Chapter 9. Evaluation of Urban Vulnerability

9-1 Seismic Evaluation of Existing Buildings

CGS and JST discussed and selected the target buildings for a seismic evaluation and retrofitting of existing buildings which included three strategic and two typical buildings. CGS and JST performed the site and building inspection of all strategic buildings with owner's architect or engineer, and got some the latest drawings and information with explain the historical circumstances.

9-1-1 Masonry Buildings

Since selected two strategic masonry buildings are very old, some characteristic of bearing wall by construction methods are unknown especially strength of joint material. CGS and JST discussed and agreed an evaluation method, a policy and judging criteria on the seismic evaluation stage, provided some plans on recommendation of retrofit design stage for the Presidential PALACE building (here in after the PALACE) and the Senator Office SENATE building (here in after the SENATE) as follows;

(1) General Matter of Seismic Evaluation for the PALACE and the SENATE

1) Evaluation Method and Policy

The evaluating shear force, judging criteria and structural analysis are followed "Algerian Seismic Code RPA 99/Version 2003: Regulations for Earthquake-Resistant Algeria" (Regles Parasismiques Algeriennes). The evaluation method is basically adopted "FEMA (Federal Emergency Management Agency) -178 and 310/ June 1992: NEHRP Handbook for the Seismic Evaluation of Existing Buildings".

The unknown structural components due to not full drawings are assumed by the engineer.

2) The judging criteria

The final judgment of the seismic evaluation will be judged based on agreement between CGS and JICA Study Team that is the Safety Factor "1.15" and the average shearing strength of the bearing wall unit "0.056 Mpa (0.056 N/mm^2)". The average resistance in compression of the bearing wall unit is 1.50 Mpa (1.50 N/mm^2). The total shear force of the masonry bearing wall is calculated based on the Algerian Seismic Code RPA 99/Version 2003.

(2) The PALACE

1) Overview of property

- Building Name: "PALAIS DU PEUPLE"/ "Presidential PALACE"
- Building Criteria: Governmental Facility; VIP Guest House
- Construction Type: Stone Masonry with structural steel arch reinforcement only
- Main Material: Stone; Density 27 kN/m^3, Bearing Wall Unit weight 22 kN/m^3

- Number of Stories: ”Old Palace”; 2- story building with 1-level basement floor, “New Palace”; 3-story building with 1-level basement floor and 1-story mezzanine floor
- Total Floor Area: “Old P.”: 703,64 m^2, “New P.”: 2,895.92 m^2, G. Total: 3,599.56 m^2
- Story Height: B1; 3.61 m, 1st Fl; 4.95 ~ 5.98m, 2nd Fl; 4.48 ~ approx. 10.30 m
- Year of Completion: “Old Palace”; Before 1830s, “New Palace”; 1915

2) The PALACE’s photographs are shown as follows;

Photo 9-1
Entrance of Old and New Palace Building

Photo 9-2
New Palace: Main Hall on 2nd Floor

3) Total Load of the Old Palace and the New Palace

A calculated total load of the Old Palace and the New Palace is shown in Table 9-1.

Table 9-1 Total Load of the Old Palace and the New Palace

Place	Story	Floor Area (m^2)	Floor Load (kN)	Wall Weight (kN)	Load Sum (kN)	Total Load (kN)
Old Palace	2nd Fl.	429.3	3,026	9,623	12,649	12,649
	1st Fl.	349.9	1,968	12,071	14,039	26,688
Entrance Block of New Palace	2nd Fl.	330.9	1,694	8,412	10,106	10,106
	1st Fl.	316.8	1,742	7,665	9,407	19,513
Main Hall Block of New Palace	3rd Fl.	630.1	2,300	9,492	11,792	11,792
	2nd Fl.	784.5	7,056	19,880	26,936	38,728
	1st Fl.	848.8	6,281	19,723	26,004	64,732

4) Wall Sectional Area of the Old Palace and the New Palace

A calculated wall sectional area of the Old Palace and the New Palace is shown in Table 9-2.

Table 9-2 Wall Sectional Area of the Old Palace and the New Palace

Place	Direction	3rd Floor (m^2)	2nd Floor (m^2)	1st Floor (m^2)
Old Palace	X	---	42.84	62.60
	Y	---	34.49	56.96
Entrance Block of New Palace	X	---	18.29	23.94
	Y	---	27.15	37.61
Main Hall Block of New Palace	X	42.11	51.93	66.51
	Y	42.59	53.01	68.51

5) Shear Force for Evaluation based on RPA 99/Version 2003

The shear force for evaluation is calculated based on the following formula.

$V = A\ D\ Q\ W/\ R = 0.4 \times 1.9 \times 1.0\ W/2.5 = 0.304\ W$

Where;

A = 0.4; Coefficient of Ground Acceleration

$\eta = \sqrt{\frac{7}{\xi + 2}} = 0.76 \quad \text{with} \quad \xi = 10\ \%)$

D = 2.5η = 1.9

Q = 1.0 ; Quality Factor

R = 2.5 ; Ductility Factor

W = m g; Building weight

6) Judgment of the Seismic Evaluation for the PALACE

The seismic evaluation is judged based on the following formula, and the judgment of the seismic evaluation is shown in Table 9-3.

$\tau_0 \geq F\ \tau \rightarrow \tau_0 / F\ \tau \geq 1.0$ ---The building is “Safe Structure”

$\tau_0 < F\ \tau \rightarrow \tau_0 / F\ \tau < 1.0$ ---The building is “Unsafe Structure”

Where;

$\tau 0 = 0.056$ MPa (N / mm^2) : Shearing strength of the bearing wall unit

F = 1.15 : Safety factor

Table 9-3 Judgment of the Seismic Evaluation for the PALACE

Place		Numerical Value					Judgment
		τ_0	X-direction		Y-direction		
			$F\tau$	$\tau_0/F\tau$	$F\tau$	$\tau_0/F\tau$	
Old Palace	2nd Fl.	0.056	< 0.104	0.54	< 0.128	0.44	Unsafe Structure
	1st Fl.	0.056	< 0.149	0.38	< 0.164	0.34	Unsafe Structure
New Palace Entrance Block	2nd Fl.	0.056	< 0.193	0.29	< 0.130	0.43	Unsafe Structure
	1st Fl.	0.056	< o.285	0.20	< 0.181	0.31	Unsafe Structure
New Palace Main Hall Block	3rd Fl.	0.056	< 0.098	0.57	< 0.097	0.58	Unsafe Structure
	2nd Fl.	0.056	< 0.261	0.21	< 0.255	0.22	Unsafe Structure
	1st Fl.	0.056	< 0.340	0.16	< 0.330	0.17	Unsafe Structure
Combined Entrance and Main Hall Block of New Palace	3rd Fl.	0.056	< 0.098	0.57	< 0.097	0.58	Unsafe Structure
	2nd Fl.	0.056	< 0.243	0.23	< 0.213	0.26	Unsafe Structure
	1st Fl.	0.056	< 0.326	0.17	< 0.277	0.20	Unsafe Structure
Combined Old Palace and New Palace	3rd Fl.	0.056	< 0.098	0.57	< 0.097	0.58	Unsafe Structure
	2nd Fl.	0.056	< 0.190	0.29	< 0.187	0.30	Unsafe Structure
	1st Fl.	0.056	< 0.253	0.22	< 0.238	0.24	Unsafe Structure

Conclusion on this evaluation:
The Presidential PALACE building is judged “Unsafe Structure“.
Therefore, the PALACE will be required the retrofitting design and work.
Refer to the Recommendation of Retrofit Plan (Refer to Chapter 11.3.2. (2).
Since the above seismic evaluation is performed based on “the shearing strength of the bearing wall unit is 0.056 Mpa (N/mm^2)”, it should be confirmed the actual shear strength of joint material in the existing bearing wall unit, before final decision. In general, the shear strength of masonry wall unit is obtained on a joint material. It can be obtained with core sampling or the other effective method

(3) The SENATE

1) Overview of property

- Building Name: “Senator Office SENATE”/ “the SENATE”
- Building Criteria: Governmental Facility; the Congress
- Construction Type: Stone Masonry by round/ cut stone at partly only
- Main Material: Stone; Density 27 kN/m^3, Bearing Wall Unit weight 22 kN/m^3
- Number of Stories: 5- story building with 1-level basement floor
- Total Floor Area: 8,683 m^2
- Story Height: B1; N.A., 1st Fl; 4.20 & 7.60m, M2 Fl; 3.40 m, 2nd Fl; 5.65 m & 9.70 m, 3rd Fl; 4.05 m, 4th Fl; 4.65 m
- Year of Completion: B1 ~ 2nd Fl: Before 1912, Extension: 3rd & 4th Fl: 1912 ~ 1915

2) The SENATE's photographs are shown as follows;

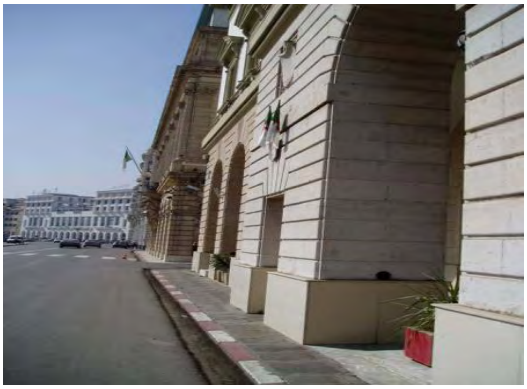


Photo 9-3
Front Side View and Front Road

Photo 9-4
Gallery in Assembly Hall

3) Total Load of the SENATE

A calculated total load of the SENATE is shown in Table 9-4.

Table 9-4 Total Load of the SENATE

Story	Floor Area (m^2)	Floor Load (kN)	Wall Weight (kN)	Load Sum (kN)	Total Load (kN)
4th Floor	1,447	9,556	22,211	31,767	31,767
3rd Floor	1,589	9,384	21,205	30,589	62,356
2nd Floor	1,501	8,658	32,258	40,916	103,272
Mezzanine Fl.	2,029	11,660	25,859	37,519	140,791
1st Floor	1,165	6,741	29,923	36,664	177,455

4) Wall Sectional Area of the SENATE

A calculated wall sectional area of the SENATE is shown in Table 9-5.

Table 9-5 Wall Sectional Area of the SENATE

Direction	4th Floor (m^2)	3rd Floor (m^2)	2nd Floor (m^2)	Mezzanine Fl (m^2)	1st Floor (m^2)
X	119.80	147.83	159.48	179.22	187.03
Y	91.82	119.76	130.91	191.85	203.31

5) Shear Force for Evaluation based on RPA 99/Version 2003

The shear force for evaluation is calculated based on the following formula.

$V = A\ D\ Q\ W/\ R = 0.4 \times 1.9 \times 1.0\ W/2.5 = 0.304\ W$

Where;

A = 0.4; Coefficient of Ground Acceleration

$$\eta = \sqrt{\frac{7}{\xi + 2}} = 0.76 \quad \text{with} \quad \xi = 10\ \%),$$

D = 2.5η = 1.9 Q = 1.0 ; Quality Factor

R = 2.5; Ductility Factor W = m g; Building weight

6) Judgment of the Seismic Evaluation for the SENATE

The seismic evaluation is judged based on the following formula, and the judgment of the seismic evaluation is shown in Table 9-6.

$\tau_0 \geq F\tau \rightarrow \tau_0/F\tau \geq 1.0$ ---The building is "Safe Structure"

$\tau_0 < F\tau \rightarrow \tau_0/F\tau < 1.0$ ---The building is "Unsafe Structure"

Where;

$\tau 0 = 0.056$ MPa (N / mm^2) : Shearing strength of the bearing wall unit

$F = 1.15$: Safety factor

Table 9-6 Judgment of the Seismic Evaluation for the SENATE

Place	Numerical Value					Judgment
	τ_0	X-direction		Y-direction		
		$F\tau$	$\tau_0/F\tau$	$F\tau$	$\tau_0/F\tau$	
4th Floor	0.056	< 0.093	0.60	< 0.121	0.46	Unsafe Structure
3rd Floor	0.056	< 0.147	0.38	< 0.182	0.31	Unsafe Structure
2nd Floor	0.056	< 0.226	0.25	< 0.276	0.20	Unsafe Structure
Mezzanine Floor	0.056	< 0.275	0.20	< 0.256	0.22	Unsafe Structure
1st Floor	0.056	< 0.332	0.17	< 0.305	0.18	Unsafe Structure
Whole of Building	0.056	< 0.332	0.17	< 0.305	0.18	Unsafe Structure
Conclusion on this evaluation: The SENATE building will be required the retrofitting design and work. Therefore, the SENATE building will be required the retrofitting design and work. Refer to the Recommendation of Retrofit Plan.						
Since the above seismic evaluation is performed based on "the shearing strength of the bearing wall unit is 0.056 Mpa (N/mm^2)", it should be confirmed the actual shear strength of joint material in the existing bearing wall unit, before final decision. In general, the shear strength of masonry wall unit is obtained on a joint material. It can be obtained with core sampling or the other effective methods.						

9-1-2 RC Buildings

(1) A Methodology of Seismic Evaluation for Reinforced Concrete Buildings

Seismic evaluation of existing Reinforced Concrete buildings was performed based on;

Standard for Seismic Evaluation of Existing Reinforced Concrete Buildings, 2001 (English version,1st edition), The Japan Building Disaster Prevention Association, Tokyo, Japan.

(2) Seismic Evaluation of Existing RC Buildings

The 2nd level seismic screening procedure was applied. A summary of the results is shown with respect to following three typical buildings;

1. A five storey apartment house, designed based on RPA 88
2. A two storey elementary school, designed based on RPA88
3. Pierre and Marie Curie Center Chemo-Therapy Building, Mustapha Hospital, designed based on RPA83. This hospital building is a strategically important building.

1) A Five Storey Apartment House

(A) General

This building is a typical apartment house of reinforced concrete moment frame, and was designed based on seismic design code RPA88.

(B) Target of Retrofit

Seismic Demand Index Iso = 0.50, C_TS_D = 0.20, and Usage Factor = 1.0 was used. These are the minimum requirements.

(C) Results of Seismic Evaluation

Seismic Index of structure, Is, is shown in Table 9-7.

a) Is of 1st storey and 3rd storey were lower than seismic demand index, Iso, 0.50.
b) C_TS_D of 1st, 2nd and 3rd storey were lower than required value, 0.20.
c) Is and C_TS_D of 5th storey were higher than required value.

Table 9-7 Seismic Index of Structure, Is, (X, Y direction)

Storey	ΣW(kN)	C	F	n+1/n+i	Eo	Is	C_TS_D
5	2090	0.57	3.2	0.545	1.10	1.02	0.32
4	4557	0.30	3.2	0.667	0.65	0.60	0.19
3	7024	0.22	3.0	0.75	0.50	0.47	0.16
2	9491	0.22	3.0	0.857	0.57	0.53	0.18
1	11958	0.19	2.25	1.0	0.43	0.40	0.18

S_D; 0.95(lack of gap at expansion joint)
T; 0.975 was used

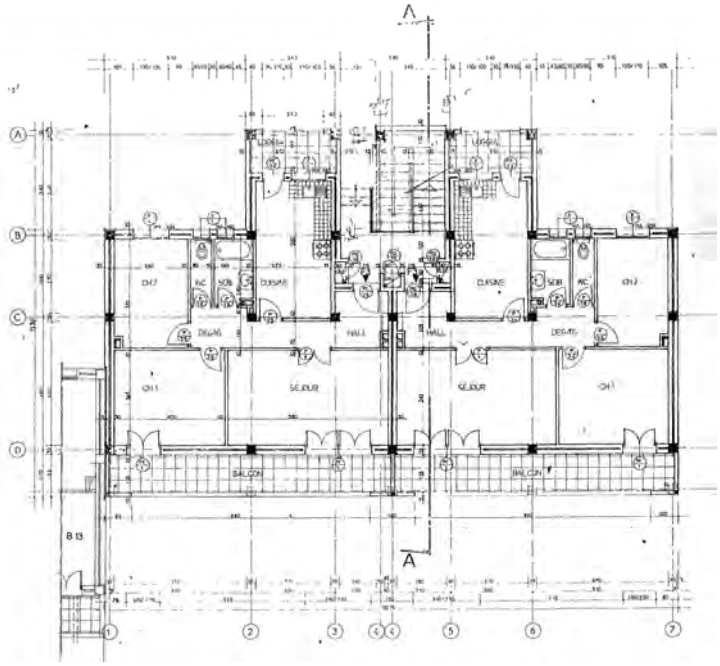


Figure 9-1 Typical Floor Plan

2) A Two Storey School designed based on RPA88

(A) General

This is a two storey reinforced concrete building with moment frame structure, and designed by RPA88. The columns of X direction at grid A were evaluated as short columns because of solid brick standing walls. A framing elevation at grid A is shown in Figure 9-2.

(B) Target of Retrofit

Seismic Demand Index Iso = 0.50, C_TS_D = 0.20 were used. These are the minimum requirements.

Usage Index of 1.0 was used, but an index of 1.25 might be recommended.

(C) Seismic Index of Structure

A summary of the results is shown in Table 9-8. Columns at grid A were evaluated as extremely brittle columns in the X direction and the irregularity by an eccentricity reduced the seismic capacity. The first storey and second storey of this school building were judged as 'Not Safe' in the X direction, and were judged as 'Safe' in the Y direction.

Table 9-8 Summary of Seismic Evaluation

Directi	Storey	C_T	F	Failure Mo	Eo	S_D	T	Is	$C_{TU}S_D$	Judgment
X	2	0.495	0.80	Ext.Brittle	0.474	0.80	0.95	0.36	0.37	NG
		0.253	3.20	Flexural						
	1	0.346	0.80	Ex.Brittle	0.338	0.80	0.95	0.26	0.27	NG
		0.152	3.20	Flexural						
Y	2	0.467	3.20	Flexural	1.491	1.00	0.95	1.42	0.47	OK
	1	0.391	3.20	Flexural	1.251	1.00	0.95	1.19	0.39	OK

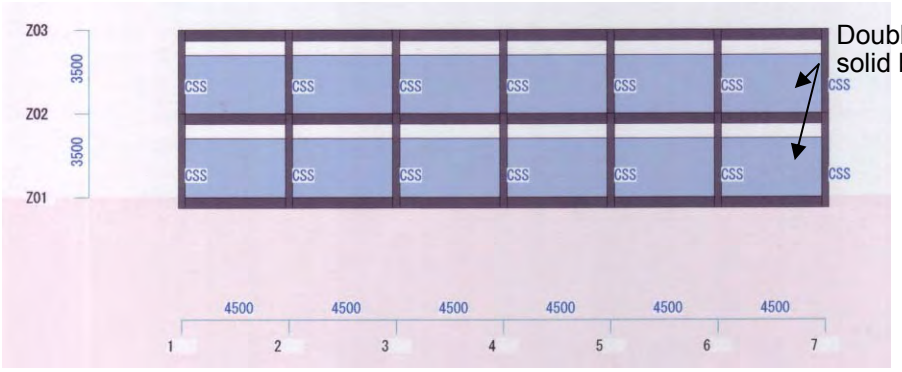


Figure 9-2 Framing Elevation at Grid A

3) Pierre and Marie Curie Center Chemo-Therapy Building, Mustapha Hospital

(A) General

This hospital is a reinforced concrete moment frame structure. This hospital building is a strategically important building. General View is shown in Photo 9-5.

(B) Target of Retrofit

Usage index of 1.5 was used. Seismic Demand Index Iso; 0.50x1.5=0.75, C_TS_D ; 0.20x1.5=0.3 was used. These are the minimum requirements.

(C) Results of Seismic Evaluation

Seismic Index of Structure, Is, and C_TS_D are shown in Table 9-9.

a) Is, of the 1st storey was slightly lower than Iso, and C_TS_D was lower than required value.
This showed that the horizontal strength at the 1st storey is inadequate.

b) Is, and C_TS_D at the 2nd storey and the 3rd storey were higher than the required value.

Table 9-9 Seismic Index of Structure, Is, and C_TS_D

Y direction									X direction	
Storey	C	F	n+1/n+i	Eo	S_D	T	Is	C_TS_D	Is	C_TS_D
3	0.76	3.2	0.67	1.61	1.11	0.95	1.72	0.84	1.74	0.85
2	0.42	3.2	0.80	1.07	1.11	0.95	1.13	0.46	1.15	0.47
1	0.24	3.2	1.00	0.76	1.00	0.95	0.72	0.24	0.72	0.24

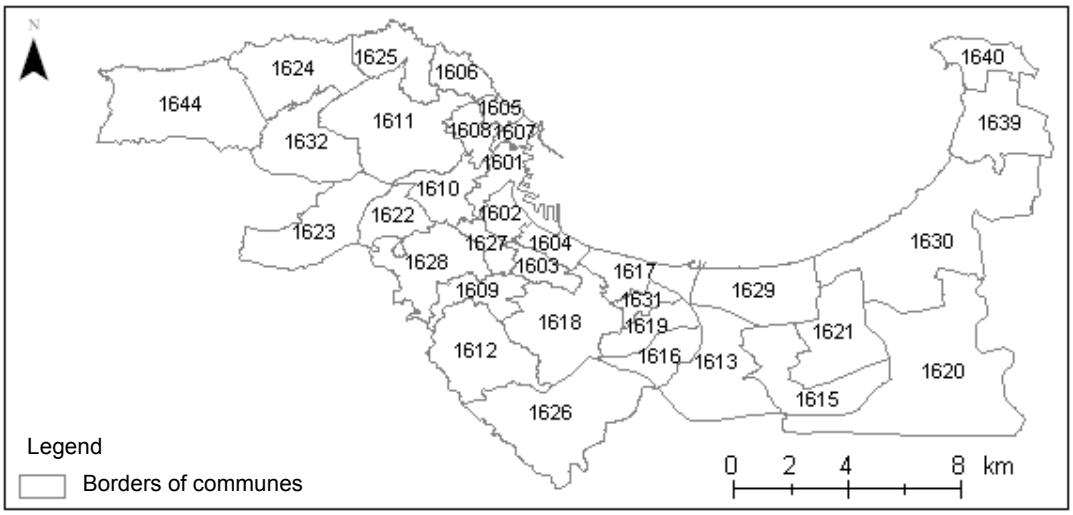
S_D 1.11(3rd and 2nd storey), 1.0 (1st storey),
S_D: Irregularity Index (Expansion Joint, x0.95, Storey Height Uniformity, x0.975, Underground Storey, x1.20, Stiffness/mass Ratio, x1.0(3rd &2nd Storey), 0.9(1st Storey)), T: Time Index (0.95 was used)

Photo 9-5 General View of Mustapha Hospital

9-2 Urban Vulnerability to Earthquake Disasters

9-2-1 Urban Vulnerability to Earthquake Disasters

The vulnerability of urban areas to earthquake disasters in the 34 communes included within the Study Area was assessed by analyzing GIS data. This assessment is a static one because no "Scenario Earthquakes" were taken into consideration. Figure 9-3 shows the 34 communes within the Study Area.



1601: ALGER CENTRE, 1602: SIDI M'HAMMED, 1603: EL MADANIA, 1604: HAMMA EL ANNASSER, 1605: BAB EL OUED, 1606: BALOGHINE, 1607: CASBAH: 1608: OUED KORICHE, 1609: BIR MOURAD RAIS, 1610: EL BIAR, 1611: BOUZAREAH, 1612: BIRKHADEM, 1613: EL HARRACH, 1615: OUED SMAR, 1616: BOUROUBA, 1617: HUSSEIN DEY, 1618: KOUBA, 1619: BACH DJERAH, 1620: DAR EL BEIDA, 1621: BAB EZZOUAR, 1622: BEN AKNOUN, 1623: DELY BRAHIM, 1624: HAMMAMET, 1625: RAIS HAMIDOU, 1626: DJASR KACENTIANA, 1627: EL MOURADIA, 1628: HYDRA, 1629: MOHAMMADIA, 1630: BORDJ EL KIFFAN, 1631: EL MAGHARIA, 1632: BENI MESSOUS, 1639: BORDJ EL BAHRI, 1640: EL MARSA

Source: INCT and JICA Study Team

Figure 9-3 Communes within the Study Area

The following criteria were set for determining the vulnerability of urban areas to earthquake disasters. Six (6) classes of criteria were defined, as listed below:

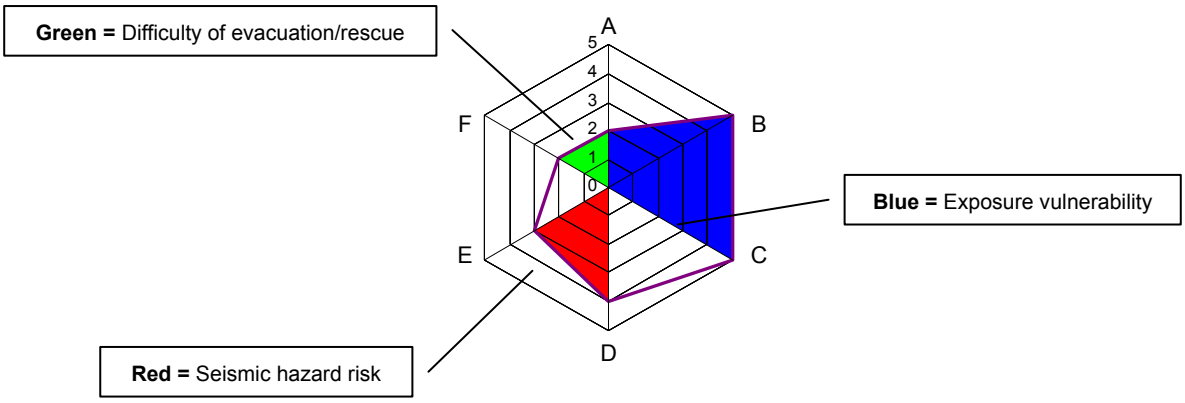
A. Population density: Relative population density within each commune;
B. Building age: Ratio (%) of relatively old buildings (constructed before 1981) to newer buildings within each commune;
C. Economic value: Extent (area) of the economically active areas within each commune;
D. Ground surface motion potential: Ground amplification factor within each commune;
E. Slope failure risk: Average slope gradient (%) within each commune; and
F. Ease of evacuation/rescue: Road networks and availability of open-spaces (public parks and sports fields) within each commune.

Each of the above criteria was evaluated for each commune and rated on a five-point scale, based on the calculated data. For each commune, the rating (score) for each of these criteria was integrated into an earthquake vulnerability chart, as shown in Figure 9-4. Table 9-10 shows the rating that was applied to each of the above criteria.

Table 9-10 Vulnerability Criteria and Rating

Vulnerability Criteria	Description	Vulnerability Rating				
		High **5**	Moderate to High **4**	Moderate **3**	Low to Moderate **2**	Low **1**
A. Population density	People/ha	60010 to 74486	45532 to 60009	31055 to 45531	16577 to 31054	2099 to 16576
B. Building age	Ratio (%) of relatively old buildings (constructed before 1981) to newer buildings within each commune	80.1 to 100	60.1 to 80.0	40.1 to 60.0	20.1 to 40.0	0.0 to 20.0
C. Economic value	Relative density of economically active areas (extent) within each commune	85 to100	69 to 84	53 to 68	37 to 52	20 to 36
D. Ground surface motion potential	Ground amplification factor; (dimensionless)	1.4613 to 1.6055	1.3169 to 1.4612	1.1726 to 1.3168	1.0282 to 1.1725	0.8838 to 1.0281
E. Slope failure risk	Average slope gradient (%) within each commune	7.1 to 17.0	3.7 to 7.0	7.1 to 10.3	3.7 to 7.0	0.3 to 3.6
F. Ease of evacuation/ rescue	(Accessibility value)	0.74 to 1.03	1.04 to 1.32	1.33 to 1.61	1.62 to 1.90	1.91 to 2.19

Source: JICA Study Team



A: Population density; B: Building age; C: Economic value;
D: Ground surface motion potential; E: Slope failure risk; F: Ease of evacuation/rescue

Source: JICA Study Team

Figure 9-4 Typical Earthquake Vulnerability Chart for a Commune

The overall vulnerability, in terms of vulnerability exposure, seismic hazard risk and difficulty of evacuation/rescue, can be assessed as follows:

- Exposure vulnerability: A + B + C (blue zone)
- Seismic hazard risk: D + E (red zone)
- Evacuation/rescue difficulty: A + F (green zone)

Figure 9-5 shows the earthquake vulnerability chart that was prepared for each of the 34 communes in the Wilaya of Alger.

9-2-2 Earthquake Vulnerability by Sector

The earthquake vulnerability rating for each of the six (6) criteria shown in the previous section were re-classified into three (3) classes, as shown in Table 9-11.

Table 9-11 Re-classification of the Vulnerability Ratings for Each of the Six (6) Criteria

Class	A. Population density	B. Building age	C. Economic value	D. Ground surface motion potential	E. Slope failure risk	F. Ease of evacuation/ rescue
High	5, 4	5, 4	5, 4	5, 4	5, 4	5, 4
Moderate	3, 2	3, 2	3, 2	3, 2	3, 2	3, 2
Low	1	1	1	1	1	1

Source: JICA Study Team

(1) Exposure Vulnerability

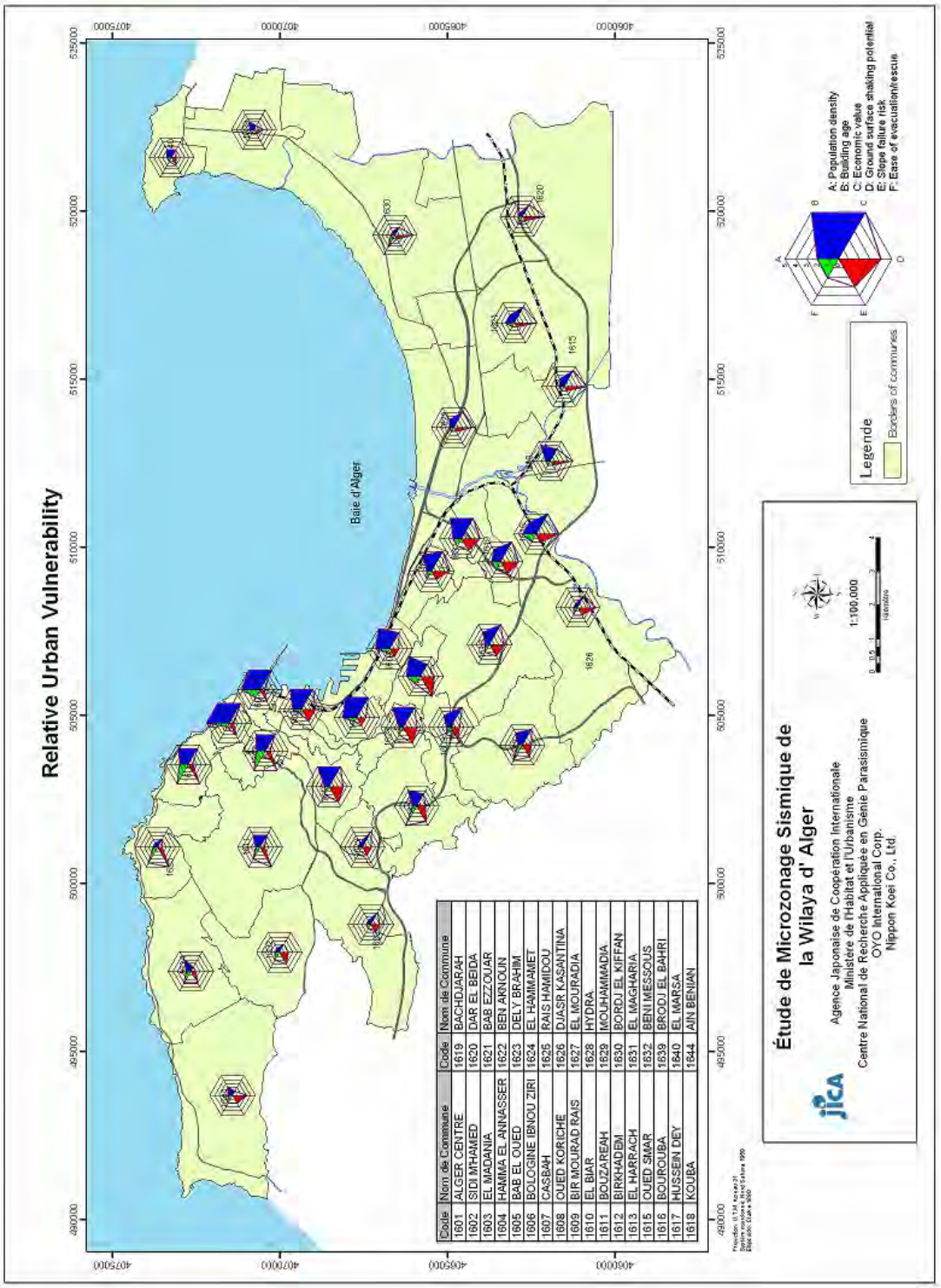
Communes within the Study Area were classified into 11 categories representing the exposure vulnerability, as shown in Table 9-12.

Table 9-12 Categories of Exposure Vulnerability for Communes

Category	A. Population Density	B. Building Age	C. Economic Value	Number communes in this category
HHH	High	High	High	2
MHH	Moderate	High	High	6
LHH	Low	High	High	3
MHM	Moderate	High	Moderate	1
LHM	Low	High	Moderate	2
MMH	Moderate	Moderate	High	3
LMH	Low	Moderate	High	5
LMM	Low	Moderate	Moderate	2
LML	Low	Moderate	Low	3
LLH	Low	Low	High	1
LLM	Low	Low	Moderate	6

Source: JICA Study Team

Exposure vulnerability in the Study Area is relatively high in the communes that are located along the southwest coastline of Alger Bay where heavy urbanization and developed has occurred, as shown in Figure 9-6.



Source: JICA Study Team

Figure 9-5 Distribution of Relative Urban Vulnerability for the Study Area

(2) Seismic Hazard Risk

Communes within the Study Area were classified into seven (7) categories representing the potential seismic hazard risk, as shown in Table 9-13.

Table 9-13 Categories of Seismic Hazard Risk for Communes

Category	D. Ground Surface Motion Potential	E. Landslide Risk	Number communes in this category
HM	High	Moderate	5
HL	High	Low	6
MH	Moderate	High	4
MM	Moderate	Moderate	10
ML	Moderate	Low	1
LH	Low	High	4
LM	Low	Moderate	4

Source: JICA Study Team

Figure 9-7 shows the distribution of seismic hazard risk within the Study Area.

In terms of seismic hazard risk, the communes in or adjacent to the Sahel Hills region have a relatively high slope failure risk, and communes on the Mitijya Plain have a relatively high ground surface motion potential within the Study Area.

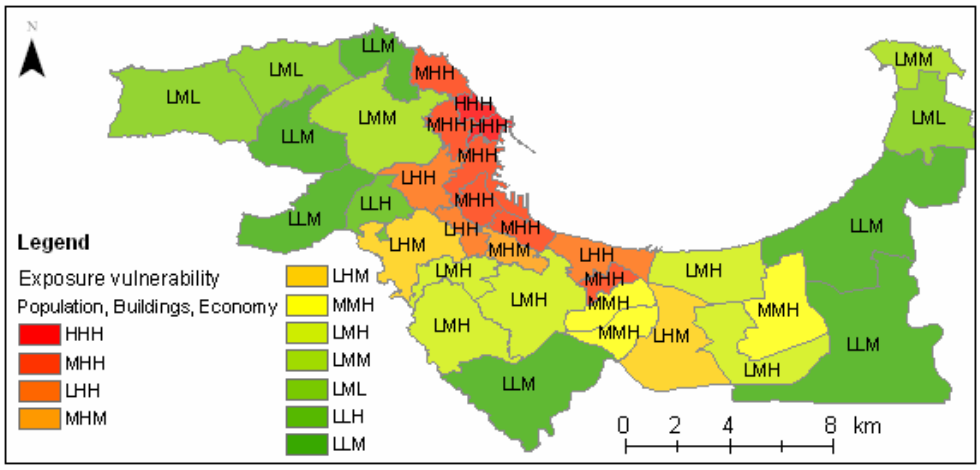
(3) Evacuation/Rescue Difficulty

Communes within the Study Area were classified into eight (8) categories representing evacuation/rescue difficulty, as shown in Table 9-14. Figure 9-8 shows the distribution of evacuation/rescue difficulty within the Study Area.

Table 9-14 Categories of the Evacuation/Rescue Difficulty for Communes

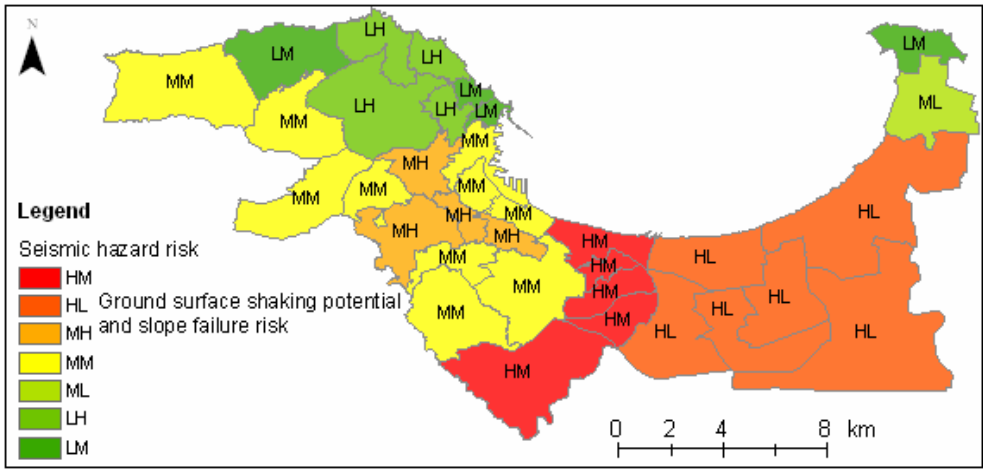
Category	A. Population Density	F. Evacuation/ Rescue difficulty	Number communes in this category
MH	High	Moderate	2
LH	Low	High	3
HM	Moderate	High	1
MM	Moderate	Moderate	4
LM	Moderate	Low	12
HL	Low	High	1
ML	Moderate	Low	4
LL	Low	Low	7

Source: JICA Study Team



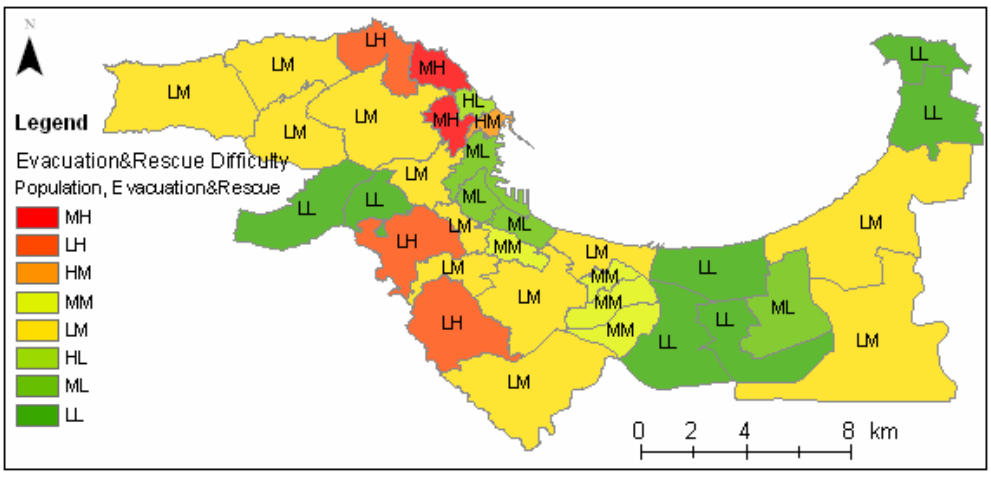
Source: JICA Study Team

Figure 9-6 Distribution of Exposure Vulnerability



Source: JICA Study Team

Figure 9-7 Distribution of Seismic Hazard Risk



Source: JICA Study Team

Figure 9-8 Distribution of Evacuation/Rescue Difficulty

9-2-3 Comprehensive Evaluation of Urban Vulnerability

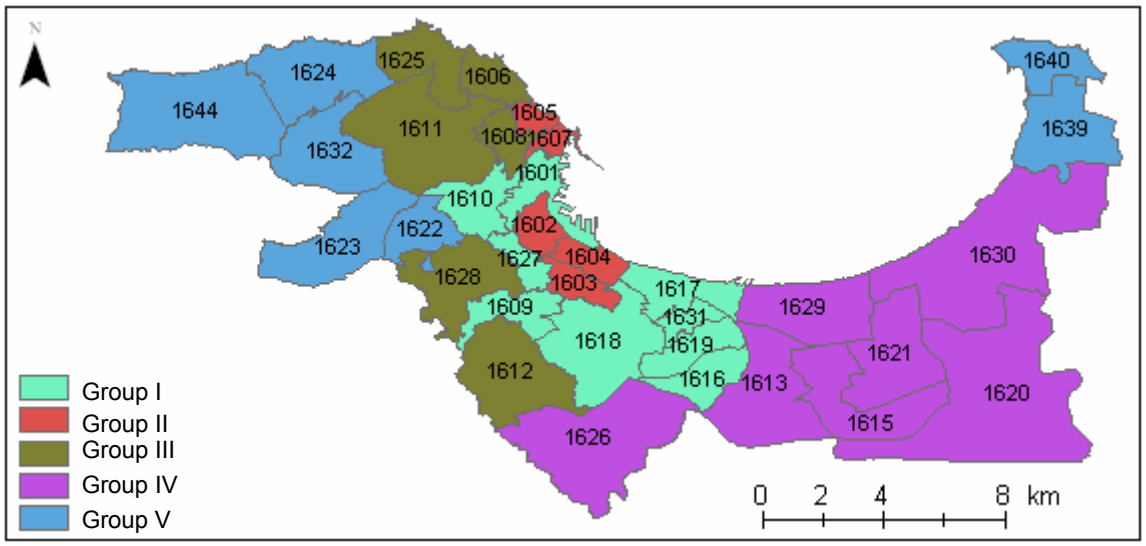
The communes within the Study Area can be classified into five (5) groups, based on their urban vulnerability characteristics, as shown in Table 9-15.

Table 9-15 Communes Grouped by Urban Vulnerability Characteristics

Group	Code	Commune	Population density	Building Age	Economic value	Ground surface motion potential	Slope failure risk	Evacuation/ rescue difficulty
I	1601	ALGER CENTRE	M	H	H	M	M	L
	1610	EL BIAR	L	H	H	M	H	M
	1627	EL MOURADIA	L	H	H	M	H	M
	1617	HUSSEIN DEY	L	H	H	H	M	M
	1631	EL MAGHARIA	M	H	H	H	M	M
	1609	BIR MOURAD RAIS	L	M	H	M	M	M
	1618	KOUBA	L	M	H	M	M	M
	1619	BACH DJERAH	M	M	H	H	M	M
	1616	BOUROUBA	M	M	H	H	M	M
II	1605	BAB EL OUED	H	H	H	L	M	L
	1604	HAMMA EL ANNASSER	M	H	H	M	M	L
	1602	SIDI M'HAMED	M	H	H	M	M	L
	1607	CASBAH	H	H	H	L	M	M
	1603	EL MADANIA	M	H	M	M	H	M
III	1606	BOLOGHINE IBNOU ZIRI	M	H	H	L	H	H
	1608	OUED KORICHE	M	H	H	L	H	H
	1628	HYDRA	L	H	M	M	H	H
	1612	BIRKHADEM	L	M	H	M	M	H
	1625	RAIS HAMIDOU	L	L	M	L	H	H
	1611	BOUZAREAH	L	M	M	L	H	M
IV	1629	MOHAMMADIA	L	M	H	H	L	L
	1615	OUED SMAR	L	M	H	H	L	L
	1621	BAB EZZOUAR	M	M	H	H	L	L
	1613	EL HARRACH	L	H	M	H	L	L
	1630	BORDJ EL KIFFAN	L	L	M	H	L	M
	1620	DAR EL BEIDA	L	L	M	H	L	M
	1626	DJASR KACENTINA	L	L	M	H	M	M
V	1622	BEN AKNOUN	L	L	H	M	M	L
	1623	DELY BRAHIM	L	L	M	M	M	L
	1639	BORDJ EL BAHRI	L	M	L	M	L	L
	1640	EL MARSA	L	M	M	L	M	L
	1624	HAMMAMET	L	M	L	L	M	M
	1644	AIN BENIAN	L	M	L	M	M	M
	1632	BENI MESSOUS	L	L	M	M	M	M

H: High, M: Moderate, L: Low
Source: JICA Study Team

Figure 9-9 shows the distribution of communes grouped by urban vulnerability characteristics within the Study Area.



Source: JICA Study Team

Figure 9-9 Distribution of Commune Groups by Urban Vulnerability Characteristics

(1) Characteristics of Urban Vulnerability

1) Group I

Within these communes, there are many old buildings constructed before 1981. These older buildings are relatively fragile and prone to damage by seismic motion because of a lack of seismic-resistant construction measures.

2) Group II

The communes in this group contain areas that are economically very important (similar to Group I) and they are characterized by a higher relative population density than Group I. Moreover, the Group II communes have a relatively high level of evacuation/rescue difficulty.

3) Group III

The communes in Group III are located on sloping land in the Sahel Hills and have a high slope failure risk in an earthquake. Moreover, the Group III communes have high levels of evacuation/rescue difficulty due to a lack of connectivity with the regional road network.

4) Group IV

The communes in Group IV have a high level of ground surface motion potential and contain areas having a moderate to high level of economic importance within the Study Area.

5) Group V

The communes in Group V have low to moderate levels of urban vulnerability.

(2) Possible Methods for Ameliorating Earthquake Disasters

The following items are possible methods that could be used to ameliorate earthquake disasters, especially in terms of urban/land use planning for the 34 communes.

- Renovation of buildings having lower seismic-resistance.
- Restricting building construction on sites close to steep slopes, and building slope protection structures.
- Increasing the number of car parking spaces, and decreasing the number of cars that are parked on narrow roads.
- Widening narrow roads.
- Improving road connectivity to the regional road network (especially for Group III communes).
- Increasing the amount of open space.
- Relocation/decentralization of central city facilities (especially for Group I and II).
- Preparation for seismic motion (especially for Group IV communes).

9-2-4 Results of Case Studies on Urban Vulnerability to Earthquake Disasters

Assessments of the following case studies were made, based on the urban vulnerability analysis work (see above) and the micro-zoning results.

(1) Case Study 1: Evacuation Point Capacity and Other Potential Refuge Sites

The micro-zoning results for this study indicate that there will be about 640,000 homeless victims when estimated by the Khair al Din model, and about 310,000 homeless victims when estimated by the Zemmouri model.

Of all the public parks and open-air sports fields identified within the Study Area, 34 parks and 29 open-air sports fields can be considered as being suitable for use as community evacuation points. These places are connected to the road network for possible evacuation/rescue and they have areas of at least one (1) ha. Six (6) community evacuation points (4 parks and 2 open-air sports fields) having areas of at least 10 ha are considered to be suitable for use as regional evacuation points.

The total area (ha) of evacuation points within the Study Area is 264.1 ha, and about 1,320,500 people can be accommodated there.

Of the 34 communes included within the Study Area, 17 communes do not have enough evacuation points for the number of homeless victims predicted by the Khair al Din model, and 11 communes do not have enough evacuation points for the number of homeless victims predicted by the Zemmouri model.

(2) Case Study 2: Safety of the Regional Evacuation/Rescue Road Network in an Emergency

Of the 148 road bridges within the Study Area, three (3) road bridges have a high probability of falling off their foundations and 19 bridges have moderate probability of falling off their foundation. In the Khair al Din model, the 'Autoroute' (highway) and National Road R.N05 might be cut. These roads are important transport links that generally follow along the southwest coastline of Alger Bay. Relevant seismic-resistance measures should be installed on road bridges having moderate/high risk of collapse. The following potential problems are the most serious secondary problems that would be caused if the 'Autoroute' (highway) and National Road R.N05 were cut:

- Alger Port might be isolated from the evacuation/rescue road network..
- Accessibility to communes located between the southwest coastline of Alger Bay and the Alger International Airport might be restricted..
- Five (5) communes (AIN BENIAN, EL HAMMAMET, RAIS HAMIDOU, BOLOGHINE IBNOU ZIRI and BAB EL OUED) might be almost completely isolated from other communes.

(3) Case Study 3: Possible Methods for Towns to Mitigate the Effects of Earthquake Disasters

SIDI M'HAMED and EL HARRACH were selected for case study on possible methods for towns to mitigate the effects of earthquake disasters. SIDI M'HAMED and EL HARRACH include densely built-up areas where there are many old buildings constructed before 1981.

Flammable or explosive fuel storage tanks are located in or around the selected communes. Moreover, roads in the older and more densely built-up areas are narrow. Therefore people might have difficulty in evacuation/rescue activities in an earthquake disaster.

For areas having moderate to high risks in an earthquake disaster, as mentioned above, it is important to immediately secure the connectivity and safety of roads that are vital for evacuation and rescue activities.

Countermeasures are needed to prevent or reduce the risk of building collapse, rock falls and bridges falling off their foundations due to seismic shocks. In the densely built-up areas, (existing) hospitals and schools should have seismic resistance so that they can safely be utilized in an earthquake hazard. This is particularly important because it is difficult to find enough open spaces that are available for use as temporary medical centers or evacuation points. Flammable/explosive fuel storage tanks should be checked as soon as possible and have seismic-resistance measures installed.

9-3 Earthquake Disaster Scenario

Based on the results of damage estimation, a consequence scenario of earthquake disaster was formulated in consideration of the present situation and the past experience of Algeria. For the preparation of the contents of the scenario, blank form of the scenario was distributed to members of the steeling committee and study team, and then, descriptions of the members were collected and combined.

It should be noted that this scenario is not a prediction of future situation. The purpose of this scenario is to provide a material for formulation of realistic disaster management plan and enhance disaster management activities, but not for criticize the present condition. From that standpoint, this scenario was arranged in the following form.

- Scenario earthquake: Khair al Dim earthquake occurred at 20:00; the most serious damage was foreseen among the six cases examined in this study.
- Subjects of the scenario: 24 kinds related to emergency response; (1) Emergency headquarters, (2) Base of support, (3) Accommodation and shelters, (4) Rescue and fire fighting, (5) Public security, (6) The injured and medial treatment, (7) Sanitation, (8) Missing persons, (9) Mortuary treatment, (10) False rumor and panic,(11) Psychological care, (12) Education, (13) Reception of support, (14) Food. (15) Drinking water, (16) Electric power, (17) Gas, (18) Telecommunication, (19) Media, (20) Air transportation, (21) Marine transportation, (22) Land transportation – Bridges, (23) Land transportation – Roads, and (24) Debris disposal
- Scenario of each subject: For each subject mentioned above, two kinds of scenarios were prepared; one for the worst case and another for an improved case, and then, recommendable measures are described in the third column
- Time axis: in order to display consequent scenario vividly, the scenario was described in 5 steps in time axis; that are (1) immediately after the earthquake to one hour later, (2) one hour to twenty four hours later, (3) one day to three days later, (4) three days to seven days later, and (5) seven days and much later

In the future, the scenario should be updated, following to the evolution of investigation and damage estimation as well as social, economic, and political situations. The recommendable measures to be promoted can be used as reference for formulation of policy and plans on disaster management of each sector or the nation. The contents are summarized in Chapter 10.

In order to arrange materials for preparation of suggestion on disaster management, important matters to be enhanced and important particular matters in each item of emergency response are selected through the following procedure, based on the above-mentioned consequence scenario.

1) Based on the consequence scenario, matters to be promoted or enhanced in each items of emergency response (see the upper portion of Table 9-16) are categorized. In the result, 12 categories (a. to l.) are picked up as shown on the left portion of Table 9-16.

2) For each item of emergency response, importance of each matter were evaluated and ranked into the following four classes.

   ◎: High priority matter, ○: Priority matter, ⋯: Related matter, ・: Less related matter.

3) Among the 12 matters, the following six (6) matters were selected as important matters, because the matters were evaluated to be high priority in many items.

   a. Seismic diagnosis and reinforcement of major facilities
   d. Education and prior information to the public
   f. Formulation of plan and training for emergency response in each sector
   g. Storing emergency supplies and materials
   j. Clarification of the procedure of formulation of rehabilitation/reconstruction plans

l. Preparation and retention of activity records, together with summary and improvement plans

4) Particular matters/measures to be promoted/enhanced were selected for each items of emergency response.

In the result, 27 matters were selected as shown in the lower portion of Table 9-16. The contents are summarized as follows.

- Among 27 matters, 17 matters are to be promoted or enhanced by initiative of administration (green-colored in Table 9-16). Most of the matters will be implemented in accordance with the prescription on detailed procedure in disaster management action plan. It is considered that formulation of systematic and comprehensive disaster management plans in accordance with damage estimation in this study will be a key issue for the promotion of these matters.
- 10 matters are to be promoted or enhanced in individual- or community-based activities (blue-colored in Table 9-16. In this occasion that peoples' awareness is raised through the Boumerdes earthquake, it is expected that individual- or community-based activities is promoted by means of adequate support from administration. Recommended contents of the support are summarized in sub-clause 11.2.

Table 9-16 Selection of Matters to be Promoted for Emergency Response, Based on Consequence Scenario

Matters to be promoted or enhaced \ Items of emergency response	1 Emergency headquarters	2 Base of support	3 Accommodation and shelters	4 Rescue and fire fighting	5 Public security	6 The injured and medical care	7 Sanitation	8 Missing persons	9 Mortuary treatment	10 False rumor and panic	11 Psychological care	12 Education	13 Reception of support	14 Food	15 Drinking water	16 Electric power	17 Gas	18 Telecommunication	19 Media	20 Air transportaion	21 Marine transportation	22 Land transportation - Bridges	23 Land transportation - Roads	24 Debris disposal	Important items relating to several matters (Remarks)
a. Seismic diagnosis and reinforcement of major facilities	◎	◎	◎	◎	◎	◎	◎	・	◎	・	・	◎	・	・	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	Sequential implementation of physical measures
b. Preparative measures such as fixing facilities	○	…	○	…	・	◎	・	・	・	・	・	…	・	・	・	・	・	◎	◎	◎	…	・	・	…	
c. Installation of emergency backup of lighting, power, and communication	○	◎	…	◎	◎	◎	・	・	・	・	・	…	・	・	…	…	…	…	○	◎	…	・	・	・	
d. Education and prior information to the public	…	…	◎	◎	◎	◎	…	◎	・	◎	◎	◎	…	◎	◎	◎	◎	…	◎	…	…	・	○	・	Enforcement of community or individual activities
e. Preparation of manual and training for quick diagnosis	・	◎	◎	…	…	◎	・	○	・	・	◎	◎	…	…	◎	◎	◎	◎	…	◎	◎	◎	…	…	
f. Formulation of plan and training for emergency response in each sector	◎	◎	◎	◎	◎	◎	◎	◎	◎	…	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	Formulation of overall and sector plans
g. Storing emergency supplies and materials	…	…	◎	◎	◎	◎	◎	◎	・	・	・	◎	・	◎	◎	◎	◎	◎	◎	◎	…	◎	◎	・	Implementation in accordance with the above plans
h. Agreement for emergency assistance with other areas or countries	◎	・	…	…	…	◎	…	・	・	・	・	…	◎	◎	…	・	・	・	…	…	・	・	・	…	
i. Reingforcement of volunteers' activity and cooperation with volunteers	・	・	…	◎	・	…	・	…	…	・	○	…	◎	◎	○	・	・	・	・	・	・	・	・	・	
j. Clarification of the procedure of formulation of rehabilitation/reconstruction plans	◎	・	◎	・	・	…	・	・	・	・	○	◎	・	○	◎	◎	◎	◎	…	◎	◎	◎	◎	◎	Securing consistency with emergency response plans
k. Promotion of international cooperation	・	・	…	◎	・	…	…	…	・	・	・	…	◎	…	・	・	・	・	・	・	・	・	・	・	
l. Preparation and retention of activity records, together with summary and improvement plans	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	

Particular matters/measures on the colored items

- Installation of facilities of Emergency headquarters
- Prescription of successors of chiefs of modules
- Formulation of disaster management plans of Communes
- Confirmation of gathering place of each family
- Prior announcement of emergency evacuation areas
- Assisstance for rebuilding houses (including cash subsidy)
- Storing mobile lighting facilities for emergency
- Prior announcement of prohibited matters in emergency situation
- Fixing furniture in houses
- Keeping a first-aid kit in each family
- Prior formulation of mobile medical teams
- Storing materials of portable toilets and shower facilities
- Prior confirmation of evacuation route in an emergency
- Storing temporary telecommunication facilities in an emergency
- Prior information of communication system to the public
- Psychological care for staffs dealing with crisis management
- Preparation of a list of victims and long-term pshchological care, based on the list
- Preparation and retention of records on earthquake experiences
- Smooth information exchange
- Storing food in each house
- Storing drinking water in each house
- Turn off power when evacuating
- Extinguishing a fire and cut off the gas in an emergency
- Keeping potable radio in each family
- Storing loudspeakers
- Prior designation of strategic roads
- Prior designation of debris disposal

◎ : High priority matter
○ : Priority matter
… : Related matter
・ : Less related matter
: Item, mainly implemeted by administration
: Item, mainly implemeted by communities

Chapter 10. Suggestions for Reduction of Seismic Damage

10-1 Clarification of Important Issues

Important issues for seismic disaster management were selected in three matrices. The contents of the matrices were compiled by the JICA Study Team based on the input from the Steering Committee members of the Algerian side on blank forms.

(1) Damage scenario (see Chapter 9)

Twenty-four (24) functions necessary for emergency response were assessed along a time axis starting at the occurrence of an earthquake, assuming damage by the Khair al Din scenario earthquake. The consequence scenario was prepared in two versions, one for the worst case and the other for the case in which improvements had been implemented, together with recommendations for the realization of the improvement scenario. In so doing, important issues were extracted as shown in Table 9-16.

(2) Assessment of the present situation on preventive activities

Sixty two (62) subcategories of seven (7) major categories concerning preventive activities (citizens, policy and planning, organizations and systems, disaster management resources, information and communications, raising awareness, and education and training) were picked for the assessment. Status quo of each subcategory was assessed, and summarized into strong points and weak points, together with recommended actions for improvement of the weak points, and then, important issues were extracted as shown in Table 10-1.

Most of the important issues extracted are to be addressed in decrees for the enforcement of Law n° 04-20. The series of decrees is expected to be formulated by the National Committee on Major Risk (DNRM) after its establishment, and will presumably consist of more than ten (10) decrees. Thus, the establishment of DNRM (promulgation of a decree to establish the committee) is most crucial.

(3) Clarification of important issues according to the disaster management cycle and the participating entities

Although this matrix partly overlaps the above analysis, seventy two (72) matters to be addressed in the aspect of seismic disaster management in Algeria were picked in a matrix of the disaster management cycle (preparation, mitigation, emergency response, and rehabilitation/reconstruction) and participating entities (official support, mutual support, and individual support) for assessment. The results of the assessment were summarized in terms of three elements (issues, the current situation, and responsible organizations) as shown in Tables 10-2 to 10-5.

Each matter was further evaluate in terms of the significance (three priorities expressed as A (highest), B and C (lowest)), the current status of implementation (three stages of progress expressed as III (most advanced), II and I (lowest)), and the urgency (three degrees expressed as a (most urgent), b and c (least urgent)). Since this evaluation directly concerns future disaster management measures, it needs to be conducted based on good understanding of the administrative, economic and social environments of the country, in light of the national

strategy and plan for disaster management. Thus, the evaluation presented herein is a proposal.

The proposal regards the following items as high in terms of importance, progress, and urgency.

- Preparedness (official support):
  1) Formulation of the national strategy and plan for disaster management
  2) Task sharing and collaboration among the organizations concerned
  3) Consideration of risk reduction in land use
- Preparedness (individual support):
  4) Understanding of the results of damage estimations and information on disaster management resources
  5) Preparation for emergency response at individual households
  6) Acquisition of information on disaster management
- Damage reduction (mutual support):
  7) Education and raising awareness
- Recovery and rehabilitation (official support):
  8) Preparation of rehabilitation and reconstruction plans

Promoting the above items is already recognized as a priority issue as prescribed in Laws n° 04-20 and n° 04-05 that stipulate the execution of the measures. The DNRM to be established in the near future is supposed to constitute the enforcement law and set up a comprehensive disaster management policy, which will cover measures for the above-stated issues.

Table 10-1 Important Issues extracted from Assessment on the Present Situation on Preventive Activities

Item		Issue	DNRM	Central Government	Local government
Policy	Policy and Plan	Formulation of national policy and national plan on DM	◎		
	Policy on comprehensive DM	Establishment of DNRM (National delegation for Major risk)	◎		
		Formulation of a systematic plan for comprehensive DM, covering preventive measures – emergency response – rehabilitation and reconstruction	○	◎	◎
		Formulation of comprehensive DM plan at national, Wilaya, and Commune levels	○	◎	◎
Institutions and organizations	Comprehensive DM	Formulation of decrees for implementation, managed by DNRM	◎		
		Establishment of an organization, exclusively dealing with DM in Wilaya			◎
	Risk reduction	Clarification of tasks and responsibilities for risk reduction measures	◎	○	◎
	Land use	Stipulation of a guideline for formulation of POS in PDAU			◎
		Preparation of a guideline for formulation of risk reduction plan (PPR)	○	○	◎
	Buildings	Installation of a support system such as subsidies for adherence to building code	◎		◎
		Fostering construction agencies and engineers	○	◎	○
		Introducing inventory book of registered buildings	○	○	◎
		Installation of incentive system for promotion of retrofitting	◎		○
	Emergency response	Improvement of modules, prescribing detailed procedures in ORSEC plans	○		◎
		Promotion of measures for securing function of capital	◎	○	◎
	Rehabilitation	Preparation of a guideline for formulation of rehabilitation and reconstruction	◎		
	Insurance	Promotion of having insurance, introducing incentive system	○		◎
		Clarification of an organization for promotion of insurance	○		◎
	Research/study	Formulation of regulations or plans to show the targets and required actions	○	◎	
DM resources	Budgeting	Securing and allocating budget for DM by DNRM	◎		
	DM resources	Formulation of a guideline, including individuals responsible, for storing emergency supplies	◎		
		Storing emergency supplies by each implementing body, according to action plan		◎	◎
Information and communications	Media	Preparation of scheduled information programs on DM, and implement programs	○	◎	◎
	Public information	Formulation of a guideline and action plan for dissemination of information	◎		
	Dedicated communication	Development of communication systems, covering all concerned organizations	○	◎	◎
		Promotion of documenting, maintaining, and utilizing the records of the past disasters	○		◎
	Database	Maintenance and updating of GIS database		○	◎
	Memory	Establishment of disaster memorial museum, collecting the past disaster records	○	○	◎
	Base and network of education	Preparation of national-level guidelines for education in DM	◎		
		Formulation of local DM education programs such as in schools		○	◎
		Establishment of base of education in each Wilaya			◎
Citizens	Community	Promotion of activities within the communities and by individual citizens on DM	○	○	◎
	Awareness	Determination of DM memorial day, and conducting campaigns for raising awareness	○	○	◎
	Cost sharing	Enhancement of official support for promotion of the activities of individual citizens for DM	○		◎
Raising awareness	Education	Prescription of guidance for formulation of education programs on DM	◎		
		Formulation of education programs for schools and communities		◎	
	Training	Formulation of periodic training programs	○		◎
		Fostering leaders of communities for promotion and assistance of local DM activities		○	◎
		Preparation of materials for training and education on DM		◎	○
		Installation of DM memorial museum as a base of training and education		○	◎
	Capacity building	Formulation of systematic capacity building programs	○	○	◎

Table 10-2 Clarification of Important issues, based on Cycle and Bodies of Disaster Management (1) Preparedness

		Official Support			Mutual Support			Individual Support
1		**Preparedness**						
		Knowledge and assessment of seismic risk						
1-1	A	Identification, analysis, and assessment of hazards and risks	5-1	B	Transmission of damage estimation results to citizens	9-1	A	Understanding of damage estimation results and disaster resource information
	III	Hazard/damage estimation has been done in this study. Updating/improvement of the results is required.		I	At present, there are few local groups which are active in the field of DM. It is desirable to enhance activities of local groups with administrative assistance.		I	For raising awareness and preparedness of citizens, the damage estimation results and resource information should be disseminated to the citizens.
	b	- *CGS and CRAAG : Scientific part* - *Wilaya (URBANIS): Urban part*		c	*'- MATE, DGPC, Wilaya : Provide assistance for enhancement*		a	*'- CGS, CRAAG, Wilaya, DGPC: Prepare materials and discuss the dissemination mode with M_Education and M_Telecommunication.* .
1-2	B	Dissemination of damage estimation results and disaster prevention measures	5-2	C	Storing and maintenance of local disaster prevention resources	9-2	A	Recognition of principles and necessity of disaster management
	I	For taking proper prevention measures and also raising awareness, the results should be disseminated to the related organizations and citizens.		I	At present, there is no local group which stores or maintains disaster prevention resources. First, it is necessity to clarify the kinds of resources which should be stored and maintained.		II	A central principle of disaster management is that one's own life and property should be protected by that individual, and all entities are important participants in DM. Understanding the risks and resources is fundamental for disaster management.
	a	- *MICL, CRAAG, M_Info, MATE: Formulation of plan* - *Wilaya, Commune: Executing with local groups, assisted by the above*		b	*'- DGPC, Wilaya: provide assistance for enhancement of local communities*		b	- *DNRM, Wilaya and communes: Disseminate responsibilities and tasks of individuals together with information on risks and resources.*
1-3	B	Identification of capacity of social resilience	5-3	B	Participation in formulation of local disaster management plan	9-3	A	Participation in community disaster prevention activities
	II	Part of the identification has been done in this study. For planning and activities on DM, detailed identification should be done.		I	Social surveys on local groups, public meetings, etc. should be included in the process of plan formulation, for enhancing participation and raising awareness.		I	Community DM activities are based on the intensions of individuals. Raising intension for or awareness of DM is essential for increasing social resilience.
	b	- *MHU & CGS: Urban and building* - *DGPC: Disaster prevention resources* - *Wilaya (URBANIS): Social characteristics*		c	- *Wilaya: Enhancing the participation in the formulation of the plan* - *DNRM: Prepare a guideline for the participation in the formulation of the plan*		b	- *DNRM, Wilaya and communes: Disseminate the importance of the activities and promote individual and community participation.*
1-4	A	Formulation of disaster scenarios and conducting disaster drills	5-4	C	Participation in the formulation of disaster scenarios	9-4	A	Confirmation of evacuation routes and communication methods among family members
	II	A disaster scenario has been prepared and table-top exercise has also been done in this study. Updating of the scenario and dissemination of the exercise are recommendable for the formulation and updating of adequate DM systems.		I	In terms of utilization of disaster scenarios for selection/implementation of measures and raising awareness, knowledge of local groups and citizens on local resources and vulnerabilities should be included in the scenarios.		I	The family will be the basic unit for emergency response, thereby, establishing a prearranged gathering place and method for confirmation of the safety of each family member are important issues for each family. Pre-confirmation among the family members should be done before disaster strikes.
	c	- *CGS, DGPC, and Wilaya (URBANIS): Updating Scenarios and conducting disaster drills*		c	- *Wilaya: Enhancing the participation in the formulation of the plan* - *DNRM: Prepare a guideline for the participation in the formulation of the plan*		a	- *DNRM and Wilaya: Disseminate and promote the matters to be predetermined among the family members.*
		Disaster management (DM) strategy and regulations						
1-5	A	Formulation of strategy and plan for DM	5-5	A	Participation in local disaster management activities	9-5	B	Participation in formulation of local DM plans
	I	There is no integrated national strategy or plan for DM. For the preparation of action plans at the local level, the national strategy and plan are indispensable.		I	DM activity in local groups is rarely seen at present. Creation of a framework of official assistance or incentives is required to enhance the participation.		I	It is important to inform individuals that they can obtain information and knowledge on disaster prevention as well as increase their social resilience.
	a	- *Wilaya: Formulation of action plan* - *DNRM: Formulation of national strategy and plan*		b	- *Wilaya and Commune: Formulation of realistic plans for the participation.* - *DNRM: Formulation of national level strategy and guideline for enhancement of participation*		b	- *DNRM, Wilaya and communes: Prepare a guideline for the participation in the formulation of the plans, and explain the necessity of participation to individuals.*

Official Support			Mutual Support			Individual Support		
1		**Preparedness**						
1-6	C	Feed back of disaster drill results to DM plan for improvement of the plan	5-6	B	Table-top simulations (DIG) and in-situ training (evacuation drills) at the local level			
	III	Formulation of the plan is a prior issue, and mechanism of feed back or evolution of the plan should be clarified in the plan itself.		I	For the selection/implementation of measures and raising awareness, DIG and the drills are very suitable tools, and should be promoted for ordinary use.			
	c	- *DGPC and Wilaya: A mechanism for feed-back or evolution of disaster management plan should be created.*		b	- *CGS and DGPC: Promote and spread DIG and the drills* - *Wilaya and Communes: Introduce as a tool for ordinary use*			
		Land use						
1-7	A	Guidance on prevention measures in land use	5-7	B	Participation in creation of local risk /resource maps	9-6	C	Cooperation in relocation of houses
	I	National-level guidance is available (SNAT 2020). Regional-level guidelines (SRAT and PAW) and local level plans (PDAU and POS) are under preparation. Local level risk prevention plans (PPR) should be formulated as soon as possible.		I	In order to utilize the knowledge and raise the awareness of the local people, it is recommendable to create local risk/resource maps with the participation of local groups.		II	Relocation of houses may be required in the course of urban renewal plans for increasing urban resilience. Cooperation with the relocation is important for the smooth implementation of the plan.
	a	- *Wilaya: Formulation of local POS integrating hazard zones in land-use* - *Special selection of specialized consultants or public services to formulate the PPR is necessary.*		c	- *Wilaya: Formulation of realistic plans for participation.* - *DNRM: Formulation of national level strategy and guideline for the enhancement*		c	- *MHU and Wilaya: Establish a legal framework for the relocation, including compensation. Prepare relocation plans based on the urban plan such as PDAU and POS.*
		Organization and institution on disasters management						
1-8	A	Allocation of tasks and collaboration among organizations, concerned with DM	5-8	A	Clarification of the tasks of the community and collaboration with other organizations	9-7	A	Receiving information on disaster management
	I	The mode of the allocation of tasks and the collaboration should be clarified in the disaster management plans to be prepared as mentioned in "1-5".		I	In terms of comprehensive DM, all bodies are important participants. The tasks of the community should be clarified, and activities should be in collaboration of all other bodies.		I	Receiving DM information fully relays on the individuals. Individuals should manage the way of receiving and their actions, based on the information.
	a	- *Wilaya: Formulation of action plans* - *DNRM: Formulation of national strategy and plan*		c	- *DNRM, Wilaya and Communes: Clarify tasks of all bodies in consultation with local groups, considering collaboration among all the bodies.*		a	- *DNRM and Wilaya: Disseminate and promote the concept that all individuals and families should provide for themselves a way of receiving information and that they should develop the ability for proper action.*
1-9	B	Collaboration between official organizations and private organizations	5-9	B	Establishment of DM information receiving/disseminating system	9-8	B	Understanding the warning system for proper evacuation
	II	In terms of preparedness for emergencies and mitigation of damages, official organizations should arrange for collaboration with private or privatizing companies concerning lifelines, relief/rescue materials, and dangerous stocks.		I	The community should be a base for dissemination of information, such as warnings and evacuation orders, assistance, and connecting officials with citizens. The receiving/disseminating system should be built into an ordinary information system.		I	Understanding of the system itself and the background of the system such as an outline of the technology and social conditions is important for proper evacuation and other actions following a warning.
	b	- *Wilaya and all supervisory authorities: Prepare and update collaboration plans with all major companies or associations of companies.* - *DNRM and DGPC: Prepare a guideline and arrange/monitor the collaboration.*		b	- *DNRM and Wilaya: Prepare a guideline for the system and assist the build-in.*		c	- *DGPC, CRAAG, and Wilaya: Disseminate explanation of the system itself, background, foreseeable conditions, etc. to the public.*

Table 10-3 Clarification of Important issues, based on Cycle and Bodies of Disaster Management (2) Mitigation

		Official Support			Mutual Support			Individual Support		
2		**Mitigation**								
		Disaster management (DM) resources								
2-1	B	Establishment of disaster management (DM) centers on a realistic scale	6-1	C	Stock and maintenance of disaster prevention (DM) materials in local groups	10-1	C	Participation in volunteer activities
	II	Together with establishment of DNRM as an institutional base for DM, it is necessary to establish DM centers as a physical base for before-, during- after disasters. The scale and equipment should be realistic for quick implementation.		I	It is recommendable to add some DM function to existing local groups, such as storing DM materials. Some camping goods such as tents, portable generators, cooking equipment and speakers, can be used during disasters.		I	Information on how to participate in volunteer work should be provided for those citizens who are willing to participate. It is recommendable that the Module for information service will include this recruiting function.
	b	*- DNRM or DGPC or Wilaya: Full responsibility for management of the center*		c	*Wilaya and Communes: Prepare list of recommended materials to be stockpiled and support for the stock by local groups*		b	*- DNRM and Wilaya: Include a volunteer recruiting function in the ORSEC plan, and conduct training for reinforcing volunteers' activities and ability*
2-2	B	Installation and maintenance of open spaces for shelters and storehouses	6-2	B	Fostering of community leaders			
	II	More open spaces and storehouses are required, especially in urban centers. Installation and maintenance of those should be planned and controlled in the urban plan.		I	The initiative of a leader is indispensable for an active local group, In order to foster group leaders it is recommendable to create a fostering program, consisting of guidance, training, DIG, simulations, and action plans.			
	b	*- DGPC and Wilaya: install and maintain open spaces and storehouses*		b	*- DGPC and Wilaya: Prepare and implement the fostering program*			
2-3	B	Storage of medical/sanitary supplies and food	6-3	C	Fostering of local NGOs			
	I	Kind and quantity of emergency stores should be determined, considering cooperation with private companies, communities, and individuals.		I	It is necessary to enhance the activities of NGOs, especially for education, raising awareness, and preparedness/training for emergency response.			
	a	*- Wilaya: Determine share among related bodies* *- DGPC: Responsibility for official support for storage*		b	*- DGPC and Wilaya: Prepare and implement the enhancing programs*			
2-4	B	Promotion of earthquake insurance	6-4	B	Promote natural disaster insurance at the local level	10-2	A	Obtaining natural disaster insurance
	I	Insurance has been compulsory for all residences. It is recommendable to monitor the ratio of residences actually covered and implement necessary measures for increasing the ratio.		II	Promotion of insurance will be effective if it is done as a part of activities of local communities.		II	Growing recognition of the damage caused by natural disasters along with incentives will assist to increase the number of insurance holders.
	a	*- MHU: Prepare a guideline on the monitoring and measures* *- Wilaya: Monitoring and implementing measures*		b	*- DNRM, Wilaya and Insurance companies: Prepare and implement local campaign of information and awareness for promotion of insurance.*		a	*- DNRM, Wilaya, and M_Finance: Prepare and disseminate measures for promotion*
2-5	C	Installation of prediction and early warning systems	6-5	A	Preparation for evacuation			
	III	Scientifically, prediction and early warning is almost impossible at present. It is recommendable to continue and update the monitoring systems for immediate determination of location and magnitude of an earthquake as it is done by CRAAG.		I	Areas and routes for evacuation should be clarified in communities for smooth evacuation with mutual support before disaster strikes.			
	c	*- CRAAG: Continue and upgrade the monitoring and announcing systems*		b	*- DNRM, Wilaya and DGPC: Announce evacuation areas to the public, prepare guidance on evacuation routes, conduct drills etc. for dissemination*			
2-6	A	Installation of information collection/dissemination system for DM	6-6	B	Communication system connecting local groups and administrators			
	I	DGPC has operated a dedicated wireless communication system using mobile units. The system is connected with CRAAG and some other agencies, and it is recommendable to connect all emergency response related bodies.		I	For not only emergency response, but also for education and raising awareness in ordinary times, it is recommendable to install communication systems connecting local groups and administrations.			
	b	*'- DGPC: Maintain, improve, and expand emergency response communication system.*		c	*- Wilaya, Communes, M_Information: Examination, planning, installation, and maintenance of the communication systems.*			
		Construction						
2-7	C	Strengthening buildings and introduction of low-cost retrofitting				10-3	A	Retrofitting or renewal of houses

Official Support			Mutual Support			Individual Support		
2		**Mitigation**						
	II	Providing an adequate number of new houses is a priority issue, rather than retrofitting. For new houses, proper application of a building code is essential. Demand by the public for means to strengthen their own houses is relatively high, but there is no information on introduction of retrofitting or any framework for official support.					I	Retrofitting or renewal of houses is essential for reducing damage to houses and human casualties. In order to promote the retrofitting information regarding an effective and economical method should be disseminated to individuals as well as contractors. Financial assistance by officials is also recommendable for the promotion.
	b	*'- CGS: Technical guidance on retrofitting* *- Wilaya: Improvement of building permit system for application of building code for all houses. Formulation of plan for retrofitting with official support.*					b	*- CGS: Examine and provide the retrofitting method* *- MHU and Wilaya: Establish subsidy system*
		Awareness - Training and Education						
2-8	B	Raising awareness of officials and capacity building of technicians	6-7	A	Promotion of education and activities on raising awareness in local groups	10-4	A	Participation in DIG and disaster drills
	II	In order to fulfill the role for official assistance, raising awareness and capacity building are indispensable. It is recommendable to introduce continuous activities for those items into the schedules of ordinary workers.		I	Program for education and raising awareness of DM is not popular in local groups. School programs are also limited. It is recommendable to install systems for activating such programs on education in local groups and schools.		I	DIG and disaster drills are effective tool for raising awareness, selection of priority countermeasures, and expansion of the circle of resources for disaster management.
	b	*'- GCS: Capacity building of technicians in charge of buildings* *- MHU and Wilaya: Raising awareness of officials in charge of urban planning and construction as well as other officials in charge of DM.*		b	*- M_National Education: Formulation of a guideline indicating required contents of the program* *- Wilaya, CRAAG, MATE: Preparation of educational materials such as booklets*		b	*- CGS, DGPC, Wilaya: Disseminate DIG manuals, execute DIG and the drills, and foster moderators.*
2-9	A	Education and raising awareness	6-8	A	Formulation and reinforcement of local DM groups			
	I	There is no particular plan or program on education at the national level, although some official agencies such as CRAAG, CGS, and DGPC conduct education programs.		I	It is recommendable to add a function or a role for DM into the present function of existing local groups.			
	a	*'- DNRM: Prepare guidelines on education and raising awareness* *- MATE, DGPC, M_Education, M_Communication: Prepare national program* *- Wilaya, Schools: Execution*		b	*'- Wilaya and Communes: Preparation of support systems and incentives for the formulation and reinforcement* *- DNRM: Formulate strategy and basic plan for the reinforcement*			

Table 10-4 Clarification of Important issues, based on Cycle and Bodies of Disaster Management (3) Emergency response

Official Support			Mutual support			Individual support		
3		**Emergency response**						
		Implementation of emergency response plan (ORSEC Plan)						
3-1	B	Launching a warning or evacuation order	7-1	B	Rescue and relief activities by community/volunteer groups	11-1	B	Decision whether to evacuate or stay at home
	II	For quick and proper response during a disaster, launching a warning and evacuation order is crucial. The criteria and procedure for the decision and releasing should be prepared before an event.		I	In case of catastrophic disaster, official support will not reach all victims quickly. It is thereby necessary to manage rescue and relief activities by the community/volunteers. It is recommendable to promote preparation for the activities, including storing materials and training citizens for the activity.		II	There are several matters to be considered for the proper decision on timing of evacuation. For clarifying these considerations, evacuation drills and preparation of evacuation material stockpiles are recommendable.
	b	- *DNRM: Prepare the criteria and procedure*		b	- *Wilaya and DGPC: Prepare guidance for promotion and facilitate the training*		c	*'- Wilaya and DGPC: Conduct evacuation drills and prepare guidance on evacuation*
3-2	A	Quick inventory of damage to buildings	7-2	A	Transfer of damage information from communities/volunteers to official agencies	11-2	B	Search and rescue of family members and neighbors
	II	Training courses for engineers should include capacity building on taking a quick inventory. It is recommendable to establish the training courses together with an authorization and registration system for engineers.		II	In case of catastrophic disaster, it will be difficult for official agencies to collect information on victims who require rescue or medical treatment. It is recommendable to involve communities/volunteers for smooth transmission of such information to be managed by the Module for information service.		II	Before official support arrives for rescue citizens will search and rescue missing family members and the neighbors. For the activities, it is recommendable to prepare materials for rescue such as a jack hammers, steel pry bars, etc. These should be available in hand or in community stock as well as conducting training.
	b	- *MHU: Establish a system for registration, and authorization of engineers* - *CGS: Conduct the training*		b	*'- Wilaya, DGPC, and DNRM: Prepare guidance showing the procedure of the transmission and facilitate the training, in cooperation with local groups*		b	- *DGPC and Wilaya: Prepare and disseminate a list of materials to be stocked for evacuation and rescue, and conduct training for rescue activities.*
3-3	B	Selection and regulation of strategic roads	7-3	B	Collaboration among communities/volunteer groups			
	II	A road network is essential for emergency response. In order to secure main arteries, selection of strategic roads should be done and the results disseminated. Plans for road clearing should also be prepared, considering equipment available.		I	For extensive mutual support, collaboration among communities/volunteer groups should be promoted. The arrangement for collaboration will be done by the Module for information service.			
	b	- *DGPC, Police, and Wilaya: Selection of strategic roads, and formulation of emergency response plan, including regulations on use of roads and preparation for road clearance.*		c	- *DNRM, Wilaya: Prescribe the mode of Information service for the collaboration in the ORSEC plan, and assist the collaboration*			
3-4	A	Establishment and operation of a crisis cell for management of all relief activities	7-4	B	Clarification of local needs			
	II	As a center for all management activities for decision-making and coordination among related bodies, details on the tasks and activities of CNAD should be prescribed in conformity with the ORSEC plan.		II	Support for victims, especially supplying material to evacuation camps, should be arranged, especially clarification of needs. Clarification of needs of the handicapped, children, and women is required in terms of adequate support for the weak.			
	b	- *DNRM and CNAD: Prepare detailed plans*		b	*'- DNRM and Wilaya: Mode of clarification of local needs should be included in emergency support in the ORSEC plan in cooperation with local communities.*			
3-5	B	Collaboration of all private organizations	7-5	B	Distribution of emergency supplies (medical/sanitary supplies and food)			
	I	In addition to collaboration among all official agencies, it is recommendable to plan and promote collaboration amongst private agencies and the communities.		II	For the efficient performance of the Module for food supply and material support, distribution of food or materials to citizens will be done in cooperation with local communities. The procedure will be prescribed in the ORSEC plan and disseminated through evacuation drills.			
	c	- *DNRM, CNAD, and Wilaya: Prepare collaboration framework with private agencies and communities.*		b	- *DNRM and Wilaya: Prescribe the general procedures for distribution in the ORSEC plan and disseminate the information regarding the procedures.*			

		Official Support	Mutual support	Individual support
3		**Emergency response**		
		Implementation of emergency response plan (ORSEC Plan)		
3-6	B	Maintenance of public order		
	II	The maintenance of public order is a responsibility of the Module for security and safety. Important information including the obligations of citizens such as matters that are prohibited in emergencies will be disseminated to the public for smoothing the operations.		
	b	*- DNRM, CNAD, M_Defense: Select matters to be pre-informed to the public and disseminate the matters.*		
3-7	B	Transportation of emergency supplies (medical/sanitary supplies and food)		
	II	The Module for food supply and material support and the Module for transportation will manage the supply and transportation, to be actually carried out by several organizations such as the military, DGPC, Red Crescent, volunteer groups, etc. The system of management, especially information on available carriers and demand/supply balance, should be established in the ORSEC plan.		
	b	*'- DNRM, CNAD: Prepare detailed management system for transportation*		
		External assistance		
3-8	C	Establishment of system for reception of foreign assistance		
	III	For catastrophic disasters, the Module for reception of foreign assistance will be established as it was in the Boumerdes Earthquake. The procedure for reception, tentative stocking, distribution, or dispatch should be prescribed in the ORSEC plan.		
	c	*'- DNRM, CNAD: Prepare detailed management plan for reception of external assistance.*		

Table 10-5 Clarification of Important issues, based on Cycle and Bodies of Disaster Management (4) Rehabilitation and reconstruction

Official support			Mutual support			Individual support		
4		**Rehabilitation and reconstruction (R/R)**						
		Support for victims						
4-1	A	Continuous and long-term support for victims	8-1	A	Psychological care of victims	12-1	C	Repairing own house
	II	It takes a long time for R/R, and support for victims should be provided continuously. It is necessary to prepare a list of victims for the continuous support.		II	In order to relieve psychological damage suffered by the victims, it is recommendable to formulate a plan for psychological care, including the efforts of the community.		II	In order to promote strengthening at the time of repairing, proper application of the building code is required and incentives may be considered for the strengthening in addition to insurance and consolation payments.
	a	*- DNRM: Formulate long-term plan for supporting victims*		b	*'- DNRM, Wilaya, and M_Health: Prepare the plan for psychological care, including the tasks of local groups*		c	*'- MHU, CTC, and Wilaya: Prepare and disseminate regulations or rules on repair, and incentives for strengthening*
4-2	B	Consideration of the weak in R/R	8-2	B	Participation in reformation of the community	12-2	B	Self-sustainability in terms of mental health and monetary concerns
	II	In general, the weak suffer from serious damage and do not recover for a longer time. Their access to information about assistance, and their economic/financial recovery should be taken into account in R/R stages.		I	Communities will be reformed, especially in resettlement areas. Plans and designs for facilities in resettlement areas should be prepared, considering reformation of the communities through a participatory process.		II	In addition to physical rehabilitation, mental and economic rehabilitation are important. Commercial or productive activity has a good effect for both. Marketing and job training will be planned in consideration of revival of local industry and small companies.
	b	*- DNRM and Wilaya: Formulation of R/R plan, including particular support for the weak*		b	*'- DNRM, Wilaya, MHU: Prepare the resettlement plan through a participatory process*		b	*'- DNRM, Wilaya, M_small and medium enterprises and crafts: Prepare plan for assisting the revival and implement the plan*
4-3	B	Support for self sustainability						
	II	For restoring ordinary life of victims so that they can once again become self sufficient, continuous support must be given to victims who are forced to relocate houses, jobs, etc.						
	b	*- DNRM and Wilaya: Formulation of plan and implementation of particular support for victims who are forced to relocate houses, jobs, etc.*						
		Planning and budgeting						
4-4	A	Formulation of R/R plan	8-3	C	Participation in the formulation of the R/R plan	12-1	C	Participation in the formulation of the R/R plan
	I	In addition to quick recovery to ordinary conditions, improvement of urban vulnerability is a key issue of R/R. Major issues relating to R/R plans, such as strengthening buildings, securing open spaces and widening of roads, especially in urbanized areas, should be adequately covered in the R/R plan.		I	Local needs should be reflected in the R/R plan. Public consultation meetings or public hearings should be held in the course of formulation of R/R plan in order to obtain local input.		I	The needs of each individual and family should be reflected in the R/R plan. For the reflection, questionnaires or interviews will be conducted, together with public consultation meetings or public hearings.
	a	*- MHU, MATE, Wilaya: Clarify outstanding issues, especially on urban vulnerability to be considered in R/R plan*		c	*'- DNRM, Wilaya, MATE, MHU: Prepare and disseminate a procedure for reflection of local needs in the R/R plan, and implement the procedure.*		c	*'- DNRM, Wilaya, MATE, MHU: Prepare and disseminate a procedure for reflection of individual and family needs in the R/R plan, and implement the plan*
4-5	B	Securing budget for R/R						
	I	Securing budget is an important issue for quick R/R. The budget should be estimated and allocated by a national level organization, based on a damage inventory.						
	a	*- DNRM: Estimate, secure, and allocate budget at the national level* *- Wilaya: Secure and allocate budget at the local level*						

		Official support	Mutual support	Individual support
4		**Rehabilitation and reconstruction (R/R)**		
4-6	C	Special financial aids according to seriousness of damages		
	II	Special financial aids will be made available for all victims, and some consideration in weighting will be added, according to previous efforts on mitigation such as owners of retrofit houses, holders of insurance, etc.		
	b	*'- DNRM: Prepare rules for consolation payments, including benefits for mitigation efforts*		
		Monitoring, control, and guidance		
4-7	B	Monitoring, control, and guidance of reconstruction plan		
	I	Control of application of R/R actions is necessary through instruments like certificates of conformity for the new constructions and local inspections. Those actions have to be implemented by specialized services in charge of control of land-use and construction conformity in normal times.		
	b	*'- Wilaya and communes: Establishing organizations and procedures for monitoring, control, and guidance f implementation of R/R plan*		

Legend

Upper row : Significance	A	High	B	Moderate	C	Low
Middle row : Current status	I	Not-implemented or slow progress	II	Implemented somewhat	III	Well implemented
Lower row : Urgency	a	High	b	Moderate	c	Low

10-2 Recommendations concerning Organizations, Systems, and Disaster Prevention Plans

10-2-1 Comprehensive Disaster Prevention

(1) Systematic disaster prevention

Natural disasters are a hindrance to sustainable development and poverty reduction. Removal or mitigation of such obstacles requires disaster prevention activities. The goals of disaster prevention are: 1) to protect the human life, 2) to protect the social and economic systems, and 3) to maintain the governance of the country. Of these, on top of 1) human life being of paramount importance, it is as well necessary to give due consideration to 2) and 3) in this project, considering that Alger is the capital, meaning the center of the society and the economy, of Algeria.

Particularly, a disaster may inflict consequences on a large scale unprecedented in Alger in recent times and paralyze the functions of the capital. Therefore, it is favored to promote disaster prevention efforts, not only based on the past experiences, but also on a recognition that hazards may occur on an unprecedented scale.

(2) Organizational disaster prevention

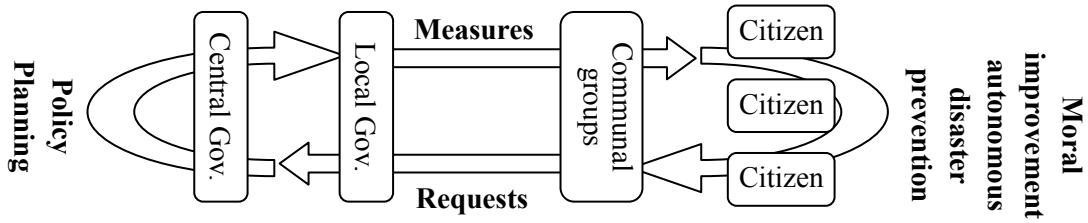
Organizations and systems associated with disaster prevention in Algeria have evolved in many aspects through the Bab El Oued Flood (2001), the Boumerudes Earthquake (2003), and other major disasters since the El Asnam Earthquake in 1980. A summary of such evolvements from the viewpoint of a disaster prevention cycle follows.

- Before the disaster (prevention/damage reduction): In accordance with Government Decree No. 85-232 that requires prevention of risks, an earthquake observation system (CRAAG), quake-resistance standards for buildings (CTC and CGS), etc. have been developed. On the other hand, implementation of measures associated with prevention and damage reduction in the other areas and organizations is still limited to promulgation of laws and regulations concerning land use (Laws No. 04-05 and No. 04-06), information and communication (Government Decree No. 04-181), natural disaster insurance (Government Decree No. 04-268), etc. While Law No. 04-20 provides for preventive measures (to prevent risks) in connection with information, education and training, strategic storing, etc., its enforcement law has not yet been established.
- Immediately following the disaster (emergency actions): Government Decree No. 85-231 regulates risk management, based on which the emergency action plan (ORSEC Plan) was formulated. In case of a large-scale disaster event, emergency actions shall be carried out according to modules (fields) based on the plan. The effectiveness and weaknesses of each measure revealed will be reflected in improvement of the plan, with Law No. 04-20 taken into consideration.
- After the disaster (recovery and rehabilitation): While a government decree concerning compensation for the damage incurred (Government Decree No. 04-268) and temporary statutes for individual disasters cover this aspect, recovery and rehabilitation activities are carried out by the ministry or agency that has the

jurisdiction over the area. Above all it should be noted that there is no comprehensive system or organization.

(3) Comprehensive disaster prevention

It is essential for all the organizations and people involved to participate in disaster prevention activities. In Alger, based on the experiences of the Bab El Oued Flood and Boumerudes Earthquake, it has been recognized as vital to carry out disaster prevention activities with participation of communal groups and residents. Further, Law No. 04-20 clearly states its importance (Article 9). The entities to be involved in disaster prevention are 1) the central government, 2) the local government, 3) communal groups, and 4) citizens, all of which desirably constitute a system, as illustrated in the example below, to activate disaster prevention activities.



The local government is responsible for the safety and health of its citizens and has the best understanding of the conditions of the area, therefore, is expected to play a leading role in carrying forward disaster prevention measures. In this regard, it is desirable that local governments prepare their own local disaster prevention plans as schemes to implement disaster prevention measures and actually implement them accordingly.

Communal groups are expected to prepare for a situation where they cannot reach sufficient public aid at the time of a large-scale disaster, in addition to promoting regular moral improvement and damage reduction efforts before disaster strikes, so as to strengthen the power of their society for disaster prevention.

Citizens are highly conscious of the necessity of disaster prevention due to their fresh memory of the Boumerudes Earthquake. Unfortunately, however, the solidarity of communities is rather weak today, owing to the chaos in the country in the 1990s and the rapid urbanization, and at the same time people still tend to be dependent on public services, which is a relic from the socialistic regime. For these reasons, introduction of a system which supports autonomous disaster prevention activities is highly needed.

(4) Specific disaster prevention

In order to implement disaster prevention activities in an effective manner, it is important to know of the damage and risks, including vulnerabilities, and prepare a disaster prevention plan to mitigate the risks, based on which the measures will be implemented in an actual situation. This study not only simulated damage but also collected data related to vulnerabilities (disaster prevention strength) of cities and societies necessary for risk assessment. It is hoped that specific plans will be prepared based on these results.

(5) Proper disaster prevention

As far as earthquakes are concerned, it is extremely difficult at the current level of modern science to predict when and where a disaster will occur or on what scale or what kind of damage that will bring. Similarly, there are many uncertain factors in risk assessment. Consequently, it is vital that the government starts with promoting measures where they can, taking requests from citizens and financial conditions into consideration, based on damage estimations and risk assessment on the best-effort basis. Accumulation of such attempts will lead to the construction of a city resistant to earthquakes and reduce damage. Also, the damage simulations and risk assessments shall be continually updated in accordance with accumulation of technology and information, while relevant plans also have to be reviewed accordingly.

10-2-2 Recommendations for disaster management in the human and social fields

Algiers is the political and economic capital of the country, place of concentration of population, services, administrations, and companies, and it is of international radiance. For these reasons, it constitutes an exceptional issue of which any deterioration can have serious consequences on the whole of the country. It is necessary to create conditions for suitable application of disaster management by all the actors in sustainable development, and thereby to evolve risk perception and local culture. We consider in this chapter the recommendations which relate to the community, social and human aspects.

(1) Recommendations dealing with culture and governorship

1) Political and socio-cultural context

Algeria published on 25 December 2004 an exemplary law (law 04-20) on the prevention of major risks and the management of disasters within the framework of sustainable development. The State also has a regulation giving protection to the entire environment. It proposes to create, under the authority of the Prime Minister, the "National Delegation on Major Risks" (DNRM), which is an institution for the coordination and evaluation of the preventive actions. This legislative framework is the fruit of the reflections of political, administrative, scientific and technical experts who know the subject well and it is nourished by the experiences of the most advanced countries. The Algiers' society as a whole must adhere to this framework, but it should be recognized that the conditions stipulated in that law have not yet been satisfied and that it will be necessary to realize it gradually. It is thus advisable to reduce the difference between theory and practice, among experts, intermediate bodies and the citizens, or between regulations' requirement and operational capacity.

The universal intervention of the State must involve professional competence and private means which come to supplement those of the public services on the one hand, to individual responsibility and citizen participation on the other hand. Consequently, the responsibilities, competence and roles of the actors must be redefined within a coherent framework.

This task is the major duty of the "National Delegation on Major Risks" (DNRM).

2) Governance and active appropriation of disaster prevention

To extend the current governance system

Following the catastrophic events that Algeria faced during the last years, the Algerian legal system has been reinforced regarding disaster management, especially on collaborations between concerned Ministries and administrations particularly for crisis management. The experience of those catastrophic events also accelerated high-level dialogue between politicians and specialists relating to definition and organization of risk prevention.

The new framework introduced by law 04-20 focuses three main actors; the State, the local authorities and the citizens. Institutional continuity between the central government and the local bodies is realized at the level of the Wilaya which ensures the connection with the APC. However there is a progressive loss of sense in the objectives and the knowledge of how to apply the tools of prevention from the central administration towards the local services. This is a traditional tendency, and the continuity should be ensured with permanent actions of information and training.

In addition to the legal system on administrative organization, raising awareness of citizens is an importance factor for disaster management, especially for mobilization of the private sector in control of building and construction, and participation of citizens in land-use and building. It is necessary to establish a legal system involving related private sector parties and all citizens in disaster management such as for enforcement of local communities/private sectors, training, and education.

Active appropriation and community participationA suitable application process should be involved in a development perspective. For that, it is necessary to apply a disaster management system in accordance with local history for supporting the collective maturation. It should be based on a sense of the common values in the local culture (expressed collective vocation).

The concept of "participative urban planning" introduced by the law constitutes a real opportunity for suitable application and allocating tasks for disaster management. We recommend that the implementation of new PDAUs falls under a process of suitable application of the principles of preventive and participative planning registered in this law. The first concerned are the services of the Wilaya, then the communes, the private actors in urban planning and construction, and finally the citizens. The media should relay corresponding information and explanations.

The proposed ideas for strengthening of local groups are as follows.

- Certain local groups or traditional structures could be encouraged and financed for participation in the information management and the reduction of the vulnerabilities to reinforce the local capacities of APC.
- The mechanisms of participation of the community in local development projects could be defined according to "public consultation". The forum of discussion must make it possible for citizens to explain and discuss their own needs as well as proposals on urban planning and to evaluate collectively what can be reasonably done to reduce the risks and to ensure suitable local development. The scientists and politicians must be organized in this direction.

(2) The information regarding preventive measures

1) Characterization of the major risks

Risk assessment

The identification of the natural hazards and the evaluation of the corresponding risks form an essential base for disaster management policy.

According to law 04-05 of 14 August 2004, the seismic zones in particular must be identified and classified according to related new decrees on vulnerability, and the construction projects must be handled jointly by approved architects and engineers.

In order to promote seismic disaster prevention under the new law 04-05 and related decrees, it is required to develop methods, means and competence for implementation, instruction and control of the projects, without procedural delays, without contradiction to the fixed objectives for urbanization. The following two actions are essential for characterization of the major risks.

- zoning and cartography of the natural hazards, then development of Risk Prevention Plans (PPR) in accordance with law 04-05 and related new decrees for application
- development of Disaster Scenarios and Impact Studies (direct and indirect) to present concrete images of possible crises to decision makers and citizens for their further actions

2) Communication: public awareness and information

Communication (information management) is an important issue because news on risk disseminates influence directly to the feelings of citizens.

The cultural change occurs in the daily lives of the citizens who sit in a flood of information. The positive passage of information to a culture of prevention is only possible if the gaps among 1) sources of scientific and specialized knowledge, 2) the management of the political and technical regulations and 3) the social diffusion of information, are filled. In this direction, three rules of action must be respected.

- Information on risks (scientific, lawful, behavioral, etc.) must be disseminated to all the stakeholders; the information must be identified on the basis of socio-cultural criteria (referents, language, level of education, role in the society, etc.); the information must be credible and regular.
- The contents of the information must be understood to be transformed into knowledge: the information intended for the decision makers, the relief services, the technicians, the schoolboys or the families must be presented in appropriate (accessible) forms to each category.
- The knowledge must be transformed for concrete decisions and social actions, through a process of suitable application of disaster management.

It is thus important to link the actions of communication to the dissemination process in application of disaster prevention.

The executive decree N° 04-181 of 24 June 2004, concerning the creation of the commission of communication on the natural and technological major risks gives the basis for an action for establishing a specialized communication system. A global strategy for communication on the major risks (awareness, information, community preparedness) is essential for the reduction of the physical, economic and social vulnerabilities of the urban concentrations in Algeria.

(3) Competence and capacity strengthening

Prevention requires that the population accept greater responsibility, possibly with the assistance of associations, but mostly from security experts. In spite of their desire to contribute to risk mitigation, but due to a lack of specific skills, many actors accept intermediate positions between experts and the population. The first mobilization decrees should be for the locals and the professionals.

1) Crises and post-crises management

The necessary early preparation of citizens for a time of crisis is not directly considered in the ORSEC plan. But it constitutes an important component of the crisis management. This task consists of education of the children and families with survival gestures, to use certain media as a tool of contacts during the crisis, to associate with the leaders of opinion, to distribute the roles between APC and public or private organizations such as the Red Crescent, etc, to organize exercises for simulations in the districts, etc. The corresponding initiatives should come from the CNAD.

2) Risk-reduction in construction and planning

Law 04-20 proposes a framework of good practices for risk-reduction and environmental-protection integrated into urban planning and development schemes at the national, Wilaya and communal levels. Sectoral plans are currently being studied (habitat, hydraulics, etc).

- As regards territorial planning, it is necessary to underline the urgency of the definition of the Plans of Prevention of the Risks (PPR) at the communal level by precisely defining their objectives and their contents (presentation, zoning, regulations), as well as the conditions of their follow-up with a schedule for realization taking account of territorial priorities.
- As regards seismic design, Algeria acquired a very effective seismic design regulation on the technical level, and it is well adapted to the Algerian framework. Unfortunately, the domestic situation in the 1990s induced the disappearance of many building firms and workers with competence (chiefs of building sites, diggers, masons, etc), and also caused a drop in the quality of constructions (nature of materials, sites management, execution, control). Law 04-06 which modifies decree 94-07 on the profession of architects and architectural production tries to offset this situation.
- A big difficulty is foreseeable for proper application of building permits if raising awareness campaigns and a process of suitable application of disaster management is not implemented, as indicated in chapter 10.3.4. This urban pedagogy will be entered into in the spirit of the “urban planning of participation” envisaged in law 04-20. That will take time and should be started quickly.

From this viewpoint, the services of the DUC, Daïra and APC should have form the new rules on urban planning, their articulation, the means of control, the sanctions envisaged, and the pedagogy to be developed.

3) Local capacity strengthening

Where there are technological or engineering resources at the central level (professional associations, service quality, technical training), the limitations in education and training of important sectors is noticeable (journalists, teachers, imams, communal services, building companies, etc). Special programs are necessary to strengthen capacities in many sectors. At the local level it is also necessary to build community capabilities:

- supporting initiatives of communal authorities in disaster risk reduction,
- building links to reduce risk (extended partnerships and networking),
- implementing local action Plans for emergencies and local infrastructures for immediate crisis intervention before the arrival of the external relief teams (emergency stocks or shelters, medical or psychological health care, training for participants),
- involving the population and developing social cohesion based on the solidarity observed during the recent disasters.

10-2-3 Recommendations concerning Organizations, Systems, and Disaster Prevention Plans

(1) Establishment of the DNRM

The realization of a comprehensive disaster prevention scheme mentioned in the previous section requires, among other things, establishment of a disaster prevention framework based on Law No. 04-20. The DNRM is supposed to play a key role in this framework, and in fact a government decree to set up the committee is now underway. The DNRM is expected to formulate, as soon as it is established, enforcement Law No. 04-20. In addition, the Secretariat of DNRM will assumedly be in charge of coordination of relevant ministries and agencies and support decision-making. It is important to assure harmony with the roles of the existing organization, CNAD.

(2) Formulation of the enforcement law

The following are the major contents of the enforcement law to be established by coordination of the DNRM.

- Regulations concerning provision of information (organization, guidelines, overall plan)
- Regulations concerning education and training (education on disaster prevention through schools and mass media, programs concerning popularization of quake-resistant standards, training on emergency actions and risk management)
- Regulations concerning reinforcement and supplement of aseismic functions of buildings (organizations, procedures, overall plans for general residential houses and strategic buildings)
- Regulations concerning the launch of an emergency action plan (ORSEC Plan) and detailed processes of support activities in each module

- Regulations concerning storing of emergency relief goods (list, storing method, usage)
- Regulations concerning financial support for victims (guidelines for conditions, implementation methods, etc.)

In addition to these, the following articles are also expected to be included in the enforcement law.

- Guidelines for preparing a risk mitigation plan necessary for formulating a land use plan
- Guidelines for preparing a recovery and rehabilitation plan
- Regulations for promoting academic research
- Regulations for promoting autonomous disaster prevention efforts (subsidy program concerning architecture, program to encourage subscription to insurance, scheme to prepare, store and use disaster records, system to prepare and update databases, and program to enhance activities by communal groups including development of local disaster prevention and evacuation bases)

(3) Coordination and monitoring of disaster prevention activities by the DNRM Secretariat

The Secretariat of DNRM is expected to not only coordinate related organizations for the purpose of implementing the disaster prevention measures stipulated in the existing laws and the above-mentioned enforcement law, but also perform monitoring necessary for secure implementation of the measures as well as carrying forward improvements as necessary. In particular, it is necessary to monitor from the standpoints of compliance with the architectural norms promoted in accordance with the existing laws, the status of formulation and implementation of land use plans and urban planning, and development of the communications network in relation to disaster prevention.

(4) Formulation of the national disaster prevention strategy and the national disaster prevention plan

As the DNRM is considered to be an organization equivalent to the Central Disaster Management Council of Japan, the committee is expected to formulate a national disaster prevention strategy and a national disaster prevention plan necessary for enhancing the above-mentioned comprehensive disaster prevention system. Listed below are items to be addressed in association with the strategy and the plan.

- Setting up mid- and long-term goals
- Identifying short-term priority measures
- Maintaining role-sharing and cooperation among ministries and agencies concerned and other entities participating in disaster prevention activities
- Coordination concerning budgeting and budget distribution (securing of personnel)
- Rationalization of implementing the measures (legal rationalization and empowerment)
- Preparation of regulations for reviewing the plan

In addition, the national disaster prevention plan shall indicate the framework of and the contents to be included in local (provincial/municipal) disaster prevention plans that act as disaster prevention implementation plans.

(5) Formulation of local disaster prevention plans (disaster prevention implementation plans) and implementation of the measures

The local disaster prevention plans to be prepared by the provinces are expected to integrate plans for disaster prevention/damage reduction and recovery/rehabilitation, while maintaining the consistency with the existing emergency action plan (ORSEC Plan). Furthermore, it is indispensable to give consideration to each of the elements necessary for realizing the above comprehensive disaster prevention scheme. The following summarizes items to be included in the disaster prevention plans, based on the tasks extracted in Chapter 10-1.

1) Mechanism for disaster prevention

It is expected that a dedicated department for disaster prevention will be set up at the provincial level, which will be responsible for coordination and monitoring of implementation of necessary measures, etc. In addition to the function as the secretariat, it is expected to set mid- and long-term goals, identify short-term measures, maintain role-sharing and coordination among parties concerned, coordinate in the budget aspect, coordinate and monitor promotion of measures, and, in particular, facilitate autonomous disaster prevention by being a direct interface with citizens.

2) Preparatory measures

- Urban planning / land use plan: The land use masterplan (PDAU) provides a set of guidelines for preparing a land use plan (POS). A POS must include identification of risks and risk mitigation plans in accordance with the guidelines provided by the central government. In addition, it is also important to include a redevelopment plan which covers securing squares and widening roads for the sake of seismic damage reduction.
- Building reinforcing plan: It is important for the procedures to observe the architectural norms to be well established and that certain measures for assuring work quality are put in place. Moreover, the plan is expected to mention fostering of inspection organizations and design and construction engineers, development of a building ledger, incentive schemes for promoting quakeproof design and compliance with relevant standards.
- Plan to develop and strengthen the disaster prevention bases and infrastructures: It is important to diagnose antiearthquake features and carry out strengthening of aseismic measures based on the diagnosis results. It is also necessary to examine establishment of facilities, such as a disaster prevention headquarters, local disaster prevention bases, disaster prevention memorial halls, etc.
- Plan to encourage the insurance scheme: It is critical to take actions to promote natural disaster insurance, which has been made compulsory, to existing buildings. An introduction of incentive schemes must be examined as a means to do so.
- Education and training plan: In accordance with the guidelines provided by the central government, it is essential to formulate a plan to continuously provide education through schools and mass media and training on emergency actions. Moreover, cooperation with various special organizations is vital in terms of the development of textbooks and manuals for this purpose. Especially, as for disaster prevention education in schools, it is indispensable to start with nurturing teachers by accumulating disaster prevention knowledge and training how to

educate students. Similarly, education and training for communal groups and citizens must necessarily start with training of trainers. Through these trainings, citizens can confirm evacuation points and routes, communication methods to be connected with other family members, how to obtain necessary information, etc. It is imperative to facilitate preparatory measures, such as strengthening houses and fastening furniture to the structure, damage reduction, and other autonomous activities. In addition, it is desirable to conduct training of experts and engineers in the plan.

- Plan to provide information on disaster prevention: The laws mandate that all citizens be equally informed. The kinds and sources of information to be disclosed should be determined in line with the guidelines provided for by the central government; in the meantime, the method of disclosure must be decided in the local plan in close cooperation with the mass media. It is also desirable to distribute the details of the GIS database for disaster prevention resources via printed materials.
- Plan to store emergency relief goods: In line with the regulations stipulated by the central government, provinces, municipalities and citizens must prepare a plan which designates the kinds, quantities, and methods of managing and updating relief goods to be stored.
- Plan for academic research and studies: In parallel with an improvement of the accuracy of seismic studies and observations by CRAAG, an update of the microzoning map by CGS, and collection of data with regard to disaster prevention resources and society by civil defense services and URBANS, it is imperative to develop a seismic damage early prediction system.

3) Emergency actions

Although an emergency action plan (ORSEC Plan) is already in place and has been revised to reflect the things learned from its actual use, it is extremely important to continue efforts to improve it. For this purpose, it is necessary to specify the procedures to respond to the 24 categories described in Table 9-16 as to respective modules, based on the damage estimation generated in this study. Particularly, it is desirable to prepare a plan which clearly states the detailed procedures to implement the priority measures given in Table 9-16 and specific actions. In so doing, it is important to maintain consistency with the preparatory measures, cooperation with citizens, and coordination among different modules, for the sake of efficient response.

4) Recovery and rehabilitation

Points to be noted in recovery and rehabilitation include restoration of the original state and formation of a city more resistant to earthquakes. Accordingly, concerning infrastructure and other social stock, it is recommended to prepare a blueprint for recovery and rehabilitation efforts in linkage with a long-term development plan in the fields of electricity, gas, communications, airports, ports and harbors, bridges, roads, hospitals, and so on, based on the guidelines provided by the central government.

As for housing, it is desired to achieve disaster insurance coverage for all buildings in place of the conventional disaster funds. Further, long-term assistance is needed in

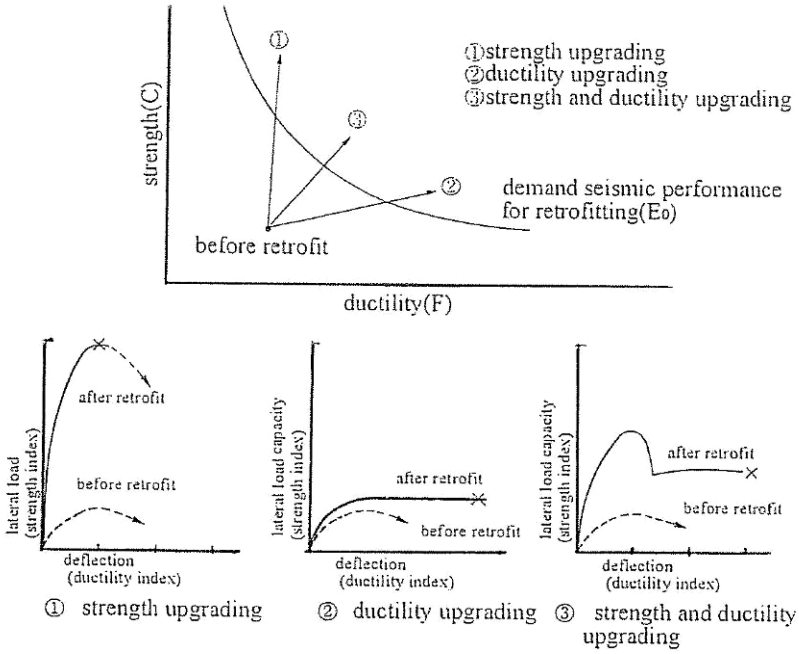
various other aspects, such as maintenance of solidarity of communities, mental care, keeping of disaster records, protection of local industry, and preservation of historical assets.

10-3 Building

The building collapse and heavy damage is most serious source on human casualties as well as in disaster due to past many great earthquakes. JST and CGS make some recommendation for seismic vulnerable buildings regard to the seismic retrofit methods of each type of existing buildings for earthquake impact reduction.

10-3-1 Concept of Seismic Retrofit

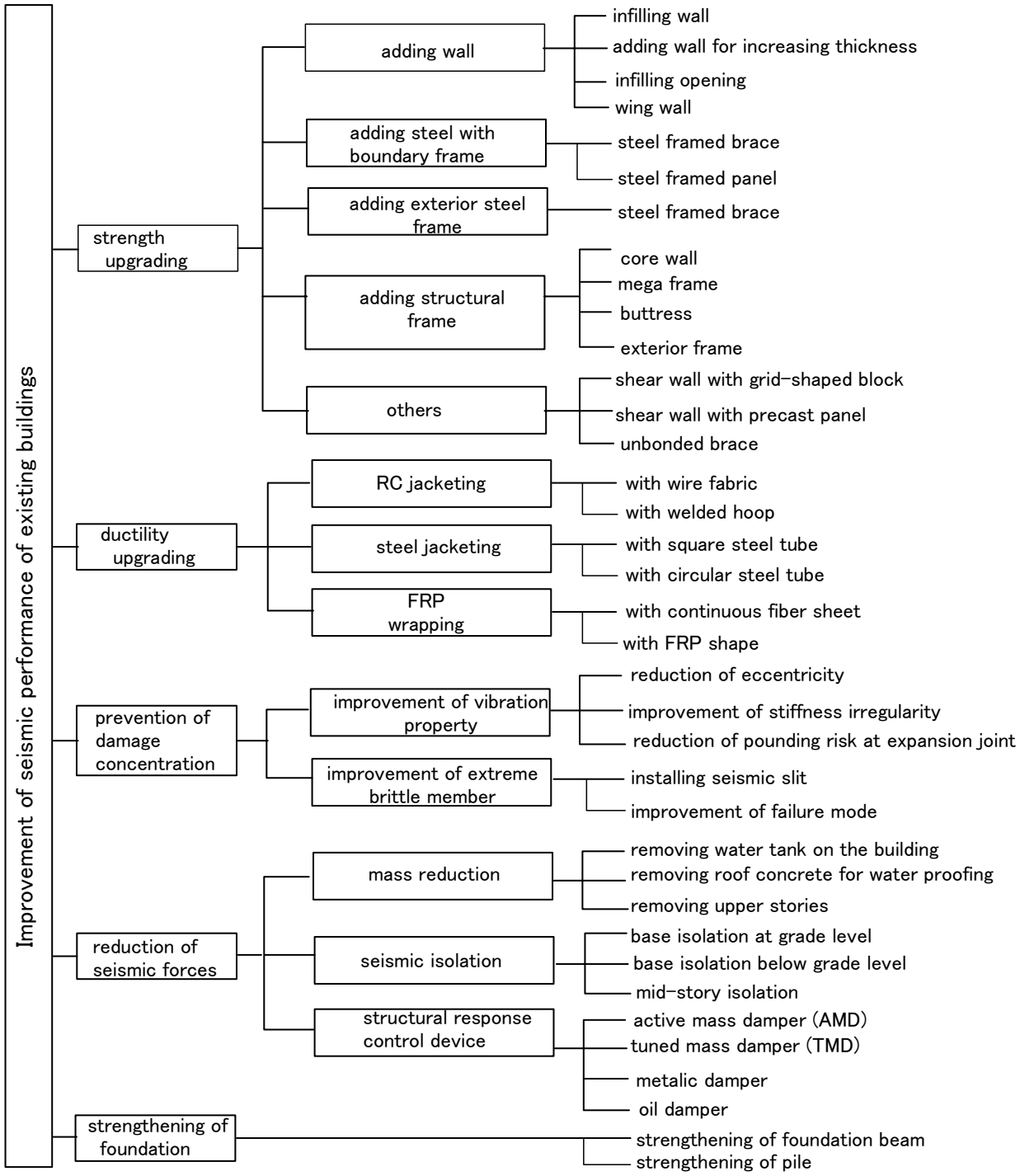
The existing seismic vulnerable buildings have basically luck of strength or luck of ductility. The seismic retrofit methods are made seismic performance upgrading with strength or ductility and/or both mixed as shown in Figure 10-1.



Source: Standard, Guidelines and Technical Manual for Seismic Evaluation of Existing Reinforced Concrete Buildings, 2001 Japan

Figure 10-1 Concept of Seismic Retrofit for Existing Buildings

In case of retrofit planning, the subject building's accurate seismic capacity must be grasped from result of seismic evaluation i.e. luck of strength or luck of ductility. It will be indicated a choice of structurally effective retrofit methods, but the building has some other conditions. Under those conditions, engineer must be select the most suitable retrofit plan with cost through discussion with building owner, building operator or user, and sometimes initial design architect and engineer. The retrofit technical purpose, retrofit methods and construction techniques are shown in Figure 10-2.



Source: Standard, Guidelines and Technical Manual for Seismic Evaluation of Existing Reinforced Concrete Buildings, 2001 Japan

Figure 10-2 Classification of Seismic Upgrading Methods

10-3-2 Masonry Buildings

(1) Retrofit Methods for Normal Masonry Buildings in Algiers

Approximately 34% of all buildings in study area made of masonry structures. 43% of masonry is simple stone, 45% of masonry is un-reinforced masonry of stone with composite slab, 12% of masonry is un-reinforced masonry of brick. Many masonry buildings are very old, for example, masonry buildings in Algiers Center were constructed from 1880 to 1940, over a range of approximately 60 years. And 48% of masonry is over 2 story, especially un-reinforced stone masonry building.

Against to the present conditions of masonry buildings in Algiers, we recommend seismic retrofit methods for stone and brick masonry structures as shown in Table 10-6.

Table 10-6 Recommended Retrofit Method

Condition	Objective	Applicable Seismic Retrofit Methods
Vulnerable Structure	Add mainly strength and ductility	• Adding RC shear wall • Covered by RC jacketing wall (for the dwelling houses) • Adding masonry wall: increasing thickness, infilling opening, buttress • Provide new frame: RC structure or Steel structure
Old Building	Add strength and ductility, and replace degraded material	• Replace to rigid diaphragm floor and roof system • Connect wall to wall and wall to floor • Provide new frame: RC structure or Steel structure • Demolish and built with suitable structure
Over Loaded Building	Reduction of over load	• Cut off the over loaded stories • Demolish and built with suitable structure
Traditional Façade	Make effort to preserve façade	• Keep façade and provide suitable structure • Adoption seismic isolation system

(2) Recommendation of Retrofit Methods for the Presidential PALACE (herein after the PALACE)

According to the result of our seismic evaluation (Refer to Chapter 10.1), the PALACE required certain seismic retrofit plan and work as soon as possible. However, Since this seismic evaluation was performed based on "the assumed shearing strength of the bearing wall unit is 0.056 Mpa (N/mm^2)", it should be confirmed the actual shear strength of joint material in the existing bearing wall unit, before final decision.

1) Recommendation of Seismic Retrofit Plan

The PALACE was constructed a traditional and historical design on exterior and interior façade with all parts at the building. The basic condition on seismic retrofit plan has to preserve these status. Therefore, we do not apply any additional

strengthening materials such as concrete shear wall and steel supports from outside of existing bearing walls and supports. Under this condition, it recommends 3 types of the retrofit plans for main structure and reinforcing plan for the arch and roof system at the main hall of new Palace. In this summary, it shows the main plan only, the other plans and detail of plan refer to Chapter 10-3-2 (2).

(A) Adoption of Seismic Isolation System at Under-ground Level

The seismic isolators with dumper are provided at under-ground level, and approx. 50cm to 60cm of clearance space around the building stamped area for the building movement during great earthquake. Since the main hall block area has a basement floor, the seismic isolators are set at upper-part of basement bearing wall or under basement floor level. The layout of isolators is shown in Figure 10-3.

Even if adopted the base isolation system for all superstructure, it will be checked the necessity of strengthening of superstructure on each floor level for safety of building. According to result of our seismic evaluation, both blocks of the New Palace on 1st and 2nd floor only may be required adequate strengthening.

The cost of this retrofitting work is quite high range (In Japan, it is approximately 40% to 80% of replacement cost). However, in this building case, it is quite useful method.

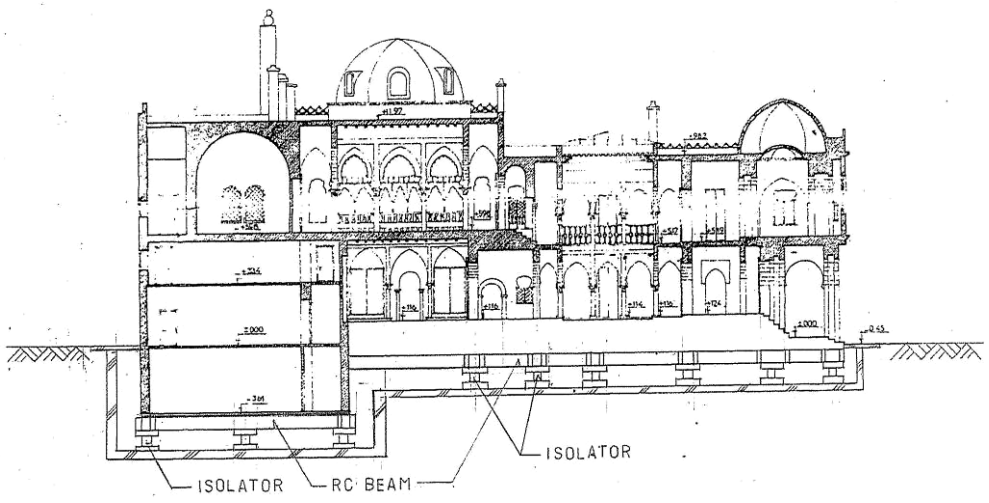


Figure 10-3 Installation Level of Seismic Isolator

(B) The arches at the Main Hall have better to reinforced with the additional steel trusses and horizontal steel bracings, and to replaced the sloped roof material.

The existing arches at the main hall were reinforced with steel arch trusses. Those are supported by the marble columns (approx. 3.0 meters height) with pin joint in present condition. However, there are no any spaces to provide the additional shear wall or horizontal supports.

The roof material of roof for the Main Hall is made of the corrugated asbestos-cement sheet. The material of asbestos is harmfulness for human health

now, and it will disposed as soon as possible. The asbestos sheet itself is not harmful material. However, when it will be changed to harmful material with scattered microscopic asbestos-fibers by removing or maintenance work.

Therefore, the sloped asbestos roof will changed to flat roof made of light material such as metal sheet, and added new steel truss beams at same level of existing steel truss beams. These steel truss beams will make rigid diaphragm with horizontal steel bracings. And the additional steel truss will be connected to the existing steel arches for vertical safety. This structural work will be careful sufficiently so as not to cause a fire in the welding work. These strengthening plan is shown in Figure 10-4.

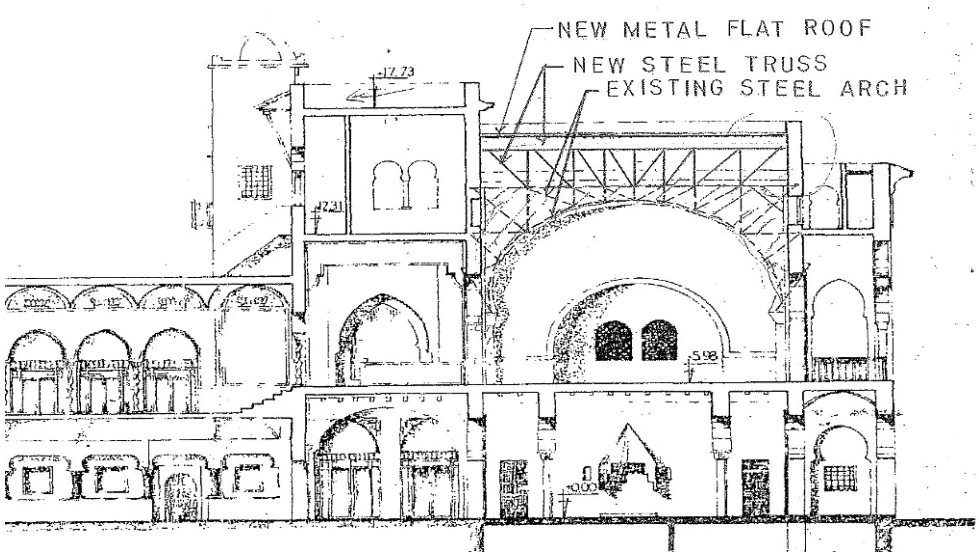


Figure 10-4 Additional Roof Truss Reinforcing for Existing Steel Arch

(3) Recommendation of Retrofit Methods for the Senator Office SENATE (herein after the SENATE)

According to the result of our seismic evaluation (Refer to Chapter 9-1), the SENATE required certain seismic retrofit plan and work as soon as possible. However, Since this seismic evaluation was performed based on "the assumed shearing strength of the bearing wall unit is 0.056 Mpa (N/mm^2)", it should be confirmed the actual shear strength of joint material in the existing bearing wall unit, before final decision.

1) Recommendation of Seismic Retrofit Plan

The SENATE building is consisted of the supporting office space and the official space such as the assembly hall, the conference room, the court and gallery, and the supporting office space. The official space is located on the centerline of building and has a traditional and historical design on exterior and interior façade. The supporting office space is located at both side of the official space. The basic condition for the retrofit design has to preserve the official space's circumstances. The subject building has very low seismic capacity. Therefore, the bearing wall in the supporting office

space can be changed, but the exterior surface of wall should be kept present condition. Under this condition, it recommends 3-types of the seismic retrofit plans. In this summary, it shows the main plan only, the other plans and detail of plan refer to Chapter 10-3-2 (3).

(A) Adoption of Reinforced Concrete (RC) Shear Wall Method on the Existing Bearing Wall

The new RC shear wall is provided on the surface of the existing stone bearing walls at inside of office rooms. It should be connected from top of the foundation and/or the top of basement wall up to shear wall through each existing floor slabs. The new RC shear wall is shown in Figure 10-5 and Figure 10-6.

A concrete strength is required more than 25 Mpa (N/mm^2) with 28-day's compressive strength, and shear strength is more than 2.0 Mpa (N/mm^2).

The cost of this retrofitting work is within quite reasonable range (In Japan, it is approx. 15% to 35% of replacement cost).

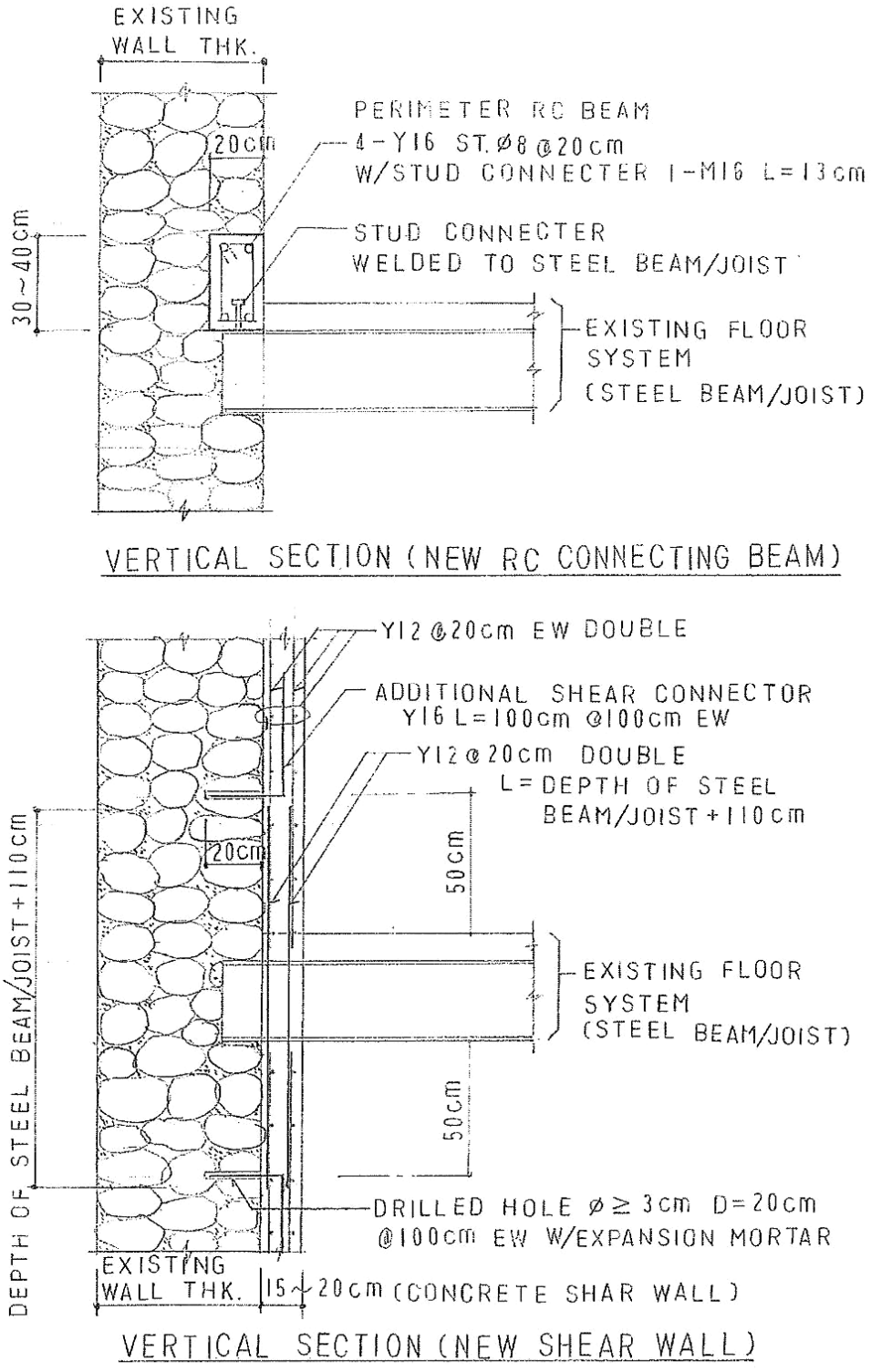


Figure 10-5 Typical detail of New RC Connecting Beam and New RC Shear Wall

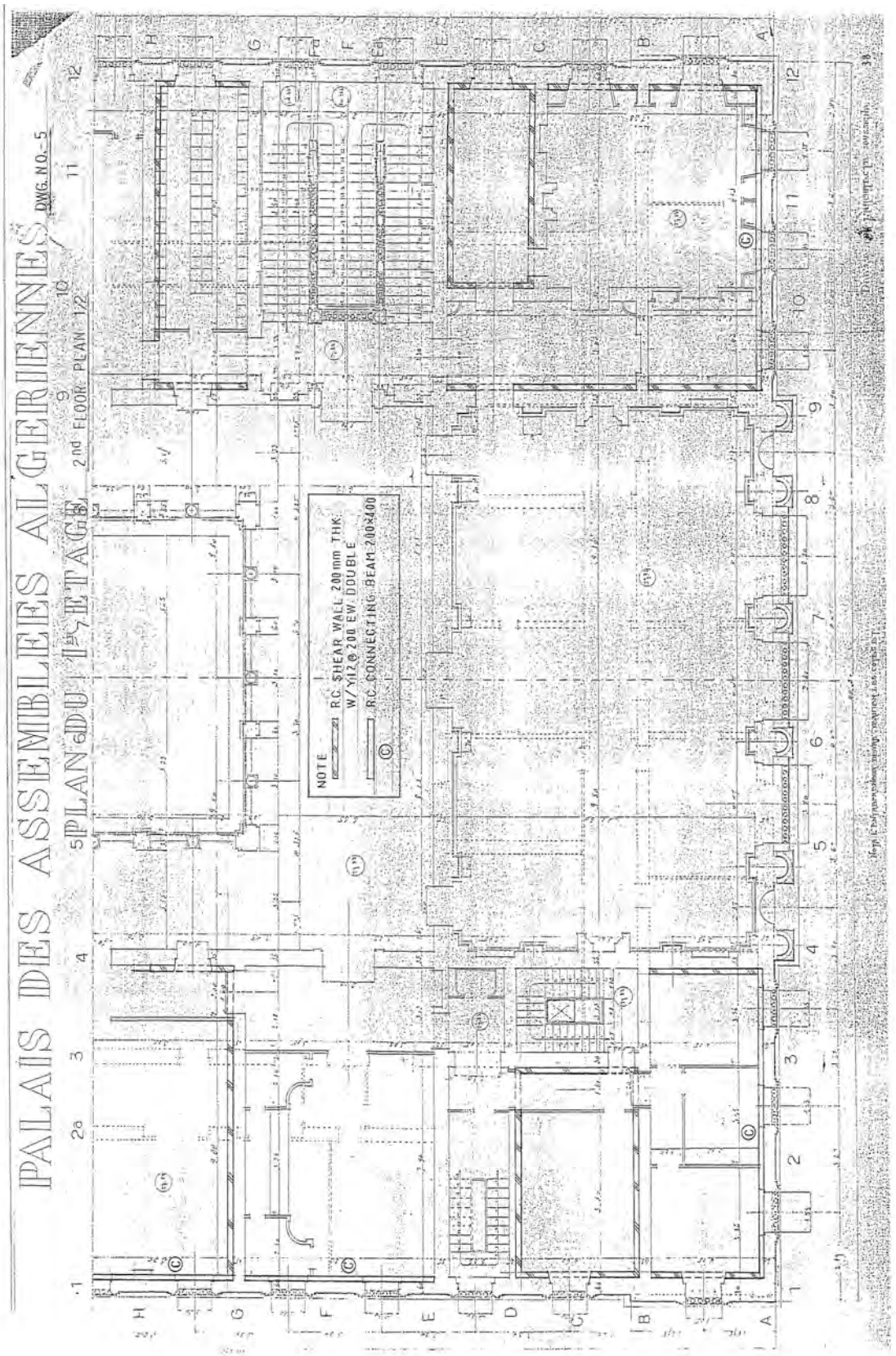


Figure 10-6 Retrofit Plan on 2nd Floor (1/2)

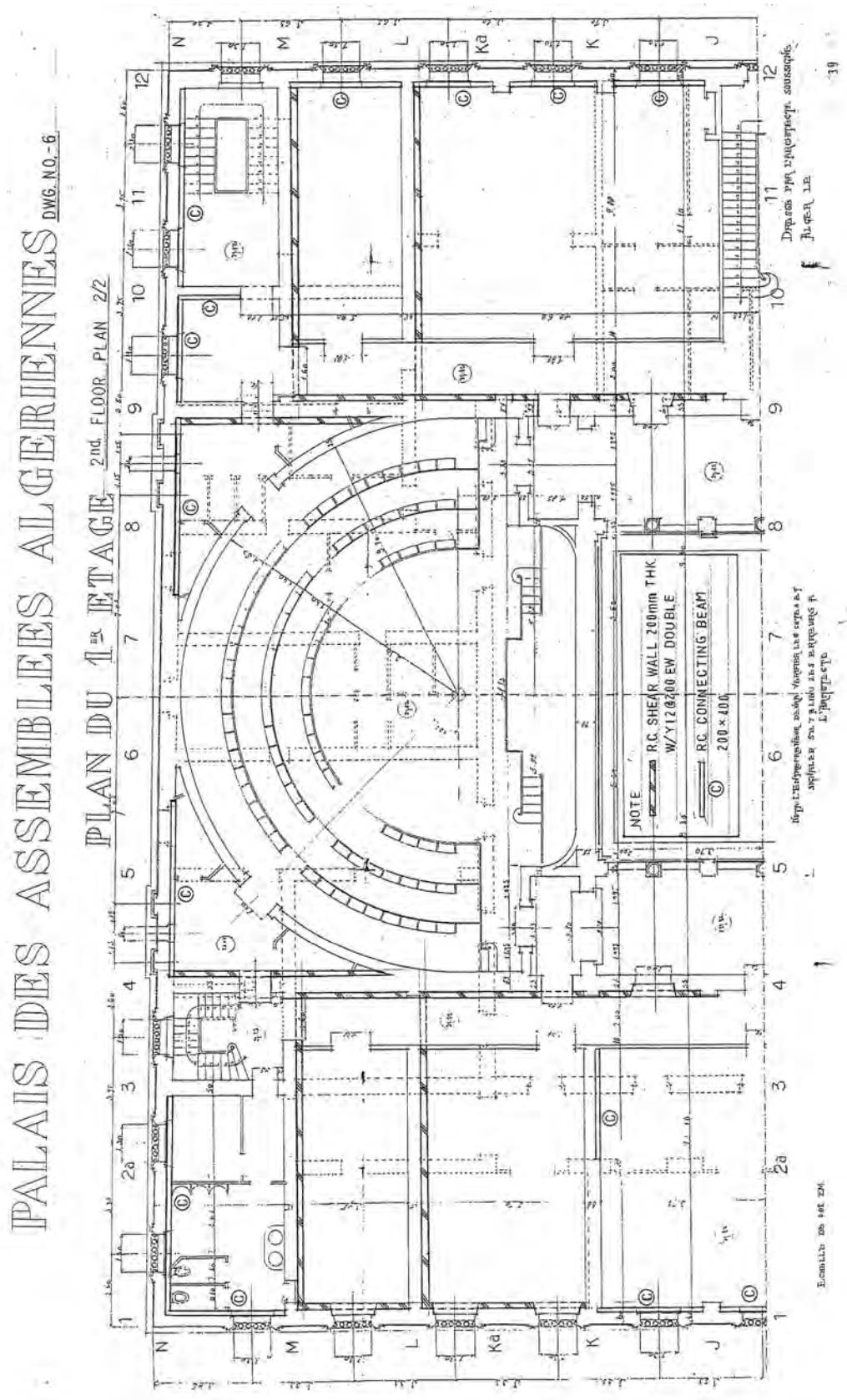


Figure 10-6 Retrofit Plan on 2nd Floor (2/2)

10-3-3 RC Buildings

(1) A Methodology of Seismic Retrofit for Existing Reinforced Concrete Buildings

Seismic retrofit of existing reinforced concrete buildings was followed by;

Guidelines for Seismic Retrofit of Existing Reinforced Concrete Buildings, 2001 and Technical Manual for Seismic Evaluation and Seismic Retrofit of Existing Reinforced Concrete Buildings, 2001(English version, 1st edition), The Japan Building Disaster Prevention Association,
Tokyo, Japan --- Reference 1

(2) Seismic Demand Index, Iso, and C_TS_D, as the Target of Retrofit

Following range of Seismic Demand Index, Iso, and C_TS_D in Algiers were recommended for a retrofit of buildings.

1) Seismic Demand Index, Iso,

Seismic Demand Index of Structure, Iso, of Typical RC Buildings in Algiers,

Iso = (0.50 to 0.60) U
is recommended, U: Usage Index, 1.0 is typical (1.0, 1.25, and 1.5)

2) Cumulative Strength Index x Irregularity Index, C_TS_D

Typical RC buildings in Algiers,

$C_TS_D \geqq$ (0.20 to 0.30)ZGU,
is recommended

(3) A Plan and Basic Design of Seismic Retrofit

Three typical buildings for retrofit are shown below. Results of seismic evaluation of buildings before retrofit are shown in Chapter 9-1-2.

1) A Five Storey Apartment House, designed based on RPA 88

(A) A Plan and Basic Design for Retrofit

Reinforced concrete walls were provided at the 1st storey to the 4th storey in the X and Y direction. These walls were estimated as flexural walls with an ductility index of 2.0. The layout of walls is shown in Figure 10-7.

(B) Target of Retrofit

Seismic Demand Index Iso = 0.50, C_TS_D = 0.20, and Usage factor = 1.0 was used. These are the minimum requirements.

(C) Result of Seismic Retrofit

Seismic Index of Structure, Is, and C_TS_D after Retrofit is shown in Table 10-7.

a) Is of the 1st storey and the 3rd storey was increased and more than 0.50.

b) C_TS_D of the 1st, the 2nd and the 3rd storey was increased and more than 0.20.
c) Is and C_TS_D of the 5th storey were decreased because of the lower S_D , while values are more than the required values and will be acceptable.

Table 10-7 Seismic Index of Structure, Is, and C_TS_D after Retrofit

Storey	After Retrofit				Before Retrofit	
	X direction		Y direction		X, Y direction	
	Is	C_TS_D	Is	C_TS_D	Is	C_TS_D
5	0.82	0.26	0.82	0.26	1.02	0.32
4	0.78	0.40	0.71	0.36	0.60	0.19
3	0.58	0.34	0.59	0.30	0.47	0.16
2	0.59	0.30	0.54	0.27	0.53	0.18
1	0.51	0.26	0.52	0.26	0.40	0.18

S_D; 0.76 (5th storey), 0.95(1st to 4th storey after retrofit),
0.95 (all storey before retrofit), T; 0.975

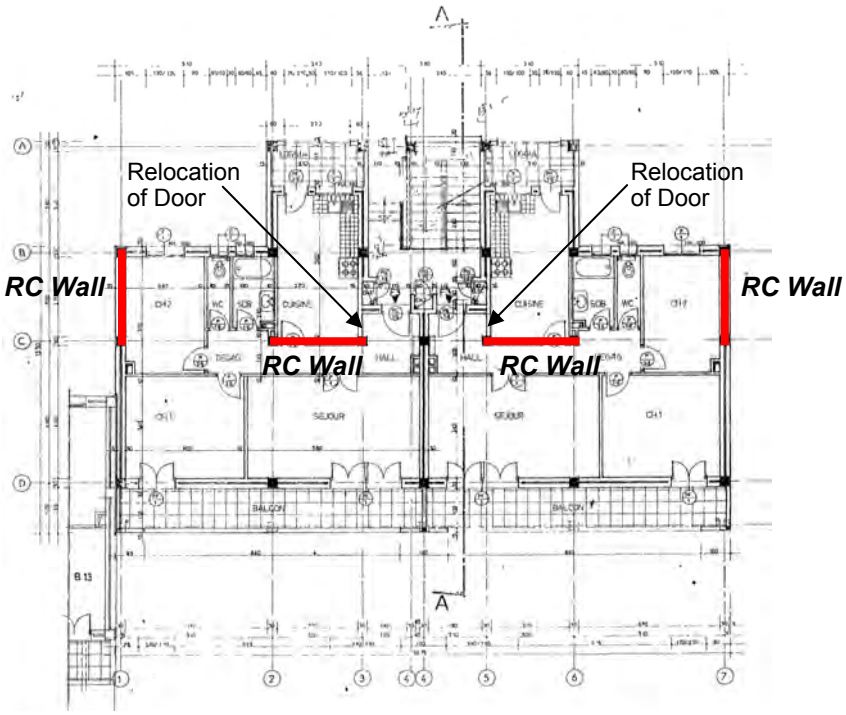


Figure 10-7 Layout of RC Wall for Retrofit

2) A Two Storey School, designed based on RPA88

(A) A Plan and Basic Design for Retrofit

A plan and basic design of 2 cases for retrofit was executed

Case 1; Retrofit by replacing brick walls and windows, and delete extremely brittle columns
Case 2; Retrofit by shear walls and wing-walls, and delete extremely brittle columns

(B) Target of Retrofit

Seismic Demand Index Iso = 0.50, C_TS_D = 0.20. These are the minimum requirements. Usage

Index of 1.0 was used, but index of 1.25 might be recommended.

(C) Result of Seismic Retrofit

Case 1, Retrofit by replacing brick wall and windows at grid A

Seismic Index of structure, Is, and C_TS_D after retrofit is shown in Table 10-8.

a) Columns at grid A have been modified from extremely brittle columns to flexural columns by replacing walls and windows, and/or providing slits on standing walls.

b) Seismic Index of structure, Is, has improved in the X direction, from 0.36 to 0.91 at the 2nd storey, and from 0.26 to 0.73 at the 1st storey.

c) $C_{TU}S_D$ at the 1st storey of X direction was 0.24 and satisfied the minimum requirement.

Table 10-8 Seismic Index of Structure, Is, and C_TS_D after Retrofit

Building Name:		Constructed Year: 1990 (RPA88)	Date: 2006/6/17
Screening Lev	2	Usage: School	Engineer:

Directi	Storey	C_T	F	Failure Mo	Eo	S_D	T	Is	$C_{TU}S_D$	Judgment
X	2	0.296	3.20	Flexural	0.963	1.00	0.95	0.91	0.30	OK
	1	0.240	3.20	Flexural	0.772	1.00	0.95	0.73	0.24	OK
Y	2	0.467	3.20	Flexural	1.491	1.00	0.95	1.42	0.47	OK
	1	0.391	3.20	Flexural	1.251	1.00	0.95	1.19	0.39	OK

C_{TU} at ultimate of F1 index, $C_T=Cx(n+1)/(n+i)$, S_D=1.0, T= 0.95

Case 2; Retrofit by providing shear wall and wing-wall, and without extremely brittle column

a) X direction

Providing wing-walls for columns was effective, because those were flexural columns with uctility index of 1.5. A wall with columns was not effective, because that was shear failure type.

Seismic index of structure, Is, has slightly decreased in the X direction compared with case 1 of retrofit, from 0.91 to 0.80 at the 2nd storey, and from 0.73 to 0.64 at the 1st storey.

'$C_{TU}S_D$' has also decreased from 0.30 to 0.25 at the 2nd storey, and from 0.24 to 0.20 at the 1st storey. This retrofit was planned for a study purpose mainly, and was recommended to cancel shear wall and to provide more wing-walls for retrofit.

3) Pierre and Marie Curie Center Chemo-Therapy Building, Mustapha Hospital, designed based on RPA83

(A) A Plan and Basic Design for Retrofit

This hospital is a three storey RC frame structure. This hospital is a strategically important building. A plan and basic design of retrofit by providing jackets for columns at the 1st storey was executed. Column jacketing at the 1st storey and standard detail is shown in Figure 10-8 and Figure 10-9.

(B) Target of Retrofit

Usage index of 1.5 was used. Seismic Demand Index Iso; 0.50x1.5=0.75, C_TS_D ; 0.20x1.5=0.3

were used. These are the minimum requirements.

(C) Results of Seismic Retrofit

Seismic Index of structure, Is, and C_TS_D after retrofit is shown in Table 10-9.

C_TS_D at 1st storey has increased from 0.24 to 0.35.

Seismic index of structure, Is, at 1st storey has increased from 0.72 to 1.06 (Y direction).

This was possible since jacketing columns have ductility index of 3.2, which was same to original.

S_D also has increased from 1.0 to 1.1 by the stiffness increase at 1st storey.

Table 10-9 Seismic Index of Structure, Is, and C_TS_D after Retrofit

Storey	X direction		Y direction	
	Is	C_TS_D	Is	C_TS_D
3	1.74	0.85	1.72	0.84
2	1.15	0.47	1.13	0.46
1	1.07	0.35	1.06	0.35

SD=1.11, T= 0.9

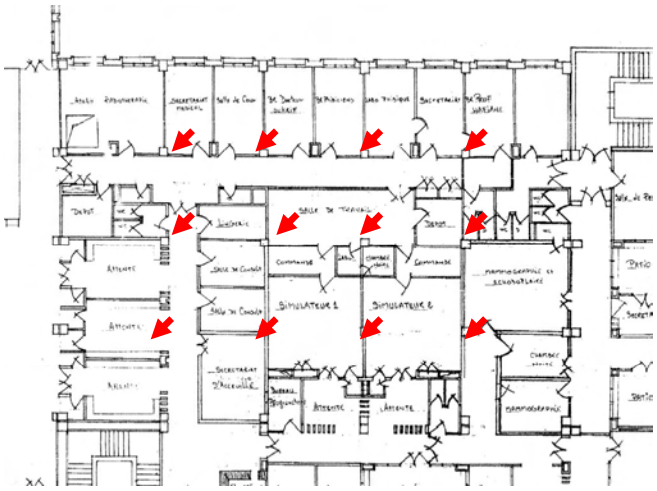


Figure 10-8
Retrofit by Column Jacketing at 1st Storey

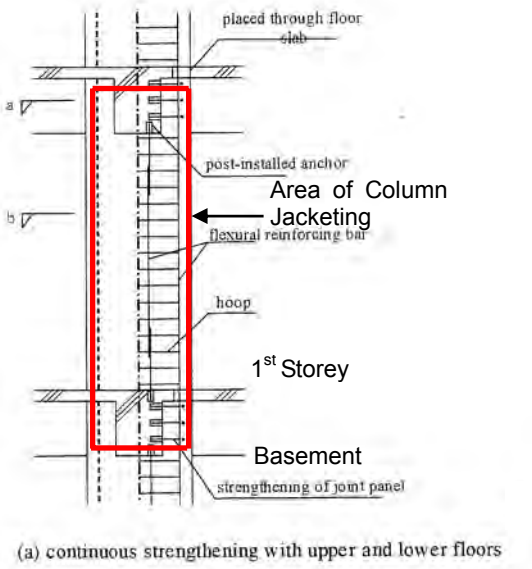


Figure 10-9
Standard Detail of Column Jacketing
(Figure 3.3.4-2 and 3.1-4 of English version of Reference 1)

10-4 Infrastructure and Lifelines

10-4-1 Infrastructure

The infrastructure includes basic facilities such as roads, bridges, ports and airports, all of which enable a population center to function properly as a base of transportation.

This section gives a summary account of the extent of damages to the infrastructure caused by earthquakes in the past, and outlines measures and steps which could contribute to the design of future disaster prevention plans.

(1) Roads

1) Characteristics of Road Damage

The Kobe Earthquake in 1995 caused a detrimental effect on traffic at 230 points of the roads under the management of the national or municipal governments, 67% (155 points) of which were due to damage to bridges and 33% (77 points) to damage to road structures. Of the damages to road structures, 62% (48 points) were attributable to damage to roadside structural objects, such as utility polls and buildings.

2) Recommendations / Measures to Strengthen and Quake-proof the Road Network

It is necessary, when planning to improve the road network or make it quakeproof, to draw up and put into effect a plan which also covers bridges and other node facilities.

(2) Bridges

Where bridges which seem to be highly or moderately likely to fall if an earthquake of various degrees happens (High Probability and Moderate Probability as shown in

Table 10-10), careful investigations must be conducted into the ground conditions and the structures of the bridges in question.

Table 10-10 Summary of Damage Estimation for Bridges

Class of Damage Grade	Khair al Din	Zemmouri
High Probability	3	4
Moderate Probability	19	7

1) Characteristics of Bridge Damage

Bridge damage observed in the events of earthquakes occurring in the past include falling girders, damage to or collapse of reinforced concrete piers due to differences in the amount of rebar, damage to foundations and their surroundings, and deformation of abutments.

The damage to bridges seems largely attributable to the poor aseismic strength of their structures and ground deformation caused by liquefaction.

2) Recommendations / Measures for to Strengthen and Quake-proof Bridges

A bridge structure can be divided into two parts: the superstructure including girders, and the substructure including piers. Figure 10-10 shows typical strengthening methods widely adopted in Japan.

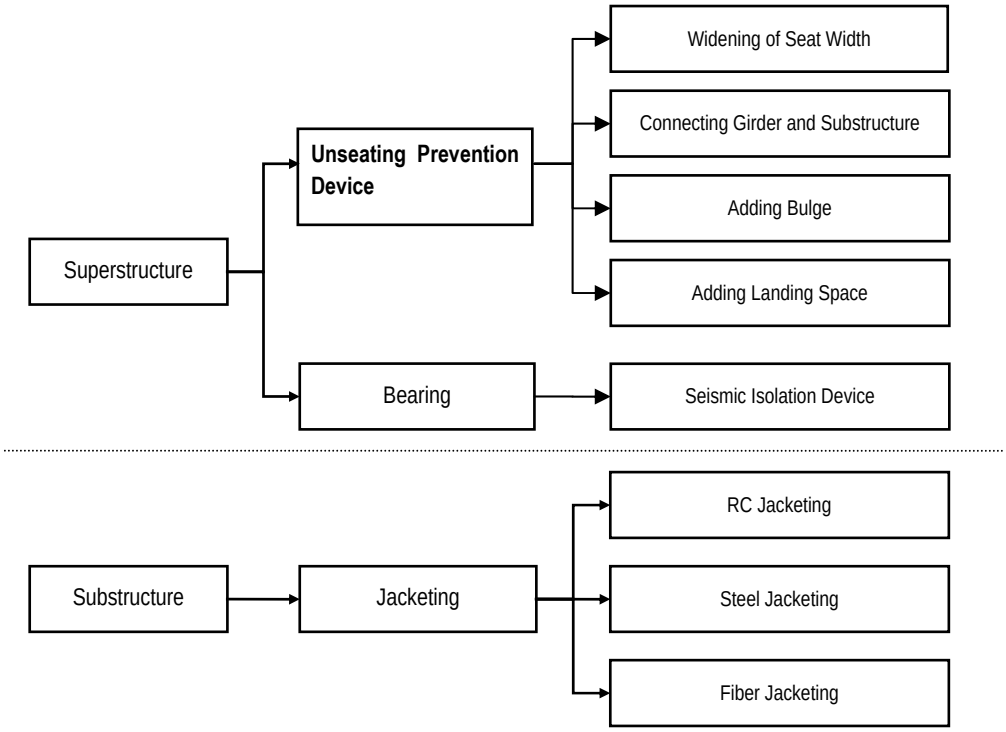


Figure 10-10 Methods of Increasing Seismic Strength of Bridge Structures

3) Ground Improvement

Incase of that it is expected to occur liquefaction underneath bridges, detailed geotechnical investigations must be conducted and, if necessary, certain measures (refer to Figure 10-11) must be also taken for bridges built on places.

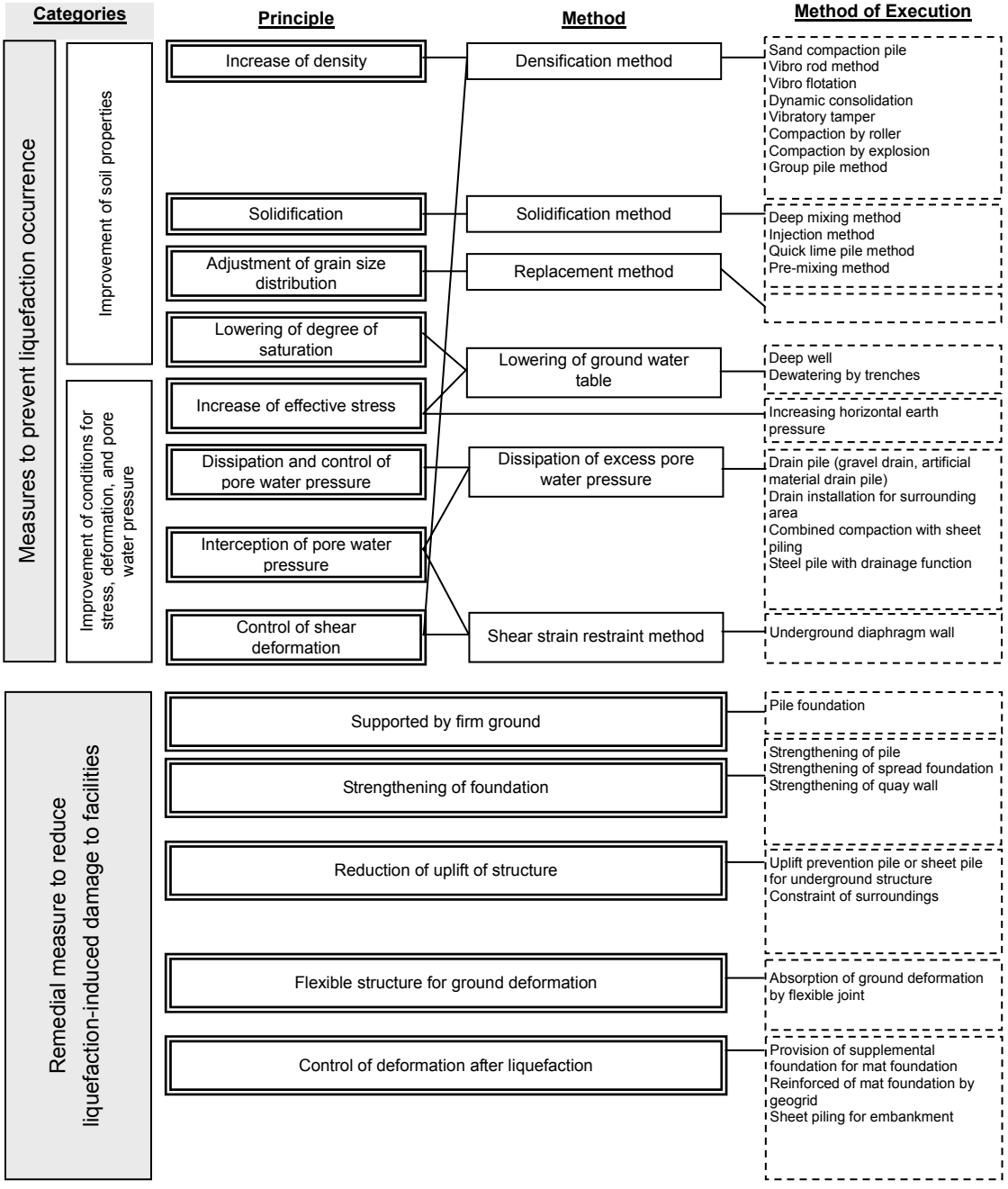


Figure 10-11 Summary of Measures to Reduce or Prevent Liquefaction

(3) Ports

1) Characteristics of Port Damage

In the event of earthquakes in the past, quite a few port facilities were subject to liquefaction. The nature of damage observed in the past is listed as follows:

- Cracks and subsidence of piers as a result of liquefaction
- Fall of gantry cranes
- Discontinuation of access routes to the port

2) Recommendations / Measures to Make Port Facilities Quakeproof

(A) Development of Seismic Resistant Quays

A damage estimation suggests that, in the event that an earthquake as great as the Khair al Din or the Zemmouri cases occurs, the central and southern parts of the Algiers port will be seriously damaged. As for the facilities within the premises of the Algiers port, it is necessary to draw up a plan to construct seismic resistant quays. Even so, it seems unrealistic, in consideration of the time and cost constraints, to make all quays quakeproof. Thus, it is recommended that, while paying attention to the existing development plans, at least one seismic resistant quay should be created in the port.

(B) Improvement of Bridges and Roads Leading to the Port Facilities

In order to prevent damage to the road network accessing the port, consideration should be given to the need of conducting seismic diagnostic examinations and retrofitting structural objects related to the bridges.

(4) Airports

1) Characteristics of Airport Damage

Although there are some reports concerning damage to airport facilities in the earthquakes in the past, there are no reports that any airports were damaged too seriously to continue operations. The nature of damage observed in the past is as follows:

- Minor damage to passenger terminals
- Minor damage to control towers
- Irregular displacement of pavement between taxiways and runways
- Damage to the surface of runways and taxiways due to liquefaction

2) Recommendations / Measures to Make Airport Facilities Quakeproof

According to results of the seismic motion analysis (of Khair al Din and Zemmouri) carried out in line with this study, parts of the Algiers airport are located in a high acceleration area. Hence, it is recommended that seismic diagnostic tests should be conducted on the airport facilities in order to reconfirm its safety.

Furthermore, loss of the electrical power supply will greatly affect the operation of the airport, and necessary strengthening of an emergency electric supply should also be examined.

10-4-2 Lifelines

Damage to the water and sewerage system, electricity, gas, telecommunications and other lifeline facilities has a considerable impact, not just on the management of these facilities themselves, but on various aspects of everyday life.

This chapter gives an account of the impacts of damage to lifeline facilities and possible future measures to make them quakeproof.

(1) Water Supply Systems

1) Effects of Damage to Water Supply Facilities

Table 10-11 shows major effects of damages to water supply facilities.

Table 10-11 Effects of Earthquake Damage to Water Supply Facilities

Effects	Expected Problems, etc.
Effects on road transportation	- Closure of road caused by road subsidence - Damage to underground facilities and blockage caused by recovery work
Effects on daily life	- Loss of drinking water - Loss of water in rest rooms or toilets - Cooking and washing facilities disabled - Bath rooms disabled
Effects on earthquake disaster activities	- Effect on medical activities - Effect on fire fighting activities

2) Recommendations / Measures to Make Water Supply Facilities Quakeproof

In the Study Area, a total nine types of materials are used for water supply pipelines. The Study has found that, in the case of the earthquake in Khair al Din, cast iron was affected the most in terms of the number of points damaged (1,483 points among 3,965 points damaged as a whole), and asbestos cement in terms of the proportion to all lines damaged (4.32 points/km).

It is recommended that materials particularly vulnerable to earthquake ground motions, such as the asbestos cement, the galvanized steel, the cast iron and the gray cast iron, should be replaced, in accordance with the existing project plans to improve the water supply system, with polyethylene pipe, a material with a strong quake resistance. Where joints of the major pipelines and joints to connect vital facilities with pipelines are concerned, it seems effective to adopt flexible connections to improve the quake resistance.

(2) Sewerage Systems

1) Effects of Damage to Sewerage Systems

Table 10-12 shows major effects of damage to sewerage systems.

Table 10-12 Effects of Earthquake Damage to Sewerage Systems

Effects	Expected Problems, etc.
Effects on road transportation	- Hazard to moving traffic caused by blockage of flow of rain water - Damage to underground facilities and blockage caused by recovery work
Effects on daily life	- Toilets Disabled - Cooking and washing inhibited - Bath rooms disabled
Effects on earthquake disaster activities	- Degradation of public sanitation condition

2) Recommendations / Measures to Make Sewerage Systems Quakeproof

The old masonry sewerage pipelines are uncertain whether or not they are in good shape, but it is highly likely that their quake resistance is less strong than that initially designed because of aging. It is thus necessary to replace them with new pipes in case of earthquakes, and manage them on a usual basis.

In the meantime, the main parts of the sewerage network have been digitalized and a GIS system has been adopted in line with this survey, while branch pipelines of the network have not been included in the GIS. Thus, it is recommended that the sewerage pipeline network as a whole should be surveyed so as to create a comprehensive database for drawing up a quakeproof plan.

(3) Electric Power Supply Systems

1) Effects of Damage to Electric Power Supply Systems

Table 10-13 shows major effects of damage to electric power supply facilities.

Table 10-13 Effects of Earthquake Damage to Electric Power Supply Systems

Effects	Expected Problems, etc.
Effects on road transportation	- Hazard to moving traffic caused by malfunction of traffic lights - Lack of lighting at night - Damage to underground facilities and blockage caused by recovery work
Effects on daily life	- Electric power failure - TVs, refrigerators, etc disabled - Elevators disabled - Panic caused by electric power failure - Effect on medical activities
Effects on earthquake disaster activities	- Computers disabled - Facilities operated by electricity disabled - Electric equipment such as TVs, videos, etc. disabled - Communication tools disabled

2) Recommendations / Measures to Make Electric Power Supply Systems Quakeproof

A survey of damage to medium-voltage electric power supply facilities in the case of Khair al Din estimates that 199 m (out of 123,797 m in total length) of the aerial cables and 1,465 m (out of 671,326 m in total length) of the underground cables were apparently damaged. The proportion of whole cables damaged is approximately 0.2%. A majority of the underground cables in the region surveyed are directly buried, so that they are very prone to any ground deformation. In the meantime, utility poles which will be brought down when a great earthquake occurs are highly likely to block roads.

Hence, in order to minimize damage to electric power cables, the existing medium-voltage cables should be moved to the multipurpose underground conduits which have been rarely damaged by natural disasters, though it is necessary, at the same time, to take into account the economic efficiency of this measure.

(4) Gas Supply

1) Effect of Damage to Gas Supply Facilities

Table 10-14 shows major effects caused by damage to gas supply facilities.

Table 10-14 Effects of Earthquake Damage to Gas Supply Facilities

Effects	Expected Problems, etc.
Effects on road transportation	- Hazard to moving traffic caused by the explosion - Damage to underground facilities and blockage caused by recovery work
Effects on daily life	- Cooking facilities disabled - Heating appliances (especially important in winter) disabled
Effects on earthquake disaster activities	- Inefficient preparation of meals outdoors

2) Recommendations / Measures to Make Gas Supply Systems Quakeproof

There are 3 types of pipe materials (steel, polyethylene and copper) for medium pressure gas pipelines used in the Study Area. If a great earthquake occurs, it is expected that the copper pipes will be damaged fairly seriously (3.06 points/km in the case of the earthquake in Khair al Din), while the damage to steel and polyethylene pipes will not be so grave.

Currently, SONELGAZ is going ahead with a project to replace the copper pipes with polyethylene pipes. It is hoped that this replacement project will be completed without any difficulties.

Risers, the pipes that connect the underground pipes to the individual premises of the consumers, are one of the most crucial facilities in a gas supply system, in that they could be damaged as seriously as the premises when hit by a severe disaster. It is necessary to consider launching measures to make gas-related risers quakeproof together with measures to reinforce quake resistance of buildings.

(5) Telecommunications

1) Effect of Damage to Telecommunications

Table 10-15 shows major effects of damage to telecommunication facilities.

Table 10-15 Effects of Earthquake Damage to Telecommunications

Effects	Expected Problems, etc.
Effects on road transportation	- Damage to underground facilities and blockage caused by recovery work
Effects on daily life	- Telephones disabled
Effects on earthquake disaster activities	- Information sharing reduced - Facsimile machines disabled

2) Recommendations / Measures to Make telecommunications Quakeproof

In this Study, no estimation was made concerning possible damage to telecommunications. Even so, it is certainly effective to make use of multipurpose underground conduits for telecommunications, as in the case of the electric supply cables described above.

The number of subscribers of mobile telephones has been sharply increasing in recent years. Therefore, it is important to minimize damage to mobile phone antennas for the purpose of securing communication networks even after such a disastrous event has happened.

Chapter 11. Database for Urban Disaster Management

11-1 Database for Urban Disaster Management

(1) Outline of the Database for Urban Disaster Management

ArcGIS (ArcView 9) for the Windows operating system was used as the standard GIS software for developing the urban disaster management database and the geographic data. The ESRI Shapefile format was used as the standard file format for vector GIS data in the urban disaster management database.

Table 11-1 shows the features that were targeted as disaster management resources in this additional dataset. Both the basic GIS datasets and the disaster management resource dataset form the urban disaster management database.

Table 11-1 Disaster Management Resources

Resources	Vector type	Targeted features
Parks	Polygon	Public Parks (all parks)
Vacant Land	Polygon	Vacant land (1 ha and over in area)
Sporting Fields	Polygon	Open-air sports fields (athletics fields,, tennis courts, etc.)
Airports	Polygon	Airfields
Ports	Polygon	Ports
Water	Polygon	Inland water (water bodies; as a possible water source)
Police	Polygon	Police stations
Military	Polygon	Military buildings, and related buildings/ facilities
Civil Protection	Polygon	Civil Protection Stations
Educational	Polygon	Educational sites: schools, colleges, universities
Administrative	Polygon	Governmental/ administrative sites, including buildings/ facilities
Public	Polygon	City auditoriums, public halls
Indoor Sports	Polygon	Gymnasiums (excluding those of schools, colleges, universities)
Medical/Health	Polygon	Hospitals, clinics, health centers
Religious	Polygon	Mosques, churches, temples
Sanitation	Polygon	Sanitation sites
Disposal/Garbage	Polygon	Waste disposal treatment sites

Data Source: JICA Study Team

By manipulating the datasets described above, relevant thematic maps that are useful to people in charge of urban disaster management were generated.

(2) Map and Data Operation System

In order to assist the Algerian counterparts to utilize the urban disaster management database developed by the JICA Study Team, the following modules were created:

1) HTML-based Module

This module presents a user-interface (map and data catalog) that allows all levels of database users to query and download the thematic maps easily.

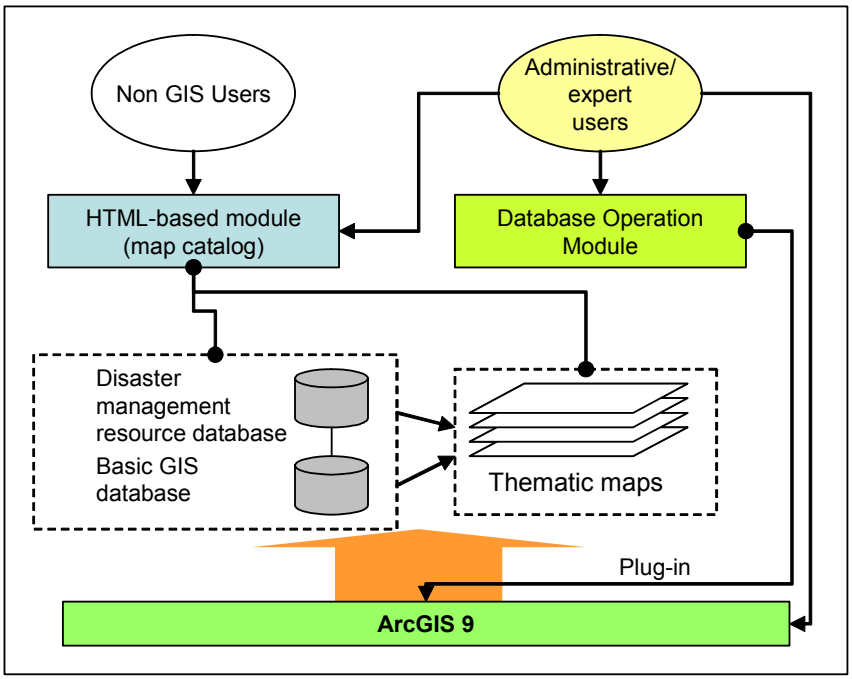
This module is easily customizable by the Algerian counterparts, and the datasets within this module can easily be shared with stakeholders by storing on the Internet or by distributing CDs or DVDs.

2) Database Manipulation Module

This module targets administrative/expert level users who need to update or edit the datasets in the urban disaster management database.

(3) Urban Disaster Management Information System

Figure 11-1 below shows a conceptual diagram for the urban disaster management information system, including the databases and the user modules.



Source: JICA Study Team

Figure 11-1 Conceptual Diagram for the Urban Disaster Management Database

11-2 Development of User Interface System

A Data Entry Support system, customized interfaces, have been created to help improve the usability of handling attribute information for longer useful lifespan of constructed database.

A Data Entry Support System has been created as a VBA (Visual Basic for Application) code for acquiring compatibility with the ESRI ArcGIS. Thus, any User can change, update or refine the created system with some knowledge of Visual Basic and ArcGISs' ArcObjects architecture.

To perform this, functions have been constructed as VBA codes within the ArcGIS project file, MXD. As the user inputs a defined event to the ArcMap, those functions are called as intended.

Non-GIS users also can access the contents through the Data Browser, which was created as HTML and linked to various outputs. Non-GIS users can see the output through a data-viewer.

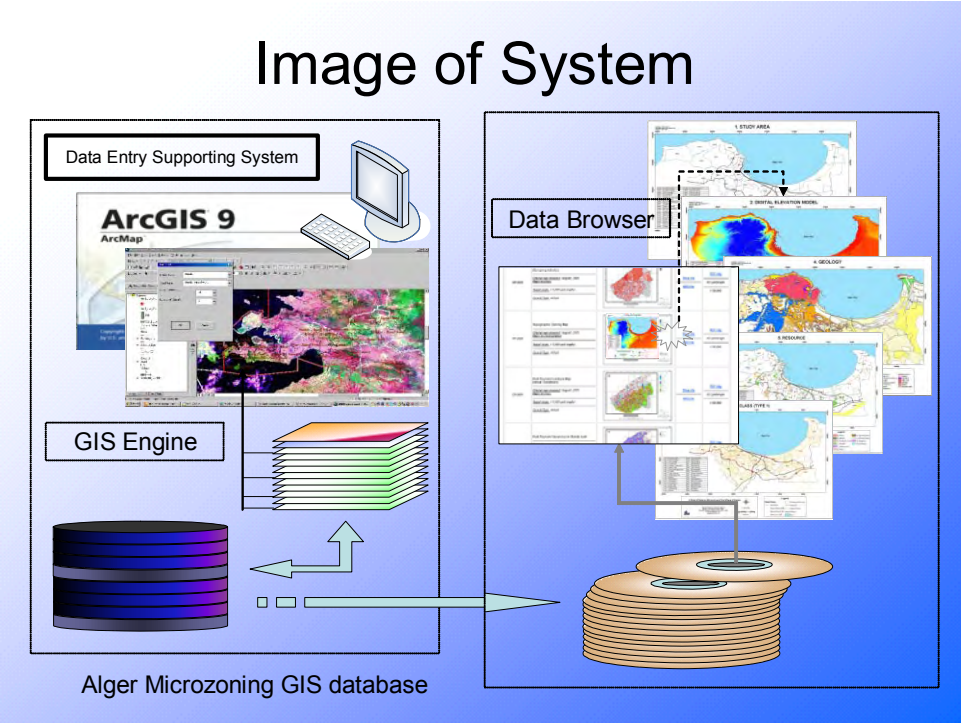


Figure 11-2 Image of Data Entry Support System and Map Browsing System

As a supplement for the system, ArcExplorer projects files for viewing the GIS database directory for users who do not have ArcGIS.

ArcExplorer is a free, lightweight GIS data viewer and can perform basic GIS functions.

11-3 Operation and Maintenance Plan

Regarding the purpose of this project, sharing the output of the analysis is essential. Concerning the circulation of the information, the two following entities will be the recipients.

1. Non GIS-Users
2. Administrative and expert GIS users

Non GIS users are the ones who have acquired information through ready made output which was created and prepared by the Administrative groups.

The Administrative group's duty is constructing, updating, refining and performing the feed back of those results to the Non-GIS users

Algerian counterparts have established cross an organizational entity which consists of **CGS**, **URBANIS** and **DGPC** for acquiring synergetic effects to help develop the skills related to GIS

matters. This entity is going to become the expert Administrative GIS user which constructs, updates and refines the GIS database for disaster prevention.

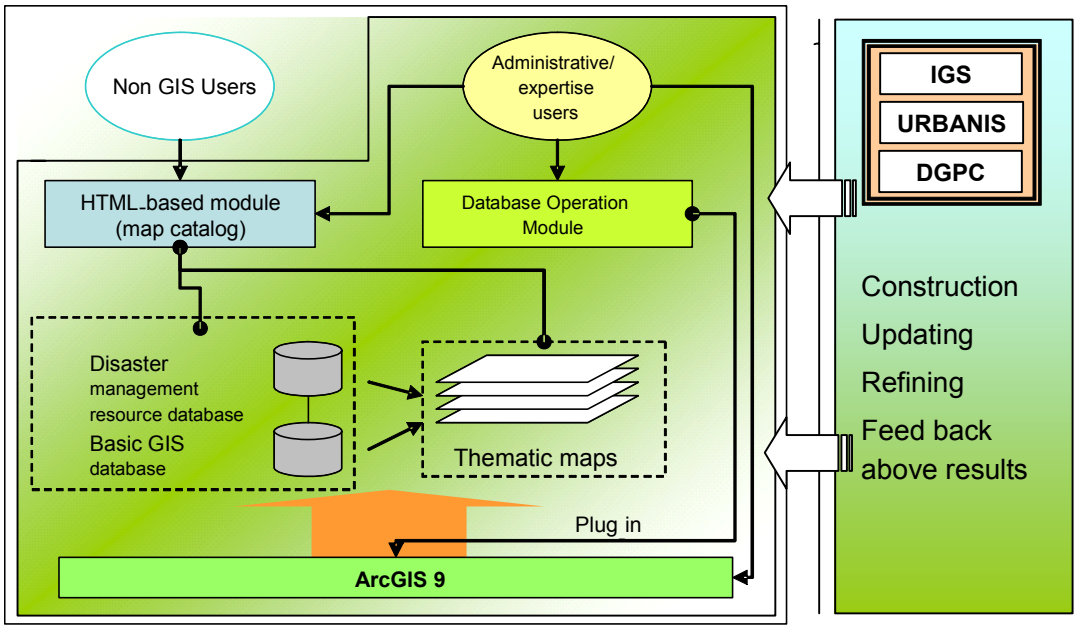


Figure 11-3 Conceptual Flow of Operation and Maintenance

Chapter 12. Technology Transfer of Seismic Microzoning

The transfer of technology was done along with the progress of the study. Overall schedule and transfer items are summarized in Table 12-1 to Table 12-7.

Table 12-1 Schedule and Contents of Technology Transfer for Scenario Earthquake

Contents	Counterpart	Study Team	Date/Time
Discussion on the CGS review report of JICA interim report	Y. Bouhadad	Mouroux, Bertrand	14/05/06 Morning
Discussion on CGS review report of JICA interim report and technology transfer	Y. Bouhadad	Bertrand	14/05/06 Afternoon
Work meeting for technology transfer (use of Excel spreadsheets, input of data, formulas and graphics).	Y. Bouhadad	Bertrand	15/05/06 Afternoon
Work meeting for technology transfer (Equation for calculation of magnitudes versus return period, attenuation laws,…)	Y. Bouhadad	Bertrand	16/05/06 Morning

Table 12-2 Schedule and Contents of Technology Transfer for Ground Modeling and Natural Hazards

Contents	Counterpart	Study Team	Date
General	N. Mezouer	Segawa	21/05/06
Soil model and response analysis	N. Mezouer	Segawa	23/05/06
Liquefaction	N. Mezouer, L. Haderbache	Segawa	24/05/06
Stability of slope	N. Mezouer, L. Haderbache, N. Guessoum, D. Ait Benameur, M. Ait Ameur	Segawa, Nishii	29/05/06
Inspection of slopes	N. Mezouer, L. Haderbache, N. Guessoum, D. Ait Benameur, M. Ait Ameur	Segawa, Nishii	03-08/06/06

Table 12-3 Schedule and Contents of Technology Transfer for Damage Function of Building

Contents	Counterpart	Study Team	Date
Approach to Damage Function	Y. Mehani, A. Remas	Inoue	16/05/06
Data collection and how to use data of disaster 2003 Boumerdes earthquake	Y. Mehani, A. Remas	Inoue	17/05/06
Basic solution with flow chart of Damage Function	Y. Mehani, A. Remas	Inoue	20/05/06
2nd and 3rd level screening procedure of seismic index of structure, Is	Y. Mehani, A. Remas	Inoue	21/05/06
Damage function and data collection	Y. Mehani, A. Remas	Inoue	29/05/06
Distribution of seismic index of structure, Is, and damage curve	Y. Mehani, A. Remas	Inoue	30/05/06
Evaluation and calculation of damage curve for RC frame	Y. Mehani, A. Remas	Inoue	31/05/06
Evaluation and calculation of damage curve for RC frame	Y. Mehani, A. Remas	Inoue	03/06/06
Evaluation and calculation of damage curve for Steel and Masonry structure	Y. Mehani, A. Remas	Inoue	04/05/06
Evaluation and calculation of damage curve for old Brick Masonry	Y. Mehani, A. Remas	Inoue	05/06/06
Evaluation and calculation of damage curve for RC frame by RPA99 and 2003	Y. Mehani, A. Remas	Inoue	06/06/06
Evaluation of methodology of damage function from damage data	Y. Mehani, A. Remas	Inoue	19/06/06

Table 12-4 Schedule and Contents of Technology Transfer for Infrastructure and Lifeline

Contents	Counterpart	Study Team	Date
Explanation of Interim Report	A. Kibboua	Miyazaki	13/05/06
Data collection and verification	A. Kibboua	Miyazaki	14-17/05/06
Damage estimation of bridge	A. Kibboua	Miyazaki	20/05/06
Damage estimation of port	A. Kibboua	Miyazaki	21/05/06
Damage estimation of airport	A. Kibboua	Miyazaki	22/05/06
Verification of the damage estimation method for bridge, port and airport (1)	A. Kibboua	Miyazaki	23/05/06
Verification of the damage estimation method for bridge, port and airport (2)	A. Kibboua	Miyazaki	24/05/06
Damage estimation of lifelines	A. Kibboua	Miyazaki	27/05/06
Damage estimation of water supply and sewerage pipeline	A. Kibboua	Miyazaki	28/05/06
Damage estimation of medium voltage aerial cable	A. Kibboua	Miyazaki	29/05/06
Damage estimation of medium voltage underground cable	A. Kibboua	Miyazaki	30/05/06
Damage estimation of medium pressure gas pipeline	A. Kibboua	Miyazaki	31/05/06
Calculation of damage estimation	A. Kibboua	Miyazaki	03-07/06/06
Review of the whole method and result of damage estimation	A. Kibboua	Miyazaki	09/06/06

Table 12-5 Schedule and Contents of Technology Transfer for Seismic Evaluation and Retrofitting of Masonry Buildings

Contents	Counterpart	Study Team	Date
Site and building inspection of the Palace, obtained design drawing on 19 Oct.	A. Remas	Kagawa	11/10/05
Site and building inspection of the SENATE, obtained design drawings on 10 Nov.	A. Remas	Kagawa	22/10/05
Discussion of evaluation method and policy for the Palace	A. Remas	Kagawa	23/10/05
Discussion of evaluation method and policy for the SENATE	A. Remas	Kagawa	24/10/05
Discussion of construction method of old masonry	A. Remas	Kagawa	25/10/05
Discussion of bearing shear strength of old masonry	A. Remas	Kagawa	26/10/05
2nd building inspection of the Palace	A. Remas	Kagawa	30/10/05
Seismic evaluation work for the Palace parallel work with A. Remas and Kagawa	A. Remas	Kagawa	31/10 – 09/11/05
2nd building inspection of the SENATE	A. Remas	Kagawa	07/11/06
Seismic evaluation work for the SENATE parallel work with A. Remas and Kagawa (by e-mail)	A. Remas	Kagawa	12/04 – 26/04/06
Evaluation method and judging criteria of Masonry	Y. Mehani, A. Remas	Kagawa	16/05/06
Outline of 1st to 3rd level seismic evaluation for RC buildings	Y. Mehani, A. Remas	Kagawa	20/05/06
Discussion of static evaluation method of Masonry buildings	Y. Mehani, A. Remas	Kagawa	21/05/06
Discussion of dynamic evaluation method of Masonry building	Y. Mehani, A. Remas	Kagawa	22/05/06
Evaluation method for the Palace	Y. Mehani, A. Remas	Kagawa	23/05/06
Evaluation method for the SENATE	Y. Mehani, A. Remas	Kagawa	24/05/06
Retrofit method with seismic isolation system for the Palace and the SENATE	Y. Mehani, A. Remas	Kagawa	27/05/06
Retrofit method with RC shear wall for the SENATE	Y. Mehani, A. Remas	Kagawa	29/05/06
Retrofit method with mortar grouting for the Palace	Y. Mehani, A. Remas	Kagawa	03/06/06
Retrofit method with mortar grouting for the SENATE	Y. Mehani, A. Remas	Kagawa	05/06/06
Retrofit method with mortar grouting for the SENATE	Y. Mehani, A. Remas	Kagawa	06/06/06
Retrofit methods for normal Masonry buildings	Y. Mehani, A. Remas	Kagawa	04/06/06
presentation to CGS “Seismic Evaluation and Retrofit for Masonry Buildings”	Y. Mehani, A. Remas	Kagawa	08/06/06

Table 12-6 Schedule and Contents of Technology Transfer for Seismic Evaluation and Retrofitting of RC Buildings

Contents	Counterpart	Study Team	Date
Outline of seismic evaluation for RC building	Y. Mehani, A. Remas	Inoue	16/05/06
Outline of 1st to 3rd level seismic evaluation for RC building	Y. Mehani, A. Remas	Inoue	20/05/06
Outline of 2nd level seismic screening for RC structure	Y. Mehani, A. Remas	Inoue	07/06/06
Concept and estimation of Ductility index, F	Y. Mehani, A. Remas	Inoue	10/06/06
Concept and estimation of Strength Effective factor, □, and Index, Is	Y. Mehani, A. Remas	Inoue	11/06/06
Concept of ductility index and axial force, Index, Is, and earthquake damage	Y. Mehani, A. Remas	Inoue	12/06/06
Study of Seismic evaluation using sample school building of the 'Standard'	Y. Mehani, A. Remas	Inoue	14/06/06
Seismic Evaluation of a school building (by 'EXCEL' form) (1)	Y. Mehani, A. Remas	Inoue	17/06/06
Seismic Evaluation of a school building (by 'EXCEL' form) (2)	Y. Mehani, A. Remas	Inoue	18/06/06
Study of Seismic Damage Index, Iso, and earthquake damage	Y. Mehani, A. Remas	Inoue	19/06/06
Seismic Evaluation of an apartment house and a hospital, Iso and RPA99 Ver. 2003	Y. Mehani, A. Remas	Inoue	20/06/06
Concept of Seismic Retrofit, and Methodology	Y. Mehani, A. Remas	Inoue	21/06/06
Standard detail of seismic retrofit of RC structures	Y. Mehani, A. Remas	Inoue	25/06/06
Estimation of Seismic Retrofit of a school	Y. Mehani, A. Remas	Inoue	28/06/06
Outline of 3rd level seismic screening, Retrofit of an apartment house/ a hospital	Y. Mehani, A. Remas	Inoue	01/07/06
Concept and estimation of Ductility Index, F	Y. Mehani, A. Remas	Inoue	02/07/06
Revised, Is, of a school, Explanation of anchor strength	Y. Mehani, A. Remas	Inoue	03/07/06
Estimation of 3rd level for wall, Summary	Y. Mehani, A. Remas	Inoue	04/07/06
Presentation for 'Seismic Evaluation, Retrofit and Seismic Demand Index'	Y. Mehani, A. Remas	Inoue	08/07/06

Table 12-7 Schedule and Contents of Technology Transfer for GIS Data Development

Contents	Counterpart	Study Team	Date
The Difference between ArcCatalog & ArcMap Displaying Shape File (GIS Data for ArcGIS)	S. Saadi (CGS) M. Boukri (CGS) R Douar (URBANIS) A. Gharbi (URBANIS) A. Allouane (URBANIS) H. Metref (URBANIS) F. Sahraoui (DGPC) R. Aliouat (DGPC) T. Benattou (INCT)	Kiyota	05/06/06
Creating GIS data as Shape File		Kiyota	05/06/06
Basic Querying Concept of Projection Cylinder Digitizing Paper Map (1)		Kiyota	06/06/06
Digitizing Paper Map (2); Practical data Resources		Kiyota	07/06/06
Creating Microzoing Cells (1)		Kiyota	10/06/06
Creating Microzoing Cells (2) Practical Training		Kiyota	11/06/06
Table Creation Importing CAD data (1)		Kiyota	13/06/06
Customizing Tool Menus Importing CAD Data (2)		Kiyota	14/06/06
Analyzing Urban Vulnerability (1); Basic		Tanaka, Kiyota	17/06/06
Analyzing Urban Vulnerability (2); Advanced		Tanaka, Kiyota	18/06/06