11	15.167	1.379
Douera	41	44.463	1.084
El Achour	12	21.224	1.769
Khraicia	20	18.929	946
S / TOTAL	**98**	**124.998**	**1.275**
El Harrach	9,42	50.160	5.325
Bachedjerah	3	93.174	31.058
Bourouba	3,39	80.274	23.685
Oued Smar	8,15	22.549	2.767
S / TOTAL	**24,29**	**246.177**	**10.135**
Hussein Dey	4,26	51.803	12.160
Belouizdad	2,16	61.410	28.430
Kouba	10,05	110.439	10.989
Megharia	1,57	31.705	20.194
S / TOTAL	**18,04**	**255.357**	**14.155**
Rouiba	41,15	53.108	1.291
Reghaia	12,4	19.387	1.563
Heraoua	27,25	70.041	2.570
S / TOTAL DAIRA	**80,8**	**142.536**	**1.764**
Sidi M'hamed	2,18	93.569	42.921
Alger Centre	3,7	99.843	26.985
El Madania	2,17	52.500	24.193
El Mouradia	1,91	30.664	16.054
S / TOTAL DAIRA	**9,96**	**276.576**	**27.768**
Zeralda	30	35.226	1.174
Mahelma	35	15.602	446
Rahmania	9	6.119	680
Souidania	15	12.338	822
Staouali	22	41.529	1.888
S / TOTAL	**111**	**110.814**	**998**
TOTAL WILAYA	**809,22**	**2.700.449**	**3.337**

Source :
Annuaire statistique de la Wilaya d'Alger (2003)

Demographic Evolution of the Communes of Algiers Wilaya

The analysis was undertaken on the basis of the results obtained in the 1987 and 1998 censuses. The estimation by the Wilaya at the end of 2002 indicates the lowest rates were recorded in a number of communes in the center of Algiers, for example -1.40% in Bab El Oued, -1.60% in Kasbah, and -1.41% in Sidi M'hamed as shown in Figure 7-2.

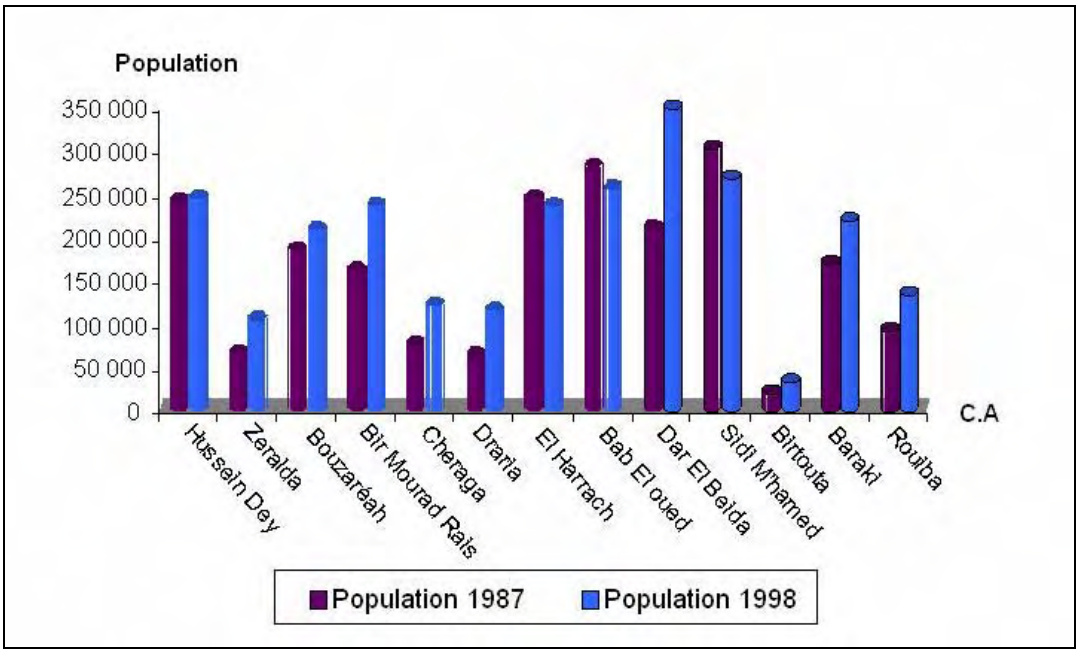


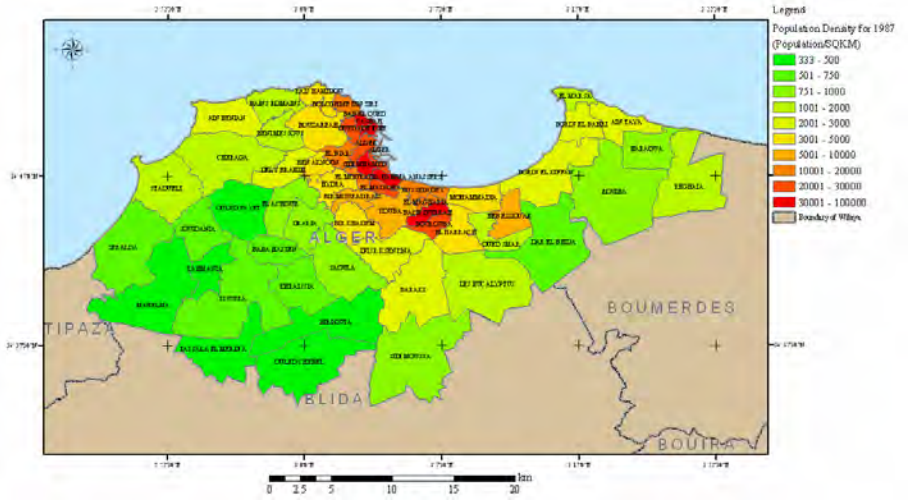
Figure 7-2 Population of Communes in the censuses of 1987 and 1998

The change in population distribution led to a redeployment towards the periphery of the Wilaya, but important buildings occupied by national and international organizations, engineering and design departments, and headquarters of private firms and services still remain in the central area.

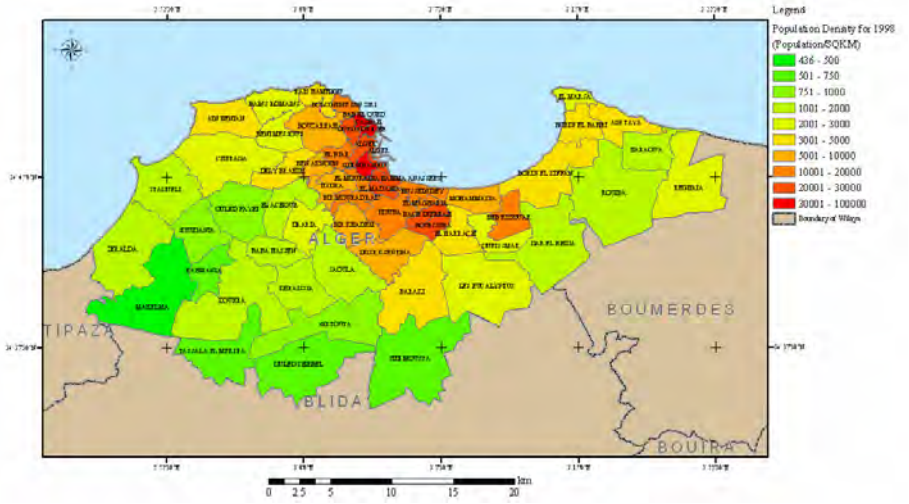
The highest rate of population growth is seen in the Communes of Dar El Beida (+8.76%), Baba Hassen (+8.08%) and Draria (+7.65%). Gué de Constantine (+8.9%) is considered to be a ward in the process of urbanization.

There is a direct connection between the demographic development of certain communes of the Wilaya and their population density. Figure 7-3 presents the evolution of the population density of the communes of the Wilaya of Algiers over the period from 1987 to 2003.

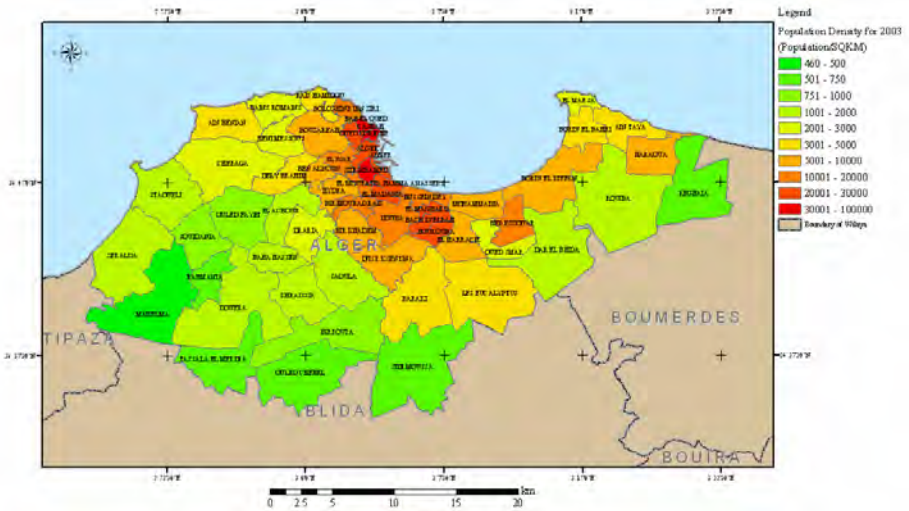
1987



1998



2003



Source: URBANIS

Figure 7-3 Evolution of Population Density from 1987 to 2003

7-1-2 Population and household profiles

(1) Population by Sex

The population of Algiers comprises 49.7% females and 50.3% males. The ratio of women is higher in the 30-34 age group but declines in the higher age groups (see Figure 7-4).

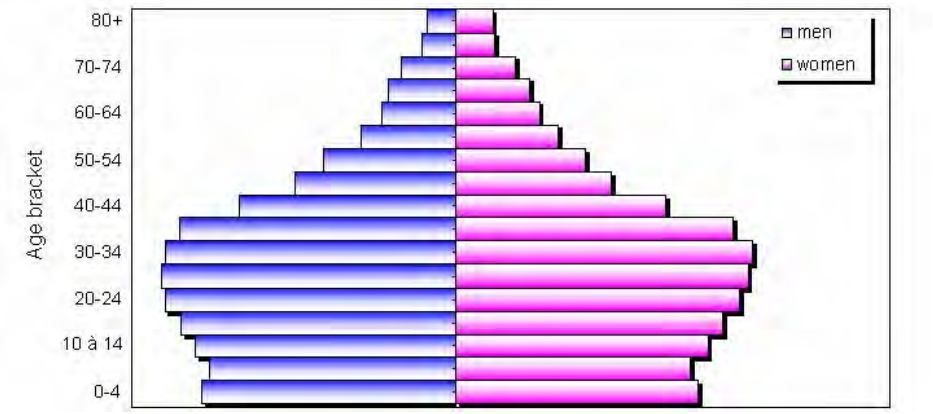


Figure 7-4 Population Pyramid

(2) Population by Age

Table 7-2 presents the figures of the census of 1998.

Table 7-2 Pattern of the population of Algiers by age brackets

Age	0-5 years	6-14	15-19	20-24	25-34	35-44	45-64	65 +	Total
Population	277,476	449,789	270,636	271,196	510,411	310,753	338,307	133,860	256,2428
% of Tot.	10.83%	17.55%	10.56%	10.58%	19.92%	12.13%	13.20%	5.22%	100.00%
	38.94%			55.83%				5.22%	100.00%

source: RGPH 1998

A decline in birth rate affects both total population and population structure, as shown in Figure 7-5. The latest reports also show a decline in the labor population. Those aged from 15 to 59 accounted for 27% of the total population in 1998, in comparison to 34% in 1987. The population aged 60 and more increased in the same period from 5.8% to 8%.

Schooling and professional occupations of the women had an influence on the fall in the birthrate and a change in social attitudes.

(3) Population Attending School

Schooling in Algeria is compulsory for children from the age of 6 to 15. Those attending school between the ages of 6 and 15 totaled 449,788 in the last census (1998). This implies a rate of school attendance of about 91% for the Wilaya of Algiers compared to a national rate of 83%.

(4) Working Population

Table 7-3 presents the result of the 1998 census concerning working activity in the Wilaya of Algiers.

Table 7-3 Figures on Work Activity of Inhabitants in the Wilaya of Algiers

Item	Number of persons	Percentage of total population	Percentage of working population
Total population	2,562,428		
Working-age population	1,632,584	63.71%	
Active population	909,780	35.50%	55.73%
Employed population	524,852	20.48%	32.15%
Unemployed	384,928	15.02%	23.58%

Source: RGPH 1998

In 1998 the working-age population (15-59) totaled 1,632,584, which represents 63.7% of the total population. The unemployment rate was high (23.58% of the working-age population). The size of the population sector that is engaged in informal employment or business remains important.

Figures 7-5 and 7-6 show the results obtained from the 500 questionnaires to households. According to the results, the number of working persons in a house hold averages 1.3, with a maximum of 11 and the total monthly household income averages about 25,400 DA, with a maximum of 225,600 DA. Sociology experts suggest that the responses may underestimate the actual incomes, because of reservations in this matter (tax payments).

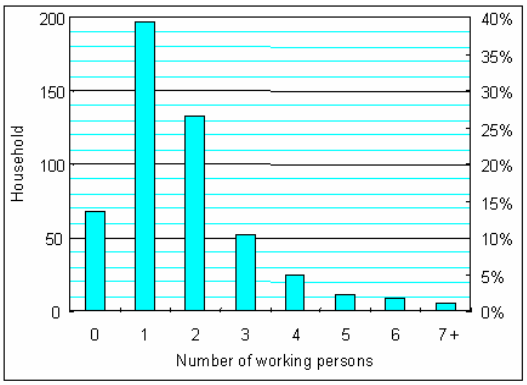


Figure 7-5
Working persons in a household

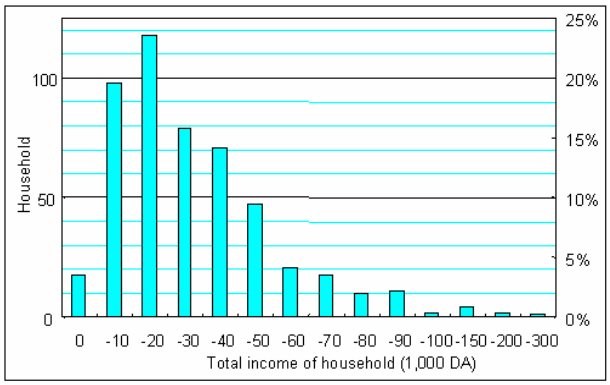


Figure 7-6
Total income of a household

(5) Physically Handicapped Persons

The result of the questionnaires to 500 households indicates that 45% of them have one or more handicapped persons, for a total of 334 persons (7.96% of total surveyed population of 4,198). According to the 1998 census, the percentage of handicapped persons in the Wilaya of Algiers was 7.78%, which is almost the same. Of those people with a handicap, category 1 (which accounts for about 30% of the total number) can be considered to be socially vulnerable. The percentage of households having handicapped people can be estimated at 15%. This represents more than 2% of the total population, which can be considered significant in terms of crisis management (see Table 7-4 and Figure 7-7).

Table 7-4 Head-count of handicapped persons in the Wilaya Algiers (Census 1998)

Data origin	Handicapped and chronic illness	Category 1					Category 2			
		Mobility	Auditory	Visual	Mental	Poly-handicap	Chronic illness	Others	ND	Total
Census in 1998	Number	18,799	4,619	11,598	13,712	7,244	89,795	48,037	5,595	199,399
	Percentage	9.43%	2.32%	5.82%	6.88%	3.63%	45.03%	24.09%	2.81%	100.00%
	Subtotal nb	55,972					143,427			199,399
	% of total popul.	2.18%					5.60%			7.78%
Social Survey	Number	334								4,198
	Percentage	7.96%								7.96%

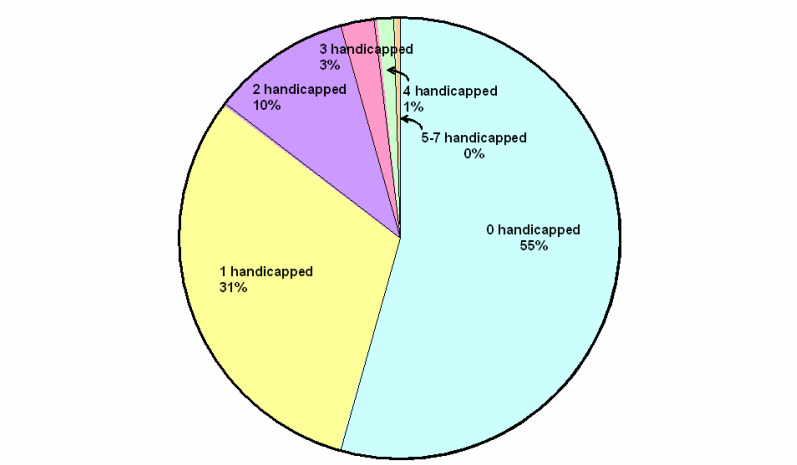


Figure 7-7 Number of households with handicapped people

(6) Household composition

The analysis of the 500 questionnaires to households indicates that nearly half the selected households (46%) are composed of at least two or more families (Figure 7-8). Married children, mostly sons, frequently live together with their parents and grandparents.

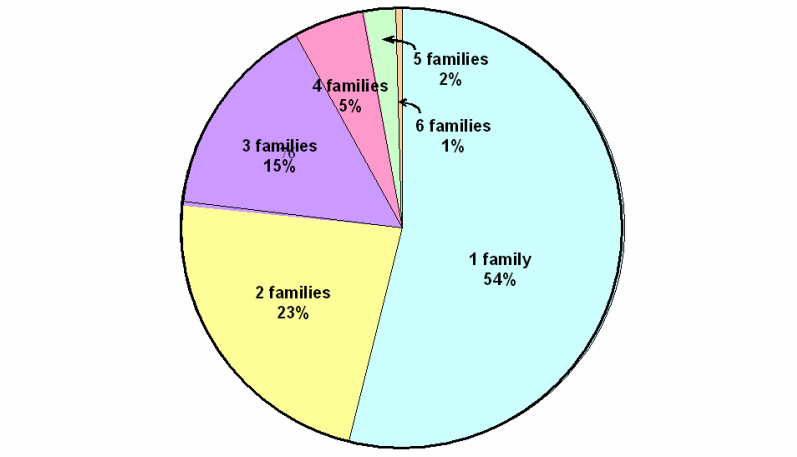


Figure 7-8 Number of families in a household

The number of members in a household is also relatively large, ranging from 1 to 36 as shown in Figure 7-9. The average number of members is 8.4 per household, with a high concentration between 4 and 8.

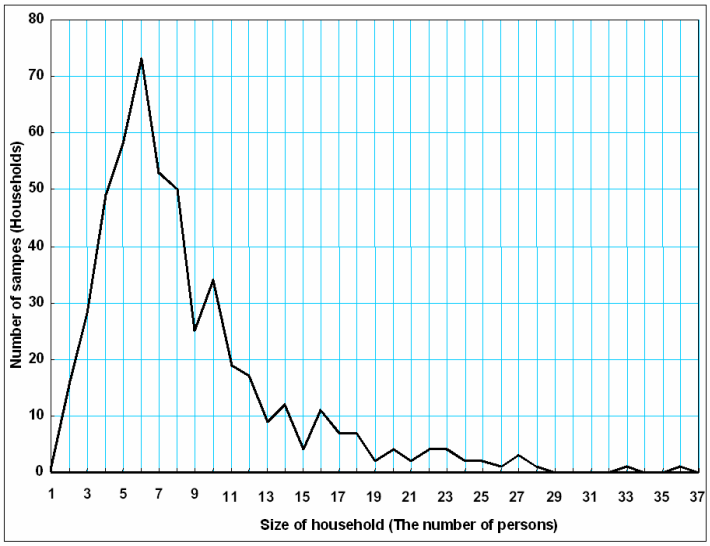


Figure 7-9 Number of members in a household

(7) Condition of house and facilities

About two-thirds of households live in detached houses, including "Huts" (2%), with the remainder (63%) in collective houses such as apartments.

Figure 7-10 shows the ground area and of lot cover percentage of the interviewed households. The modal area is about 200 m^2, with an average of about 500 m^2. The lot cover percentage is inversely proportional to area and declines from 80% to 50% in the range between 200 m^2 and 1,000 m^2.

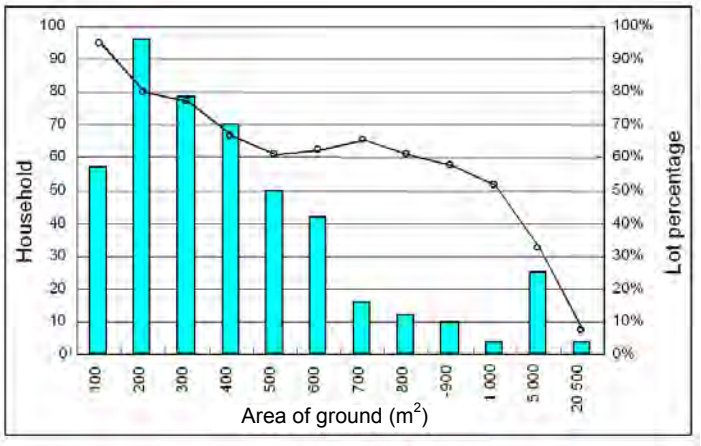


Figure 7-10 Area of ground and lot cover percentage

Public service piped water supply to each house is dominant (more than 95%). The available days per week are shown in Figure 7-11. Households without piped supply take water from wells, ponds or neighbors. Although piped water is installed, it is not always

available as shown in Figure 7-11. In order to secure daily water use, water tanks are installed at 189 households (roof: 116, underground: 42, others: 31). The capacity of the tanks varies, ranging from 100 m^3 to 20,000 m^3 with an average of about 2,000 m^3, as shown in Figure 7-12. According to experts on sociology, small water tanks with a capacity of 30 m^3 to 100 m^3 still remain in many houses, though they are not recorded in the questionnaire, reflecting more serious conditions relating to water supply in internal war.

Availability of other public services is also high, with electricity at 98%, sewerage at 96%, and piped gas supply at 77%.

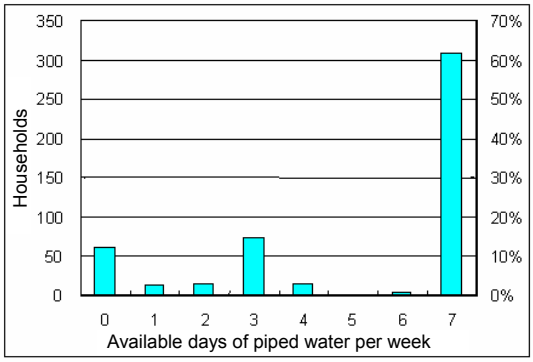


Figure 7-11
Available days of piped water per week

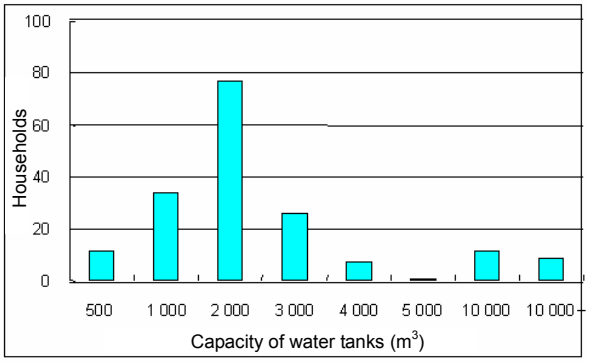


Figure 7-12
Capacity of water tank (m^3)

7-1-3 The seismic risk that households face in Algiers

(1) Perception of Risk

Regarding past earthquakes, 99.6% of the interviewed householders (498/500) remembered the date of the Boumerdes earthquake and 83.8% responded that they experienced violent tremors.

In terms of future earthquakes, 76.2% (381 householders) considered that earthquakes are fate. Their likelihood for future earthquakes is "certain" for 35%, "very probable" for 43% or "not so probable" for 17%. The peoples' concerns associated with earthquake risk are "daily" for 4%, "frequent" for 25%, and "occasional" for 65%.

Specific householders concerns are shown in Table 7-5 in descending order.

Table 7-5 Specific risks by householders

Order	Specific risks	Rating
1	Building collapse	2.9
2	Collapse of walls	3.1
3	Blockage of roads	4.4
4	Rupture of gas network	4.5
5	Explosion of power station	4.5
6	Failure of electric lines	4.6
7	Rupture of water supply networks	5.5
8	Others (including Tsunami)	5.6
9	Explosion of service stations	6.1

In the opinion or image of interviewed householders, the physical resistance of their houses was classified as shown in Figures 7-13 for householders in collective housing and 7-14 for detached housing.

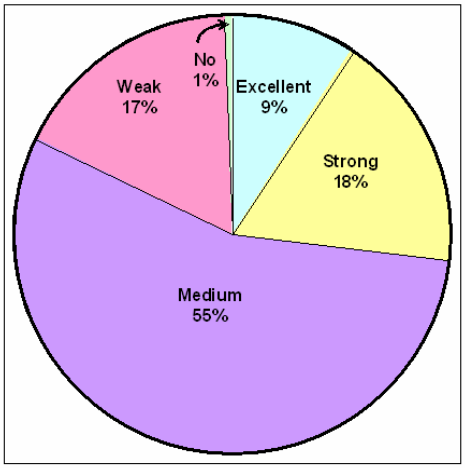


Figure 7-13
Evaluation of their houses
by the householders in collective housing

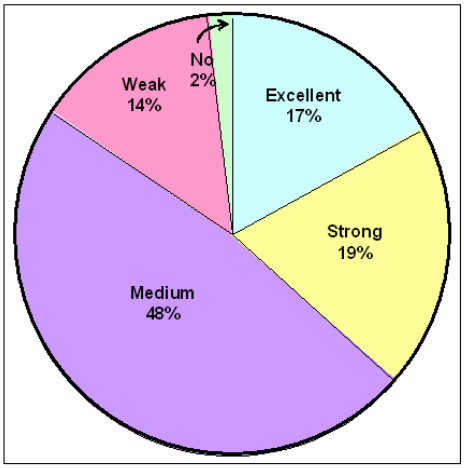


Figure 7-14
Evaluation of a their houses
by the householders of detached house

Concerning retrofitting, 62% of householders (319 persons) intended to retrofit their houses, and 171 householders indicated an acceptable cost for retrofitting. The acceptable cost varied from 1% to 100% of original construction cost, averaging around 20%.

The opinion of the householders on the physical resistance of schools is shown in Figure 7-15.

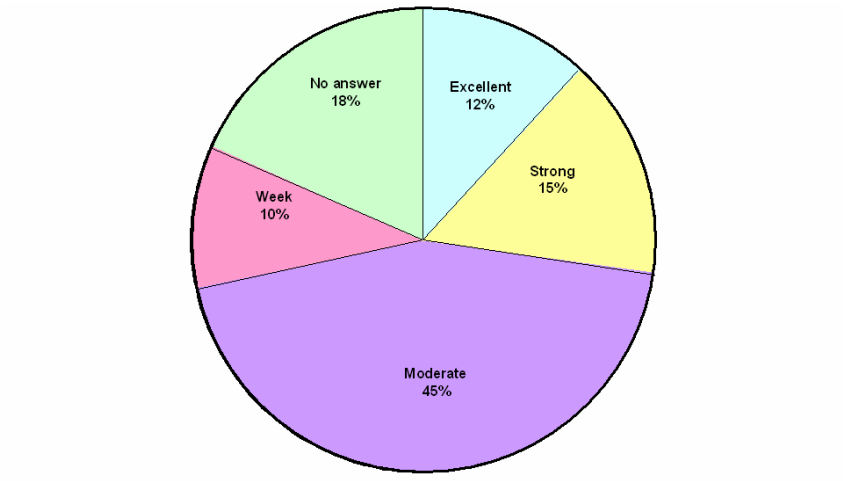


Figure 7-15 Householders opinions on physical vulnerability of schools

For the surveyed householders, the order of importance of facilities is shown in Table 7-6.

Table 7-6 Order of importance of facilities as rated by householders

Order	Facility	Rating
1	Hospital	2.0
2	Telephone	4.0
3	Civil Protection	5.6
4	Water supply network	6.4
5	Electric networks	6.5
6	Bridges and roads	6.5
7	Crisis cell	7.9
8	Fire station	8.1
9	Police station	8.5
10	Police force Barracks	9.0
11	Schools	9.3
12	Mosque	9.6
13	Shops	9.8
14	Administration facilities	11.5

(2) Information and safety preparedness

✓ ***Information and education***

The popular media used by the surveyed households is shown in Table 7-7. Through media outlets, 265 householders (53%) obtain sufficient information on major risks, 239 householders (48%) obtain sufficient information on risk prevention, and about 260 householders (52%) obtain necessary information immediately after earthquakes.

Table 7-7 Popular media of surveyed household

Media	Number	Percentage
TV	482	96%
Radio	251	50%
Local paper	228	46%
International paper	92	18%
Internet	47	9%
Others	5	1%

On knowledge and education for risk prevention, 236 householders of 500 interviewees (47%) think they know the possible measures for risk reduction and 288 (58%) wish to obtain greater knowledge or information on risk reduction. The desired means of learning is outlined in Table 7-8.

Table 7-8 Desired means of learning about risk reduction

Means	Number	Percentage
Through TV	378	76%
Through radio	130	26%
By books and magazines	72	14%
From family	60	12%
At school	59	12%
Others	18	4%

Most householders (94%) think that education in schools regarding earthquakes and risk reduction is efficient for children.

✓ ***Safety***

Conceivable reaction at the time of an earthquake is outlined in Table 7-9.

Table 7-9 Conceivable reaction at the time of an earthquake

Action	Number	Percentage
Go outside	324	65%
Go up to roof or terrace	18	4%
Open windows	22	4%
Extinguish gas and electricity	155	31%
Phone family, etc.	9	2%
Go under a table	60	12%
Gather family members	180	36%
Others	25	5%

At the time of an earthquake, 82% of the surveyed householders would ask neighbors for help, 4% ask friends for help, and 3% ask associations or the family. The shelters to which the surveyed households intend to evacuate, are: homes of friends (39%), tents (18%), neighbours (14%), APC (11%), schools (6%), mosque (3%) and associations (1%).

As an indicator of the degree of mutual assistance that may be available in a disaster, the possibility of sharing of food, water and shelter with other persons was discussed and the responses are shown in Table 7-10.

Table 7-10 Possible sharing of food, water and shelter with others

Item	Person for sharing	Percentage acceptance
Food	Family only	27%
	Other chosen persons	15%
	Other persons	59%
Water	Family only	25%
	Other chosen persons	16%
	Other persons	59%
Shelter	Family only	53%
	Other chosen persons	14%
	Other persons	33%

However, in regard to mutual support of neighbors, the declared frequency of visits to neighbors is “rare or none” for 53% of the interviewees, “sometimes” for 29% and “daily” for 15%.

Participation in activities of local groups is not common, and only 12% of the households attend meetings for culture (4.6%), street cleaning (3.2%), sports (2.6%), and mutual aid (1.4%).

7-2 Land-use and Urban Development

7-2-1 General considerations of Algiers metropolis

Algiers, the political and economic center of the nation, is the 2nd biggest metropolis of North Africa after Casablanca. It has an area of 809 km^2, extending over the Mitidja Plain, the coastal hills of the Algiers Sahel and a part of the Blida Atlas to the south.

Historically, development of Algiers started initially from Casba. Most buildings in Casba were, however, destroyed by an earthquake in 1716 and those currently existing are from the Ottoman era or later. Before the colonial period, most dwellings were concentrated in Casba and located on rocky slopes. In ancient times, people preferred to live in rocky and sloping areas, because of the greater levels of safety and to preserve the limited flat/cultivatable areas. In the colonial period from 1830 to 1962, European dwellings replaced the old buildings in the northern part of Casba and expanded towards the east along the bay. Further expansion of urban dwellings occurred in those eastern areas with flat topography and soft foundation conditions.

(1) Urbanization of Algiers

During the colonial era, the first phase of urban growth developed between 1880 and 1920. In this period, multistory buildings such as the Wilaya offices and central post office were constructed in the new districts of Telemly, Michelet and Upper Mustapha together with numerous private houses. Between 1920 and 1950, urban growth continued to intensify and several important buildings such as Government offices, the City Hall and Agriculture House were constructed.

World War II marked a major turning point in the growth of the capital with a massive influx of the Algerian population to Algiers. This saw an infilling of the “holes (habitable places)” in the urban fabric through a natural increase in dwellings (El Madania) or through national projects for large-scale construction of rental houses. This saturation of the center of Algiers led to the creation of suburban centers in the surrounds such as El Biar, Bologhine, Hussein Dey, Bir Mourad Rais, etc., with these areas referred to as Greater Algiers in September 1959.

Shortly after independence, Algiers gave the impression of being a colonial city but without the infrastructure required to function as a capital. The infrastructure necessary to raise the city to an international level, such as the National Palace, Hotel Aurassi, and the Olympic Complex developed rapidly based largely on economic advances led by the hydrocarbon industry.

(2) A New Challenge for Algiers

Algiers is the most important city of the country in terms of the number of inhabitants, economical/financial/industrial/intellectual activities, the hub of transportation, and its historical role in the formation of the Algerian State as well as being the political center.

Even if the population increase has peaked in the central part of the city, a high rate of population growth is occurring in peripheral communes where people often settle under relatively poor conditions. Algiers is today facing complex issues related to urban development, housing, public transportation, water supply and roads and traffic. Exceptional and urgent measures are therefore required to raise these services to the levels of other similar metropolises in the Mediterranean area.

In addition to the needs for sustainable development, needs for risk reduction and environment preservation have recently been emphasized. The Boumerdes earthquake and Bab el Oued flood have greatly contributed to the collective realization of a need to improve natural disaster management. In December 2004, Algeria adopted an exemplary law concerning risk reduction and crisis management within the framework of sustainable development.

In order to reduce risks and damage, it is required that the authorities and individuals accept policies and activities in the course of the challenge established by these recent laws.

7-2-2 Recent Situation of Urban Planning and Administrative Organization

(1) Recent History of Algiers' Urban Planning and Territorial Organization

Over the years, the city planning and territorial boundary of Algiers knew many changes which make it difficult to understand its policy of development**.** Table 7-11 presents the principal steps of the evolution of the urban management framework of Algiers and the rules for risk reduction.

Immediately after independence in 1962, the Algerian territory was divided into 15 Wilayas; the Wilaya of Algiers was bordered on the east by Tizi-Ouzou, on the south by Medea and on the west by El Asnam Wilaya.

The Permanent Committee for the Study and Organization of Greater Algiers (COMEDOR) was established in 1968 to initiate an urban development plan for Algiers, including development of infrastructure. The committee proposed first the "Structural Scheme for Algiers by 1985", which was subsequently frozen, and then a "General Organization Plan" (POG) for 2000, which was adopted in 1975. The POG set forth a strategy of integrated development, but this was rescinded in 1979.

The administrative boundary of Algeria has been changed several times. In 1974, the number of Wilayas was increased to 31 and then increased again to 48 in 1984. The area of the Wilaya of Algiers is now smaller with a sharing of its territory with the Wilaya of Boumerdes on the east and the Wilaya of Tipaza on the west.

A new and long study was undertaken in 1980 by the CNERU. Its objective was to draw up an "Urban Development Master Plan (PUD)" for Algiers, but it was never approved. It was picked up again in 1990 through the formulation of the "Master Plan for Land-use and Urbanism (PDAU)" which was finally approved at the end of 1995.

In 1997, twenty-four (24) communes of adjacent Wilayas were integrated into the Wilaya of Algiers by Ordinance n 97-14, and the "Governorate of Greater Algiers" was created by Ordinance n 97-15. The new administrative units of fifty-seven (57) Communes were assigned into thirteen (13) districts (called Daira). Of these fifty-seven (57) Communes, twenty-eight (28) were considered to be "urban wards", while the remaining twenty-nine (29) had a status of "peripheral communes". The Governorate prepared the "Grand Urban Project for Algiers, the Capital of the 21st Century" as the grand vision for urban planning.

Today the "Governorate of Greater Algiers" has reverted to its previous designation as a Wilaya and the twenty-eight (28) wards have again become Communes. The preparation of a new PDAU and POS for the Wilaya of Algiers was commenced in 2005 within the preventive framework defined by law 04-05 of 14/08/2004, but the new PDAU has not been completed.

Table 7-11 Evolution of city planning and risk reduction in Algiers

Year	Earthquakes	Paraseismic regulation	Regulation on Prevention	City planning	Legal texts on town planning	Organisation
1954	Orleansville (9/09/1954)					
1955						
1956						
1957						
1958						
1959						
1960						6 Wilayas
1961						
1962	Independence					
1963						15 Wilayas
1964						
1965						
1966						
1967						
1968				**Launching of the POG** Organisation in charge: COMEDOR	Decree 625-68 of the 20/11/1968	
1969						
1970						
1971						
1972						
1973						
1974				**Advance of the POG** > Diagram of the structures of Algiers by 1985 > POG (Plan of general organization) by 200(		31 Wilayas
1975						
1976						
1977						
1978	Death of the President Boumédienne (December 1978)					
1979				Downgrading of the POG		
1980	El Asnam (10/10/1980)			**Launching of the PUD** Organisation in charge: CNERU > *work does not advance usefully*	Decree 275-80 of the 22/11/1980	
1981		RPA 81 (except decree)				
1982						
1983						
1984						48 Wilayas
1985	Constantine (27/10/1985)		2 decrees of the 25/08/1985 on: > ORSEC (85-231) > PR (85-232)			
1986						
1987						
1988						
1989	New constitution					
	Tipaza (29/10/1989)					
1990				Operation of the **Wilaya of Algiers**	**Law 90-09** of 7/04/1990 relating to Wilayas and Decree of the 20/11/1996	
				Launching of the PDAU of Algiers and the POS on its 31 communes > the PDAU takes as a starting point the PUD, ever approved	Law 90-29 of the 1/12/1990 on Land-use and Urbanisme > PDAU > POS > Construction permit > Parcel permit	

Year	Earthquakes	Paraseismic regulation	Regulation on Prevention	City planning	Legal texts on town planning	Organisation
1991			Decree 91-503 of the 21/12/1991 on the organization of the DGPC		Decree 91-175 of the 28/05/1991 on the general regulations on land-use, town planning and construction	
1992	Legislative elections					
			Decree 92-54 of the 12/02/1992 on the organization of the external services of the DGPC			
1993						
1994	Mascara (18/08/1994)					
1995				**Approval of the PDAU of Algiers**		
1996	Aïn Benian (4/09/1996)				**Decree 96-417** of the 20/11/1996: Organization and operation of the Wilaya of Algiers	
1997				Integration of 24 bordering communes in the Wilaya on Algiers	Ordonnance 97-14 of the 31/05/1997 on the territorial organization of the Wilaya of Algiers	
				Creation of the Governorship of Great Algiers (metropolitan authority) > 57 communes (28 urban districts and 29 peripheral communes)	Presidential decree 97-298 of the 2/08/1997: organization and administration of the Governorship of Large Algiers	
1998						
1999	Aïn Temouchent (22/12/1999)	RPA 99 (stopped ?)				
2000	Beni Ourtilan (10/11/200)			> 13 circonscriptions (Daïras)	Presidential decree 2000-45 of the 1/03/2000 bearing modification of the Governorship of Great Algiers	
2001				**Great Urbain project of the capital** : Algiers, Capital of the 21st century > the 28 urban districts are transformed into communes **> the Governorship of Great Algiers becomes again Wilaya of Algiers** which counts 57 communes with Deputy Walis	Ordonnance 2001-01 of the 1/03/2001 giving a particular statute to the Governorship of Great Algiers Law 01-20 of the 12/12/2001 on land-use and the sustanable development of the territory	
2002						
2003	Zemouri - Boumerdes (21/05/2003)		Ordonnance 03-12 du 26/08/2003 on insurance on natural disasters		Law 03-10 of the 19/07/2003 on protection of the environment	Creation of the CONAD (Decree 03-332 of the 8/10/2003) for crises survey and prevention
2004		RPA 99 version 2003 (decree of 4/01/2004) Decrees 04-268 and 270 on the insurance on natural disasters Law 04-05 of the 14/08/2004 on land-occupation and the prevention	Law 04-20 of the 25/12/2004 on the prevention of the major risks and the management of natural disasters Decree 04-181 of the 24/06/2004 creating the commission of communication on the Major Risks		Law 04-05 of the 14/08/2004 on land-occupation and the prevention	
2005				Launching of the PDAU and the POS in the Wilaya of Algiers within a preventive framework		
2006				New PDAU starts again ?		

(2) Territorial Organization and actual administration

As mentioned in the previous section, the Wilaya of Algiers is presently divided into fifty-seven (57) Communes. The Communes are assigned to thirteen (13) districts (Daira), chaired by a Wali delegate (see Tables 7-12 and 7-13 and Figure 7-16).

Table 7-12 Dairas and Communes in the Wilaya of Algiers

Daira	Commune	Daira	Commune	Daira	Commune
ZERALDA	Staoueli	BIR MOURAD RAIS	Birkhadem	SIDI M'HAMED	El Madania
	Zeralda		Djasr Kacentina		El Mouradia
	Mahelma		Hydra	EL HARRACH	El Harrach
	Rahmania		Saoula		Oued Smar
	Souidania	BOUZAREAH	El Biar		Bourouba
CHERAGA	Dely Brahim		Bouzareah		Bach Djerah
	Hammamet		Ben Aknoun	BARAKI	Baraki
	Ain Benian		Beni Messous		Eucalyptus
	Cheraga	BAB EL OUED	Bab el Oued		Sidi Moussa
	Ouled Fayet		Bologhine	DAR EL BEIDA	Dar el Beida
DRARIA	El Achour		Casbah		Bab Ezzouar
	Draria		Oued Koriche		Mohammadia
	Douera		Rais Hamidou		Bordj el Kiffan
	Baba Hacene	HUSSEIN DEY	Hamma el Annasser		Ain Taya
	Khraissia		Hussein Dey		Bordj el Bahri
BIRTOUTA	Birtouta		Kouba		El Marsa
	Tessala el Merdja		El Magharia	ROUIBA	Heraoua
	Ouled Chebel	SIDI M'HAMED	Alger Centre		Rouiba
BIR MOURAD RAIS	Bir Mourad Rais		Sidi M'Hamed		Reghaia

Table 7-13 Chiefs of Administrative Units

Administrative Units	Chiefs of Administrative Units	
	Wilaya of Algiers	Other Wilayas
Wilaya	Wali	Wali
District (Daira)	Delegate Wali	Chief of Daira
Commune	Chief of APC*	Chief of APC*

* APC: Popular Communal Assembly

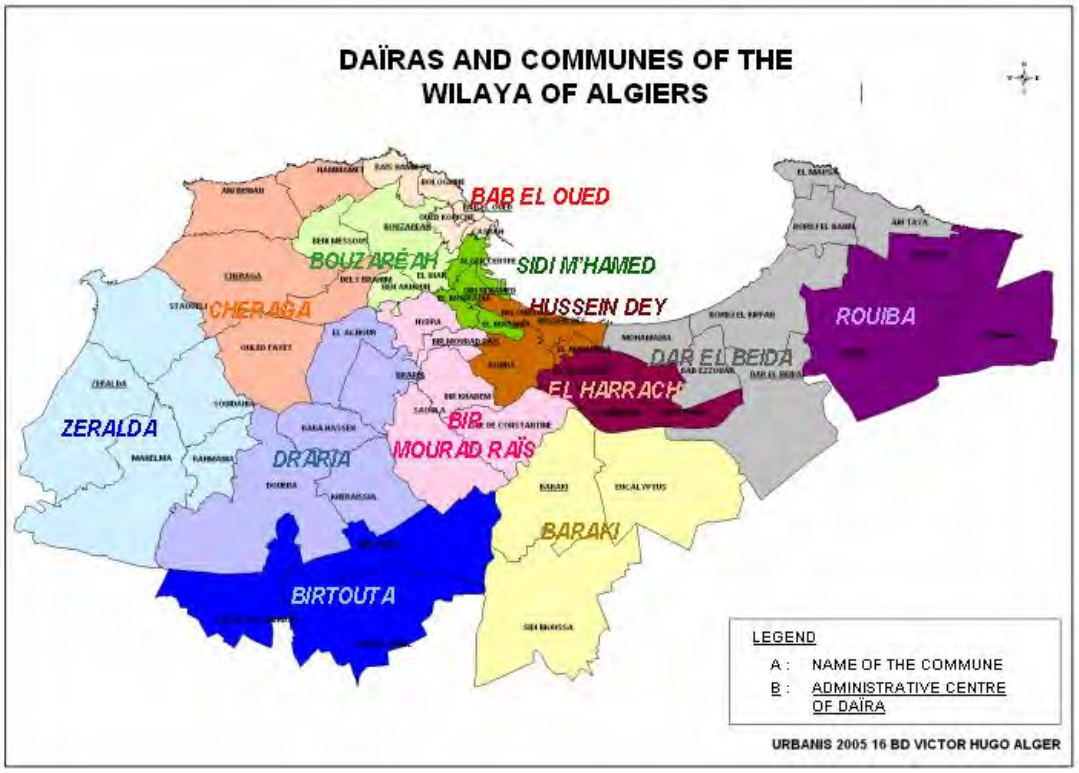


Figure 7-16 Dairas and Communes of the Wilaya of AlgiersOriginal document URBANIS completed with the name of Daira

7-2-3 Land-use Development planning and Environment Preservation Planning

(1) Instrument for Land-use and Urban Planning

There are two main instruments for land-use and urban planning.

- **PDAU** (*Plan directeur d'aménagement et d'urbanisme*): Master Plan for Land-use and Urban planning, to be implemented at the communal and inter-communal levels. The plan was drawn on a scale of 1/5,000 (1/10,000 for the Great Algiers)

  The **PDAU** determines the above-mentioned four categories for urban planning for a commune or an association of communes.

- **POS** (*Plan d'occupation des sols*): Land-use Plans (generally five to ten POS per commune) drawn on a scale of 1/500 (Urban Composition Plans)

  The **POS** defines in a detailed way the means of implementation, such as the rights of land-use/construction, regulations, and detailed drawings. It defines four categories of urbanization, namely U (*urbanisé*) for urbanized areas, AU (*à urbaniser*) for areas to be urbanized, UF (*urbanisation future*) areas for future urbanization, and NU (*non-urbanisable*) rural areas.

Since 1990, the basic instrument for urban planning has been the PDAU. The method and procedure of the preparation of PDAU and POS are defined by law n° 90-29 (1/12/1990), modified and complemented by law n° 04-05 (14/08/2004) after the Boumerdes earthquake, and related decrees. The following four decrees define the procedure (28/05/1991).

- 91-175: RGA (*Règles générales d'Urbanisme*) General Rules of Urbanism
- 91-176: Procedures for instruction and delivery of Urbanism Acts
- 91-177: Procedures for elaboration and approval of the PDAUs
- 91-178: Procedures for elaboration and approval of the POS

The principle of participation of the citizen in the process of execution of the PDAU ("town planning of dialog") was introduced in 2004.

Currently, the PDAUs of Algiers are prepared by the CNERU (Public Consultant Agency in urbanism) under the supervision of the Direction of Urban planning of the Wilaya.

The major modifications introduced by law n° 04-05 are as follows:

- Permit for construction: Civil engineering study is required to obtain a permit.
- Land-use planning studies: Natural and technological risks are considered in land-use and construction plans.
- Control of application of laws n° 04-05 and n° 04-06 (which modify decree n° 94-07 on the legislation of professional architects and architectural production).

The corresponding decrees for implementation have not been prepared to date, but the following have been implemented through law n° 04-05:

- Conditions of risk reduction in land-use and construction will be defined in PDAU and POS.
- Seismic zones in particular must be identified and classified, considering vulnerability of the area.
- Registered architects and engineers must be involved in construction projects.
- Provisions for the demolition of constructs which do not follow the rules and procedures.

(2) Present Condition of Urban Planning

For the Wilaya of Algiers, a "great" PDAU of Algiers covering 37 Communes (31 of the ancient Algiers and 6 communes) has been prepared, and an additional 20 communal PDAUs have been prepared for the other 20 Communes.

The Wilaya of Algiers is divided into 500 areas for POS. Currently, 126 POS are in the course of being prepared (in general 8 months are required for technical examination and 12 months for the administrative procedure) among the 500 areas. Drawings for special plans have been prepared on MAPINFO for 80% of the 126 POS.

A new PDAU, covering the Wilaya of Algiers (57 communes) should be initiated, because the 20 communal PDAUs are inconsistent with the following requirements imposed by laws n° 04-05 and n° 04-06:

- Global approach
- Environmental criteria

- Sustainable development
- Consideration of natural and technological hazards

A US consultant (Ernest Young) is developing the Land-use Scheme for the North-Central Region (projection 2025) of Algeria concerning ten (10) Wilayas for the Minister of Land-use and Environment. This program will be finished at the end of 2005.

The POS gives the orientation of land-use and detailed implementation plans. However, actual implementation depends on the decision of the Minister of Planning, and realization and funding are managed by the DPAT (*Direction de la Planification de l'Aménagement du Territoire*; Direction of Land-use Planning). The revision of POS for perimeter areas takes 5 years for category "U" and 10 years for categories "AU" and "UF".

7-3 Risk Perception and Culture in Algiers - Social Factors of Vulnerability and Resilience

7-3-1 General considerations

All the interviewed persons have ***re-realized natural risks*** in Algeria through the terrible experience of the Bab El Oued floods that afflicted the capital centre in 2001. The floods concerned public authorities and triggered off a general review of major risk policy, accordingly. The seismic episode of Boumerdes reaffirmed the reality and variety of natural disasters inflicting the Algiers area. This fact illuminates the importance of appropriate preparedness for efficient crisis and post-crisis management, and for seismic risk mitigation, especially in construction.

Assistance to victims inescapably involves a sense of generosity and arrogance. In fact, when solidarity is extensively demanded in various ways (popular, municipal, governmental, international), certain segments of the population feel concern about the threat of abuse and lack of civility, resulting in extravagant control or compulsion. On the other hand, solidarity and initiatives of mutual assistance by the voluntary efforts of youth during the recent disasters are positive indications for the future.

Vulnerability is firstly a matter of the degree of physical resilience of buildings and infrastructures such as roads, pipelines (water, sewerage, and gas), cables (electricity and telephone), and other node facilities (bridges, airports, petrol stations, power stations, etc). The poor condition of buildings and infrastructures are major risks in natural disasters, which threaten human life as well as social activities. Then, the vulnerability turns can become a psychological matter. The psychological disturbance may cause destruction of social bonds and security as well as governance of society and the nation, resulting in intensifying and expanding damage to human life and social stocks as well as the governance. Poverty, ignorance, disequilibrium, and weak bonds in society are latent risks, which may exacerbate psychological disturbance. In order to reduce the risk, it is necessary to provide assistance in all levels (public, mutual, and private), especially to isolated and fragile segments of the population with reconstruction of social bonds. For the reduction of both physical and psychological risks, awareness of and preparedness for disaster management are essential. To promote awareness and preparedness, all the efforts should be taken, considering the financial situation and cost effectiveness. Several key issues highlighted in this chapter are for the selection of effective measures.

7-3-2 Viewpoints expressed by the different stakeholders

(1) The institutional leaders

1/ Politicians and the elected people

Politicians are conscious of the actual vulnerability of Algiers and other big cities in coastal areas in Algeria. They are wedged in the middle between the population, from whom they receive complaints or demands, and the superior executive powers to which they can forward proposals.

The present policies for risk reduction are reflected in the recently-adopted regulations and legislative processes. They recommend putting priority on the measures relating to a vulnerability reduction policy. They also speak about the importance of urban management, the security of the manufacturing sector, and the development of a risk culture.

2/ Administrators of the Wilaya

The Wilaya administrators are more conscious about the seriousness of major risks due to the recently experienced disasters. Their concern is firstly on the high seismicity in the area of Algiers, and secondly the topographic and geological conditions of Algiers. They emphasize widespread carelessness which leads to illegal construction and uncontrolled urban expansion.

Through the experience of the last natural disasters (floods and earthquake), they are aware of the importance of information, especially documents for appropriate management of major risks. They are concerned about the manner of application of the legislation in force. They stress the necessity to inform the population about natural disaster prevention and the necessity to develop an adequate role for the media. But no one is acting on these concerns.

3/ The presidents of APC

The communal management is concerned about the improvement of citizens' living condition (maintenance of roads, sewage, and drinking water networks). The communes do not have staff or budget for risk management. There is almost no capacity for intervention in terms of prevention and emergency response at a local level in spite of the willingness and awareness of the elected people as well as the members of the public.

The presidents of APC emphasize the need for preparation and mobilization of the members of the public to increase crisis management capacity. They focus on construction standards and the necessary training of construction companies. There must be rigorous management of urban planning and construction at the local level.

4/ Religious leaders (Imams)

Most of the religious leaders agree on introducing scientific viewpoints on natural disasters, even though some religious men foretell disastrous events as a divine message. The majority reject the concept that disasters are divine punishment, and they manifest a special interest in disaster management or prevention without relying on fatalism.

Mosques provide occasion to comfort people by appeasing their pains, fears, and agonies. Religious leaders wish to manage the panicked reactions of people and remind them of the Muslim principles of faith, patience and courage. They appeal to solidarity, especially in crisis periods. They encourage people to respect rules of hygiene, and environmental preservation. Religious men could play an important role in promoting awareness of methods for reducing the impacts of disasters with preliminary training of Imams. They usually recommend that people have life or automobile insurance, but not natural disasters insurance, because it is not well known.

(2) Public authorities and private services

5/ Crisis managers and 6/ Police and Civil Protection

Previously it was thought that disasters could be managed with strong leadership, mobilizing public powers and fulfilling missions of public organizations in accordance with the requirements of the authorities. But the last efforts at disaster management revealed the importance of involvement of the public at large. To optimize collaboration, it is required that each person should have a scope and task for intervention. The civil protection services must play a role in the coordination and monitoring of the collaboration such as the arrangement of information for decision making, and the distribution of information to the population.

As regards cooperation, they do not want interference from international aid organizations when the national solidarity has already been secured, although they do wish to have international technical cooperation.

The officers in charge of crisis management have a great deal of experience in dealing with natural disasters and recognize the lack of technical capacity. They think that human potentials should also be exploited, particularly the trained volunteer firemen.

All agree that the culture of risk reduction must be developed. Currently, there are few voluntary activities taking place in the public sector and for the promotion of such activities, it is necessary to develop ongoing means of disseminating information and training.

7/ Public services

Public service officers understand that they have an important role in the crisis and post-crisis management. Their mission is to respond to the citizens' requests, including technical and institutional matters, and they should keep in touch with the population for fulfilling the mission. Social peace and welfare rely on their capacity of intervention and assistance, although their tasks involve difficulty in managing vulnerability. In an emergency, they must be able to restore ordinary life as rapidly and efficiently as possible, responding to citizens' needs.

Those public service officers who have already managed disastrous events, particularly the Bab el Oued floods and Boumerdes earthquake, have invaluable experience. They are aware that their capacity for intervention remains insufficient, and therefore, they are requesting the State's to refine their roles to promote efficient intervention.

They think that involvement of the population is important for risk prevention as well as crisis management.

8/ Health services

Health services understand that they are important actors in disaster management. Their major role is to save human lives by relieving physical and psychological injuries. But, they are aware that they do not have sufficient training for response in a crisis. They frequently request information, training and means for better crisis management and prevention. They consider their role as efficiently fitting the expansion of a prevention culture.

9/ School Directors

Teachers and directors of primary schools think that they do not have adequate training, because there is no national level initiative in education for development of a culture and knowledge of risk reduction or disaster management. All the teachers' knowledge of risk reduction and disaster management has been acquired personally, as there is no lecture or course on that. A few teachers and students personally attend training or simulation on crisis management organized by specialists such as Civil Protection.

During the last disaster, schools provided accommodation to refuges for psychological care and other support to students and families. This function was previously developed to counter the threat of terrorist attack to care for people who suffer trauma. They have already recognized the necessity of preparedness in case people ask schools for assistance, especially psychological care.

Teachers consider that many school buildings do not meet the requirements of the new building code in terms of seismic resistance, and this may be critical in the issue of the vulnerability of the capital.

10/ University professors

University professors are perfectly aware of the natural disasters which threaten the city of Algiers. They focus on danger emanating from the industrial factories in the urban areas. Lectures on risk management have been started in social sciences, but the lectures are not popular, except for some sessions held in the end of the last year. In the scientific field, programs relating to risk management are mostly on the issues of buildings. Natural and industrial risks are studied in the University of Architecture & Urbanism, particularly in the session of "urban development".

Interviewed professors express an optimistic opinion on the State policy for global risk management, integrating national level land use planning, led by the MATE. They also express an opinion that the Algerian approach to disaster management put too much importance on crisis management and prevention should be given greater emphasis. Further efforts, such as introducing sessions on prevention into the Civil Protection training school, and arranging budget for preventive measures, are required to promote a preventive system.

11/ Economic actors

Business persons are aware of the importance of the major risks which may affect their production, sales, or service. In order to secure their businesses, they have agreed to invest in disaster management, such as staff training and applying seismic standards to their buildings.

The management of all the big hotels have agreed to insure their clients' security, although it seems that to date, they have neither taken sufficient measures nor prepared an adequate plan for disaster management.

12/ Insurance companies

Issuance is not popular in Algeria, because many Algerians do not rely on insurance contracts such as warranties or accept the principal of indemnification. After the last disasters, some people have purchased insurance covering their businesses or houses.

Ordnance 03/12 dated 26 august 2003 prescribes that all Algerian inhabitants should have insurance to protect against damage caused by natural disasters, which replaced the previous indemnification system, the "Natural Calamity Fund" (Fond de calamité naturelle, FCN), but most people were not well aware of the regulation at that time.

Nowadays, any administrative application procedure for residence requires submission of an insurance certificate together with other the documents for application, and thereby, CAT NAT insurance has gradually grown this year, as is shown in the responses to the questionnaire survey conducted in this study that householders stated that they were willing to obtain natural disaster insurance.

13/ Media

Media people recognize that they have a fundamental role in major risk reduction, since the media can widely distribute information from experts/authorities on the importance/necessity of knowledge/measures regarding natural disasters and its management through audiovisual means, resulting in raising awareness of the population. For crisis management, TV and radio are very important in prompt and wide dissemination of crucial information on damage/relief to victims and decision makers. The role of the newspapers is also important in disseminating detailed data and analysis as well as denunciation/correction of any errors in the information which TV or radio may have broadcast.

There is neither concrete policy nor strategy agreed among the media about their role/activity in an emergency situation as was revealed during the last disasters. Although the media contributed much to managing disasters, there is a possibility that overblown or incorrect news dispersed by some media caused confusion and panic among the populous. The Environmental Press Club, which unites most media journalists, can arrange opportunities such as conferences, seminars, and workshops for discussion of the above-mentioned issues among the media. It is also necessary to improve communication channels for prompt acquisition of correct information.

(3) The civil society

14/ District Committees

The leaders of local government (APC and Daira) mention that they have a role to transfer information and messages between the population and the local government (APC, Daira) as well as other public services, although they are not necessarily required to engage in any particular preparation for crisis management or preventive actions. They stand in a position to relay information in campaigns for raising awareness of the local population in disaster management. They are contributing to and participating in the activities and campaigns involving the youth segment of the population.

They explain the persisting anxiety of the population living in built-up areas regarding the deterioration of buildings as well as the infrastructure networks that were damaged in the last earthquake. They expect promulgation of a policy for relocation or restoration of the buildings.

They request special training for efficient sharing of information on prevention and for adequate preparedness to mitigate any possible future crisis in accordance with local conditions.

15/ NGOs

The intervention of associations in preparation for and during crisis includes coordinating volunteers (first aid actions in particular), raising funds, organizing solidarity chain, supplying emergency materials, and the psychological care. Amongst the associations, the Algerian Red Crescent (CRA) and the Algerian Muslim Scouts (SMA) act as major players. Most of the NGOs that provided help during the last events did not have financial backing.

The requests from the NGOs are as follows:

- Reinforce coordination with the disaster management delegates, through consultation with the NGOs
- Establish local plans for emergency response, including clarification of the roles of each participant
- Execute emergency response simulations and training so that the participants may learn the necessary means for initial response before the arrival of official assistance
- Replacing or restoring decayed buildings and lifeline systems under preventive urban planning
- Raising the awareness of children and women through program at schools and cultural centers
- Promoting campaigns through media for raising awareness
- Training specialists and volunteers in disaster management

7-3-3 Social and community factors of vulnerability and resilience

(1) Factors of governance and sustainability on disaster management

The factors required for good disaster management governance are the quality of the legislative framework, simple decision-making processes, good linkage among organizations, clear definition of roles and responsibilities, good ability of officials, simple legislation system, appropriate local action plans, capacity of mobilization and implementation, etc.

The factors required for disaster management sustainability are a comprehensive risk assessment system, the integration of risk reduction in sustainable development planning (preventive development on the national, regional and urban scales), and permanent and participative structures.

The Algerian legislative framework for comprehensive disaster management was formulated with Decrees n° 85-231 and n° 85-232 on 29 May 1985, following the El Asnam earthquake. After the Bab el Oued flood and Boumerdes earthquake, the approach evolved and Law n° 04-20 was promulgated on 25 December 2004. Law n° 04-20 is more sophisticated and has been applied in the recent trend toward "the prevention of the major risks and crisis management within the framework of sustainable development". A new series of decrees for implementation will be promulgated shortly.

Organizations responsible for crisis management showed good performance during the last disasters, although there is some room for improvement in communication and clarification of tasks. Concerning risk prevention, activities and linkage of organizations are not as well developed as possible and further improvement will take place in accordance with a series of new decrees for implementation and formulation of an action plan for each organization concerned.

The results of interviews and social surveys in this study reveal that most people recognize the importance of disaster management and also the vulnerable condition of Algiers. A remarkable issue pointed out is the big gap between theoretical opinions regarding the management/measures that should be taken and the actual implementation/activities that the management/measures have actually taken. Generally, for instance, after having given a relevant theoretical speech stressing the necessity of implementing measures to address the problem of deteriorated old buildings and illegal construction that took place without following the building code, the speakers express several kinds of limitations that reduce their means of action. Many interviewees mentioned the need for capacity building and proper knowledge of disaster management, however only a few training or education programs have actually been held.

(2) Human and Socio-economic Factors

The factors of human vulnerability are related mainly to poverty and the weak (the handicapped, the aged, chronically ill persons, and infants), and it is also related to solidarity and social bonding.

Destitute families often build illegal and vulnerable houses in unstable areas. The physical vulnerability comes with socio-economical and psychological vulnerability. Damage to the vulnerable houses is very serious, and the psychological conditions of the

inhabitants decline following the physical damage. The poor suffer more serious damage with natural disasters and fall further into poverty resulting in an obstacle for development of society as a whole. To avoid such "death spiral", the improvement of vulnerable houses is of primary importance.

Some people report that emergency response after the Boumerdes earthquake and the collection of damage information and mobilization of rescue assistance were quicker and more efficient in the areas where the community network and social bonding were tight. Especially, the voluntary efforts by the youth were remarkable. Similarly, the function of district committees is an important factor in the creation of social cohesion as some committees acted like local crisis cells and successfully engaged in coordination of the relief services and organization of solidarity chains and family contacts after the Boumerdes earthquake.

However, some people think that this willingness to volunteer and the social bonding is much greater in Boumerdes than in Algiers. Regardless of whether that is true or not, it is necessary to take action to cultivate and promote the willingness to volunteer and to nurture social bonding in order to increase the capacity of the human factor.

(3) Factors of skill and ability

The factors of skill and ability referred in this section are about technology and engineering (building regulations, engineering resources, professional associations, service quality, construction projects, and technical training) and preparedness (emergency action plans, local information and exercises to improve crisis management, etc.).

According to the interviews and questionnaire survey, many people think that activities for raising awareness, information dissemination and preparations for disaster management are not sufficient. There is neither a clear vision on the role of media nor programs on education and training for disaster management. Journalists do not have sufficiently close relationships with specialized/scientific organizations. There are only a few programs or classes on disaster management in schools. Those are important factors that increase vulnerability, which could possibly result in panic and stress.

The lack of local disaster management action plans and local infrastructures for immediate intervention (lack of stock, shelters, medical or psychological care, and training) are other crucial points that increase vulnerability.

More globally, the insufficiency in the education and training of important stakeholders (journalists, teachers, imams, communal services, building companies, etc.) is cause for concern and should be rectified.

CHAPTER 8

EXISTING DISASTER MANAGEMENT SYSTEM

Chapter 8. Existing Disaster Management System

8-1 Legal Framework for Disaster Management

8-1-1 Introduction

Algeria is exposed to several natural and technological risks. Catastrophic damage by the El Asnam earthquake in October 1980; the Bab el Oued Flood in November 2001 and the Boumerdes earthquake in May 2003 are fresh in the memory of all Algerians. In order to secure human life, personal property, and social capital as well as sustainable development, public authorities became aware of the necessity to reduce the damage by, firstly, introducing preventative actions and, secondly, implementing appropriate crisis management measures. For implementation of the actions and measures, an institutional organizational framework was formulated after the El Asnam earthquake and further evolved after events such as the Boumerdes earthquake. This evolution is also in line with the requirements of society for protection, reflecting the values of a particular time, according to economic/political conditions and their development.

Seismic risk particularly constitutes a strong concern due to the extent of the affected areas, the substantial damage, and the heavy social/economic/environmental impacts. In addition to the major events mentioned above, numerous seriously damaging events have occurred in the northern part of Algeria as shown in Table 8-1. Considering the concentration of population, activities, and social stock, particularly in large coastal urban areas in the northern part of Algeria such as Algiers, seismic risk has been given priority as a new approach for disaster management to actively cope with development.

Table 8-1 Major Historic and Hazardous Earthquakes in Algeria

Location	Date	Intensity	Magnitude	Death Toll	Remarks
Alger	03.01.1365	- (Strong)	- (Strong)	some	
Algiers	10.03.1673				*1
Mitidja	03.02.1716	X		20,000	*1
Oran	09.10.1790	X		2,000	*1
Blida	02.03.1825	X		7,000	*1
Jijel	22.08.1856	X			*1
Aurés	16.11.1869	IX		30	*1
Gouraya	15.01.1891	X	7.5	38	
El Kalaâ	29.11.1887	IX-X (VIII)	6.5/7.5	20	
Sour. el Ghouzléne (Aumale)	24.06.1910	X (VIII)	6.4/6.6	30	
A. el Hassan (Cavaignac)	25.08.1922	IX-X	5.1	2	
El At -El Ab (Carnot)	07.09.1934	IX (VII)	5.0	none	
Béjaia	12.02.1960	VIII- IX	5.6	264	
Chlef (Orléansville-ElAsnam)	09.09.1954	X-XI	6.7	1,243	
M'sila	21.02.1960	VIII	5.6	47	
M'sila	01.01.1965	VIII	5.5	5	
Mansourah	24.11.1973	VII	5.1	4	
Chlef (El Asnam)	10.10.1980	IX	7.3	2,633	
Constantine	27.10.1985	VIII	5.9	10	
El Affroun	31.10.1988	VII	5.4	none	
Dj. Chenoua (Tipaza)	29.10.1989	VIII	6.0	22	
Mascara	18.08.1994	VII	5.6	175 *2	
Alger	04.09.1996	VII	5.7		
Ain-Temouchent	22.12.1999	VII	5.8	25 *2	
Béni-Ouartilane	10.11.2000	VII	5.4	2	
Zemmouri (Boumerdes)	21.05.2003	X	6.8	2,278	

Source: CRAAG homepage, http://www.craag.edu.dz/ess/labos/banque_donnees/Histo/histo_seismes.htm
*1: Source: URBANIS, Study report on Social Survey sublet in this study
*2: Source: CRAAG, but only for “Death Toll” number from URBANIS’s report

Considering the objective of this study, which is to suggest an earthquake disaster management plan for Algiers, the following points were taken into account during collection of data and information:

- The elements of Algerian policy that relate to major risk reduction and crisis management, related to seismic risk
- Coordination among different players in planning and implementation of disaster management, in relation to legal and regulatory measures through their missions and organizations
- Master Plans for Land-use Planning at different levels: (National level, SNAT: Schéma national d’Aménagement du Territoire; Regional level, SRAT: Schéma regional d’Aménagement du Territoire; Wilaya level, PAW: Plan d’Aménagement de Wilaya)

- Laws and regulations for the design and implementation of civil engineering works and the analysis of measures for reduction of seismic risk
- Earthquake disaster management in urban planning, through spatial planning PDAU (Plan Directeur d'Aménagement Urbain; Master Plan for Urban Land-use Planning) and POS (Plan d'Occupation des Sols; Plan for Land-use Planning on a commune scale)
- Local earthquake disaster management systems within the national-level framework and distribution of responsibilities at different levels (national, regional, local)
- A global analysis of the present situation and evolution focusing on the development of a policy of earthquake disaster management, together with complementary missions of different players and recognized needs for improvement
- Clarification of development towards an integrated earthquake disaster management system.

The following four kinds of activities were considered important and were focused on for analysis or evaluation of an earthquake disaster management system:

- Activity for seismic risk assessment in relation to damage estimation and social vulnerability
- Activity for seismic risk prevention in terms of mitigation, such as regulations for land-use planning, construction, retrofitting of existing buildings, community enforcement, training, education, dissemination of information, and so on
- Activity for seismic risk reduction in terms of preparedness, such as land-use planning, surveys for identifying risk, installation of warning systems, insurance, preparation of materials for rescue/relief, and so on
- Activity for emergency response following the past disasters.

The survey also allows an examination of how all these kinds of activities fall within the scope of sustainable development as well as the environmental aspects in development planning.

8-1-2 Legal framework

(1) Disaster management in the Constitution

The Constitution of Algeria was revised following the referendum on 28 November 1996, in presidential decree n° 96-438 dated 7 December 1996.

In the Constitution, the following chapters and sections mention disaster management, but there is no direct reference to Disaster Management.

- Article 24 in Chapter III (about the State): "The State is responsible for the safety of persons and goods. It ensures the protection of all citizens abroad".
- Article 53 about the right to education: "This right is warranted. It is free in the conditions fixed by the law. Fundamental education is mandatory. The State organizes the system of education. The State makes sure of equal access to education and professional training."
- Article 54: "All citizens have a right to protection of their health. The State ensures the prevention and fight against epidemic and endemic diseases".

- Article 58: “The family gets the protection of the State”.
- Article 122 defines the actions of the parliament in the legal domain as a general rule in the following sections:
  (16): related to education and scientific research
  (17): related to public health and population
  (19): related to the environment, way of living and land-use planning
  (20): related to protection of flora and fauna
  (21): related to National Defence and the use of armed forces by civil authorities, and related to the protection and safeguard of cultural and historic heritage

(2) Formulation of legal framework

1) Drawing up of legal framework

The institution for disaster management was formulated following the catastrophic El Asnam (Chlef) earthquake in 1980. After this event, an inter-ministerial working group was organized under the aegis of the Prime Minister, and the group identified fourteen (14) kinds of major natural and technological risks to which Algeria may be exposed. Out of the fourteen, the seven kinds of natural risks mentioned are as follows:

- Earthquakes
- Floods
- Mass movement (landslides, rock falls, etc.)
- Subsidence and settlement
- Violent winds
- Drought
- Forest fires
- Locus invasion

The seven kinds of technological risk are as follows:

- Explosions and fires
- Maritime disasters
- Air disasters
- Railway and road disasters
- Irradiation
- Pollution
- Biological disasters

Works undertaken by the working group were associated with risk surveys of related disasters, concerning the nature of the hazards, issues, and measures for reducing damages.

Because of its high seismicity and economic and political importance, priority was consequently given to earthquakes occurring in the northern part of Algeria, where significant financial impact is also concentrated. Particular attention was paid to institutional organizations, research activities, studies and observations.

2) Formulation of legal framework

Decrees n° 85-231 and n° 85-232 were promulgated on 29 May 1985. The two decrees were the first regulations relating to integrated disaster management in Algeria, fitting a system of crisis management and risk reduction as summarized below:

- **Decree n° 85-231** defines the organization and procedures for implementation of the interventions and assistance in the event of catastrophes. The decree allows the installation of the "Plans of organization of the interventions and assistance (ORSEC Plans)" on a unit, Commune, and Wilaya.
- **Decree n° 85-232** relates to the prevention of natural and technological risk. It is very short and comprises only eleven (11) Articles. The "Prevention of the Risks", of natural or technological origin, is indicated (Article 2), but without detailed description of its objectives, its contents and its realization.

These two decrees have been the base for disaster management in Algeria for 20 years.

3) IDNDR activity and disaster management policy

The contribution of Algeria to IDNDR (International Decade for Natural Disasters Reduction), 1990-1999, under the auspices of UNO, has led to the activities of a National Committee for the Decade. The inter-ministerial committee was coordinated by the Algerian Ministry for Foreign Affairs in accordance with the resolution of United Nations. It should be mentioned that UNO identified fourteen (14) kinds of major risk, of which the following ten (10) concerned Algeria:

1) Earthquake and geological risks
2) Floods
3) Climatic risks
4) Forest fires
5) Industrial and energy risks
6) Radiological and nuclear risks
7) Risks dealing directly with human health
8) Risks dealing with animal and vegetal health
9) Atmospheric, hydraulic, on and off-shore pollution
10) Disasters due to excessive human settlement

A national policy for natural and technological risk reduction and disaster management mainly involves national and local institutions and concerns the domains of both risk reduction and preparedness for risk.

Action programs were created for the most critical issues of the fourteen (14) kinds of major natural and technological risks. Measures were also established in institutional, regulatory, and organizational aspects, as well as aspects on improvement of scientific, technical and operational potentials.

In the objectives of the national disaster management policy, the following can be noted:

- Development of knowledge related to identification/assessment of hazards and risks for the preparation of risk maps
- Enhancement of the information and education system
- Reinforcement of the capability of institutions and organizations concerned in risk reduction
- Incentive measures focused on collaboration among institutions and organizations concerned
- Promotion and development of cooperation at regional and international levels

4) Activities in earthquake disaster management, following the promulgation of two decrees

Algeria has been affected by eight major earthquakes with magnitudes exceeding 5.4 on the Richter scale since 1980. These are the Chlef 1980/7.3, Constantine 1985/5.9, Tipasa 1989/6.0, Mascara 1994/5.7, Alger (Ain Benian) 1996/5.7, Ain Temouchent 1999/5.7, Beni Ouartilane 2000/5.4, and Boumerdes 2003/6.8. The consequences of those earthquakes were also very disastrous in terms of casualties (2,633 killed for Chlef, 175 for Mascara, and 2,300 for Boumerdes) and physical loss (US$ 3 billion for Boumerdes). The following equipment was installed in order to monitor seismic activity:

- Networks for seismic monitoring: thirty-two (32) stations installed between 1990 and 1992 (CRAGG)
- Network for monitoring strong seismic motions; this network is composed of three hundred (300) accelerometers installed between 1985 and 1992, and thirty (30) others in reserve from 2002 to 2004 (CGS)
- Ten (10) mobile accelerometers by CGS and as many (CRAAG)
- Mobile and permanent equipment for dynamic tests of structures (CGS)

A series of studies have been conducted to clarify the seismic risks, and the following results have been produced:

- Maps of seismic hazards, at a national scale
- Maps of “microzonation” (local seismic hazards) of about thirty (30) urban areas in the regions of Chlef, Algiers, Ain Temouchent, and in the area of important facilities (dams, electric power stations, hospitals, etc.)
- Surveys of the seismic vulnerability of some strategic buildings
- Surveys of the seismic vulnerability and risk in the centre of Algiers (current buildings)

5) Disaster management in other fields

After the promulgation of the Decrees n° 85-231 and n° 85-232, the following plans for risk reduction and emergency action at different national and local levels were elaborated:

- National plan to fight forest fires
- National plan to prevent desertification (with a special national map for raising awareness of desertification)
- National plan to fight locusts (with a special map providing an index of potential vegetation zones vulnerable to an outbreak of harmful insects, covering southern Algeria and areas to the north of Mali and Niger)
- National emergency plan against maritime pollution (Tell Bahr)
- Plan for prevention and intervention in all economic and industrial hazards

Early warning systems for several risks were also installed as follows:

- National system of warning by radio for forest fires
- National meteorological system for identification and monitoring of tempests and violent winds
- Early warning system for dumping of hydrocarbon waste at sea
- Early warning system by radio for dam failure and emergency release of reservoir water
- Pilot system for provision and warning of floods in Oued Sebaou basin
- Early warning system for large industrial hazards

(3) Institutional improvement

1) Involvement of all bodies in disaster management

Several issues requiring improvement of the present disaster management system were revealed and emphasized during the Bab el Oued flood on 10 November 2001 and the Boumerdes earthquake on 21 May 2003. These two events exposed the importance of links among different administrations and technical services and coordination of post-disaster intervention by national and local authorities.

In addition, the importance of the roles of NGOs, local communities, and volunteers was recognized, because official support for thousands of victims is limited in case of catastrophic disasters in terms of number of staff and available support materials. The volunteers also have an important role during ordinary times in education, raising awareness, and training.

Private companies have many human and physical resources which can be mobilized for emergency response. During ordinary times, the private companies can take actions for their own preventive measures and for emergency response preparedness.

Individuals also should make efforts for disaster prevention, standing on a principle that individuals should secure/protect their own lives and property. Participation of individuals in community activities for disaster management is also recommendable to increase the capacity of mutual support.

It is therefore important to deal with all bodies as substantial players in disaster management, and integrate them all for a resilient society. Institutional, legal and regulatory frameworks should be arranged for integration to establish a good partnership among them.

2) Initiatives by the President

In a speech given during an international symposium on "Major risks and land-use plan" on 15 and 16 March 2004, in Algiers, the President of the Republic announced the following:

> *"Today still more than yesterday, the State must engage actions of prevention, of anticipation, of forecasting disaster consequences, and of disaster management. Considering the problem of major risks as its priority concern, the State presently works in order to provide all means to allow in the long term the attenuation of natural, industrial and technological hazards and risks to which the country is heavily exposed. The strategy elaborated by Authorities in order to increase the efficiency of their interventions involves two levels. The first level aims at the general reduction of risks of natural disasters foreseen due to concentrations of populations, activities and economic infrastructure, especially highly concentrated areas such as the Tellian fringe. Above all of this, we set the policy of land-use planning and sustainable development launched in 2001, in its mission of permanent technological development monitoring, of anticipation, and of adequate response to these risks. The strong consideration of major risks, in this new framework of land-use planning, is essential and imperative as a central element for each development project of the territory. The second level concerns the prevention of major risks, relating to the reconsideration of the regulatory and legal framework in 2003, concerning building codes and earthquake resistant regulations, of the institutional leveling up, and of emergency, and specific measures to be taken for vulnerable zones."*

3) Promulgation of Law n° 04-20 for comprehensive disaster management

At present, the most important legal outcome on disaster management is promulgation of Law n° 04-20 on 25 December 2004, concerning "Prevention of Major Risks and Crisis Management in the Framework of Sustainable Development". The law establishes a system of risk prevention and crisis management for ten (10) kinds of risks identified by UNO with the following objectives:

- Improvement of knowledge of risks, the technology of survey and prediction, and development of preventive information
- Consideration of risks in land-use planning and in the construction process
- Setting up of measures aiming at systematic and integrated measures in accordance with local conditions

The Law highlights the following issues as being of fundamental importance:

- Preparation and precautions
- Consistency of measures
- Preventative and corrective measures against risks

- Participation of the citizens
- Adequate introduction of new technology

The Law assigns a large part of the description for information and training for risk prevention and crisis management. It defines general rules and the outline of measures for each identified risk. The Law also lays down the measures for securing safety on three particular strategic subjects; roads/highways, telecommunications, and important buildings, together with complementary measures on insurance and land expropriation.

The national system for crisis management prescribed in the Law is composed of the following two elements.

- Plans for assistance and intervention, adapted for all levels; national, inter-Wilaya, Wilaya and communes, as well as for critical sites defined on ORSEC plans
- Stratified measures for the interventions: strategic supplies, restoration of damage, and specialized institutions, notably the creation of a "National Delegation on Major Risk", which will be established under the Prime Minister

The Law n° 04-20 is the highest level of legal means for all measures on disaster management at the stages of risk reduction and intervention (emergency response), but it does not deal with rehabilitation and reconstruction, which is a latter stage of the disaster management cycle.

It is scheduled that the Law be followed by at least 10 decrees which will fix details for implementation such as organizations, procedures, methodology, particular rules, etc. One of the decrees, concerning the National Delegation of Major Risk has been drafted and will be in discussion for finalization. Other decrees will be finalized by the National Delegation to be established in accordance with the new decree.

(4) Institution of Particular Issues on Disaster Management

1) Laws and regulations for the design of buildings

A brief history and contents of seismic design codes to date is presented below:

- There was no official seismic design code in Algeria until 1955.
- AS55 was introduced in 1955 and PS62 to PS69 were introduced from 1962 to 1969. Those were guidelines and recommendations only, and there was no obligation for them to be incorporated in building design.
- The first code of Algerian Earthquake Design Requirements (RPA) appeared as RPA81 in 1981 after the El Asnam earthquake on 10 October 1980. This was revised in 1983 as RPA83. RPA81 and RPA83 prescribed obligations for public buildings but not for private buildings.
- RPA99 was introduced in 1999. The objectives of this code were outlined as requiring 'Essentially elastic behavior of a structure while facing a relatively frequent moderate seismic event' and 'no collapse or loss of stability while facing a rare major seismic event'. Seismic design code RPA99 was revised as RPA99/Version 2003 by an order of MHU on 4 January 2004, according to the revision of seismic zones with higher design accelerations in Algiers after the

Boumerdes earthquake on 21 May 2003. The regulation applies to all buildings, public and private.

2) Laws and regulations for land-use and urban planning for disaster management

Law n° 90-29 of 1 December 1990, concerning land development and urban development, was promulgated, aiming at regulating suitable land use in the framework of inter-sectoral and environmental balance. The law defines urban development instruments constituted by PDAU ("Plan Directeur d'Aménagement et d'Urbanisme", or the "Land Development and Urban Development Master Plans" in English) and POS ("Plan d'Occupation des Sols", or the "Land Occupation Plans") with spatial and inter-sectorial functions for each category. The PDAU determines four (4) categories for a commune concerned or an association of communes: 1) urbanized, 2) to be urbanized soon, 3) to be urbanized in the more distant future, and 4) not to be urbanized.

A procedure for launching PDAU for an area of less than 200,000 inhabitants begins with a draft preparation through the initiative of the president of the Communal People's Assembly (APC), then, consultation in public hearings, and finally, submission to Wali for approval. For an area of 200,000 to 500,000 inhabitants, the draft is sent to the Minister of housing and urban planning for approval. For the Commune or association of Communes, the draft is approved by an executive decree.

POS stipulates land use, condition of construction, and detailed regulations for development with layout drawings of houses, infrastructures, and other establishments. The draft POS comes into force through draft preparation with the initiative of APC, public hearings, and approval by APC.

Law n° 90-29 prescribes rules and procedures for issuing a building permit. Although Law n° 90-29 takes into account natural, cultural and historical spaces to be protected, it mentions "risk" only in a general manner in Article 69 without a detailed description for promotion of disaster management measures.

Law n° 04-05 of 14 August 2005 amends Law n° 90-29 and supplements it, particularly regarding the limitation land development where natural and technological risks are foreseen. The Law requires that seismic zones, in particular, must be identified and classified according to degree of risk, and architects and approved engineers should be engaged in construction projects. Law n° 04-05 adds provisions concerning demolition of structures built in violation of urban development and construction rules.

Although the new provisions of Law n° 04-05 move in the direction of prevention of damage due to natural disasters, especially those by earthquakes, particular construction projects require rapid development without administrative lassitude, contrary to the objectives of the law for control over urban development and management of risks. The above-mentioned situation causes difficulty in controlling all the construction strictly in accordance with the law.

3) Other decrees for risk management

- Executive Decree n° 90-402 of 15 December 1990, regarding organization and operation of the funds for natural disasters and major technological risks
- Executive Decree n° 03-332 of 8 October 2003, regarding creation, organization and operation of the National Operational Centre for Support and Decision (CNAD)
- Executive Decree n° 04-181 of 24 June 2004, regarding creation of the commission of communication related to the major natural and technological risks
- Executive Decree n° 04-268 of 29 August 2004, regarding identification of the natural events covered by insurance and the methods of declaration of a state of natural disaster

Appendix 5.1 presents a list of the Laws and Decrees related to risk reduction and crisis management, and Appendix 5.2 presents related institutions at all levels. Appendix 5.3 gives a summary table of the Laws and Decrees, stipulating missions and organization of all institutions concerned with risk reduction and crisis management, followed by a summary of the content of the listed Laws and Decrees.

(5) Issues for further improvement

1) Schedule of promulgation of new decrees

Law n° 04-20 stipulates that the implementation mode and detailed procedures about the following will be established by other regulations:

- Mode of organization, promotion, and support of any information campaign or action on risk reduction and crisis management
- Implementation mode for training
- Organization and procedures on restoration of buildings damaged by seismic and geologic hazards
- Mode of planning for vulnerability studies on strategic buildings
- Mode of elaboration and achievement of prioritized reinforcement plans of strategic buildings
- Mode of setting up, management, and particular rules on launching the ORSEC plan
- Formulation of modules and mobilization procedures for each category of the ORSEC plan
- Mode of requisition of necessary persons and materials for crisis management
- Condition, elaboration, and adoption of particular intervention plans for each risk and hazard
- Mode of elaboration and implementation of internal plans of industrial installations for intervention
- List, manner of reserving, management, and use of strategic reserves for crisis management
- Conditions and mode of financial assistance for disaster victims
- Mission, organization, and function of the National Delegation for Risk prevention and Crisis Management (DNRM)

The mode and details will be established by new decrees to be promulgated in the near future. The drafts of the new decrees are scheduled to be sent to the cabinet secretariat in order to secure consistency among the decrees, but so far, none of the drafts has been submitted to the cabinet (as of June 2006). According to some newspapers, the decrees will be proclaimed in 2006, but no schedule of promulgation has been announced officially. The study team will make particular recommendations or suggestions on the new framework after obtaining and studying the drafts.

2) Background and key issues of further improvements

- Strong Initiative by the President and the Prime Minister

In Algeria, the President of the Republic exercises initiatives in the field of disaster management and related fields. For example, the President's speech at an international symposium in March 2004 had a positive influence on raising awareness and increasing activities for disaster prevention. During the crisis management following the Boumerdes earthquake, the President's quick response led to deployment of rescue and relief activities, as summarized in Table 8-4 in sub-section 8-4-3. The President also implemented initiatives for the provision of houses to the victims of the Boumerdes earthquake.

The President possesses several powers in the government, including responsibility for national defense. A new system of disaster management will be formulated respecting the powerful initiative of the President.

Table 8-2 Powers of the Three Branches of the Algerian Government

Executive power	The President of the Republic is elected by vote for all incarnates of the nation and exerts the supreme office within the limits fixed by the Constitution. He is responsible for national defense, chairs the Council of Ministers, names the Prime Minister, and signs the orders in Council. He names the civil and military officials of the State in particular, the President of the Council of State, the Secretary-General of the Government, the Governor of the Bank of Algeria, the magistrates, and the persons in charge for the concerned safety units, Walis. The Prime Minister (CG) proposes the ministers with the nomination by the President of the Republic and submits his program to the Council of Ministers. He subjects his program to the National Popular Parliament (APN) for approval, with communication with the Council of the Nation (CN). The CG carries out and supports the program adopted by the APN. It annually presents a declaration of general policy at the APN and CN. The CG chairs the Council of Government. He/she signs the executive decrees and names the officials of the State. The application of the Laws comes under the lawful field of the CG.
Legislative power	Parliament is made up of two rooms, the National Popular Parliament (APN) and the Council of the Nation (CN) and controls the action of the Government. The members of the APN (appointed) are elected by the vote of all. The members of the CN (senators) are elected, 2/3 among and by the members of the Communal Popular Assemblies (APC) and of the Popular Parliament of Wilaya (APW) and 1/3 by appointment from the Chairman of the Republic. The private bills arise through the initiative of the CG and the deputies. They are presented in the Council of Ministers after seeking the opinion of the Council of State before deposit on the desk of the APN. In the event of a vacancy in the APN or during the time of recessions of the Parliament (2 per annum, 4 months minimum), the President of the Republic can legislate by ordinance, the text of which he submits to the Parliament for adoption during the following session.
Judicial power	The judicial power is independent and is exerted in the name of the Law. Justice is returned to the people. All the bodies of the State are required to carry out the decisions of the court. The judge obeys only the Law. The magistrate is responsible to the Higher Council for the Magistrature. The Law protects defendants against any abuse or any deviation by the judge and the right to a defense is recognized. The Supreme Court (CS) is the regulating body for the activity of the courses and the courts. The Council of State (EC) is the regulating body for the activities of the administrative jurisdictions. The Higher Council of the Magistrature is chaired by the President of the Republic. He decides nominations, changes and the career profiles of the magistrates.

- **Influence of the French Disaster Management System**

Although a new system for disaster management will not established until related decrees to Law 04-20 are launched, the new system could be of a similar framework to the French system. The latter is based on the Ministry of Environment being the main jurisdictional authority for risk reduction before an event. The Ministry of Interior is mainly for crisis management, and other concerned ministries respectively control the rehabilitation and reconstruction. It seems that continuity or coordination for integrated or overall disaster management before, during and after a disaster are not well established. This may be due to the fact that major risks that threaten governance of a nation seem to be "technical risks", such as nuclear accidents and armed invasions. Although France suffers from natural disasters such as forest fires, floods and heat waves, the affected areas are mainly in the south and west of the nation, not in the capital, Paris.

Algiers, the capital, is being threatened with seismic risk, and Algeria is in a different situation from France, where there is little seismic risk to the capital, Paris. It is therefore recommended that the system to be established for disaster management not be similar to the French system.

- **National Delegation for Major Risks (DNRM)**

As described in Law 04-20, the National Delegation for Major Risks will be established under the authority of the Prime Minister in order to assess and coordinate actions on risk reduction and crisis management. This will follow the promulgation of a new decree, which will define its mission, organization, and function. Although the details of the National Delegation have not been announced, it should be a permanent committee, consisting of Ministers and representatives of concerned sectors along with associated technical teams and an administration office (secretariat), in order to deal with all the matters in disaster management. Continuity or coordination for integrated or overall disaster management before, during and after disasters should also be secured and maintained by the National Delegation.

- **The Community**

In Algeria, many people changed their place of residence during the Algerian independence in 1962 and the conflicts in the 1990s. According to the results of the social survey in this study, the duration of current residency of the majority of the population is about 26 years, and only 10% of residents have remained in the same location since the independence. Cohesion of people in communities of Algiers seems to be rather loose. Socialism introduced after independence appears to have adversely affected the cohesion of society. Since public services cover a wide range of sectors in urban areas, there is some difficulty associated with voluntary or community activities, although liberalism has been promoted. For example, it is sometimes difficult to achieve a consensus among inhabitants on street cleaning or repairing an elevator in an apartment, because the inhabitants consider that those are a part of the official services.

At the time of the Boumerdes earthquake, initial communication of damage was achieved smoothly through community leaders in the Wilaya of Boumerdes. However, no similarly smooth link was reported in the Wilaya of Algiers.

Therefore the issue is how to reinforce community activities for disaster management or how to establish a functional disaster management system in a population with weak cohesion.

- **Raising awareness**

The catastrophic disasters like the Boumerdes earthquake and Bab el Oued flood are still fresh in the memory of most Algerians. After the Boumerdes earthquake, the awareness of people regarding earthquake disaster prevention has developed well, as shown in the results of the social survey; 95% of respondents showed a positive response to gaining knowledge on disaster prevention; 53% of respondents intended retrofitting at an average cost of 13% of the building cost; while 47% of the respondents think "an earthquake is fate".

An issue is how to maintain the people's intentions and increase awareness in order to reinforce their efforts to reduce damage, even if an earthquake is thought to be due to "fate". People also prefer to receive information or knowledge through TV and radio.

- **Media**

Freedom of the media in Algeria is of high priority from the upper levels of Government. On the other hand, some press agencies disperse unreliable news, which could lead to a misunderstanding of events and confusion of the public, although poor media coverage will be screened and removed through people's selection processes. It is important to provide support to the media in its acquisition and dissemination of correct information.

An issue is how to examine and define the manner for dissemination of information from officials to the media and thence to the people, both for risk reduction and crisis management.

- **Insurance**

Indemnification of victims of natural disasters is processed according to Order n° 03-12, dated 26 August 2003. Although detailed records of the indemnification of victims of the Boumerdes earthquake were not available to this study, interview results indicate that indemnification of the victim families has been processed. In order to assist rehabilitation activities and share the risks, official support or incentives will be considered for purchasing insurance by individuals or small business owners.

An issue is how to establish legal and organizational systems for official support and incentives to inhabitants for enhancement of the insurance system, together with a system for raising awareness.

8-2 Institutional and Organizational Systems

A general description of Institutions and Organizations concerned with Disaster management and Risk Prevention and Reduction is given hereafter.

8-2-1 National Level

(1) Ministry of Housing and Urbanisation (MHU)

1) Central Office

(A) Mission

The Minister of Housing and Urbanisation has the responsibility for national policy, plans, and implementation regarding housing, urban development, construction in compliance with government general policy and the state action program and the Laws and regulations in force. The Minister reports the results of concerned activities to the Prime Minister, the Government Counsel, and the Ministers' Board with respect to standards, terms and commitments.

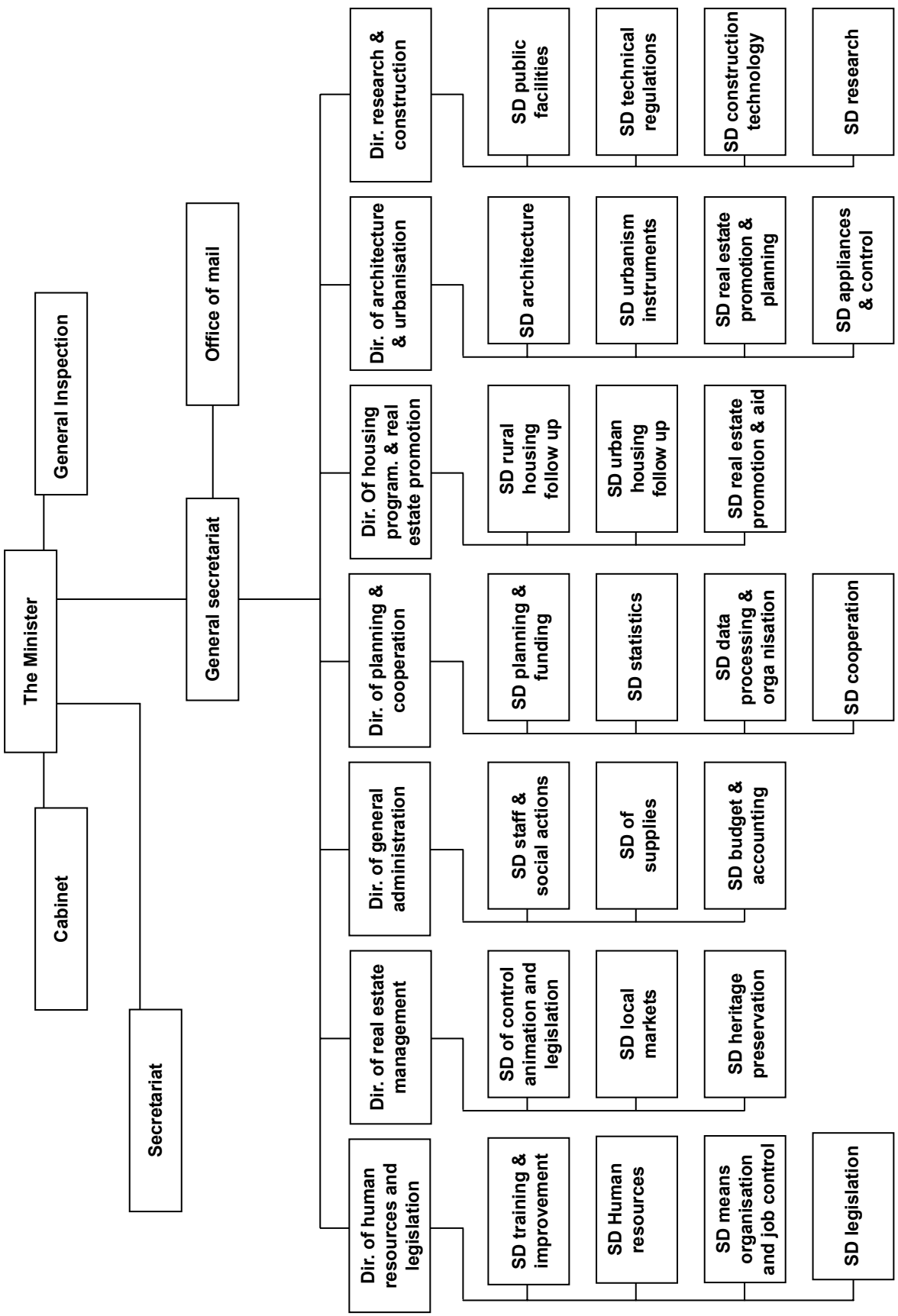
Regarding risk reduction, the Ministry is particularly concerned with;

- In terms of housing, to establish strategies for housing development, for installation and management of estates, and for the maintenance and preservation of heritage,
- In terms of urban development, planning and implementing urban development activities that contribute to national plans in the urban areas. The activities of urban development include the definition of rules on land use for the installation of houses, facilities, and infrastructures for economic, social and cultural development. The activities also include setting up of instruments for all urban planning in compliance with the national and regional country planning schemes in particular,
- Elaborating and implementing technical & functional prescriptions corresponding to constructions,
- In the scope of construction, defining building material standards, and regulating the use of the materials as well as regulating building jobs and markets.

For those purposes, the Minister develops and implements legislative measures.

(B) Organization

The organizational chart of the Ministry of Housing and Urbanisation is shown in the following figure:


The Minister
General Inspection
Cabinet
Secretariat
General secretariat
Office of mail
Dir. research & construction
SD public facilities
SD technical regulations
SD construction technology
SD research
Dir. of architecture & urbanisation
SD architecture
SD urbanism instruments
SD real estate promotion & planning
SD appliances & control
Dir. Of housing program. & real estate promotion
SD rural housing follow up
SD urban housing follow up
SD real estate promotion & aid
Dir. of planning & cooperation
SD planning & funding
SD statistics
SD data processing & orga nisation
SD cooperation
Dir. of general administration
SD staff & social actions
SD of supplies
SD budget & accounting
Dir. of real estate management
SD of control animation and legislation
SD local markets
SD heritage preservation
Dir. of human resources and legislation
SD training & improvement
SD Human resources
SD means organisation and job control
SD legislation

The Directors concerned in particular with risk reduction are as follows:

The Directors that are most concerned with risk reduction, are the Director of Human Resources and Regulations (DRHR), Director of Planning and Cooperation (DPC), Director of Housing and Real Estate Promotion Programs (DPHP), Director of Architecture and Urbanisation (DAU), and the Director of Research and Construction (DRC).

2) Decentralized services in the Wilaya

The Director of Urbanisation and Construction (DUC) was set up in the Director of Country Planning, Urbanisation and the Deterrence and Reduction of Precarious Housing (DATUPRHP) for the Wilaya of Algiers, and the Director of Housing and Public Equipment (DLEP).

3) Organizations under authority of MHU

There are several organizations relating to risk reduction under the authority of MHU, those are the National Fund for Housing (Caisse Nationale du Logement-CNL), Offices for Housing Promotion and Management (OPGI), National Agency for Housing Improvement and Development, National Earthquake Engineering Centre (CGS): the National Centre of Research and Integrated Building Studies (CNERIB), and the Fund for Mutual Guarantees.

4) Institution under authority of MHU ;National Centre for Earthquake Engineering (CGS)

(A) Purpose of establishment

The Chlef earthquake on 10 October 1980 resulted in serious damage and raised concerns about disastrous future earthquakes. The Algerian Government decided to establish this centre, considering clarification and reduction of risks of future earthquake.

CGS has contributed to elaboration of several preventive measures such as preparation of seismic risk maps and the revision of seismic standards, playing a pivotal role of in organizations concerned with seismic risk reduction.

(B) Mission

The approach targeting risk reduction includes the following actions.

- Conducting research for better knowledge of seismic activity, earthquake behavior of structures, and ground/structure interaction, in order to formulate or improve regulations on construction
- Training of technical officers and distributing information on research results
- Disseminating the technical regulations on construction for proper application
- Conducting studies on appropriate land use planning

(C) Legal text on CGS

Decree n°85-71 of 13 April 1985 concerns the establishment of CGS. It has been modified by Decree n°86-212 of 19 august 1986. Decree n°83-521 of 10 September 1983 specifies the status of the research centers.

(D) Organization

For fulfilling the missions, the following four (4) scientific and technical departments and a general secretariat have been organized.

- Seismic hazard Department (DAS)
- Seismic microzoning Department (DMS)
- Seismic engineering Department (DGS)
- Law and seismic risk reduction Department (DRS)

5) Another institution under authority of MHU; National Organization of Construction Technical Control (CTC)

(A) Background

The CTC was established in 1971 and extends its coverage all over the national territory with regional directorates and offices. Regional divisions were set up in 1986 as socialist companies, then later, each division was converted to its current status as an economic public enterprise (EPE/Spa) in 1990.

(B) Organization

The CTC organization consists of the central directorates (Finance and administration directorate, technical directorate, etc.) and operational units (Agencies) located in Wilayas where the company is working.

(C) Activities

The technical control and standardized inspection of construction for risk reduction are major activities of CTC. The activities target the reduction of risk of substandard constructions, considering cost and safety as well as function.

The control of construction consists of two phases.

- The first phase is control of plans (inspection of drawings and calculations)
- The second phase is control of construction work (visual inspection and testing)

Secondary activities are specific studies, technical assistance, laboratory tests, and various technical evaluations of constructions.

CTC prepares technical references related to the control operation based on legislation and construction standards, aiming at regulating the scope, guaranteeing safety, and securing durability.

A point to be considered is that the above-mentioned control is compulsory only for public constructions (except for the Wilaya of Chlef, which requires the control for private constructions).

(2) Ministry of Interior and Local Collectivities (MICL)

1) Organization of the Ministry

(A) Mission

As prescribed in Executive Decree n° 94-247 of 10 august 1994, the mission of the Minister includes the management of catastrophes regarding public security, national interest and emergency operations, coordination of activities regarding local development, territorial organizations, the environment, and civil protection.

Concerning the civil protection, the Minister has the following missions.

- Protecting people and property against incident risks, natural disasters or social disturbance,
- Examining, simulating and controlling civil protection matters at a national level,
- Simulating and arranging risk reduction plans,
- Coordinating organizations based on intervention/relief plans in the event of disasters,
- Coordinating and controlling the operation of the civil protection services,
- Promoting collaboration among institutions that are dealing with environmental preservation,
- Contributing to the implementation of civil defense programs.

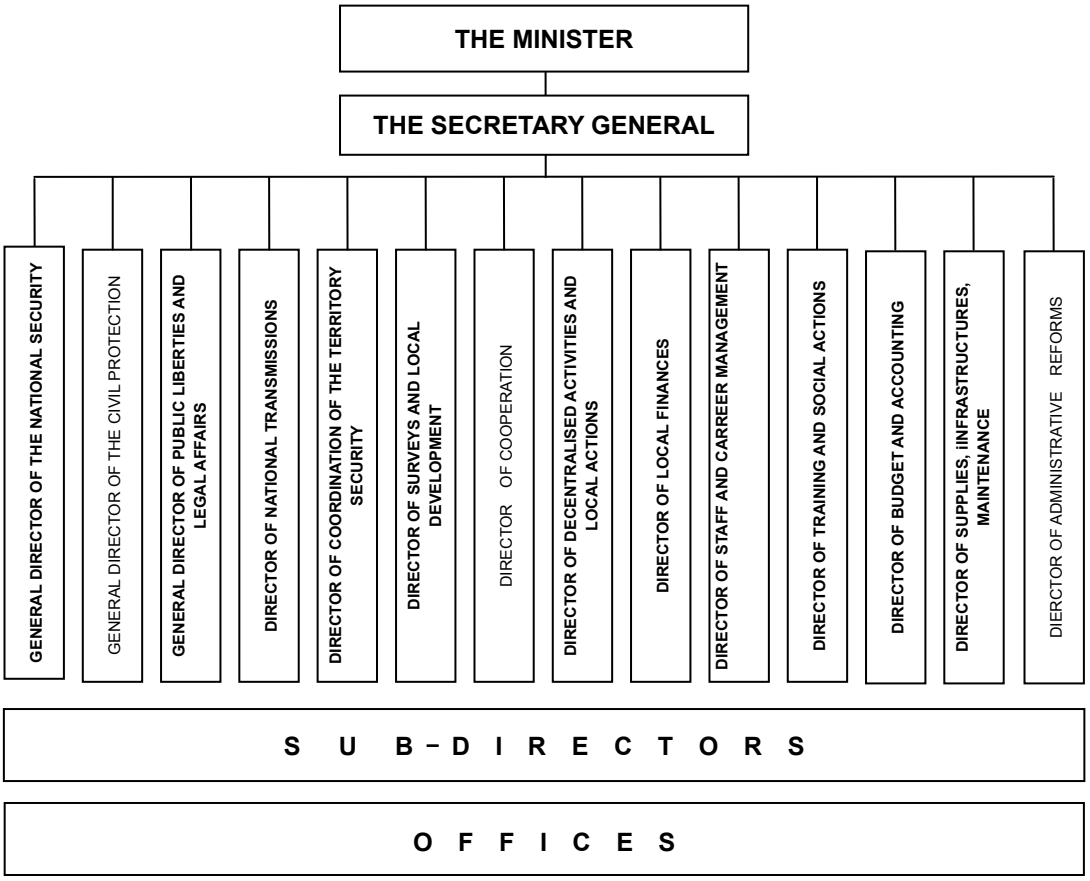
It should be noted that missions regarding environmental conservation and risk reduction are assigned to other ministries, such as the Ministry of Country Planning and Environment and the Ministry of Housing and Urbanisation. The missions should be defined more coherently in the future in the new decrees for implementation of Law 04-20.

(B) Organization

The following directors are concerned with disaster management:

- General Director of Civil Protection (DGPC),
- Director of national transmissions,
- Director of coordination and territory security,
- Director of decentralized activities and local act control,
- Director of studies and local development,
- Director of training and social action, and
- Director of supplies, infrastructures and maintenance.

Most of the time, DGPC controls the coordination and coherence of actions related to intervention in the events of crisis when ORSEC plans are launched.



2) General Director of Civil Protection (DGPC)

(A) Mission

Missions of DGPC have been specified in Decrees n°85-231 and 232 as well as Law n°96-138. The DGPC is in charge of the implementation of the general risk reduction policy related to natural and technological hazards. DGPC has a mission to define the conditions and terms of the concerned authorities at all levels (State, inter-Wilayas, Wilayas, Communes, etc.) on intervention and relief in the event of disasters. In addition, DGPC has to efficiently coordinate the implementing means, through training, information to the public, and the optimization of resources and means.

(B) Organization

Decree n° 91-503 of 21 December 1991 specifies the organization of DGPC. It is presented in the following chart.

The central administration of DGPC consists of inspection services as follows.

- The risk reduction director, which is in charge of sub-directors of studies/regulations, major hazards, statistics, and information.
- The director of organization and relief coordination is in charge of sub-directors of operational planning, operations, medical relief, communications, and operational links.
- The staff and training director is in charge of sub-directors of staff, training and social action.
- The logistics and infrastructure director is in charge of sub-directors of budget/accounting, infrastructures, and equipment/logistics.

3) Research Centre for Astronomy, Astrophysics and Geophysics (CRAAG)

(A) Background

CRAAG was established in 1985 with centers in the Bouzareah astronomic observatory, built in 1890, and the institute of physics of the Algiers Globe in 1931.

(B) Mission

The following are missions of CRAAG, relating to risk reduction, information, and training.

- Monitoring seismic activity and events
- Updating maps on seismicity and seismo-tectonics
- Evaluating hazards and risks for reduction
- Conducting studies for prediction of earthquakes
- Informing the public of seismic risks

(C) Activity

CRAAG carries out several studies on seismicity and seismic risk mitigation, and also seismicity monitoring. CRAAG carries out public information services and education concerning seismic risk and its systematic reduction, and in particular, the production of French and Arabic booklets for education and raising awareness. This institution is committed to those issues in cooperation with national and international organizations in the same field and contributes to the training of graduate and post-graduate students in cooperation with the universities.

(3) Ministry of Environment and Land-Use Planning (MATE)

(A) Mission

The missions of MATE are prescribed in Executive Decree n° 01-08 of 7 January 2001 as follows.

- In terms of sustainable development, the Ministry is in charge of;
  - Elaborating, proposing and implementing the national development plan and strategy on environmental preservation and sustainable development,
  - Formulation of plans and regulations for the development of cities, and balanced distribution of activities, equipment and population,

  - Development and optimization of all infrastructures and resources, with consideration for preservation of vulnerable areas such as coasts, mountains, steppes, the southern part of the country and bordering areas,
  - Elaborating, proposing and follow up of the governmental action plan.

- In terms of standards and regulations, the Minister is in charge of;
  - Environmental impact assessment of country planning and development projects,
  - Implementation of technical regulations and standards related to country planning and environment.

- Regarding the environment, the duties of the Minister are;
  - Proposing rules and measures for control of pollution, environmental deterioration and public health problems,
  - Elaboration and implementation of governmental action plans,
  - Proposing rules and appropriate measures for preservation of natural and biological resources and of ecosystems.

- The Minister promotes scientific and technical research regarding environmental preservation and sustainable development.

- The Minister supports the smooth operation of central & local organizations under the Ministry, the international collaboration of concerned authorities, and development of human resources in the field of environmental preservation and sustainable development.

- The Minister establishes information systems for the fulfillment of the missions and duties through preparation of the objectives, organizations, and human, material and financial resources.

Some of the above-mentioned missions can not be clearly differentiated from missions assigned to other Ministries, particularly missions related to risk reduction. Although disaster management (risk reduction and crisis management) should be promoted national wide, the missions of each Minister should be clarified. In the present situation, it seems that there are some duplicate, missing, and conflicting activities on disaster management, which may be caused by the unclearly assigned missions among the Ministries.

(B) Organization

Executive Decree n°01-09 of 7 January 2001 prescribes organization of MATE as follows.

- Secretary General, and Principal Private Secretary
- Directors
  - The General Director of Environment,
  - The Director of Prospective studies, General Studies and Programming of Land Use Planning
  - The Director of Regional Action, Synthesis and Coordination
  - The Director of Great Works of Land Use Planning

- The Director of Urban Development
- The Director of Legal Affairs
- The Director of Cooperation
- The Director of Administration and Logistics

The General Director of environment ensures that urban and industrial "milieus" are prevented from causing pollution or damage. The General Director accomplishes this through activities such as the monitoring of the environmental conditions, the approval of environmental impact studies, and the promotion of training, education, and communication in the field of the environment. The General Director is in charge of;

- The Director of Urban Environmental Policy,
- The Director of Industrial Environmental Policy,
- The Director of Preservation of the Biological Diversity and Natural "Milieux" ,
- The Director of Communication, Awareness and Environmental Education, and
- The Director of Planning, Studies and Environmental Evaluation.

Decree n° 01-10 of 7 January 2001 prescribes the mode of operation and general inspections of the Ministry of the Environment and Land use Planning.

(C) Activity

In relation to risk reduction, the Ministry of the Environment and Land use Planning is responsible for the coordination of service activities with respect to Law n° 04-20 of 29 December 2004, regarding risk reduction and disaster management as far as sustainable development is concerned.

8-2-2 Local Level (Wilayas and Communes)

(1) Legal and institutional framework

At the level of the Wilaya, Law n° 90-09 of 7 April 1990 regulates the operation of institutions. The Law encompasses the following assignments:

- Organization of Wilaya,
- APW (Assemblée Populaire de Wilaya: Popular Assembly of Wilayas),
- Assets of APW,
- Power of Wali as regards APW executive and State representatives,
- Administration of Wilaya,
- Finances of Wilaya.

Decree n° 83-873 of 8 May 1983 prescribes the powers of the Wali in terms of maintenance of public order. Executive Decree n° 96-417 of 20 November 1996 prescribes, in particular, the organization and function of the Wilaya of Algiers. Ordnance n° 97-14 of 31 May 1997 concerns Algiers' territorial organization.

Presidential Decree n° 2000-45 of 1 march 2000 modifies Presidential Decree n° 97-292 of 2 august 1997 that described the administrative organization of the Governorate of Greater

Algiers, re-defining the status of Wilaya and the creation of administrative "circonscriptions" (districts), managed by "Wali délégués" (delegated Wali).

At the Commune level, Law n° 90-09 of 7 April 1990 regulates its activities. The Law prescribes the following;

- Organization of Communes,
- Administration body of Communes, that is APC - Assemblée populaire communale (Communal Popular Assembly) and the President of the APC,
- Administrative position and internal administration of Communes,
- Finance,
- Tasks and functions.

Concerning disaster management, Decrees n° 85-231/85-232 and Law 04-20 regulate the function of Wilaya and Communes. Similarly, the Laws in 1990 and 2004 regulate the planning and land use of Communes.

(2) Organizations related to disaster management

1) Wilaya

(A) Organization of Wilaya

Under the former Law n° 90-09, the local planning and implementation of Wilaya was carried out under the authority of APW. After the recession of Wilaya territory, APW dealt with the same fields, which are establishment, initiation, and implementation of Wilaya plans, infrastructures, educational & professional training, housing, etc.

Decree n° 96-417 stipulates the following structure in Wilaya;

- General secretariat,
- Security delegation,
- General inspection,
- Cabinet.

External services of ministerial departments in Wilaya are z Director of the civil protection of Wilaya (DPCW), Director of land use planning, urbanisation, prevention and reduction of precarious housing (DATUPRHP), Director of lodgment, and other Directors on equipment, public works, hydraulics, and health, etc.

Other Directors of Wilaya services, relating to disaster management, are as follows.

- Director of regulations,
- Director of general affairs,
- Director of the budget and heritage management,
- Director of the local administration,
- Director of the administration and logistics,
- Director of human resources,
- Director of economic, social and cultural development,

- Director of district development and restructuring, attached to the DATUPRHP (Director of Land-use planning, Urbanisation, Prevention and Reduction of Precarious Housing).

(B) Director of lodgment of Wilaya (DLW)

The missions of DLW are as follows:

- To propose housing policy, through periodic evaluation, based on the condition of the Wilaya,
- To create the conditions for the realization of house construction in cooperation with concerned organizations such as "collectivités locales" (local institutions) and the promotion of private investments,
- To initiate study on rural & modern housing techniques in compliance with local specificities,
- To confer admission to specialists necessary for the study and management of construction work, and delivering construction licenses,
- To monitor and inspect the study, public equipment, and construction,
- To approve legislative and regulating texts in terms of public accounting, markets and workforce.

There are three service sections and several offices in DLW as follows.

- Housing service consisting of three offices
  - Office of social housing
  - Office of public allowances
  - Office of development and real estate promotion
- Public equipment service consisting of three offices
  - Office of appraisal studies and market formalization
  - Office of management and follow up of operations
  - Office of accounting management of operations
- Service of administration and supplies consisting of three offices
  - Office of staff management
  - Office of the budget & accounting and supplies
  - Office of legal affairs

The following information has been acquired from an interview with the Director of Lodgment:

He is one of the Wilaya executive counsel directors. He is participating in the country planning, conducting and following up of housing operations in the Wilaya of Algiers, and for all that concerns public and private types of operations.

With respect to "the local housing plan", he performs the registration of programs according to the needs expressed in terms of housing, equipment and miscellaneous networks.

Those needs are localized in compliance with operations, institutions and prime contractors.

He is also responsible for "the housing safety", as regards the rehabilitation of Algiers constructions and old district reconstruction, in particular, those dated from the 1950's in order to give them better housing conditions: a hundred cities are concerned with this restructuring program. Following is an example of such a program.

A rich heritage of constructions dated from the 17th to the 19th centuries is under restoration. That concerns a set of 28,000 old houses. But this restoration work does not take into account earthquake resistant standards. The Director of Lodgment performs other secondary and tertiary actions, as regards housing.

The Director of Lodgment participates in the **National Program for 1,000,000 houses, by 2010:**

- **For the Wilaya of Algiers**: The National Plan was established with respect to the "Local housing plan", to 2009, corresponding to 1,000,000 houses.

  The Wilaya of Algiers is concerned with a tenth of this plan, or approximately 100,000 houses. The Director of the Wilaya already expects to increase this program by from 10 to 14%, i.e. 10,000 to 14,000 additional houses for a total of 110,000 to 114,000 houses, as a result of the contribution of private promotional programs.

  The director of housing has already selected and defined the lands for construction, in relation to the director of urbanism and communes: these lands have been selected with respect to the expressed needs and to their viability (equipment and public highways), for a minimal cost. We are actually using less agricultural land.

  This selection has been realized through a "committee for land selection" in a local plan, then a "technical committee" within the Wilaya commission. This was submitted for approval to the APW (Wilaya Popular Assembly) that establishes a decision of transfer, with respect to Decree n° 3-313 of 16 September 2003 describing the "seizing of lands by the State" (usually agricultural lands).

- **On a national plan**, the director of housing of the Wilaya of Algiers contributes to seminars with all the sector professionals and provides opinions about the things that concern the country: how and for how long to operate this program, and with which typology. International tenders have been launched in order to go beyond usual construction techniques (post beams, walls or tunnel formwork) and also to investigate additional means of construction engineering.

(C) Director of land use planning, urbanisation, prevention and reduction of precarious housing (DATUPRHP)

Missions of DATUPRHP are as follows.

- Implementing urban development and construction at the local level
- Working in correlation with the "collectivités locales" (local Institutions) services for the implementation of urban development and facilities
- Promoting activities in line with the urban development policy, improvement of the architectural quality of construction, and historical, cultural & natural sites preservation

- Undertaking all actions aimed at building improvement and housing development in compliance with the sociological geological and climatic conditions and real estate planning
- Collecting data relating to house construction (study, methodology, economy, etc.)
- Monitoring and controlling the construction costs
- Conducting technical assessment of urban development plans and activities, especially POS (land use plan)
- Controlling planning and studies of urban development, aiming at initiating communal development
- Supporting and controlling urban restoration & real estate development activities
- Preparing a inventory of buildings for preservation and management

DATUPRHP consists of three service sections and several offices as follows.

- The urbanisation service consists of three offices
  - Office of urbanisation instruments
  - Office of planning and architecture
  - Office of regulations
- The construction service consists of three offices
  - Office of studies and standards
  - Office of public equipment
  - Office of housing
- The administration and supplies service consists of three offices
  - Office of staff management
  - Office of the budget, accounting and logistics
  - Office of disputes

(D) Agency for Planning and Urbanisation of the Wilaya of Algiers (URBANIS)

The statutory missions of URBANIS (under the authority of the Wilaya of Algiers) are as follows.

- Defining public establishments, local institutions, and all the bodies aiming at the development planning and arrangement of the Wilaya of Algiers area, in collaboration with the central administrations
- Arranging policy/strategy, instruments and regulations concerning land use planning and urban development
- Integrating all activities in urban development in the Wilaya of Algiers area, in collaboration with the concerned organizations

In order to fulfill the missions mentioned above, URBANIS has responsibility for;

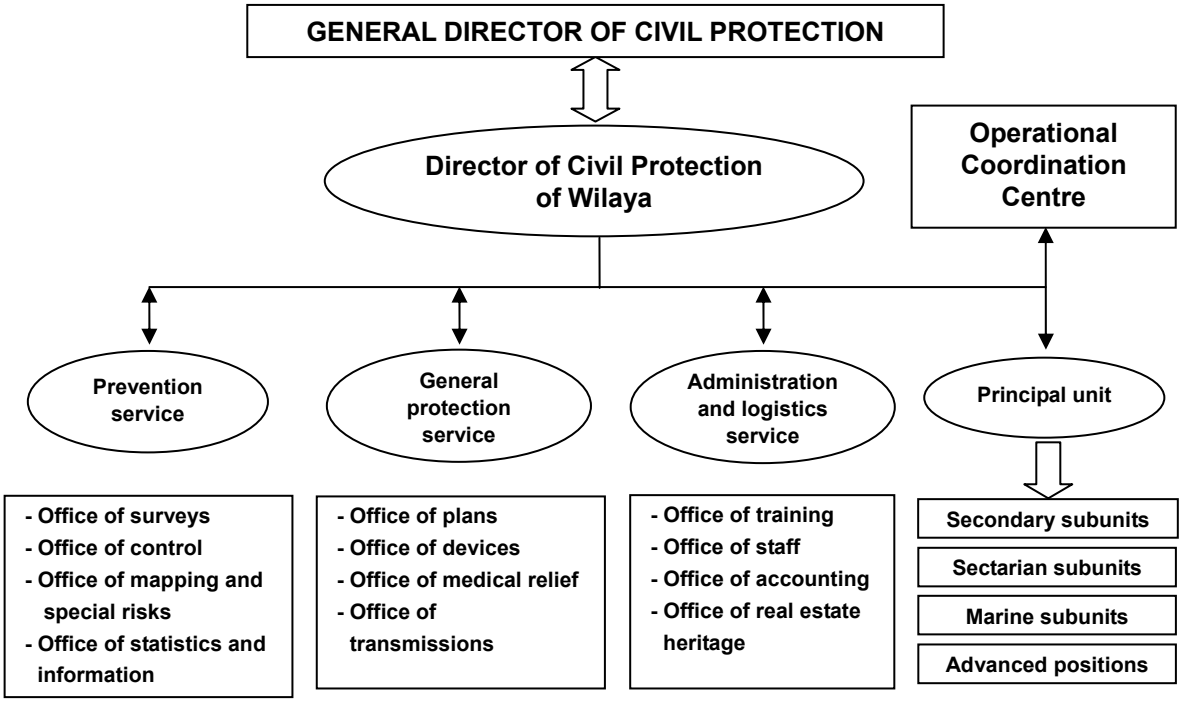
- Conducting studies for guidance, control and direction of urban development of the Wilaya of Algiers,
- Conducting studies for the improvement of development activities and organization of Algiers from demographic, sociological and functional aspects,
- Controlling the technical and legal compliance of all means for urban development in the Wilaya of Algiers,
- Preparing plans and measures for urban development of the Wilaya of Algiers,
- Searching, processing, and arranging economic, technical and social information on the situation and development of Algiers as well as updating the data,
- Managing archives on urban development and construction for the Wilaya of Algiers.

(E) Director of Civil Protection of Wilaya (DPCW)

The organization and missions of the DPCW are specified in Executive Decree n° 92-54 of 12 February 1992. The services of DPCW are provided from three (3) service sections. The tasks of each service are as follows.

- Risk Reduction Service
  - Controlling the implementation of regulations and security measures as regards risk reduction
  - Conducting surveys on risk and safety of public and private establishments and participating in studies related to the civil protection, initiated by various bodies in the Wilaya
  - Providing, controlling and implementing risk reduction plans
  - Initiating and organizing information campaigns about risk reduction
- The General Protection Service
  - Providing, implementing and updating crisis management plans
  - Establishing and maintaining alert networks
  - Controlling the means for relief and rescue in the event of a disaster
  - Establishing and managing measures for security of life and property
  - Implementing all measures for relief and rescue activities, managing humanitarian movement and national solidarity
- Administration and Logistics Service
  - Managing the material and financial means of the civil protection services of Wilaya
  - Maintaining equipment and infrastructures
  - Managing general accounting, bookkeeping, inventories, income and outcome of materials and goods and maintaining parking and workshops
  - Managing the careers of the staff of the civil protection of Wilaya

The organization of DPCW is shown in the following figure.



In case of an emergency that requires ORSEC plans to be launched, the Director of Civil Protection of Wilaya will coordinate the activities. More details on ORSEC plans are given in sub-section 9.3.

At the level of the Wilaya, the Operational Coordination Centre (CCO) is organized in a Principal unit consisting of 36 subunits (33 distributed throughout the Wilaya and 3 marine subunits) for services offered directly to people.

The General protection service is in charge of operation in the ORSEC plan at the level of the Wilaya, and the details are mentioned in sub-section 9.3.

2) Communes

The President of the APC (Communal Popular Assembly) represents the communes and cares for all administrative and civil activities, as prescribed in Article 59 of Law n° 90-08 of 7 April 1990.

Under the authority of the Wali (article 69), he is responsible for public order, security, safety and health as well as measures to maintain those in good condition. In an emergency, the President has the right to order security measures and demolition of walls and buildings (Article 71). Regarding relief and rescue activities, he has the right to requisition people and goods. He is responsible for urban planning and development (Article 75), and approves POS (land use plans or Plan d'Occupation des Sols).

According to Decree n° 85-231, ORSEC plans should be organized at the commune level too. In an emergency, Wali has the power of substitution (articles 81 to 83 of the Law), and the Wilaya ORSEC plan will come into force, as in cases such as the Bab el Oued flood and Boumerdes earthquake.

As regards urban planning and development, Communes play an important role in many matters such as POS (land use plans), conservation of the environment, preservation of architectural heritage sites, etc. (Articles 90 to 95). According to Law 04-05, natural and technological risks should be considered in the formulation of POS. At present, identification of risks and preparation of risk reduction plans are in slow progress, which may cause difficulty in smooth formulation of POS. The commune is also in charge of hygiene and public health preservation (article 107).

8-2-3 The Community and NGOs

(1) Legal and institutional framework

Previously, there was no definite legal framework for supporting the formulation and activity of associations or civil groups concerning risk reduction, although Decree n°92-54 mentions a bit in Article 2 about linkage between the General protection service of DPCW and relief activities.

In spite of the remarkable contribution of NGOs in assisting victims in the events of the Bab el Oued floods and Boumerdes earthquake, no official action has been taken for associating NGOs to risk management processes.

The Red Crescent Association provides proposals to the public authorities on actions in an emergency based on their experience with national and international cooperation in disaster management as described below.

(2) Organizations related to disaster Management

1) The Algerian Red Crescent (CRA)

(A) Background

The CRA was the first humanitarian organization in Algeria and is supported by thousands of volunteers, providing humanitarian emergency help to people in the country. Created in Tanger (Morocco) in 1956 during the country's liberation war, CRA was created with the support of the Algerian authorities who were carrying out the war of independence at that time. Both male and female volunteers that joined the CRA had provided remarkable aid to people in restricted zones and refugee camps at the frontiers.

In 1960, the Provisional Government of the Republic of Algeria (GPRA) applied to the International Committee of the Red Cross in Switzerland for membership in the Geneva Convention. The creation of the CRA was prescribed in the Decree of 3 September 1962, as one of the first eminent steps of the new government of Algeria.

(B) Mission

The CRA endeavors to prevent and alleviate human suffering while maintaining its impartial and neutral status. There is no religious or political discrimination regarding anyone who needs assistance. Every year, thousands of volunteers

respond to CRA's call for donation of blood and food, especially during the holy month of Ramadan.

The CRA endeavors to sustain universal solidarity and humanitarian principles. The activity is volunteer based respecting to conscientious movement at national and international levels (solidarity & cooperation).

(C) CRA Structure

The CRA is based in the 48 Wilayas of the country. Supported by a volunteer ship, CRA invites the participation of any people who are willing to provide assistance in accordance with CRA's mission and regulation. It combines regular members, honorary members and supporting members. They provide annual donations and participate in humanitarian actions. The CRA is represented by elected delegates in the following units.

- General Assembly
- National Counsel
- Leading Committee
- Mandatory Commissions
- Local and Regional Organizations

The CRA headquarters office implements and controls the national and international activities of the organization ensuring the coordination of the Wilayas committees' activities.

2) Others organizations

Other organizations and NGOs have provided assistance immediately after the past disasters. Except for the Red Crescent and some others, most of these organizations have taken impartial actions for assisting the population, often in an efficient manner, as was the case for "Touiza Solidarité", "Village enfants SOS", "les Amis de la terre", Handicap International, etc.

Some of these organizations and NGOs work in the field of information, but few organizations work for risk reduction such as education, training, and raising awareness.

8-3 Disaster Management Plan

8-3-1 Introduction

Considering the serious damage incurred due to the past disasters, the Government is willing to improve the conditions on risk reduction and crisis management as it has been demonstrated in **Law n° 04-20 of 25 December 2004.** Following the Law as well as the intention, a crisis management system has been established through the improvement of ORSEC plans and several efforts of DGPC and concerned organizations and their performance was confirmed at the time of the Bab el Oued floods and the Boumerdes earthquake.

It can be said that there is no perfect condition in terms of disaster prevention, because natural disasters are sometimes too huge to control. On the other hand, capability to deal with natural

disaster should be improved continuously to improve the conditions. In Algeria, establishment of the Major Risk National Delegation (DNRM; Délégation Nationale aux Risques Majeurs) was one of the most important steps for the improvement as is prescribed in Law n° 04-20; however, DNRM has not been established as of September 2006. Formulation of the Disaster Management Global Plan in Algeria (national policy, strategy, and action plan) will be an urgent task of DNRM for comprehensive and systematic disaster management.
In the global plan, the following issues will be included for comprehensive and systematic disaster management in all the stages (before, during and after disaster).

- Collaboration with task sharing among all the official organizations concerned with disaster management
- Cooperation between official and private organizations for disaster management in all the stages, particularly on securing and restoring lifelines and infrastructures (gas, electricity, water, telecommunications, roads, etc…)
- Involvement and enhancement of individuals, communities, and NGOs in all stages of disaster management
- Installation of a disaster management centre through the initiative of DNRM, for coordinating, monitoring, promotion, etc.
- Promotion of continuous efforts on strengthening buildings with legal, organizational, physical, and promotional measures
- Creation and maintenance of open spaces for evacuation and sheltering within the framework of well established land use and urban development plans, particularly in highly urbanized areas
- Creation of warehouses and storage for emergency materials
- Promotion and enhancement of policies, systems, and application of insurance against natural disasters
- Installation of reliable communication systems, not only for emergencies, but for all the stages of disaster management
- Promotion and enhancement of academic, engineering, social, medical, and psychological studies and research for continuous improvement of the knowledge and techniques of all related fields

These points are described once again in Chapter 11 concerning recommendations for the improvement of disaster management.

As mentioned above, the ORSEC plan is an operational action plan for crisis management in Algeria. The plan itself and crisis management activities in accordance with the plan are prominent components in Algerian disaster management, which have been launched two times in Algiers. The plan and related activities are summarized and reviewed in the following sub-clauses.

The ORSEC plan for the Wilaya of Algiers consists of description of the introduction, mission, framework and organization, mechanism, implementation, and 14 modules (one for each organization and mission).

8-3-2 ORSEC plan: Introduction

(1) Presentation of the Wilaya of Algiers

After describing the historical and geographical background (including some geological and geotechnical aspects), the plan roughly defines the constraints in the Wilaya and points out the seismic risk in the Algiers' area.

(2) Characteristics of the Wilaya of Algiers as regards risks

The plan describes the risks of natural or technological origins, which may afflict the Wilaya of Algiers, followed by summaries of the recent disasters as follows.

Risks

- Marine, soil, and air pollution
- Fires and explosions
- Railway accidents
- traffic accidents
- Fire on ships
- Earthquake, etc.

The recent disasters

- Floods (the Bab el Oued floods on 10 November 2001, causing more than 500 deaths and dozens of missing persons)
- Landslides and house collapses
- Forest fires (the forest fire of Bainem in the summer 2001)
- Drownings in summer

An international airport and dense network of roads and railways must be seriously considered regarding the possibility of generating mass casualties. The port of Algiers is a gateway for marine transport and the first hydrocarbon filling station in the Mediterranean Sea.

Densely built up areas in the urban center with an average of 3,310 inhabitants per km² and industrial areas in the periphery (four major areas including 400 socio-economical plants) require efficient protection and risk reduction measures for the population.

(3) Review of a disaster concept

A disaster is defined as "an event or successive events causing human death and/or injury, destruction of facilities, and serous disturbance of life and lifelines". Most disasters cause problems of shortage of shelters, drinking water, food, toilets, medical supplies, etc.

For disaster prevention or reduction, the risk should be evaluated and preventive measures should be taken for minimizing or controlling the root causes, such as natural hazards. Since some kinds of hazards, such as earthquakes and floods can not be controlled, preparatory operations and prior measures are necessary for disaster mitigation.

For preparation of effective measures against possible disasters affecting the capital, the Director of Civil Protection of the Wilaya of Algiers improves relief activity organizations such as improvement of a relief module able to act in any affected areas, creation of a module for "disaster medicine", etc.

8-3-3 ORSEC Plan: Framework and Command Body

(1) General

Decree n° 85/231 of 25 August 1985, Articles 21, 29, 31 & 33, prescribes the organization for Wilaya ORSEC Plan. The ORSEC plan for Wilaya should be prepared under the authority of Wali. The Wali should establish a crisis cell and coordination organization equipped with reliable communication means. The crisis cell shall be managed by an appointed person, called the "Director of Operations". The crisis cell is responsible for;

- Search, collection and dissemination of information,
- Coordination of operations and allocation of staff and materials,
- Control of evacuation and sheltering of victims.

(2) Missions of this Framework and Command Body

Immediately after summoned by Wali, the Technical Director of Operations should take the following actions.

- Collecting and processing information
- Disseminating information to organizations concerned
- Arranging for actions to be taken
- Distributing necessary relief means
- Designating a provisional command post
- Launching ORSEC plans

Immediately upon launching the ORSEC plan, the crisis cell shall be divided in two elements; PCO and PCF as described below.

1) PCO (Poste de Commandement Opérationnel - Operational Command Post)

PCO is composed of the chiefs of modules defined in the ORSEC plan and staff. The PCO shall be set up at a safe, accessible, identifiable location, close to affected areas, in order to ensure communication for efficient coordination with the Wilaya and the organizations concerned. The PCO is the most important base for transmission of information, connecting each affected site to the assisting bodies.

This location should be well known by people in the affected areas, and communication between the PCO and the people should be secured as much as possible so that the affected people can send requests/information and receive necessary news/information, especially on rescue and relief.

2) PCF (Poste de Commandement Fixe - Fixed Command Post)

PCF is located in the Wilaya building, and composed of deputy leaders of all modules under the authority of the Deputy Director of Operations. The mission of the PCF is as follows.

- Ensuring coordination with the authorities of the PCO and the other local/central services
- Processing collected information and received instructions
- Coordinating and transmitting information and requests to the assembling points indicated by the PCO

8-3-4 Implementation Mechanism of the ORSEC Plan

Before launching the ORSEC Plan, there are two alert phases, as described in the action plan.

(1) Alert phases

1) Alert Phase n°1 (preparatory phase)

This phase is launched at the time that the possibility or threat of disaster is identified. At that time or when Alert Phase n°2 is launched in a neighboring Wilaya the Commune ORSEC plan is launched.

When the Alert Phase n°1 is launched, Wali should take the following actions.

- Specify modules concerned with the disaster
- Warn responsible persons of the concerned modules
- Ensure the presence of the responsible civil protection "Director of Operations" at the location of the disaster
- Get information on condition of preparation of the modules from the responsible persons of the modules
- Get information on the evolution of the disaster from the Director of Operations or the specialized services
- Consult the intervention plan suitable for the disaster
- Decide whether the cancellation of the Alert Phase n°1 or the launching of Alert Phase n°2 is in order

2) Alert Phase n°2

Wali declares the launching of Alert Phase n°2 in the following conditions.

- The disaster threat is confirmed (authorized by the Director of Civil Protection or by the specialized services)
- The disaster is getting serious (authorized by the Director of Civil Protection or by the specialized services)
- The extension of the disaster from an affected Wilaya to another neighboring Wilaya is occurring (possibility of launching of the national plan)

In the case of the launch of the national plan or if Alert Phase n°2 is launched, each responsible person of the modules is responsible for;

- Setting up responsible services to the level of "ORSEC permanence", and
- Informing Wali about the completion of the set up.

At the Wali's decision, the responsible persons of the modules have to be dispatched to the PCF or PCO, and start operation of the responsible modules.

(2) Implementation Phase – Release of the ORSEC Plan

Wali launches the operation in accordance with the ORSEC plan and ensures the following actions are being implemented.

- Commencing the operation of the modules concerned with the disaster
- Dispatching senior staffs to PCF
- Ensuring the dispatching the Director of Civil Protection to the PCO
- Consulting the map, showing the situation of the Wilaya, and controlling the processing of the information transmitted from the PCO
- Informing the Minister of the Interior and Local Collectives of the launching of the operation
- Informing Walis of neighboring Wilayas of the threatening situation and possible request for assistance
- Consulting the operation plan for adjustment to the real situation
- Checking the action list to be performed by the modules
- Regularly informing the central authority of the state of the disaster and making quick estimations of the situation

Concerning the PCF, responsible persons of the modules are required to take the following actions.

- Ensuring the presence of the responsible person of the module operation in the affected areas
- Ensuring the availability of the scheduled resources of operation of his module
- Checking the activity of installed troops and coordination in the module
- Checking the status of the module in the field of operation
- Controlling the mobilization of the available reserved resources

When Wali visits the affected areas, the PCF shall be placed under the authority of the Secretary General of the Wilaya.

8-3-5 Organization and Missions of the ORSEC Plan the 14 Modules

Fourteen modules have been defined for the operation of the ORSEC plan. The concerned authorities and the missions of the modules are presented in Table 8-3.

Table 8-3 Authorities and Missions of the ORSEC Plan Modules of the Wilaya of Algiers

N°	Module	Concerned authority	Mission
01	Relief and rescue	Civil Protection	- Research, rescue and the protection of life and property
02	Security and public order	National Security	- Ensure the security of people and property, and public order in the affected areas - Control the movement of people and property - Collect and register official documents
03	Medical health care, evacuation and hygiene	Director of Health	Control all operations related to health care and to disease and epidemic prevention - Control food security - Control hygiene in the affected areas - Manage sanitary treatment
04	Coordination and Telecommunications	Director of post offices and tele-communications P.T.T	- Provide relief devices for coordination and transmission. - Repair the damaged telecommunication network
05	Surveys and recommendations	D.R.A.G	- Provide technical opinions on accurate points - Estimate damage - Clarify the decision of command
06	Information	Cabinet of Wali	- Disseminate information to the affected people - Collect and process data in relation to the disaster - Release official announcements
07	Temporary housing	Director of Urbanisation	- Arrange and provide shelter to the affected people - Define the conditions of rehabilitation of the damaged houses
08	Supply of food and relief	Director of Commerce	- Evaluate and satisfy the needs for food for the affected people and assisting teams - Repair the damaged networks
09	Transport	Director of Transports	- Provide transport means
10	Hydraulics	Director of Hydraulics	- Provide water to the affected areas - Ensure water quality in cooperation with the health services - Control all actions in relation to the sector of hydraulics
11	Energy	Director of Industry and mines	- Provide energy sources to relief facilities and people - Repair the damaged network
12	Public works	Director of public works	- Provide diverse public work resources - Repair infrastructures
13	Materials and various facilities	Director of local administration	- Provide materials and facilities (accessories, tools, etc.)
14	Appraisals and balance	Director of Land-use planning	- Collect data necessary for damage evaluation, and estimated amount of relief operations - Propose actions and measures necessary for rehabilitation and reconstruction in the areas - Prepare reports on operation

8-4 Lessons Learnt from Past Disasters

8-4-1 El Asnam Earthquake (10 October 1980)

(1) General

Algeria has suffered from earthquake disasters many times as listed in Table 8-1, and the political authorities and the scientific communities of Algeria have become aware of the importance of seismic risks in the country as reminded several times and in particular as described in the magazine "Habitat & Construction n°6 (Sept-Oct 1999)" by Dr. BELAZOUGUI, the CGS Director. Since the El Asnam earthquake, the necessity of risk mitigation, particularly seismic risk, has been embedded in the Government's programs. The awful experience of the El Asnam earthquake (M=7.3) on 10 October 1980 led to the creation of the first seismic regulation "AS 55" in Algeria.

The El Asnam Earthquake caused serious damage, about 2,600 deaths and nearly 10,000 injured. More than 20,000 buildings collapsed, and more than 100,000 people lost their houses. The cost of the damage was estimated to be 2.0 billion US Dollars, and additional indirect loss was about 30% to 40% of the direct losses.

(2) Crisis management

The experience of the El Asman earthquake has been a vivid reminder for many years. The Wilaya services were not operational because most resources such as staff, buildings, and facilities were seriously damaged. The government decided that the Popular National Army (ANP) should take charge of crisis management, consisting of;

- Securing public order in the affected areas,
- Organizing the victims' health care and body treatment, considering the inability of hospitals and clinics due to damage suffered, and
- Rapid care of homeless people through the installation of tents and temporary houses.

The army worked in an authoritative way, installing all the capable forces of the nation, particularly able staff and materials (cranes, bulldozers, power-shovels, etc…). More than 20,000 houses have been constructed all around the city and another 20,000 in rural areas, in order to await the result of the microzoning study (per discussions held with Mr. AMEUR of CGS). All this organization was the basis for the definition and installation of the ORSEC plan, which was formulated later on.

(3) Building assessment

A system for assessment of damaged buildings, classifying five grades through filling out a special form for impartial assessment, was quickly developed by CTC, an organization for construction control. The CTC carried out surveys, using this form, of all of the structures of the city of ECH-CHELIFF (5,148) and all the state-owned structures (1,390), including houses, within the severely afflicted areas, with participation of a hundred engineers over two months.

The analytical result of the survey is summarized as follows.

- 34% of the buildings in Ech Chlef and 44% in other affected areas did not suffer any structural damage and those were in a safe condition for habitation.
- 42% of the buildings in the entire affected area required some repairing.
- 24% of the buildings in Ech Chlef and 14% of the buildings in other affected areas could not be repaired and were demolished.
- The intensity of the earthquake attenuated after a short distance, and damage to buildings was very limited to the areas located about 50 km from the epicenter.
- Schools, houses, and socio-cultural constructions were damaged much more seriously than other categories of buildings.
- Damage to buildings was intense in proportion to the increase in the height of the buildings.
- Technical control and seismic calculations have improved the earthquake behavior of buildings.

The CTC observations on earthquake behavior are summarized as follows, and a similar situation is foreseeable in Algiers.

- Buildings of un-reinforced masonry showed very bad earthquake behavior.
- Concrete frame buildings showed bad behavior.
- Structural steel and shear wall buildings showed good behavior.

Similar assessment results were presented concerning the earthquakes in the 1980's and 1990's as well as the Boumerdes earthquake in 2003.

(4) Evolution after the El Asnam earthquake

According to Mr. BELAZOUGUI, the "National Plan for Disaster Prevention and Intervention & Relief Organization", for short, mid and long term activities, were formulated by the Government on 29 may 1985.

The contents of both issues (prevention and Intervention & Relief Organization) are included in Decrees n° 85-231 and 85-232 of 25 August 1985, as mentioned in sub-section 9.1.

The main points of the plan are as follows.

- Each Ministry and Wilaya should prepare risk reduction and intervention plans (units) and ORSEC plans (commune, Wilaya)
- Setting up, at each level, available human and material resources
- Creating a specific organization to be in charge of the follow up of the efficient realization of the plans
- Organizing seminars for the persons concerned
- Launching studies on microzoning for the great urban centers
- Launching studies on vulnerability of decayed areas and the strategic buildings in the capital

- Carrying out risk mapping for the whole of the country.
- Creating a computerized database encompassing all information on prevention, management and intervention for the all kinds of risks indicated on the national risk maps
- Creating a specialized hospital for seriously burnt patients.

Concerning seismic regulations, the CTC studied regulations in 1979, in collaboration with the University of Stanford, resulting in launching seismic regulation RPA-81. Since 1987, CGS has undertaken the update of this set of regulations, and published RPA-88, RPA-99, and then, RPA-99 in 2003 after the Boumerdes earthquake.

In the field of seismic engineering, Algerian major outcomes after the El Asnam earthquake are as follows.

- Establishment of the National Centre of Seismic Engineering (CGS), in January 1987, with the mission mentioned in sub-section 9.2
- Study on regional seismic hazards and microzoning for nine (9) urban areas in Chlef (1985), and then for the city of Tenès in 1993
- Study on seismic hazards for the areas of Algiers and Ain Defla (1998)
- Study on seismic microzoning in Algiers (1998), for an area of approximately 120 km²
- Study on vulnerability of the strategic buildings in the city of Algiers
- Seismic risk assessment for the city of Algiers as the first seismic risk assessment in Algeria
- Installation of a seismological telemeter network, managed by CRAAG in 1995
- Installation of a powerful national seismic registering network managed by the CGS (90 devices in 1983 and 120 in 1991). Using this network, data on “strong ground motion” has been accumulated through monitoring of the earthquakes of Constantine in 1985, Tipaza in 1989, Mascara in 1994 and Ain Benian in 1996.
- Updating of the seismic regulations
- Installation of modules for seismic calculations in civil engineering institutes

However, it should be noted that some of the issues intended for implementation since formulation of the National Plan in 1985, have not been realized yet; especially, the establishment of the National Delegation for Major Risk (DNRM: Délégation Nationale aux Risques Majeurs) should be the most urgent issue as it is also prescribed in Law n° 04-20. In addition, the preparation of the ORSEC plan (or disaster management plan) for each Ministry, Wilaya, Commune, and major public services, and nation-wide risk mapping are also outstanding issues requiring immediate realization.

8-4-2 Bab El Oued Floods (10 November 2001)

According to evaluation reports made by the services in the Wilaya of Algiers, as well as interviews with some key persons, the emergency response in accordance with the ORSEC plan

was somewhat badly operated at the beginning of the events[1, 2], which required improvement as the report proposed. In addition to operational and physical matters on the response, raising a sense of solidarity and awareness of disaster management of both officials and individuals are important matters.

On 10 November 2001, huge cloudbursts and consequent heavy flooding attacked the capital, causing nearly 1,000 dead or disappeared, serious damage to buildings (2,750 were red-class[3]). The cloudburst produced 290 mm of rainfalls in two and half hours, which equaled 40% of the average annual rainfall, and the flood reached an estimated peak flow of 730 m^3/sec, and a run-out volume of 2.6 million m^3.

The serious damage was due to the fact that the main drain system, designed for 20 m^3/s flow, could handle the discharge of the flood peak. Violent muddy flood waters carrying all sorts of wastes rushed down the basin slopes and devastated the highly urbanized districts, mostly in the Commune of Bab el Oued, which remained particularly vulnerable due to the decayed buildings of the colonial era and rapid urbanization with illegal housing during the last twenty years.

At the beginning of the disaster, in spite of mobilization of human resources and materials, the operation fell into confusion, including failures in the organizational plan. One of the reasons for the confusion seemed to be the dysfunction of the alert system, due to lack of attention to "Major Risks" by services and institutions as well as lack of a risk culture in Algerian society. Although an Executive Counsel was held on 15 July 2001, following catastrophic fires, no discussion was made for a detailed study on the contents of an ORSEC plan, which was proposed in Decree n° 85/231. This means that there was little effort to obtain feedback from the past disaster. A direct cause of the confusion was a total failure of the communication network due to the destruction of the telephone exchange centre in Bab el Oued. Neither disaster information nor requests for assistance were promptly conveyed to the operation center from the affected areas. Neither instructions nor inquiries were promptly conveyed to affected areas from the operation center.

Although there were many failures and difficulties in the initial response, an efficient organization was created concerning the sheltering of the victims; 1,544 families in Bab el Oued and 400 families in the neighboring corridor could settle in temporary dwellings at 36 sites in the Wilaya of Algiers by 31 December 2001. All the roads had been restored by 25 January 2002, and access to the city of Bab el Oued became possible.

The failures or confusion in the initial response had possibly been caused by the following problems.

- Inadequate assessment of the situation at the initial stage
- Absence of reaction of the "security module", resulting in difficulty or inability in approaching affected areas for rescue and relief
- A scattering of resources for emergency response in the Wilaya (insufficient storage of

[1] Assessment of the implemented device during the 10.11.2001 disaster and recommendations for legal and operational measures to be implemented for major risk prevention and intervention in the events of disasters, Wilaya of Algiers, September 2002

[2] Disaster of 10 November 2001, Module of relodging, Wilaya of Algiers, Director of Housing

[3] Of which 1950 were precarious houses

materials resulted in considerable reduction of the capacities for rescue and relief)

- Lack of materials (pumps, excavating equipment, lighting, etc) for rescue and relief at the initial stage
- Confusion or anarchy in distribution of rescue and assistance due to lack of damage information
- The interference of some organizations and institutions outside of the Wilaya, without integrating priorities for operation of rescue and relief
- Absence or inefficient presence of elected local leaders whose essential role was care of the population (the absence caused difficulty in the census activities for the affected population, the damaged buildings, and their survey missions)

Thereafter, urgent measures were taken by 18 modules, integrated in the operational organization, in accordance with the ORSEC plan as follows.

1) Distribution of rescue: setting up six (6) rescue centers with a of capacity of 303 beds with tents, mattresses, blankets and food
2) International Aid: in total, 28 countries and 27 NGOs and associations provided food and various materials with 54 airplanes and 110 supporters
3) Psychological assistance
4) Sheltering: undertaken early in the initial stage
5) Temporary lodging: the total number reached about 2,000 families by the end of 2001
6) Care of the afflicted families: efficiently organized
7) Medical Assistance: started at the initial stage
8) Indemnification: death allowance (728 treated files) and indemnification for those that had disappeared
9) Repair of infrastructures: road and water supply
10) Energy: gas pipeline and electric line networks were gradual restored, following removal of the sediment
11) Telecommunications: communications were totally impossible even on 10 November, and which hampered rescue activities seriously due to lack of a radio system
12) Release of occupied structures and facilities: (particularly public buildings) Occupiers were progressively released and given back their surety
13) Assessment of damaged buildings: 31 survey crews, consisting of staffs of CTC and the Director of Construction of the Wilaya, were summoned for survey of 6,120 houses, and 1,907 houses were judged dangerous
14) Care of damaged commercial premises: the Director of Competition and Prices summoned 50 crews for survey of 556 premises, and 118 were demolished
15) Removal of damaged vehicles
16) International technical assistance: (particularly for sewerage networks) Morocco, France and Germany provided equipment

17) International assistance for search and rescue of buried persons: France, Belgium and Morocco provided assistance with equipment

18) Communication and information: for enhancing and organizing the press activities

Based on the above mentioned observations, the evaluation reports proposed legal and operational measures for smooth operation of each unit of the Wilaya, according to the type of risks. In the reports, specific measures for each risk were considered, and then, measures for "flood risks" and "seismic risks" were particularly proposed concerning both emergency response and preparedness. The contents of the proposals are very important and will be reflected in the new ORSEC Plan for the Wilaya. Some of the points in the proposals already improved the emergency response to the Boumerdes earthquake and the formulation of Law n° 04-20.

8-4-3 Boumerdes Earthquake (21 May 2003)

A number of documents are available for review that recall the Boumerdes earthquake, although some important data such as the number of causalities in each Commune were not obtained. Those available documents e.g. Belazougui (2003)[4], Azzouz (2005)[5], MATE (2003)[6], Laouami (2003)[7], MICL-DGPC (2003)[8] and the results of interviews, particularly with Mr. Smail (DLW - Wilaya of Algiers) and Mr. Azzouz (CTC- Chlef) were used for the description of this sub-section.

On Wednesday 21 May 2003 at 7:44 pm, the north-central area of Algeria experienced a powerful earthquake of magnitude 6.8. The epicenter was located offshore to the north of the city of Zemmouri. This was a shallow earthquake with an origin at approximately 10 km in depth.

This earthquake particularly affected the Wilayas of Boumerdes, Algiers, Tizi Ouzou, Bouira and Blida. The tremor was felt within a radius of 200 km from the epicenter, even on the Baleares Islands in Spain. The areas that suffered serous damage to life and property extended to the cities of Boumerdes, Zemmouri, Dellys, Reghaia, Boudouaou and Bordj El Bahri. The human damage included 2,278 deaths, more than 10,000 injured, and 180,000 suffered from direct damage such as losing houses. Hundreds of aftershocks followed the main shock, and the biggest aftershock was of magnitude 5.8. These aftershocks threatened people; especially those who, having no scientific information, were scared that a shock similar to the main shock would strike them again.

Concerning damage to buildings, approximately 7,400 buildings totally collapsed and nearly 7,000 others were seriously damaged in the Wilaya of Boumerdes. Not less than 8,500 buildings were lost and more than 20,000 seriously damaged in the Wilaya of Algiers.

A quick assessment of the building damage was conducted in order to clarify the safety of houses for people and to collect damage information for officials. For the assessment, the Ministry of Housing and Urbanisation appointed technical teams, consisting of experts of CGS, CTC, local administrations (DUC, DLEP), OPGI, offices of surveys, etc. In the week following the earthquake, more than 700 engineers and experts were on the sites in two groups managed by

[4] Belazougui M.et al, 2003, Le séisme de Zemmouri-Boumerdes du 21 mai 2003, Evaluation et causes des dommages, CGS

[5] Azzouz H. et al, sept. 2005, Boumerdes 2003, leçons d'un séisme, CTC Chlef

[6] MATE, juillet 2003, le risque sismique et le redéploiement des activités et de l'urbanisation-Algérie 2020

[7] Laouami N.et al, 2003, Caractérisation du séisme de Boumerdès, Analyse des enregistrements du séisme principal, CGS

[8] MICL, DGPC, juin 2003, séisme du 21 mai 2003, Alger et Boumerdes

Civil Protection of Boumerdes and Algiers. Some senior engineers were anxious that the results were not as qualified as the results of the El Asnam earthquake, because the number of reliable experts was limited for conducting such an extensive survey in such a short time.

According to the above-mentioned reference *[4], 97,044 buildings were assessed by the end of June 2003 and classified into five levels as summarized below.

- **55,496 buildings (55%) were classified into levels 1 and 2 (green color)**, which indicated the condition of "not or slightly damaged".
- **32,904 (34%) were in levels 3 and 4 (orange color)**, which indicated "moderately to heavily damaged", requiring further assessment or analysis in the second phase for a repairing.
- **10,644 (11%) classified in level 5 (red color)**, which indicated "collapsed or condemned" buildings requiring demolition or reconstruction.

The damage to the buildings in Algiers and Boumerdes can be summarized as follows.

- Building collapse due to many reasons
- Shear of short columns in concrete-frame buildings
- Generation of plastic hinges at the extremities of reinforced concrete columns for many reasons (insufficient sizing, torsional effect, side displacement due to flexible floors, etc.)
- Horizontal or diagonal cracks
- Separation of bearing walls in masonry
- Rupture by shearing of nodes and post-beams of reinforced concrete frames with infilling of masonry
- Shearing and dislocation of numerous masonry infillings due to significant inter-floor movements
- Cracking or failure of adhesion of the external roughcasting (usually thick)
- Numerous vertical and horizontal cracks at the connection of the structure and the infillings, due to vertical and horizontal movement
- Collapse or cracking of traditional chimneys

In addition to the intense seismic tremors as the trigger factor, the following insufficiencies were essential factors of the damage.

- Negligence of engineering and technology: such as non-engineered construction, but rather based on the experience of workers and available materials, many of whom had low cost as their prime objective (particularly private houses)
- Design errors: such as inappropriate architectural configurations for buildings without consideration of earthquake resistance
- Calculation errors or under-sizing
- Bad or no quality control on construction work and materials

Reference *[5] also mentioned the following important points.

- The damage to the lifeline networks was limited, and most of the function of lifelines was restored within a few days. Roads were not seriously damaged, a few bridge beams were displaced a little bit, and there was no interruption of transportation for rescue and relief activities. There was no serious damage to the nodes of the lifelines such as power stations and substations, as well as the distribution networks for electricity, gas, and water, but the supply through the networks was suspended for a few days to permit careful safety checks.
- The buildings constructed in conformity with seismic regulations behaved well and suffered less damage.
- The traditional masonry of decayed buildings of more than 50 years old was affected seriously. Cracks and fractures developed in walls resulting in partial or complete collapse.
- **Buildings with reinforced concrete frame behaved badly**, mainly due to the combination of unfavorable factors such as bad design, insufficient wind bracing, structure-masonry interaction, critical errors in construction work, and ignorance of the soil characteristics.
- Wind-bracing frames in reinforced concrete stems behaved better, but faults in design and construction work remained the main causes of damage.
- **Buildings with shear walls showed efficient earthquake resistance** due to the wall redundancy and less influence of errors in construction work than in the columns.
- Buildings with steel frames showed good behavior.
- Many cases of damage and collapse could have been avoided if quality control by owners, construction companies, or authorities would have been carried out properly.
- It is obvious that the buildings constructed after 1990 (after RPA 88 was enforced) showed better behavior.

It should be reminded that most of the above-mentioned points had been recognized since the El Asnam earthquake in 1980 and before the Boumerdes earthquake. Based on the records and assessments of damage by the past earthquakes, it is clear that the updating of the Algerian seismic regulations was effective for improving building quality, with the condition that the control of design and construction is well done. In other words, it is suggested that a weak point is insufficient quality control in design and construction work.

The chronology of crisis management and the main points of the record on the Boumerdes earthquake are summarized in Table 8-4.

Table 8-4 Summary of Crisis Management for Boumerdes Earthquake

Date and Time		21 May 2003 (Wed) at 19:44 (a day before the beginning of the weekend)
Affected Wilaya		Mainly Boumerdes and Algiers, and 9other Wilayas (Tizi Ouzou, Bouira, Bejaia, Msila, Méédééa, Ain Defla, Blida, Tipaza and Chlef)
Communes declared affected		75 Communes in the Wilayas of Algiers, Boumerdes, and Tizi Ouzou
Death toll		2,278
Number of injuries		11,450
Number of affected families		27,371
Damaged buildings		198,000, including 16,715 completely collapsed or subsequently demolished
Damaged infrastructure		6,181 (red level: 462, orange level: 2,054, green level: 3,665)
Temporary housing		30,646 tents in 271 sites in Wilayas of Algiers and Boumerdes 241 administrative officials for supervision and coordination of site operation Services at the sites (Security guards, Power supply, Drinking water supply, Hot meal service, Showers and medical care, Garbage collection, Free telephone, Mailing service, Movies, Magazine and newspaper services, Health maintenance tools)
Mobilized officials		130,000 (6,434 from Civil Protection, 22,000 from the Army, 17,00 from National safety, 3,500 from the communal guard, 5,000 from health sectors, 70,000 from other agencies)
Chronological record		
21	- 20:00	Launching of national-level ORSEC plan, following launching Wilaya ORSEC plans
		Minister of State and Minister of Interior visited Boumerdes
	- 20:30	Formulation of National Cell for crisis management
21-22	Midnight – dawn	Setting up the following modules: 1. First aid, rescue and evacuation 2. Safety and public order 3. Information and communication 4. Medical care and hospitalization 5. Urgent restoration of communication network, etc.
		The President visited the National Cell
		The President visited affected areas in Algiers and Boumerdes
22		First evaluation of damage of important facilities in adverse condition (without telephone and electricity network) Setting up the following modules: 1. Mobilization of materials and reinforcement of manpower 2. Potable water supply 3. Energy 4. Food and provisioning of population 5. Installation of tents 6. Transport
23		Starting damage assessment by experts

According to Mr. Smail, the Director of Housing of the Wilaya of Algiers and the chief of the "Module of lodging" of the ORSEC plan, the situations during and after the earthquake are summarized as follows.

At the time of the first shock, it seemed that the tremor came from the east of Algiers, although there was no information on the earthquake and damage. The response was quick. Within 15 minutes after the shock, the brigades had been summoned and went out to collect damage information by 20:15. The collected damage information was transferred by radio and recorded on a map that displayed all the networks. Helicopters could not go to the affected site during the night.

The Secretary General of the Wilaya, appointed as the chairman of the ORSEC Committee, organized the rescue teams on the order of Wali, in the presence of the Director of Civil Protection and the Director of Health. Mr. Smail and the Director of Forests arrived in Boumerdes at 03:00 in two cars of the brigade and became aware of the damage situation.

By 22:00, the transfer of dead bodies was commenced. The brigade essentially aimed at collecting information and transferred the information to the general headquarters for the decision of measures to be implemented. For instance, the brigade provided information on the tremendous state of conditions in Bordj El Bahri and Dergana, to the general headquarters, and accordingly, the headquarters decided to dispatch troops of Civil Protection, National Security, Police, etc. to the afflicted areas.

Concerning transportation to/in the affected areas, it was a concern that many people may try to rush to the affected areas and clog road traffic resulting in hampering transportation for rescue and relief activities. In order to avoid the hamper of transportation, the authorities decided to set a priority lane indicated with in green on the highway from Algiers to Boumerdes.

The general headquarters for implementation of the ORSEC plan of the Wilaya of Algiers was set up in the Wilaya building. In Boumerdes, the general headquarters was also set up within the Wilaya building, which, fortunately, had not collapsed. The Wilaya of Algiers had previously reinforced the building in order to prevent seismic damage, together with installation of specific rooms for operation and sheltering of leaders, right after the first microzoning performed by the CGS on 1998.

Concerning telecommunication, the network centre had been repaired and functioned after the Bab el Oued events. But the El Harrach centre had been damaged. So, in the event of disasters, rescue teams used walkie-talkies. In the Wilaya of Boumerdes, since telecommunication was not available in many areas, DGPC installed a mobile wireless telecommunication system with several relay bases. Considering national and world level communication, it is necessary to consider installing a better performing system, such as satellite communications.

Concerning personnel for rescue activities, especially leaders, some staffs and leaders could not engage in the rescue operation because of damage or injuries to themselves or their property or family members. Arrangement of successors and back up members in catastrophic disasters is an important issue. Involvement of the staffs of the neighboring Wilayas is a possible solution, but the problem is that the staffs do not well understand the condition of other Wilayas. This issue should be reexamined for improvement of the ORSEC plan.

Concerning national-level organizations, the **National Delegation for Major Risks (DNRM)** should be created at an early date in accordance with Law n° 04-20. It is expected that the delegation will deal with all the matters related to disaster management at the national level, covering all the stages of disaster management (before, during, and after a disaster). Mr. Smail has been asked to rehabilitate and reinforce 102,000 houses in Algiers within two years, in addition to re-housing of families which still stay in 6,885 temporary houses in Algiers by June 2006. He still spends time managing disputes resulting from the disaster. In Boumerdes, 15,000 persons still stay in temporary houses. Arrangement or instruction of the national level delegation will be of help for earlier solution of many issues.

Concerning insurance, it is believed that nothing had been envisaged or arranged before the disasters. Following Law n° 04-20, CTC approval in technical issues is required for obtaining construction permits both for public and private buildings, otherwise construction could never be conducted. Registration of residences also requires having insurance.

Concerning improvement of the ORSEC plan, the Executive Counsel of the Wilaya of Algiers has held meetings three times since 2001 for the improvement. Some improvement will be done both on the ORSEC Plans and for other related matters, such as the realization and implementation of risk reduction plans at an early date in conformity with the new Decrees, related to Law n° 04-20. The new Decrees will be prepared in the year 2006, right after the formulation of the National Delegation for Major Risks.

Considering cooperation among Wilayas, such as dispatching staffs to seriously damaged Wilaya, as well as the broad similarity in characteristics of natural hazards, there is an opinion that the ORSEC plan or a plan for cooperation at the inter-Wilaya level would be effective for the northern part of the country: Algiers - Boumerdes - Tipaza - Bouira - Medea - Tizi Ouzou.

8-4-4 Summary

Through the tragic experiences of the past disasters, such as the El Asnam earthquake in 1980, the Bab el Oued flood in 2001, and the Boumerdes earthquake, Algeria has made several efforts in disaster management.

In terms of a legal framework, it can be said that Decrees n° 85-231 and 232 of 1985 were the first step for comprehensive disaster management, and consequently, crisis management (emergency response) systems have been established as has been seen in the ORSEC plan and the past activities during emergencies. The second step was launching Law n° 04-20 in 2004, aiming at improvement of risk reduction (mitigation), and Decrees for implementation are under preparation.

The most important and urgent issue for implementation of Law n° 04-20 is to launch a new Decree for the establishment of the **National Delegation for Major Risks (DNRM).** Other Decrees for the implementation of the Law will be prepared by the DNRM. After the legal framework has been established, the DNRM will formulate the national policy and action plan in order to show guidelines for preparation of disaster management plans for all levels of organizations, promoting activities in each level of actors, including individuals. The action plans should cover all the disaster management stages and secure conformity and continuity with the ORSEC plan. Detailed action plans on information, training, and education for risk reduction (as an activity before disaster) will also be prepared as is prescribed in Law n° 04-20. The key points to be suggested are described in Chapter 10.