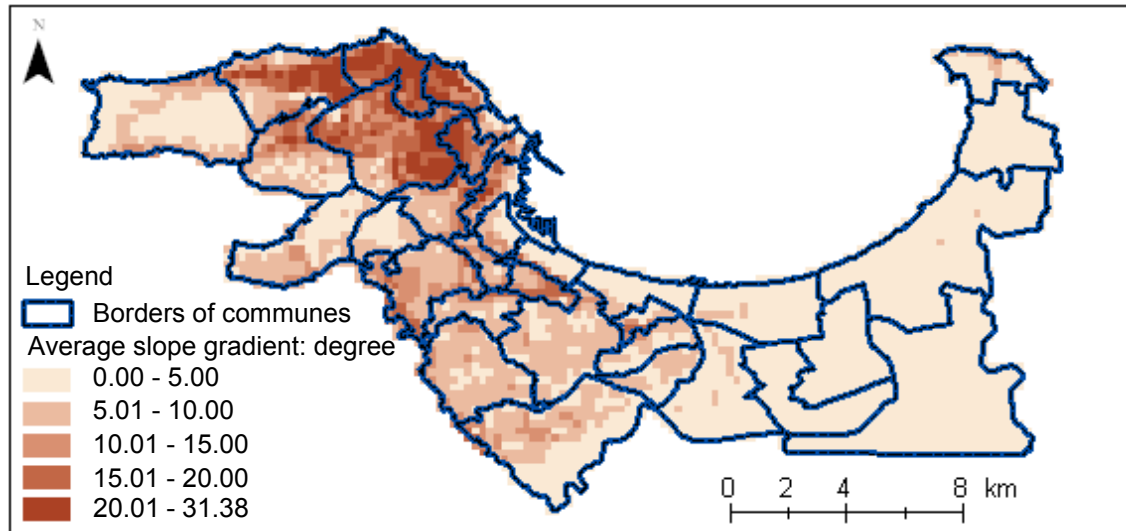


9-2-8 Slope Failure Risk

Slope gradient is an important factor that is used for assessing the potential for slope failures to be triggered by an earthquake. The average slope gradient was calculated for each commune by using GIS. The slope gradient was determined from 5m digital elevation model data for the built-up areas within the Study Area. Figure 9-17 shows the distribution of the average slope gradients within the Study Area.



Source: JICA Study Team

Figure 9-17 Distribution of Slope Gradients within the Study Area

Table 9-15 shows the average slope gradient of the built-up areas within each commune.

The built-up areas within OUED KORICHE, RAIS HAMIDOU, BOUZAREA, BOUZAREAH, BOLOGHINE IBNOU ZIRI and EL MADANIA have relatively high average slope gradients. EL BIAR, EL MOURADIA and HYDRA follow these five (5) communes and they have relatively high average slope gradients.

Table 9-15 Average Slope Gradient of Built-up Areas within Each Commune

Code	Commune	Average slope gradient (degree)	Class
1608	OUED KORICHE	17.0	5: High
1625	RAIS HAMIDOU	14.8	5: High
1611	BOUZAREAH	14.6	5: High
1606	BOLOGHINE IBNOU ZIRI	14.5	5: High
1603	EL MADANIA	12.5	5: High
1610	EL BIAR	11.0	4: Moderate to high
1627	EL MOURADIA	10.3	4: Moderate to high
1628	HYDRA	9.5	4: Moderate to high
1609	BIR MOURAD RAIS	8.6	3: Moderate
1605	BAB EL OUED	8.3	3: Moderate
1607	CASBAH	8.1	3: Moderate

Code	Commune	Average slope gradient (degree)	Class
1601	ALGER CENTRE	7.5	3: Moderate
1631	EL MAGHARIA	7.1	3: Moderate
1612	BIRKHADEM	6.9	3: Moderate
1624	EL HAMMAMET	6.7	3: Moderate
1618	KOUBA	6.6	3: Moderate
1619	BACH DJARAH	6.3	3: Moderate
1632	BENI MESSOUS	6.3	3: Moderate
1602	SIDI M'HAMED	5.9	2: Low to moderate
1604	HAMMA EL ANNASSER	5.7	2: Low to moderate
1626	DJASR KASANTINA	5.1	2: Low to moderate
1616	BOUROUBA	5.1	2: Low to moderate
1622	BEN AKNOUN	5.1	2: Low to moderate
1623	DELY BRAHIM	4.3	2: Low to moderate
1644	AIN BENIAN	4.2	2: Low to moderate
1640	EL MARSA	3.5	2: Low to moderate
1617	HUSSEIN DEY	3.1	2: Low to moderate
1629	MOUHAMMADIA	2.8	1: Low
1613	EL HARAACH	2.6	1: Low
1621	BEB EZZOUAR	1.4	1: Low
1630	BORDJ EL KIFFAN	1.3	1: Low
1639	BORDJ EL BAHRI	0.9	1: Low
1615	OUED SMAR	0.9	1: Low
1620	DAR EL BEIDA	0.3	1: Low

Source: JICA Study Team

9-2-9 Ease of Evacuation/Rescue

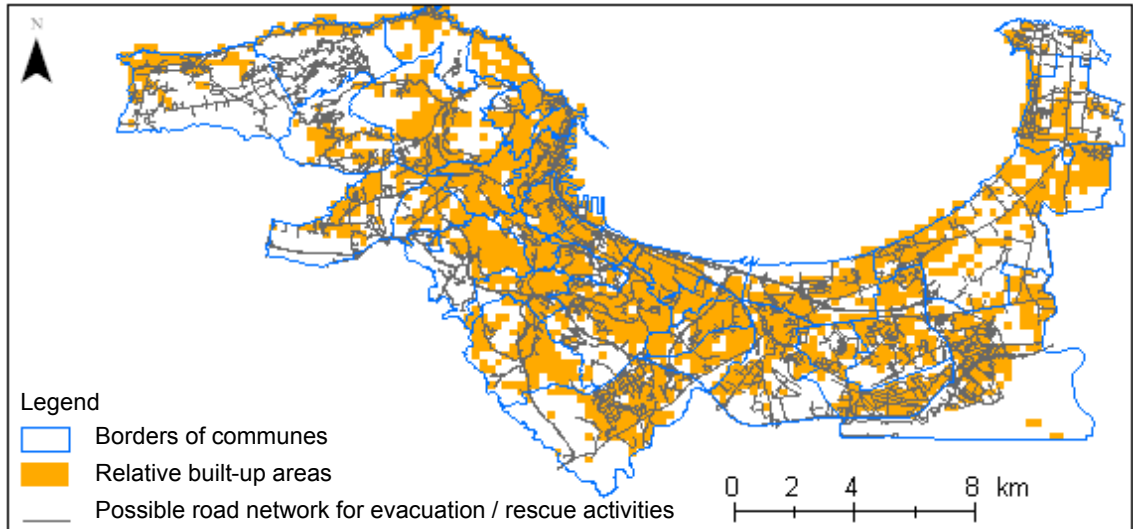
(1) Road Network

The road network within the study area was evaluated in terms of the ease of evacuation/rescue activities if a hazardous earthquake occurred. The evaluation was done in GIS by using road network data prepared by the JICA Study Team. In this evaluation for the Study Area, the following criteria were used to identify roads that would be suitable to use for evacuation (on foot) and for regional rescue activities. These criteria are based on the experience gained from the South Hyogo Earthquake which occurred in Japan on January 15, 1995:

- All roads having a width of 8 m or more.
- Roads having a width between 4 m and 8 m that would not be influenced by any collapsed buildings.
- Of the roads that met the first two conditions, above, only those roads that formed a continuous corridor within the regional road network that extends into the 34 commune areas were determined to be “suitable” roads for evacuation/rescue activities. For

example, a road that is generally 4 meters wide, but the width decreases to just 2 meters in some places, would be excluded.

By analyzing the distribution of suitable roads, areas that are likely to be isolated from the regional road network were identified. Figure 9-18 shows a possible evacuation/rescue road network for the 34 communes.

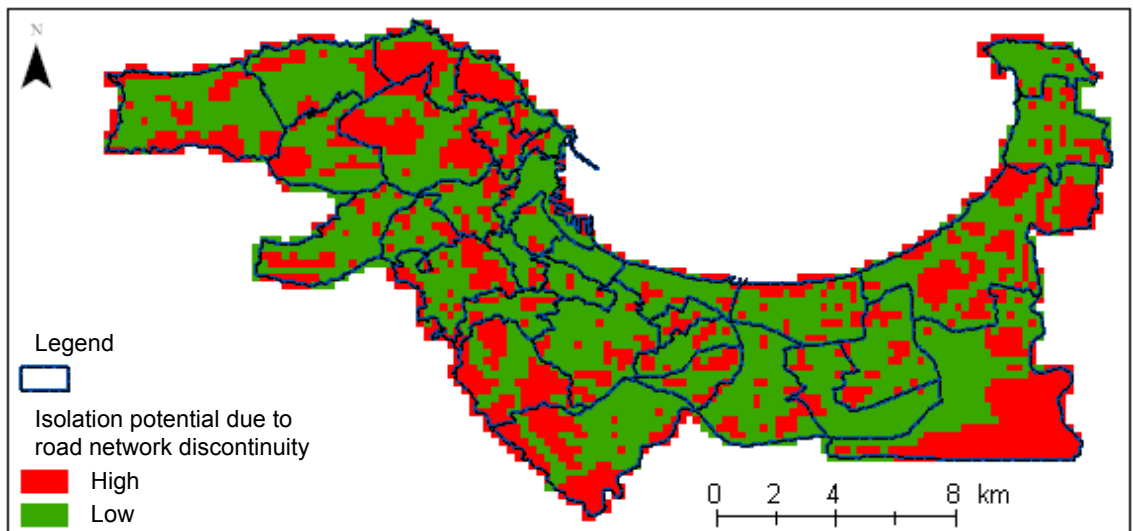


Source: JICA Study Team

Figure 9-18 Possible Road Network for Evacuation/rescue Activities

Figure 9-19 shows areas that have a high potential to be isolated because they are not serviced by the possible evacuation/rescue activity road network defined above.

Details of the analysis work that was done using GIS are described below.



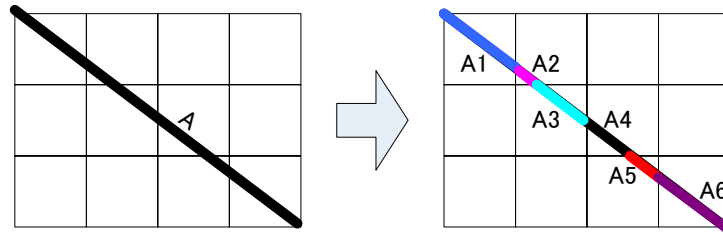
Source: JICA Study Team

Figure 9-19 Relative Isolation Potential Due to Road Network Discontinuity within the Study Area

(2) Using GIS to Identify Possible Evacuation/Rescue Roads and Potentially Isolated Areas

1) STEP I-1: Splitting roads by the micro-zoning GRID

All road lines (vectors) were split using the micro-zoning GRID.



Source: JICA Study Team

Figure 9-20 An Example of Splitting a Road by the Micro-zoning GRID

For example, splitting road line 'A' with a GRID (4 x 3 cells) gives five (5) road line segments ('A1', 'A2', 'A3', 'A4', 'A5', and 'A6'), as shown in Figure 9-20 above.

2) STEP I-2: Ranking roads according to width

Each road line was given a rank value according to 'Criteria I' below:

Criteria I: To be applied to all roads

Roads having a width of 8m or more: **Rank A**

Roads having a width between 4m and 8m: **Rank B**

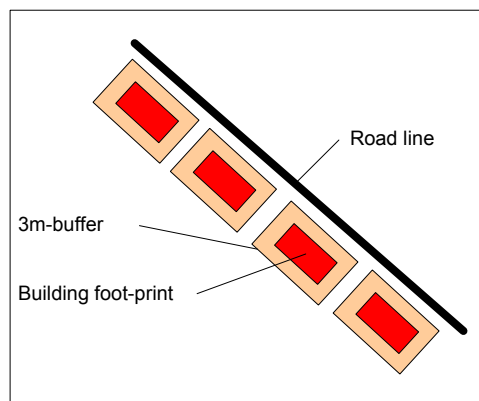
Roads having a width of less than 4m: **Rank C**

3) STEP I-3: Ranking roads according to the potential for blockages to occur due to building collapse

Each of the roads that were assigned Rank B (above) was given a rank value according to Criteria II below:

Criteria II: To be applied to all Rank B roads

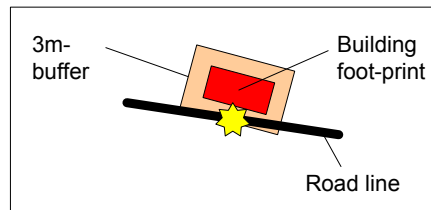
Rank B roads that do not intersect a 3m-buffer zone outside of building footprints: **Rank Ba**



Source: JICA Study Team

Figure 9-21 Generalized View of a Rank "Ba" Road

Rank B roads that do intersect a 3m-buffer zone outside of building footprints: **Rank Bb**



Source: JICA Study Team

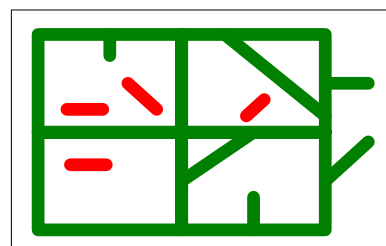
Figure 9-22 Generalized View of a Rank "Bb" Road

4) STEP I-4: Preliminary selection of 'safe' roads

The Rank A and Rank Ba roads were selected and temporally classed as 'safe' roads for input to the next step (STEP I-5 below).

5) STEP I-5: Connectivity assessment of preliminary 'safe' roads

The connectivity of the Rank A and Rank Ba roads selected above was assessed. Those roads that had unbroken connectivity to the regional road network that extends into the 34 commune areas were classified as "safe" roads. Safe roads could be used for evacuation/rescue activities following an earthquake. Isolated roads, i.e. those roads that were not connected to the regional road network, were classified as being unsuitable for evacuation/rescue activities. These isolated roads can be created where the road width changes along the road length. For example, a road that is generally 5 m wide may narrow to a width of only 3 m in some places. The presence of these narrow sections could lead to the road becoming blocked at these locations if they are affected by rubble from damaged buildings. Therefore, these roads would not be suitable for use during evacuation/rescue activities. Figure 9-23 shows a conceptual view of 'Safe' roads and 'Unsafe' (unsuitable) roads.



Legend

Green: 'safe', Red: 'unsafe'

Source: JICA Study Team

Figure 9-23 Conceptual View of 'safe' Roads and 'unsafe' Roads

6) STEP I-6: Road suitability classification of cells in the micro-zoning GRID

The network of suitable ('safe') roads was reviewed, and areas that were likely to be isolated from the regional road network were identified. Cells in the micro-zoning GRID that are joined to the regional 'safe' road network were assigned a value of one (1). All other cells were assigned a value of zero (0), as shown in Figure 9-24.

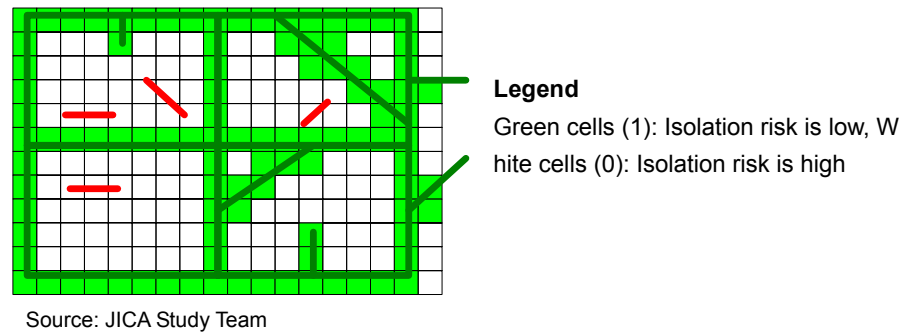


Figure 9-24 Conceptual View of Cell-based Isolation Risk

(3) Availability of Evacuation Point

The availability of evacuation points in the Study Area that can be used as refuges for residents was reviewed. Public parks and open-air sports fields were targeted as suitable disaster management resources in this review. The following criteria were applied for the review:

- A suitable disaster management resource has to have an area equal to at least one (1) ha.
- The urban area that is to be serviced by the evacuation point must lie within a 500 m radius of the disaster management resource.
- All evacuation points must be accessible from the evacuation road network previously described.
- All evacuation points must be located at least 250 m away from highly flammable facilities/fuel tanks.

The above criteria were used to determine the distribution of suitable evacuation points within the 34 communes. Figure 9-25 shows the relative availability of disaster management resources, i.e. evacuation points (that meet the above specifications), within the Study Area.

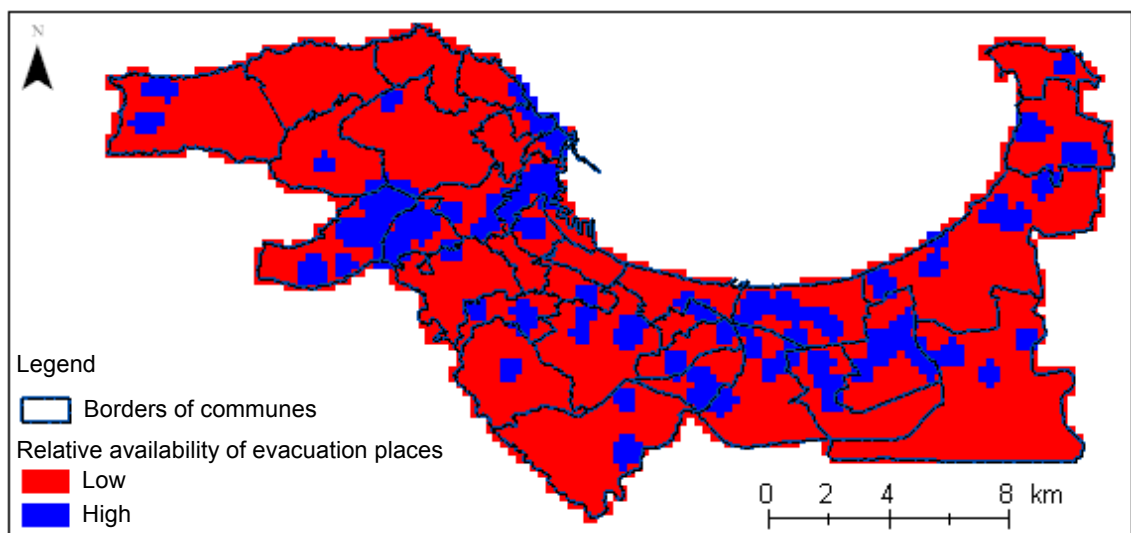


Figure 9-25 Availability of Evacuation Points within the Study Area

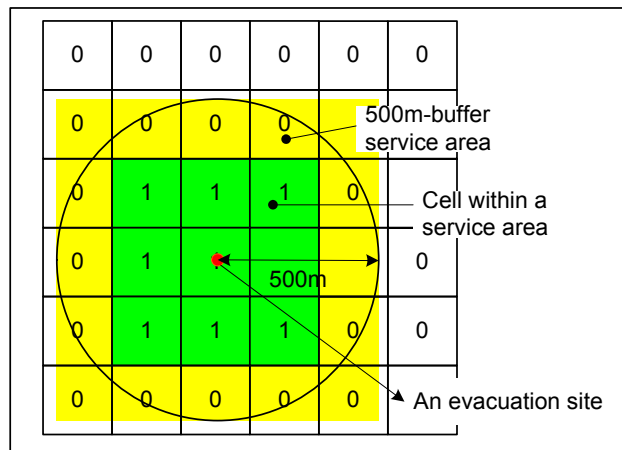
Details of the analysis work that was done using GIS are described below.

1) STEP II-1: Selection of evacuation/rescue sites

Public parks and ‘open-air’ sports fields were selected as evacuation/rescue sites. Initially, all parks and sports fields that had an area of 1 ha or more were selected as potentially being suitable for use by evacuated people in an emergency.

2) STEP II-2: Buffering of potentially suitable evacuation sites for use in an emergency

In this step, the service area of the potential sites selected in the previous step was determined. This was done by creating a 500 m wide buffer (circle) around each site, as shown in Figure 9-26.



Source: JICA Study Team

Figure 9-26 Conceptual View of a 500 m Wide Buffer around a Site, and Its Classification

3) STEP II-3: Classification of evacuation site cells within the micro-zoning GRID

Where a cell in the micro-zoning GRID was completely included within a 500 m wide buffer surrounding an evacuation site, this cell was assigned a value of one (1). All other cells were assigned a value of zero (0), as shown in Figure 9-26 above.

(4) Evacuation Accessibility

Each cell in the micro-zoning GRID was assigned a new value according to the following formula:

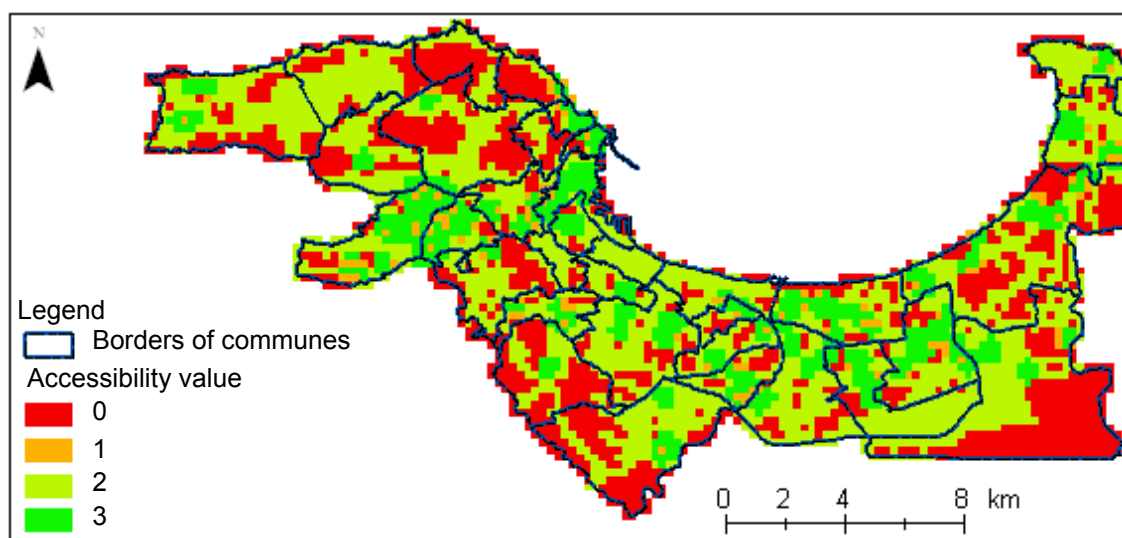
$$[\text{New cell value (accessibility value)}] = ([\text{Assigned cell value from STEP I-6}] \times 2) + [\text{Assigned cell value from STEP II-3}]$$

In the above formula, the road suitability (access) is emphasized by weighting it as being two times as important as the evacuation site suitability (location).

By using the above formula, the new calculated cell value would be one of four numbers: 0, 1, 2 or 3. In general, it is considered that a value of three (3) indicates good accessibility to at least one evacuation place; however, values of zero (0) or one (1) indicate poor accessibility.

If a cell has a value of zero (0), this suggests that the roads included within the cell are not connected to a suitable/safe road network that can be used for evacuation/rescue in an emergency and that the cell is not located within 500 m of at least one potentially suitable evacuation site for use in an emergency. If a cell has a value of (1), this suggests that the area included within the cell is located within 500 m from at least one potentially suitable evacuation site for use in an emergency; however roads within the cell are not connected to the regional road network. If a cell has a value of three (3) , this suggests that roads within the cell are connected to the regional road network, and that the cell is within 500 m of at least one potentially suitable evacuation site for use in an emergency.

Figure 9-27 shows the distribution of the accessibility values within the Study Area and Table 9-16 shows the sum of the accessibility value of all cells in each commune.



Source: JICA Study Team

Figure 9-27 Distribution of Accessibility Values in the Study Area

Table 9-16 Accessibility Value for Each Commune

Code	Commune	Accessibility Value	Value Class
1608	OUED KORICHE	74	5: High
1606	BOLOGHINE IBNOU ZIRI	90	5: High
1628	HYDRA	96	5: High
1612	BIRKHADEM	107	4: Moderate to high
1625	RAIS HAMIDOU	119	4: Moderate to high
1630	BORDJ EL KIFFAN	142	3: Moderate
1611	BOUZAREAH	148	3: Moderate
1624	EL HAMMAMET	160	3: Moderate
1619	BACH DJARAH	165	2: Low to moderate
1610	EL BIAR	166	2: Low to moderate
1644	AIN BENIAN	167	2: Low to moderate
1616	BOUROUBA	168	2: Low to moderate
1627	EL MOURADIA	168	2: Low to moderate

Code	Commune	Accessibility Value	Value Class
1617	HUSSEIN DEY	169	2: Low to moderate
1609	BIR MOURAD RAIS	170	2: Low to moderate
1631	EL MAGHARIA	175	2: Low to moderate
1603	EL MADANIA	176	2: Low to moderate
1620	DAR EL BEIDA	183	2: Low to moderate
1618	KOUBA	183	2: Low to moderate
1626	DJASR KASANTINA	184	2: Low to moderate
1632	BENI MESSOUS	185	2: Low to moderate
1607	CASBAH	188	2: Low to moderate
1621	BEB EZZOUAR	191	1: Low
1629	MOUHAMMADIA	197	1: Low
1639	BORDJ EL BAHRI	200	1: Low
1604	HAMMA EL ANNASSER	200	1: Low
1640	EL MARSА	200	1: Low
1615	OUED SMAR	202	1: Low
1605	BAB EL OUED	205	1: Low
1622	BEN AKNOUN	208	1: Low
1602	SIDI M'HAMED	212	1: Low
1623	DELY BRAHIM	216	1: Low
1613	EL HARAACH	217	1: Low
1601	ALGER CENTRE	219	1: Low

Source: JICA Study Team

9-2-10 Preparation of Earthquake Vulnerability Charts

The available data were reviewed and evaluated taking into account the matters mentioned above. This allowed the JICA Study Team to set the following criteria for determining the vulnerability of urban areas to earthquake disasters. These criteria were applied to the 34 communes in the Wilaya of Alger. Six (6) classes of criteria were defined, as listed below:

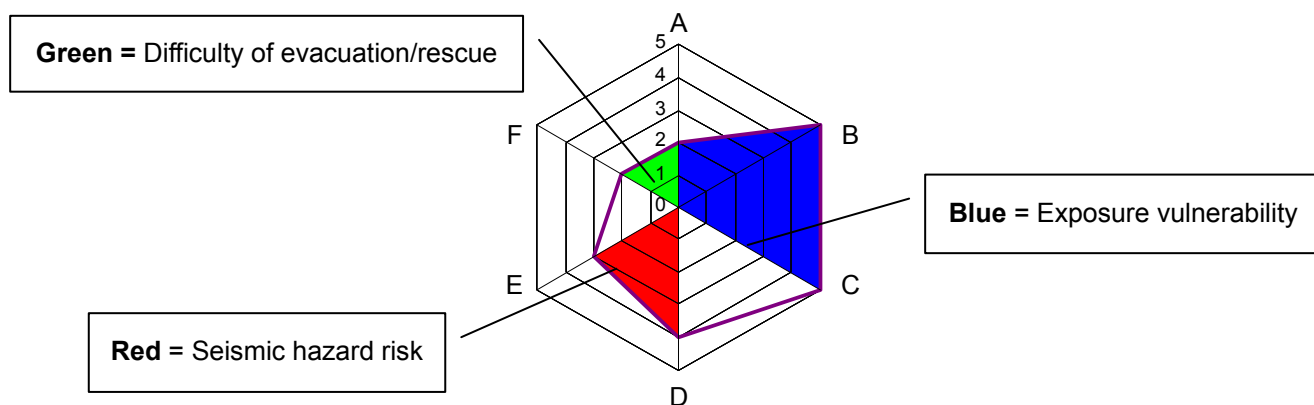
- A. Population density: Relative population density within each commune;
- B. Building age: Ratio (%) of relatively old buildings constructed before 1981 within each commune;
- C. Economic value: Extent (area) of the economically active areas within each commune;
- D. Landslide risk: Average slope gradients within each commune;
- E. Ground surface motion potential: Ground amplification factor 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 9-28. Table 9-17 shows the rating that was applied to each of the above criteria.

Table 9-17 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 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 to 100	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)	0.3 to 3.6	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 9-28 Typical Earthquake Vulnerability Chart for a Commune

An earthquake vulnerability chart is a useful way of representing the potential impact on urban areas. 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 9-29 shows the earthquake vulnerability chart that was prepared for each of the 34 communes in the Wilaya of Alger.

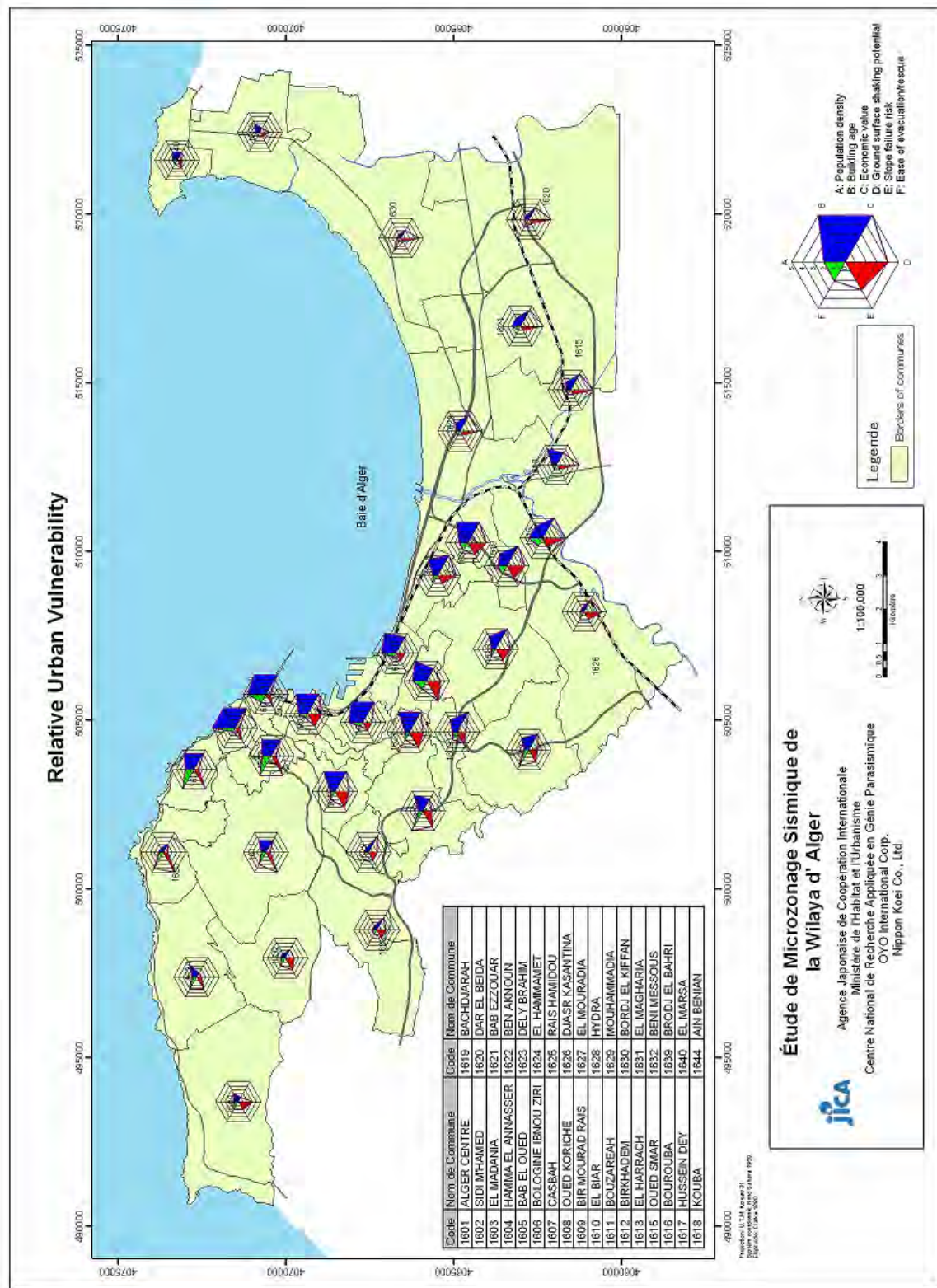


Figure 9-29 Distribution of Relative Urban Vulnerability for the Study Area

9-2-11 Earthquake Vulnerability by Sector

The rating for each of the six (6) criteria shown in the previous section were re-classified into three (3) categories as shown in Table 9-18.

Table 9-18 Re-classification of Ratings for Each of the Six (6) Vulnerability 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 exposure vulnerability, as shown in Table 9-19. These 11 categories were derived from the relative vulnerability/risk ratings of the communes for three (3) criteria: (A) population density, (B) building age, and (C) economic value.

Table 9-19 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 it has been heavily urbanized and developed. Figure 9-30 shows the distribution of exposure vulnerability within the Study Area.

1) High Vulnerability: HHH/MHH/LHH/MHM/LHM

There are fourteen (14) communes that are categorized as having a high exposure vulnerability (HHH, MHH, LHH, MHM or LHM). Various important or central facilities for governance, economy, education, and medical treatment are located within these communes. The exposure vulnerability for these communes is characterized by particularly high ratios of aging buildings. This implies that the highest level of risk for

people and the economy exists within these communes. BAB EL OUED and CASBAH were both evaluated as HHH and are the most vulnerable communes in terms of exposure vulnerability.

BOLOGHINE IBOU ZIRI, OUED KORICHE, ALGER CENTRE, HAMMA EL ANNASSER, and EL MAGHARIA follow the above two (2) communes in terms of exposure vulnerability, as they all have a relatively high exposure vulnerability. Relative population densities EL BIAR, EL MOURADIA and HUSSEIN DEY are low within the Study Area; however, these three (3) particular communes have high ratios of aging buildings, and therefore, there are likely to be many casualties when an earthquake occurs. Other communes are likely to incur the loss of human lives or economic value if a strong earthquake occurs.

2) Moderate Vulnerability: MMH/LMH/LMM/LML

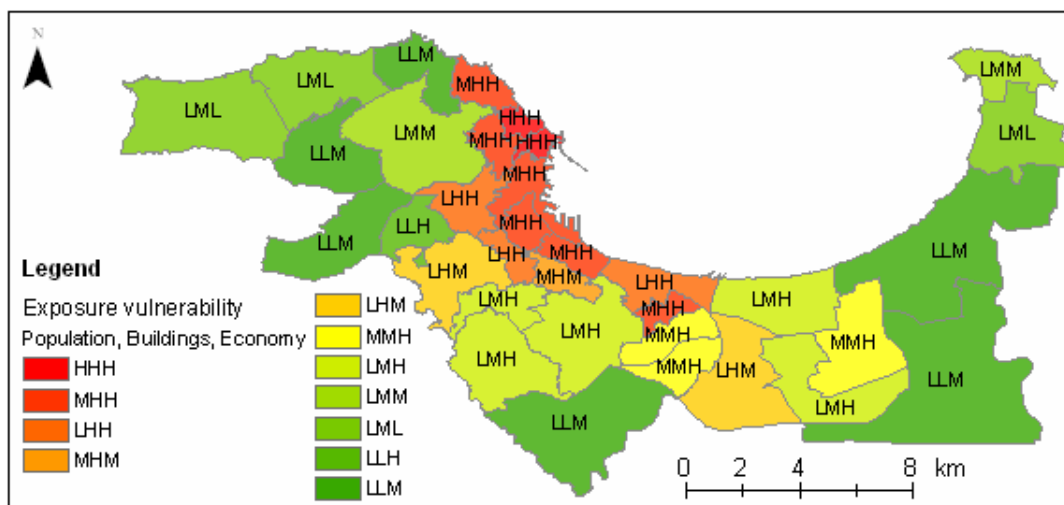
There are thirteen (13) communes that are categorized as having a moderate exposure vulnerability (MMH, LMH, LMM or LML). These communes are characterized by moderate ratios of aging buildings that were constructed before 1981.

Depending on the condition of the buildings, there is a possibility that a lot of damage might occur within these communes. Among the 13 communes that have a moderate exposure vulnerability, EL MADANIA, BACH DJARAH, BOUROUBA, and BEB EZZOOUR have relatively higher exposure vulnerabilities than the rest.

3) Low Vulnerability: LLH/LLM

There are seven (7) communes that are categorized as having a low exposure vulnerability (LLH or LLM). These are DJASR KASANTINA, DAR EL BEIDA, BORDJ EL KIFFAN, DELY BRAHIM, BEN AKNOUN, RAIS HAMIDOU, and BENI MESSOU.

Communes that are categorized into LLH or LLM are in areas that are characterized by relatively low population densities and fewer aging buildings; however the economic value within these areas is moderate to high.



Source: JICA Study Team

Figure 9-30 Distribution of Exposure Vulnerability

(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 9-20. These 7 categories were derived from the relative vulnerability/risk ratings of the communes for two (2) criteria: (D) slope failure risk and (E) ground surface motion potential.

Table 9-20 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 9-31 shows the distribution of seismic hazard risk within the Study Area.

1) High Risk: HM/HL

There are eleven (11) communes that are categorized as having a high seismic risk (HM or HL). These 11 communes are characterized by high levels of ground surface motion potential and slope failure risk.

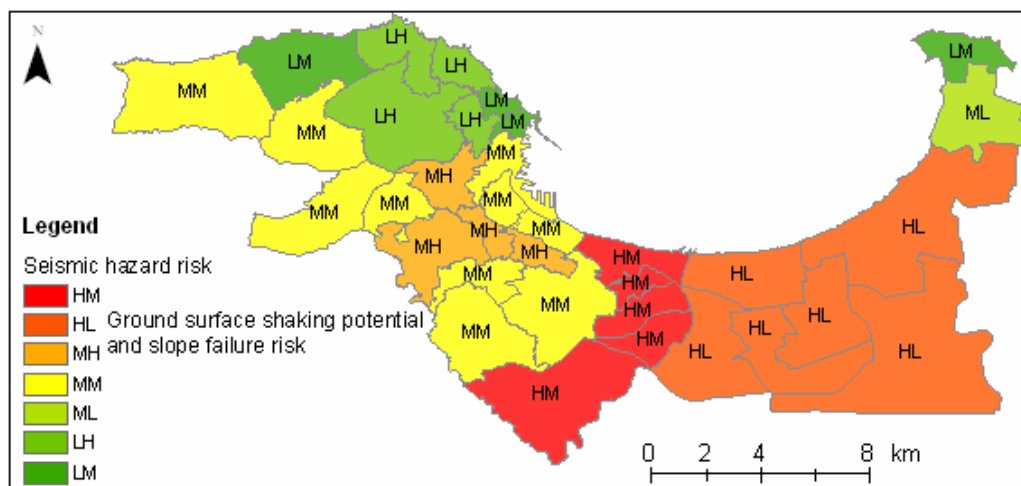
HUSSEIN DEY, EL MAGARHIA, BACH DJARAH, BOUROUBA and DJASR KASANTINA were evaluated as HM. BORDJ EL KIFFAN, DAR EL BEIDA, OUED SMAR, EL HARRACH, BORDJ EL BAHRI and MOHAMMADIA were evaluated as HL.

2) Moderate Risk: MH/MM/ML

There are fifteen (15) communes evaluated as having a moderate seismic risk (MH, MM or ML) within the Study Area. These 15 communes have moderate ground surface motion potential. Of these 15 communes, EL BIAR, HYDRA, EL MOURADIA and EL MADANIA have relatively higher slope failure risks, compared to other communes. The other communes (ALGER CENTRE, SIDI M'HAMED, HAMMA EL ANNASSER, KOUBA, BIRKHADEM, BIR MOURAD RAIS, BEN AKNOUN, DELY BRAHIM, BENI MESSOUS, AIN BENIAN and BORDJ EL BAHRI) have a low to moderate slope failure potential.

3) Low Risk: LM/LH

There are eight (8) communes evaluated as having a low seismic risk (LM or LH). Of these communes, RAIS HAMIDOU, BOLOGHINE IBNOU ZIRI, BOUSAREAH and OUED KORICHE have relatively higher slope failure risks. EL HAMMAMET, BEB EL OUED and EL MARSJA follow these four (4) communes.



Source: JICA Study Team

Figure 9-31 Distribution of Seismic Hazard Risk

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 in 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 9-21. These 8 categories were derived from the relative vulnerability/risk ratings of the communes for two (2) criteria: (A) population density and (F) ease of evacuation/rescue. Figure 9-32 shows the distribution of evacuation/rescue difficulty within the Study Area.

Table 9-21 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

1) High Level of Difficulty: MH/LH

There are five (5) communes categorized as having a high level of emergency evacuation/rescue difficulty (MH or LH). BOLOGHINE IBNOU ZIRI and OUED KORICHE are evaluated as having a difficulty rating of MH, and RAIS HAMIDOU, BIRKHADEM and HYDRA are evaluated as having a difficulty rating of LH.

The above communes have a relatively high difficulty of evacuation in an emergency. Of these, BOLOGHINE IBNOU ZIRI and OUED KORICHE have the highest difficulty.

2) Moderate Level of Difficulty: HM/MM/LM

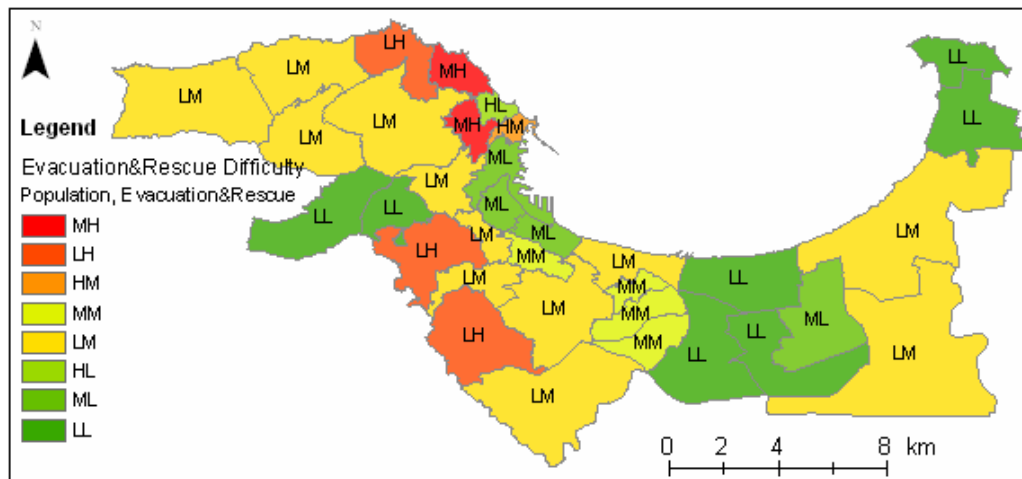
There are seventeen (17) communes categorized as having a moderate difficulty of evacuation/rescue in an emergency. Only CASBAH was evaluated as having a difficulty rating of MH; EL MADANIA, EL MAGHARIA, BACH DJARAH and BOUROUBA were all evaluated as having a difficulty rating of MM; and another 12 communes were evaluated as having a difficulty rating of LM.

Within the 17 communes having a moderate difficulty of evacuation/rescue in an emergency, CASBAH has the greatest difficulty.

3) Low Level of Difficulty: HL/ML/LL

There are twelve (12) communes categorized as having a low difficulty of evacuation/rescue in an emergency. Only BAB EL OUED is evaluated as HL difficulty; ALGER CENTRE, SIDI M'HAMED, HAMMA EL ANNASSER and BEB EZZOUAR are each evaluated as ML difficulty; and EL MARSA, BORDJ EL BAHRI, MOUHAMMADIA, OUED SMAR, EL HARAACH, BEN AKNOUN and DELY BRAHIM all have the same lowest difficulty rating within the Study Area.

Although there is a relatively low difficulty of evacuation within the above 12 communes in the Study Area, in the case of a big earthquake disaster, there is likely to be a shortage of open spaces for use as temporary shelters in an emergency.



Source: JICA Study Team

Figure 9-32 Distribution of Evacuation/rescue Difficulty

9-2-12 Review of Existing Urban Vulnerability and Micro-zoning Results

(1) Earthquake Models

Of the six (6) earthquake models proposed for use in this study, two (2) of these models were selected and applied for damage estimation by using the micro-zoning technique. The

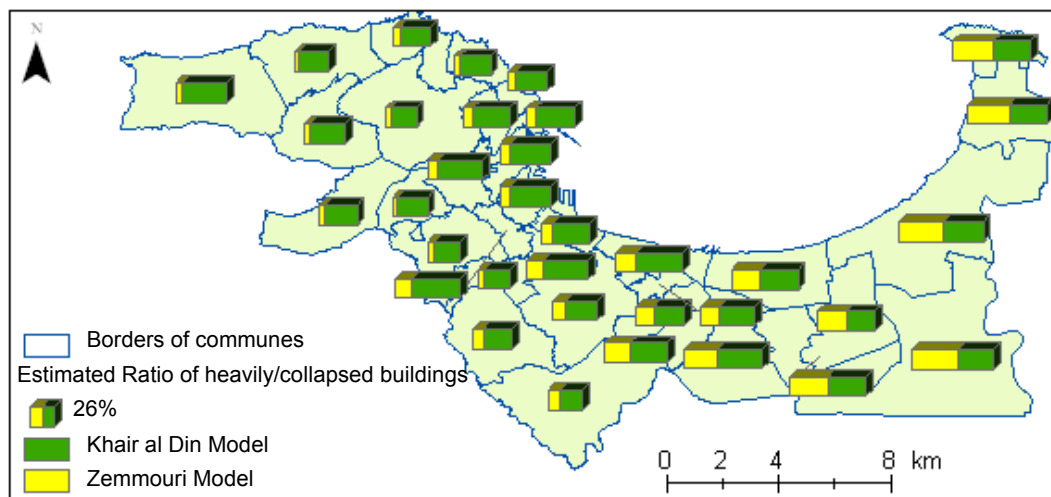
models that were selected are: a) Khair al Din Scenario Earthquake (Khair al Din Model), and b) Zemmouri Scenario Earthquake (Zemmouri Model), as mentioned in the previous chapters.

Tests conducted for the study area using all six models that were proposed showed that seismic intensity is relatively high on the Mitidja Plain and relatively low in the Sahel Hills region.

Of the proposed six (6) models, the Khair al Din model showed the highest seismic intensity distribution pattern within the Study Area. Using the Khair al Din model, the seismic intensity for each commune was estimated to be at least 8 or more on the MSK scale. The Zemmouri model showed a relatively moderate to high seismic intensity distribution within the Study Area compared to the other the six (6) models. For the Zemmouri model, seismic intensity (MSK scale) was estimated to range between 8 and 10 on the Mitidja Plain and range from 6 to 7 in the Sahel Hills region.

(2) Estimated Building Damage

Figure 9-33 shows the distribution of estimated building damage for both the Khair al Din model and the Zemmouri model.



Source: JICA Study Team

Figure 9-33 Comparison of the Estimated Distribution of Heavily Damaged/collapsed Building Ratios due to the Khair al Din and Zemmouri Models

1) Distribution of Damage Predicted by the Zemmouri Model

In general, communes having a relatively high ratio of predicted heavily damaged/collapsed buildings are the communes that have a relatively high seismic hazard risk (HM/HL). These communes are located on the Mitidja Plain. It is noted that the Zemmouri model gives seismic hazard risk a stronger emphasis than exposure vulnerability.

2) Khair al Din Model

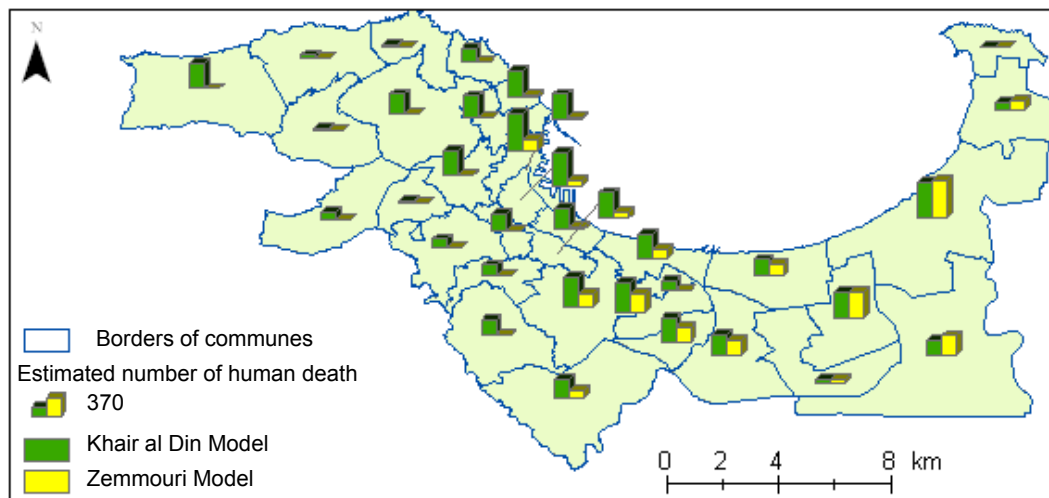
Under the Khair al Din model, all communes have a higher ratio of heavily

damaged/collapsed buildings as compared to the Zemmouri model. In addition to seismic hazard risk, the impact of exposure vulnerability tends to be emphasized more strongly in this model (seismic intensity was estimated to be 8 or more on the MSK scale).

(3) Estimated Social Damage

As for social damage, the death toll, number of seriously/slightly injured survivors, and number of homeless victims predicted to result from an earthquake were estimated using the micro-zoning technique.

Figure 9-34 shows the distribution of the estimated death toll for both the Khair al Din model and Zemmouri model.



Source: JICA Study Team

Figure 9-34 Comparison of the Distribution of the Death Toll Estimated by the Khair al Din and Zemmouri Models

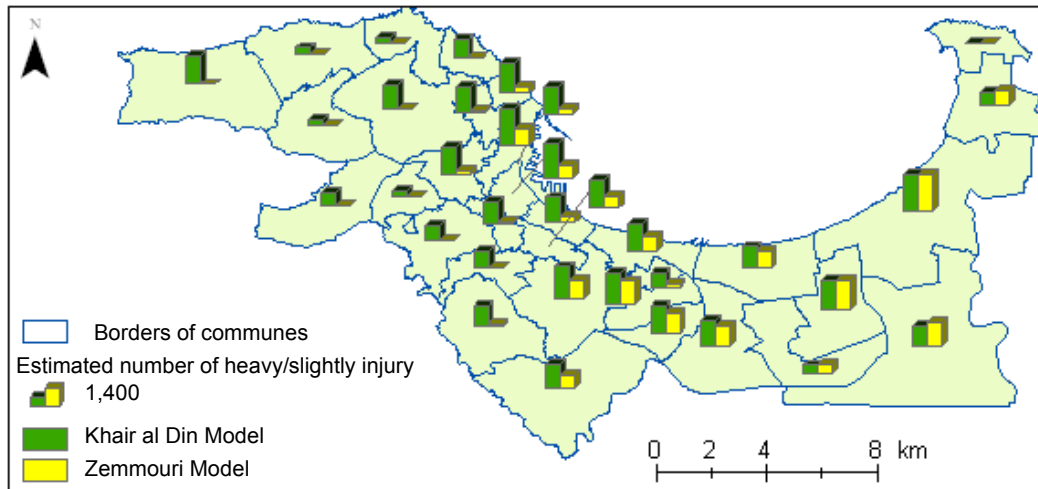
The death toll in the Study Area estimated by the Zemmouri model is relatively high in areas where the seismic hazard potential is also relatively high. For the Khair al Din Model, the estimated death toll is likely to be high in the communes having a relatively high exposure vulnerability in addition to the communes that have a high seismic hazard risk.

Of the 34 communes within the Study Area, BORDJ EL KIFFAN and adjacent communes located on the Mitidja Plain have extremely high estimated death tolls predicted by both models, in spite of the relatively low population density in these localities.

BORDJ EL KIFFAN has the highest maximum PGA value (1,047 gal was predicted by the Kahair al Din model and 1,141 was predicted by the Zemmouri model). This commune also has the highest level of maximum seismic intensity (9.6 was predicted by the Kahair al Din model and 9.8 was predicted by the Zemmouri model), compared to other communes.

It is noted that BORDJ EL KIFFAN and adjacent communes, which are located mainly on the Mitidja Plain, are the most likely communes to have high death tolls of the 34 communes in the Study Area. This is due to the high seismic hazard risk (especially high ground surface motion potential) that was predicted by all seismic models, in spite of these communes having a lower exposure vulnerability.

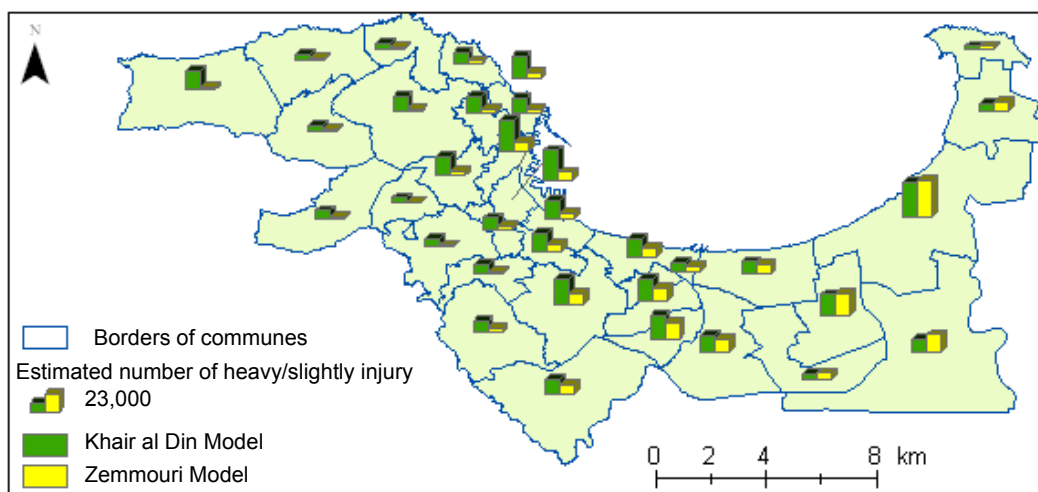
As for the predicted number of injured and homeless victims, the distribution pattern of these numbers within the Study Area is similar to the distribution pattern of the death toll predicted by the Khair al Din model and Zemmouri models, as shown in Figures 9-35 and Figure 9-36.



Source: JICA Study Team

Figure 9-35 Comparison of the Distribution of the Estimated Number of Injured Victims due to the Khair al Din and Zemmouri Models

It is also noted that the damage estimated for AIN BENIAN due to the Khair al Din model is relatively high, in spite of this commune's low to moderate urban vulnerability when compared to all the 34 communes. The major reason for such high damage levels being predicted for AIN BENIAN due to the Khair al Din model is attributed to this commune having the highest PGA value (max. 1,200 gal) and seismic intensity (max. 9.8 on the MSK scale) of all the 34 communes. In the Khair al Din model, seismic intensity for AIN BENIAN is estimated to be nine (9) or more within the vicinity of AIN BENIAN, such as BORDJ EL KIFFAN.



Source: JICA Study Team

Figure 9-36 Comparison of the Distribution of the Estimated Number of Homeless victims Estimated by the Khair al Din and Zemmouri Models

(4) Analysis of Current Urban Vulnerability within the Study Area

Table 9-22 shows a comparison of the current urban vulnerability and estimated damage using the micro-zoning technique.

Urban vulnerability within the Study Area is discussed further below.

Table 9-22 Comparison of Current Urban Vulnerability and Estimated Damage

Commune Code	Commune name	Existing urban vulnerability			Estimated Damage: Khair al Din Model				Estimated Damage: Zemmouri Model			
		Exposure vulnerability	Seismic hazard risk	Ease of evacuation/rescue	Number of heavily damaged/collapsed buildings	Number of human death	Number of Injury	Number of homeless victims	Number of heavily damaged/collapsed buildings	Number of human death	Number of Injury	Number of homeless victims
1601	ALGER CENTRE	MHH	MM	ML	1,395	748	2,766	38,820	379	206	1,201	10,532
1602	SIDI M'HAMED	MHH	MM	ML	922	686	2,615	37,129	235	136	908	9,490
1603	EL MADANIA	MHM	MH	MM	1,435	523	2,194	23,093	492	121	842	7,974
1604	HAMMA EL ANNASSER	MHH	MM	ML	834	433	1,941	22,351	265	50	480	7,184
1605	BAB EL OUED	HHH	LM	HL	616	548	2,260	28,083	155	56	519	7,126
1606	BOLLOGHINE	MHH	LH	MH	899	246	1,341	13,026	212	0	0	3,122
1607	CASBAH	HHH	LM	HM	1,067	515	2,173	19,133	282	50	479	5,150
1608	OUED KORICHE	MHH	LH	MH	978	437	1,952	19,755	246	15	218	5,058
1609	BIR MOURAD RAIS	LMH	MM	LM	1,249	211	1,219	11,294	331	0	0	3,046
1610	EL BIAR	LHH	MH	LM	3,393	513	2,167	23,570	820	32	360	5,785
1611	BOUZAREAH	LMM	LH	LM	2,633	392	1,821	18,178	454	0	0	3,206
1612	BIRKHADEM	LMH	MM	LH	1,852	306	1,551	15,489	617	11	179	5,248
1613	EL HARRACH	LHM	HL	LL	2,076	435	1,946	21,489	1,555	316	1,582	16,106
1615	OUED SMAR	LMH	HL	LL	1,339	80	650	8,214	1,352	82	662	8,290
1616	BOUROUBA	MMH	HM	MM	1,892	482	2,079	30,008	1,259	311	1,567	19,979
1617	HUSSEIN DEY	LHH	HM	LM	2,155	486	2,093	22,747	1,024	199	1,173	10,838
1618	KOUBA	LMH	MM	LM	2,884	623	2,456	33,329	1,195	260	1,391	13,812
1619	BACH DJERAH	MMH	HM	MM	1,895	585	2,359	27,670	1,119	362	1,727	16,319
1620	DAR EL BEIDA	LLM	HL	LM	2,941	273	1,439	15,990	3,848	379	1,781	20,895
1621	BAB EZZOUAR	MMH	HL	ML	1,490	511	2,162	26,219	1,531	523	2,194	26,943
1622	BEN AKNOUN	LLH	MM	LL	1,009	47	464	5,885	166	0	0	978
1623	DELY BRAHIM	LLM	MM	LL	1,309	152	974	10,347	198	0	0	1,583
1624	HAMMAMET	LML	LM	LM	687	43	436	6,032	98	0	0	866
1625	RAIS HAMIDOU	LLM	LH	LH	1,047	38	401	6,662	200	0	0	1,277
1626	DJASR KACENTINA	LLM	HM	LM	785	375	1,767	18,408	424	151	969	9,988
1627	EL MOURADIA	LHH	MH	LM	1,675	328	1,619	14,754	512	9	159	4,597
1628	HYDRA	LHM	MH	LH	1,967	185	1,116	9,885	417	0	0	2,133
1629	MOHAMMADIA	LMH	HL	LL	1,671	335	1,641	15,938	1,304	246	1,340	12,449
1630	BORDJ EL KIFFAN	LLM	HL	LM	4,637	712	2,680	43,340	4,911	735	2,736	45,916
1631	EL MAGHARIA	MHH	HM	MM	974	178	1,085	11,043	493	17	233	5,667
1632	BENI MESSOUS	LLM	MM	LM	821	33	367	6,338	125	0	0	973
1639	BORDJ EL BAHRI	LML	ML	LL	1,799	148	956	10,480	2,022	188	1,126	11,754
1640	EL MARSА	LMM	LM	LL	504	0	0	3,329	556	0	0	3,672
1644	AIN BENIAN	LML	MM	LM	2,986	504	2,143	24,061	385	0	0	3,166
Total					55,817	12,109	54,831	642,088	29,176	4,453	23,826	311,121

Source: JICA Study Team

- Of the six (6) earthquake models proposed in this study, the Khair al Din model gives the highest level of building/social damage within the Study Area, and this model is considered to represent a special and worst case scenario. In comparison, the Zemmouri model is considered to represent one of the possible and typical earthquake disasters that may occur within the Study Area.
- Total damage estimated by the Khair al Din Model is about two (2) or three (3) times greater than that estimated by the Zemmouri model.

- Damage rapidly becomes greater when the seismic intensity exceeds about 8 on the MSK scale in any area when using the models described above.
- Within the Study Area, communes located on the Mitidja Plain have a relatively high vulnerability to earthquakes, compared to the communes in/around the Sahel Hills.
- As a result of doing the urban vulnerability assessment and the damage estimation using a micro-zoning technique in this study, the following points were noted:
 - When seismic intensity reaches or exceeds seismic intensity 8 on the MSK scale, communes having a high seismic hazard risk and communes having a high exposure vulnerability are both likely to be heavily damaged. (For example, as predicted by the Khair al Din model.)
 - When seismic intensity is less than seismic intensity 8 on the MSK scale, communes having a high seismic hazard risk are likely to be heavily damaged. (For example, as predicted by the Zemmouri model.)
- It is considered that the Khair al Din model is more suitable than the Zemmouri model for emphasizing the threat that earthquake hazards present within the Study Area. This is because the former model predicts seismic damage, not only for communes having a high seismic hazard risk, but also for communes having a high exposure vulnerability.

9-2-13 Comprehensive Evaluation of Urban Vulnerability

Through doing the assessment and analysis work mentioned above, urban vulnerability and potential solutions within the Study Area can be evaluated comprehensively.

The communes within the Study Area can be classified into five (5) groups, based on their urban vulnerability characteristics, as shown in Table 9-23.

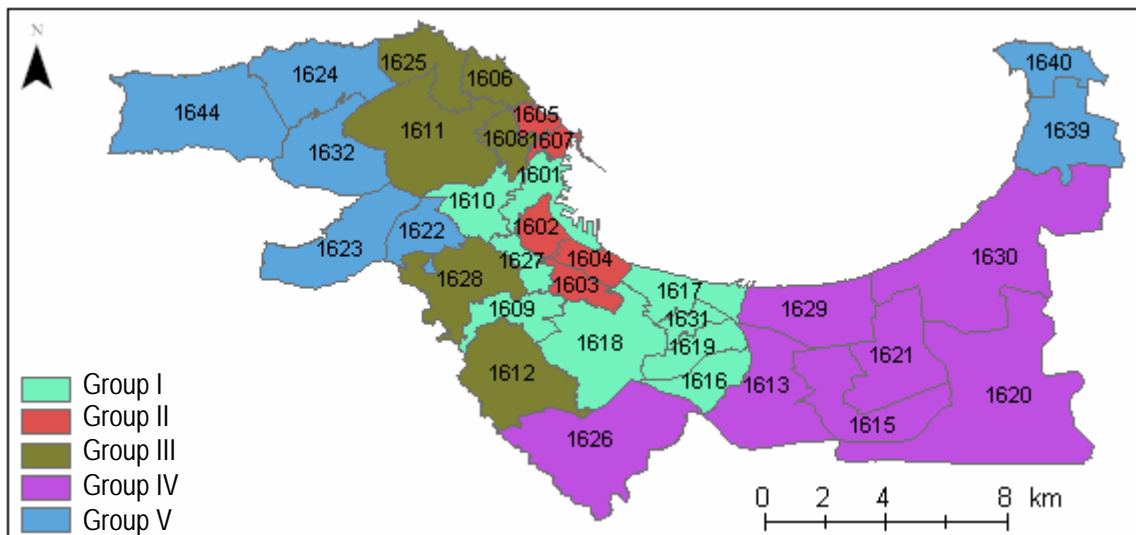
Table 9-23 Commune Groups by Urban Vulnerability Characteristics

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

Group	Code	Commune	Population density	Building Age	Economic value	Ground surface motion potential	Slope failure risk	Evacuation /rescue difficulty
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 MARSА	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 9-37 shows the distribution of commune groups by Urban Vulnerability Characteristics within the Study Area.



Source: JICA Study Team

Figure 9-37 Distribution of Commune Groups by Urban Vulnerability Characteristics

(1) Characteristics of Urban Vulnerability

1) Group I

There are nine (9) communes that have been allocated to Group I. The communes in this group contain areas that are economically very important and they have a relatively high exposure vulnerability. Within these communes, there are many old buildings constructed before 1981. These buildings are relatively fragile and prone to damage by seismic motion because of lack of seismic-resistant construction measures. The seismic hazard potential is moderate to high, and evacuation/rescue difficulty is moderate within the Study Area.

In addition to the characteristics mentioned above, there are many narrow and sloping communal roads within each community. The current high level of car ownership in the communes has resulted in a serious lack of car parking spaces. Usually, both sides of communal roads are occupied by parked cars and commercial vehicles during the day. Such parking on the streets often causes traffic jams at many points. This situation may result in heavy casualties during seismic hazards due to the difficulty of access for rescue operations.

“Potential Solutions”

- Renovation of buildings having lower seismic-resistance
- Increasing the number of car parking spaces, and decreasing the number of cars that are parked on narrow roads
- Restricting building construction on sites close to steep slopes, and building slope protection structures
- Widening narrow roads
- Increasing the amount of open space
- Relocation of central city facilities or relocation of residents

2) Group II

There are five (5) communes that have been allocated to 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. Therefore, the communes in Group II have the highest level of exposure vulnerability. The seismic hazard potential is lower than for Group I. However, the Group II communes have a relatively high level of evacuation/rescue difficulty.

“Potential Solutions”

- Renovation of buildings having lower seismic-resistance
- Increasing the number of car parking spaces, and decreasing the number of cars that are parked on narrow roads
- Restricting building construction on sites close to steep slopes, and building slope protection structures
- Widening narrow roads
- Increasing the amount of open space
- Relocation of central city facilities or relocation of residents

3) Group III

There are six (6) communes that have been allocated to Group III. The communes in Group III are located on sloping land in the Sahel Hills. Therefore, the communes in this Group have a high slope failure risk in an earthquake. However, the ground surface motion potential is low to moderate. The Group III communes have high levels of evacuation/rescue difficulty due to lack of connectivity with the regional road network.

Of the 6 communes in Group III, BOLOGHINE IBOU ZIRI, OUED KORICHE, HYDRA and BIRKHADEM have higher levels of exposure vulnerability.

“Potential Solutions”

- Restricting building construction on sites close to steep slopes, and building slope protection structures
- Increasing the amount of open space
- Improving road connectivity to the regional road network (accessibility)
- Renovation of buildings having lower seismic-resistance

4) Group IV

Group IV comprises seven (7) communes that are located on the Mitidja Plain. 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.

Of the 7 communes in Group IV, MOHAMMADIA, OUED SMAR, BEB EZZOUR and EL HARRACH have higher levels of exposure vulnerability and the other communes have a low to moderate exposure vulnerability.

“Potential Solutions”

- Preparation for seismic motion. For example, securing unstable fixtures such as infrastructure, machines and instruments in factories, furniture in buildings, etc.
- Renovation of buildings having lower seismic-resistance

5) Group V

Group V comprises seven (7) communes. The communes in Group V have a low to moderate urban vulnerability.

“Potential Solutions”

- Introducing the above points into communal land use plans

9-2-14 Case Study 1: Evacuation Point Capacity and Other Potential Refuge Sites

The potential damage estimated by using the micro-zoning technique gives an estimated number of about 640,000 homeless victims for the Khair al Din model and an estimated number of about 310,000 homeless victims for the Zemmouri model. These people will be homeless due to the destruction of their houses by earthquakes. The homeless victims might have to move to safe evacuation points and need to be accommodated in temporary shelters. These people might be located in community or regional evacuation points until when they are able to return to their original homes or move to new destinations.

As a case study, the capacity of existing evacuation points was reviewed, as described below.

(1) Evacuation Point Definitions Used in Japan

There are two (2) types of evacuation points that are defined in Japan. These are:

- 1) Community evacuation points; and
- 2) Regional evacuation points.

1) Community Evacuation Points

A community evacuation point is for people who have to evacuate temporarily (then be moved to a regional evacuation point). Public parks, sports fields, schools or other suitable places are usually selected for community evacuation points in Japan. Open space requirements for a community evacuation point are recommended to be 2 m² or more per person in Japan. The population area served by each community evacuation point should be circular and have a radius not exceeding approximately 500 m, or stated another way, no person should have to travel more than 500 m straight line distance to reach a community evacuation point. In Japan, a community evacuation point should have a total area of at least one (1) ha.

2) Regional Evacuation Points

A regional evacuation point is an open space such as a large park or large sports fields where evacuated people will finally be moved to through evacuation activities. The open space requirement for a regional evacuation point is recommended to be 3 m² or more per person in Japan. The population area served by each regional evacuation point should be circular and have a radius not exceeding approximately 2 km. In Japan, a regional evacuation point should have an area of at least ten (10) ha.

In this case study, only public parks and open-air sports fields are considered as being potential community/regional evacuation points. These facilities have been targeted by DGPC as possible evacuation points in an emergency.

(2) Selection of Possible Community/Regional Evacuation Points

A total of 118 public parks and 132 open-air sports fields were identified by the disaster management resource survey that was undertaken by the JICA Study Team.

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 (mentioned in Section 9-2-8) and they have areas of at least 1ha. In addition, these places are located at least 250m away from highly flammable facilities/fuel tanks.

Out of the suitable community evacuation points mentioned above, six (6) community evacuation points (4 parks and 2 open-air sporting fields) having areas of at least 10 ha are considered to also be suitable for use as regional evacuation points.

(3) Capacity of Community Evacuation Points for Homeless Victims

There are nine communes that do not have suitable community evacuation points within the boundary of the commune. These are EL MADANIA, HAMMA EL ANNASSER, BOLOGHINE IBNOU ZIRI, CASBAH, OUED KORICHE, RAIS HAMIDOU, EL MOURADIA, BENI MESSOUS and EL MARSA.

The total area (ha) of evacuation points within the Study Area is 264.1 ha. The capacity (number of homeless victims that can be accommodated) within the Study Area is calculated according to the following formula: Capacity = [Gross area of open space] / [space needed for one person], i.e. Capacity = [264.1 ha] / [2 m² per person]. Therefore, the total capacity of community evacuation points for homeless victims in the Study Area is calculated to be 1,320,500 people. The calculated capacity of evacuation points within each commune is shown in Table 9-24.

Table 9-24 Capacity of Evacuation Points for Homeless Victims

Code	Commune	Number of open spaces (parks and open-air sports fields)	Gross area (ha) of open space	Capacity for homeless victims
1601	ALGER CENTRE	5	20.5	102,500
1602	SIDI M'HAMED	1	1.8	9,000
1603	EL MADANIA	0	0.0	0
1604	HAMMA EL ANNASSER	0	0.0	0
1605	BAB EL OUED	3	4.9	24,500
1606	BOLOGHINE IBNOU ZIRI	0	0.0	0
1607	CASBAH	0	0.0	0
1608	OUED KORICHE	0	0.0	0
1609	BIR MOURAD RAIS	2	4.0	20,000
1610	EL BIAR	2	3.1	15,500
1611	BOUZAREAH	1	1.3	6,500
1612	BIRKHADEM	1	1.1	5,500
1613	EL HARRACH	2	4.4	22,000
1615	OUED SMAR	2	4.1	20,500
1616	BOUROUBA	1	11.3	56,500
1617	HUSSEIN DEY	1	1.3	6,500
1618	KOUBA	2	6.8	34,000
1619	BACH DJERAH	1	3.3	16,500
1620	DAR EL BEIDA	2	5.4	27,000
1621	BAB EZZOUAR	5	23.8	119,000
1622	BEN AKNOUN	4	26.9	134,500
1623	DELY BRAHIM	5	71.8	359,000
1624	HAMMAMET	5	10.3	51,500
1625	RAIS HAMIDOU	0	0.0	0
1626	DJASR KACENTINA	1	8.5	42,500
1627	EL MOURADIA	0	0.0	0
1628	HYDRA	1	1.4	7,000
1629	MOHAMMADIA	1	3.7	18,500
1630	BORDJ EL KIFFAN	7	17.6	88,000
1631	EL MAGHARIA	1	3.2	16,000
1632	BENI MESSOUS	0	0.0	0
1639	BORDJ EL BAHRI	4	16.5	82,500
1640	EL MARSA	0	0.0	0
1644	AIN BENIAN	3	7.1	35,500

Source: JICA Study Team

(4) Comparison of the Capacity of Evacuation Points and Estimated Number of Homeless Victims

In the micro-zoning in this study, about 55,000 homeless victims were estimated by the Khair al Din model and about 24,000 homeless victims were estimated by the Zemmouri model. These numbers of estimated homeless victims are smaller than the calculated capacity of the evacuation points for homeless victims within the Study Area.

However, of the 34 communes included within the Study Area, 17 communes do not have enough evacuation point capacity for the number of homeless victims predicted by the Khar al Din model, and 11 communes do not have enough evacuation point capacity for the number of homeless victims predicted by the Zemmouri model, as shown in Table 9-25.

Table 9-25 Balance of Capacity of Evacuation Points for Homeless Victims

Code	Commune	Calculated Capacity	Estimated number of homeless victims		Estimated excess capacity for homeless victims ([Calculated Capacity] - [Estimated number of homeless victims])	
			Khair al Din model	Zemmouri model	Khair al Din model	Zemmouri model
1601	ALGER CENTRE	102,500	38,820	10,532	63,680	91,968
1602	SIDI M'HAMED	9,000	37,129	9,490	-28,129	-490
1603	EL MADANIA	0	23,093	7,974	-23,093	-7,974
1604	HAMMA EL ANNASSER	0	22,351	7,184	-22,351	-7,184
1605	BAB EL OUED	24,500	28,083	7,126	-3,583	17,375
1606	BOLOGHINE IBNOU ZIRI	0	13,026	3,122	-13,026	-3,122
1607	CASBAH	0	19,133	5,150	-19,133	-5,150
1608	OUED KORICHE	0	19,755	5,058	-19,755	-5,058
1609	BIR MOURAD RAIS	20,000	11,294	3,046	8,706	16,954
1610	EL BIAR	15,500	23,570	5,785	-8,070	9,715
1611	BOUZAREAH	6,500	18,178	3,206	-11,678	3,294
1612	BIRKHADEM	5,500	15,489	5,248	-9,989	252
1613	EL HARRACH	22,000	21,489	16,106	511	5,894
1615	OUED SMAR	20,500	8,214	8,290	12,286	12,210
1616	BOUROUBA	56,500	30,008	19,979	26,492	36,522
1617	HUSSEIN DEY	6,500	22,747	10,838	-16,247	-4,338
1618	KOUBA	34,000	33,329	13,812	672	20,188
1619	BACH DJERAH	16,500	27,670	16,319	-11,170	181
1620	DAR EL BEIDA	27,000	15,990	20,895	11,010	6,105
1621	BAB EZZOUAR	119,000	26,219	26,943	92,781	92,058
1622	BEN AKNOUN	134,500	5,885	978	128,615	133,522
1623	DELY BRAHIM	359,000	10,347	1,585	348,653	357,415
1624	HAMMAMET	51,500	6,032	866	45,468	50,634
1625	RAIS HAMIDOU	0	6,662	1,277	-6,662	-1,277
1626	DJASR KACENTINA	42,500	18,408	9,988	24,092	32,512
1627	EL MOURADIA	0	14,754	4,597	-14,754	-4,597
1628	HYDRA	7,000	9,885	2,133	-2,885	4,867
1629	MOHAMMADIA	18,500	15,938	12,449	2,562	6,052
1630	BORDJ EL KIFFAN	88,000	43,340	45,916	44,660	42,084
1631	EL MAGHARIA	16,000	11,043	5,667	4,958	10,333
1632	BENI MESSOUS	0	6,338	973	-6,338	-973
1639	BORDJ EL BAHRI	82,500	10,480	11,754	72,020	70,746
1640	EL MARSA	0	3,329	3,672	-3,329	-3,672
1644	AIN BENIAN	35,500	24,061	3,166	11,439	32,334
Total		1,320,500	642,088	311,121	678,412	1,009,379

Source: JICA Study Team

For communes located on the Mitidja Plain, where the seismic hazard risk is relatively high and the exposure vulnerability is relatively low, there is enough evacuation point capacity for the predicted number of homeless victims. However, for communes located in the Sahel Hills region, where the seismic hazard risk is relatively low and the exposure vulnerability is relatively high, the evacuation points often do not have sufficient capacity for the predicted number of homeless victims. This is especially the case for the Khair al Din model, which predicts greater numbers of victims. Therefore, the following potential countermeasures might be required in order to accommodate homeless victims in the 17 communes that are predicted to have insufficient capacity, as listed above:

- Option A: Move victims to evacuation points that are located in communes that are immediately adjacent to the affected communes, and which have enough excess capacity to accommodate the additional homeless victims
- Option B: Move victims to evacuation points that are located in the general vicinity (i.e. further away than the adjacent communes), which have enough excess capacity to accommodate the additional homeless victims
- Option C: Evacuate victims to other types of open spaces such as grasslands, agricultural lands, etc.

Of the three (3) options listed above (A - C), when applying option A and B, but excluding option C, the following evacuation plan for homeless victims within the 17 communes is suggested as a possible countermeasure.

Communes listed in Table 9-26 can take Option A if needed, and communes listed in Table 9-27 can take Option B if needed.

Table 9-26 Communes Needing to use Evacuation Points in Adjacent Communes

Commune	Capacity shortfall	Targeted communes and capacity for additional homeless victims	
EL MARSА	3,329	BORDJ EL BAHRI	72,020
BACH DJARAH	11,170	BOUROUBA	26,492
BIRKHADEM	9,989	DJASR KASANTINA	24,092
RAIS HAMIDOU	6,662	EL HAMMAMET	45,468
BENI MESOUS	6,338	DELY BRAHIM	348,653
BOUZAREAH	11,678	DELY BRAHIM	348,653
EL BIAR	8,070	BEN AKNOUN	128,615
HYDRA	2,885	BEN AKNOUN	128,615
OUEД KORICHE	19,755	ALGER CENTRE	63,680
CASBAH	19,133	ALGER CENTRE	63,680
SIDI M'HAMED	28,129	ALGER CENTRE	63,680

Source: JICA Study Team

Table 9-27 Communes Needing to use Evacuation Points in the General Vicinity

Commune	Capacity shortfall	Targeted communes and capacity for additional homeless victims	
BOLOGHINE I. Z.	13,026	EL HAMMAMET	45,468
BAB E. OUED	3,583	EL HAMMAMET	45,468
HAMMA. E.A.	22,351	BEN AKNOUN	128,615
EL MOURADIA	14,754	BEN AKNOUN	128,615
EL MADANIA	23,093	BEN AKNOUN	128,615
HUSSEIN DEY	16,247	BOUROUBA and EL MAGHARIA	31,450

Source: JICA Study Team

(5) Other Potential Sites Required in an Emergency

In order to construct temporary shelters for homeless victims, or temporary hospitals for injured people and others, additional open spaces might be needed. Table 9-28 shows the potential available area by commune.

The area of land that may be used in the future for potential sites in an emergency or for future development projects was calculated using the GIS. For this calculation, the generalized land cover map for 2000/2001 (as mentioned in Section 9-2-1 above) was used as the base data.

The calculation was based on the following assumptions:

- Exclusion of the “Forest” and “Water” classes (land to be conserved);
- Exclusion of the “Bare Land” and “Shrub” classes. (The area of these two (2) classes is very small within the study area, and these two (2) classes are often located on slopes that are unsuitable for urban development or use as potential sites in an emergency.);
- Exclusion of the “Urban”, “Industrial” and “Infrastructure” land cover classes. (“Urban” land is already urbanized, and both the “Industrial” and “Infrastructure” areas would be unsuitable for urban development);
- 50% of the “Mixed Urban” class area could be utilized; and
- 100% of the area of the “Grassland” and “Cropland” classes could be utilized.

Based on the calculation that was done using the GIS, it was determined that a total of 5,664 ha could potentially be utilized for emergency response in a hazardous earthquake such as is predicted by the Khair al Din model.

Of the 34 communes in the Study Area, DAR EL BEIDA has the largest potential for future development (about 1,500 ha). This comprises 65% of the DAR EL BEIDA commune area. The commune with the next largest available area is BORDJ EL KIFFAN. This commune has an area of 890 ha that is available for potential urbanization after 2000/2001.

Table 9-28 Potential Land Area Available for Future Utilization, by Commune

Commune Name	Area (ha)	Commune Name	Area (ha)	Commune Name	Area (ha)
ALGER CENTRE	2	EL HARRACH	316	D. KACENTIAN	498
SIDI M'HAMED	8	OUED SMAR	150	EL MOURADIA	8
EL MADANIA	16	BOUROUBA	0	HYDRA	145
H. E. ANNASSER	2	HUSSEIN DEY	0	MOHAMMADIA	108
BAB EL OUED	1	KOUBA	13	BORDJ EL IFFAN	890
BOLOGHINE I. Z.	21	BACH DJERAH	0	EL MAGHARIA	0
CASBAH	0	DAR E. BEIDA	1,532	BENI MESSOUS	174
OUED KORICHE	6	BAB EZZOUAR	146	BORDJ EL BAHRI	196
BIR MOURAD RAIS	7	BEN AKNOUN	48	EL MARSAS	100
EL BIAR	26	DELY BRAHIM	232	AIN BENIAN	682
BOUZAREAH	61	EL HAMMAMET	20		
BIRKHADEM	180	RAIS HAMIDOU	76		

Source: JICA Study Team

9-2-15 Case Study 2: Safety of the Regional Evacuation/Rescue Road Network in an Emergency

(1) Possible Road Bridge Collapse Predicted by the Khair al Din Model

There are 148 road bridges that were checked by the JICA Study Team within the Study Area. Of these 148 road bridges, the Khair al Din model predicts that three (3) road bridges have a high probability of falling off their foundations and 19 bridges have moderate probability of falling off their foundations. When the Khair al Din model was used, the remaining bridges were considered to have a low probability of collapse.

(2) Potential Road Cuts and Possible Problems Predicted by the Khair al Din Model

In this case study, it was assumed that the road bridges having a moderate/high risk of collapse, as predicted by the Khair al Din model, would cause roads to be cut.

Figure 9-38 shows the locations where the 'Autoroute' (highway) and National Road R.N.05 may be cut, as predicted by the Khair al Din model. These roads are important transport links that follow generally along the southwest coastline of Alger Bay.

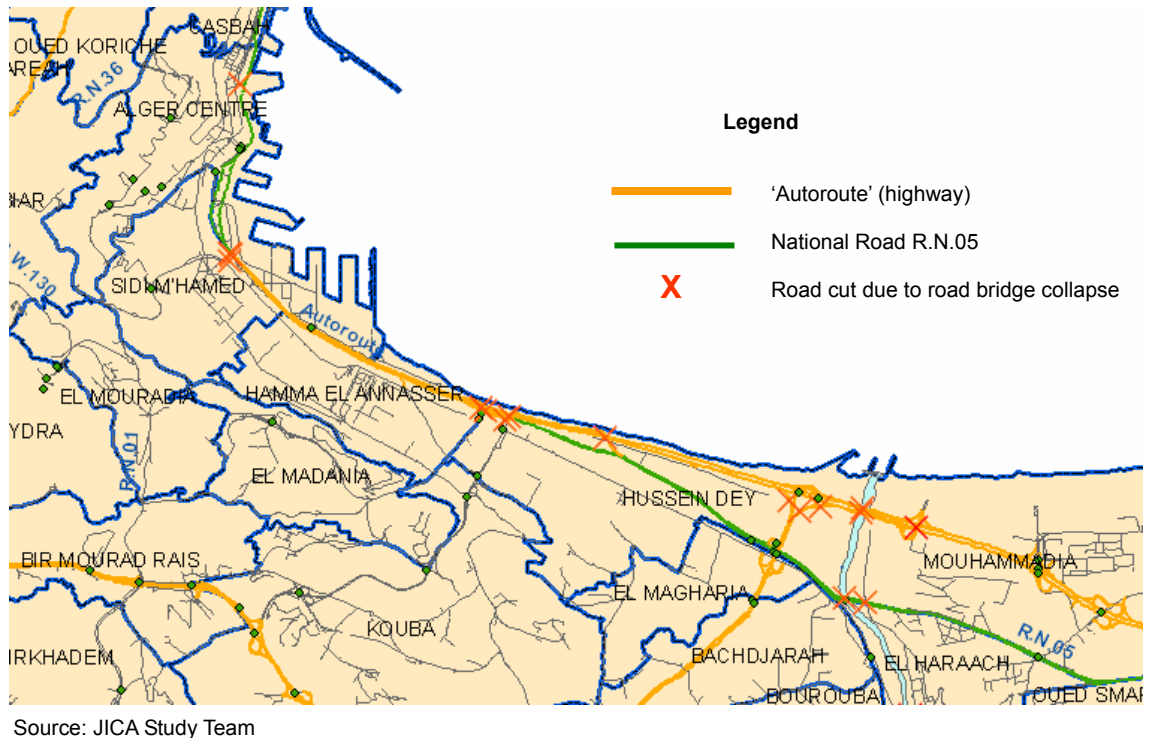


Figure 9-38 Location of Possible Road Cuts on the 'Autoroute' (Highway) and National Road R.N.05 between ALGER CENTRE and MOUHAMMADIA

If roads are cut due to the collapse of road bridges in accordance with the above assumptions, the following problems may affect the evacuation/rescue road network within the Study Area:

- A section of National Road R.N.05 might not be usable between MOUHAMMADIA and ALGER CENTRE.
- Alger Port, located between ALGER CENTRE and SIDI M'HAMED, might be isolated from the evacuation/rescue road network within the Study Area. Therefore, accessibility to communes located between the southwest coastline of Alger Bay and the Alger International Airport, located in DAR EL BEIDA, might be restricted.
- If sections of National Road R.N.05 and the 'Autoroute' (highway) located along the coastline of Alger Bay are cut, access between MOUHAMMADIA and HUSSEIN DEY might be restricted. Communes located to the west of HUSSEIN DEY and communes located east of MOUHAMMADIA might only be accessible by using the remaining 'active' roads via the Alger International Airport, which is located in DAR EL BEIDA.
- EL MADANIA might not be serviced by any highways, national roads or communal roads that are suitable to be used as evacuation/rescue routes within the Study Area. As a result, only local roads might connect EL MADANIA to other communes.
- Five (5) communes (AIN BENIAN, EL HAMMAMET, RAIS HAMIDOU, BOLOGHINE IBOU ZIRI and BAB EL OUED) might be almost completely isolated from other communes within the Study Area.
- Within the Study Area, National Road R.N.24 might be the only route that connects communes located west of BORDJ EL BAHRI and EL MARSJA to the other communes.



Source: JICA Study Team

Figure 9-39 Location of National Road R.N.24 between BORDJ EL KIFFAN and BORDJ EL BAHRI

- (3) Important Issues Relevant to the Evacuation/Rescue Road Network within the Study Area
- Marine transport or aerial transport might be needed in an emergency for communes that are likely to be isolated along the Alger Bay coastline. It is vital that these communes prepare for all kinds of disasters.
 - Seismic-resistance measures should be installed on road bridges, especially those on the 'Autoroute' (highway) and National Road R.N.05 that are located along the coastline of Alger Bay.
 - Narrow roads and streets should be widened; illegal car-parking on roads should be controlled.
 - Existing (local) roads in EL MADANIA and adjacent communes should be improved so that they are suitable for use in an emergency such as that predicted by the Khair al Din model.
 - Improvement of National Road R.N.24, or construction of a new road parallel to R.N.24, might be needed to ensure accessibility to BORDJ EL KIFFAN, BORDJ EL BAHRI and EL MARSA.
 - Possible regional evacuation points that have enough space for evacuation/rescue activities in DELY BRAHIM and BEN AKNOUN might play an important role for communes that might become isolated in by a disaster of the scale predicted by the Khair al Din model. This is especially important for the five (5) communes that are located in/around the Sahel Hills region (AIN BENIAN, EL HAMMAMET, RAIS HAMIDOU, BOLOGHINE IBOU ZIRI and BAB EL OUED). In an emergency, National Road R.N.11 will be a vital route for accessing these potentially isolated communes.

- Access roads between regional evacuation points located in DELY BRAHIM and BEN AKNOUN and the above five (5) communes should be improved so that they are suitable for evacuation and rescue use in an emergency.

9-2-16 Case Study 3: Possible Methods for Towns to Mitigate the Effects of Earthquake Disasters

This case study suggests possible methods for selected built-up areas in SIDI M'HAMED and EL HARRACH to mitigate the effect of earthquake disasters in terms of urban development.

(1) SIDI M'HAMED

1) Area of Interest

An area of about 210 ha in SIDI M'HAMMED and adjacent communes was selected for this case study. Figure 9-40 shows the extent of the case study area and the existing conditions relevant to the study that are present in this area.

2) Risks in an Earthquake Disaster

The following points can be identified as risks in an earthquake disaster. The locations of Areas A - F, which are described in the following sections, are shown on Figure 9-40.

'A' Area

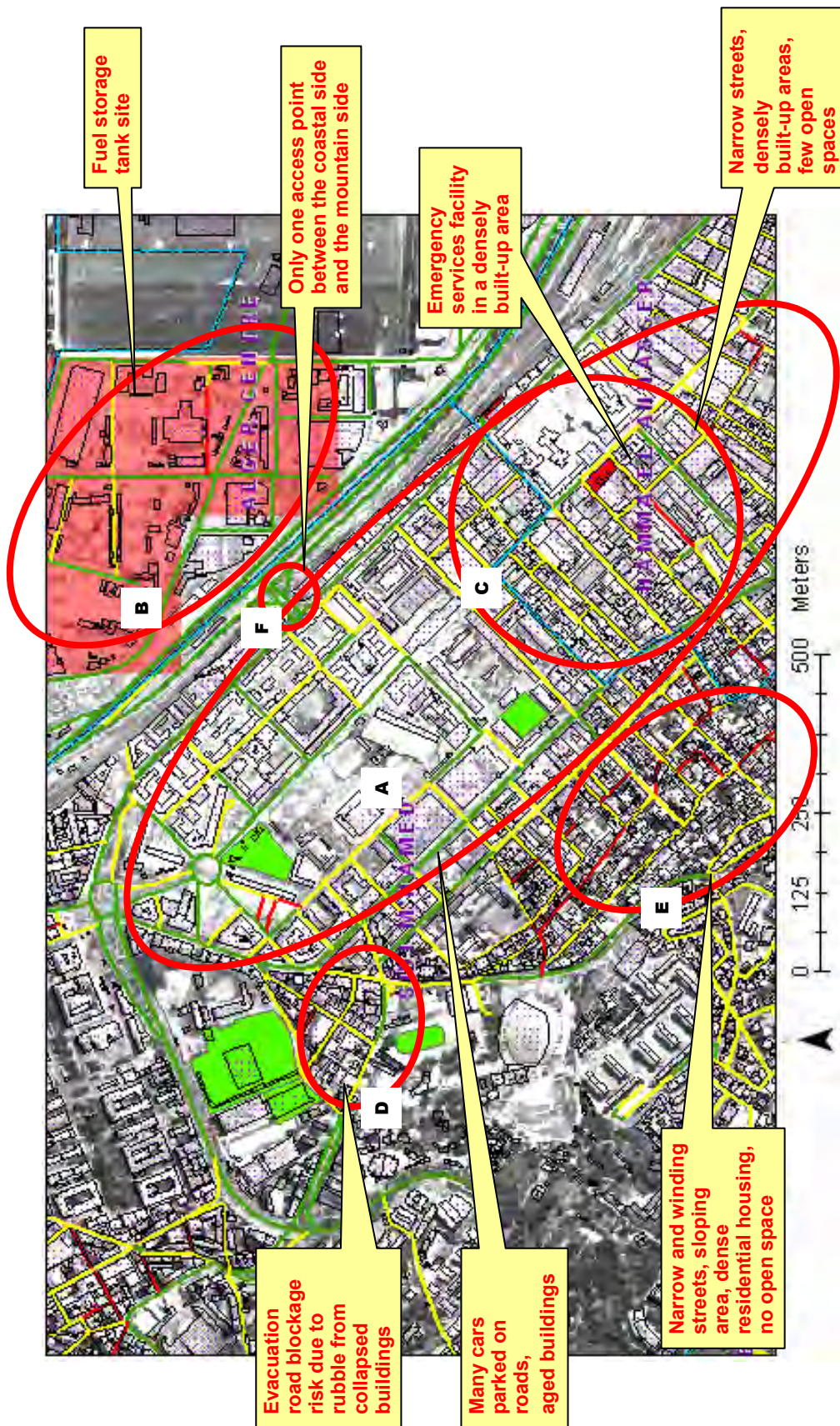
- Almost of all the buildings were constructed before 1981, which indicates that they have a relatively low resistance to seismic shocks.
- The area includes important buildings and facilities for government, the economy, education, etc.
- The area has a relatively high population density.
- Both sides of communal roads are usually occupied by illegally parked cars that are owned by residents and visitors. Illegal parking occurs because there is a shortage of car-parking places.

'B' Area

- The area is located on the Alger Port site and there are flammable or explosive fuel storage tanks.
- The area has high potential for liquefaction and ground surface motion caused by seismic shocks.

'C' Area

- There are many narrow communal roads having a width of less than eight (8) meters. These roads are likely to be blocked by rubble induced by building collapse due to seismic shocks. It might become difficult for evacuation/rescue activities to be carried out in an emergency following a hazardous earthquake.
- A Civil Protection station is located in the southeast part of the area. Narrow communal roads in this area might block activities related to their emergency response work. Illegal car-parking on roads will also cause difficulty for rescue activities.



Roads: less than 4 m wide (red), 4 m - 7.99 m wide (yellow), 8 m and more wide (green); Borders of communes (cyan dashed line)

Figure 9-40 Existing Condition of the Selected Area in SIDI M'HAMED and Its Adjacent Communes

‘D’ Area

- The area is located between two open spaces that can be used for communal or regional evacuation points.
- There are many narrow roads that might be blocked by rubble from collapsed buildings and densely built-up housing sites. Residents might not have access to the evacuation points described above.

‘E’ Area

- The area is located in gently sloping land and has densely built-up housing sites. The area shows a pattern of urban sprawl.
- The area lacks open spaces that can be used for community evacuation points and evacuation routes.

Roads are less than eight 8 m wide and some of the roads are less than 4 m wide. In an emergency, such as a hazardous earthquake, this area might be isolated from adjacent areas.

‘F’ Area

- There is an important road bridge connecting the coastal highway (‘autoroute’) and National Road R.N.05. The bridge might fall off its foundations in a severe earthquake, such as that predicted by the Khair al Din model. If the road bridge that connects the coastal highway and R.N.05 is damaged or destroyed, the road network in the area might be cut and the areas mentioned above would experience extreme difficulty in an emergency situation.

3) Suggestions on Urban Development

The following points are important for possible urban development projects and in terms of disaster management.

‘A’ and ‘C’ Areas

- The areas have already been densely built-up. Therefore, in the short term, it might be difficult to promote new urban development plans that have advantages for disaster management.
- In order to upgrade safety in evacuation/rescue activities for residents, accessibility to communal roads should be secured by positive measures, such as restricting illegal car-parking on narrow roads.
- In addition to securing the safety of roads for evacuation/rescue activities, the number of potential road network cuts should be reduced by improving the seismic-resistance of old buildings that currently have a low resistance to seismic shocks.
- At present, there are not enough open spaces to accommodate the residents. Existing facilities/buildings, e.g. schools that are not part of the open spaces resources should have their seismic-resistance improved. These facilities could then be used as temporary shelters for evacuees or as rescue operation bases in an emergency.

'B' Area

- Checking the resistance of fuel storage tanks to seismic shocks is recommended as soon as possible.
- Access roads to the tanks must always be kept clear by restricting parking on the roads.

'C' Area

- Road accessibility around the emergency services facility in this area should be secured by widening the roads.

'D' Area

- The same measures that are recommended for Area 'A' should also be applied to Area 'D'.
- In particular, accessibility to open spaces in the adjacent communes should be secured.

'E' Area

- The same measures that are recommended for Area 'A' area should basically be taken in 'E' area.
- Accessibility to other areas should be secured by widening existing roads.
- Restrictions might need to be applied on new building construction projects in steeply sloping areas.
- Slope protection work is recommended for residential sites and communal roads where it is needed.

'F' Area

- The road bridge between the coastal highway ('autoroute') and National Road R.N.05 should be checked in terms of its seismic-resistance. If needed, countermeasures and renovation work should be implemented.
- In a severe earthquake, the bridge may fall off its foundations. Therefore, alternative routes that would be usable in an emergency should be considered based on the existing road network.

(2) EL HARRACH

1) Area of Interest

An area of about 200 ha in EL HARRACH and adjacent communes was selected as another area to be evaluated in this case study. The selected area coincides with the town centre located in the northern half of EL HARRACH. Figure 9-41 below shows the extent of the case study area and the existing conditions on the ground.

2) Risk in an Earthquake Disaster

The following points were identified as risks in an earthquake disaster (See Figure 9-41 below).

'A' Area

- The area is located on sloping ground that has been eroded and formed a valley.
- There are many old buildings that were constructed before 1981, which have a relatively low seismic-resistance.
- Densely built-up areas extend from northeast to southwest along the valley axis within 'A' area.
- The area comprises small shops and dwellings, with relatively narrow roads having widths of less than 8 m. If a seismic shock occurs, the narrow roads in this area might be blocked by rock falls and rubble from collapsed buildings.
- There is heavy non-stop traffic passing through this area because it is a junction point connecting communes located to the east and west of this area.

'B' Area

- The area includes industrial sites and is economically important.

'C' Area

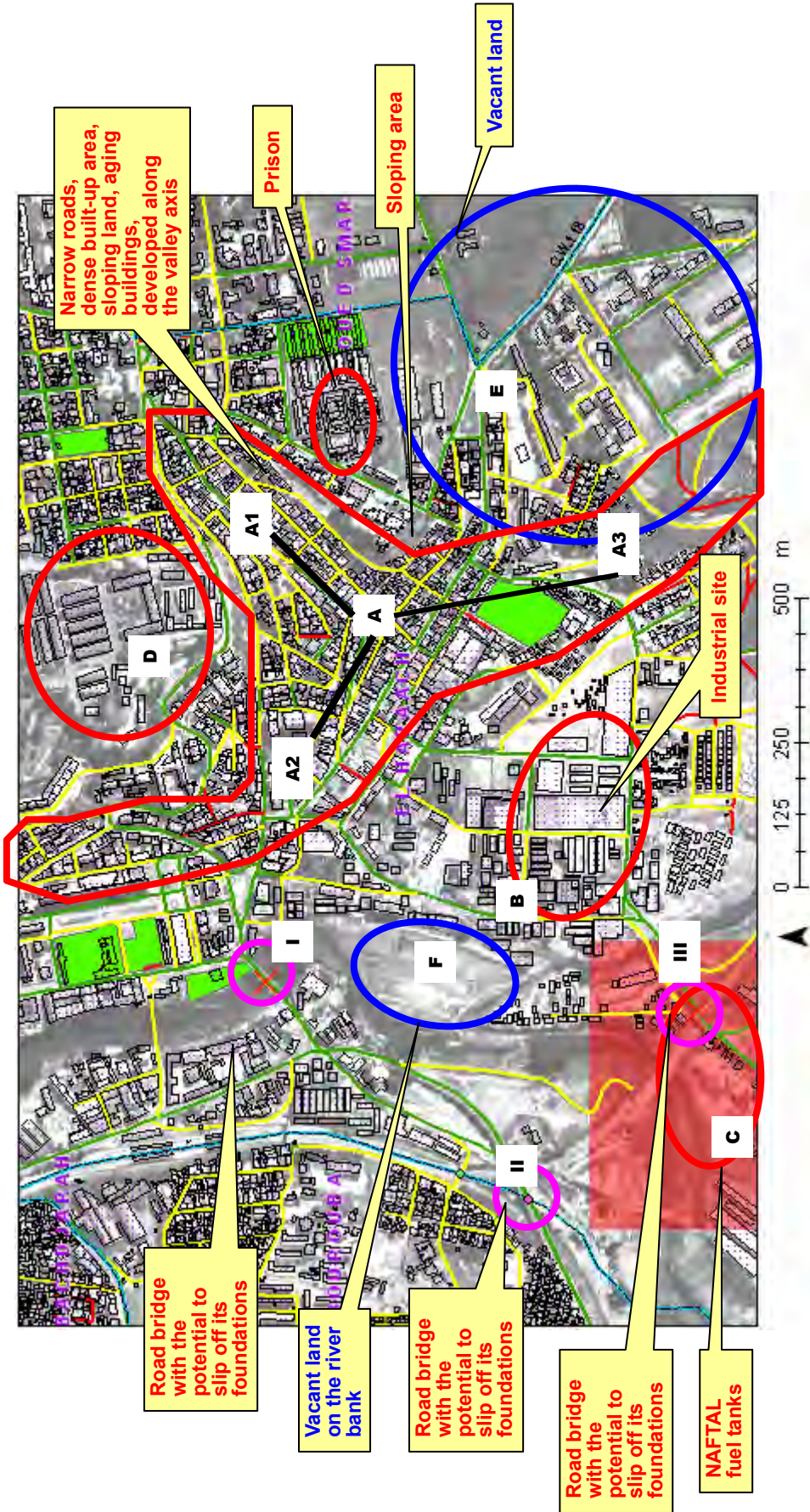
- The area includes a NAFTAL fuel (gasoline) factory (a distribution depot).

'D' Area

- There is a drinking water production facility in this area.

'E' and 'F' Areas

- There is vacant land having enough space for disaster management on the Mitidja Plain. The 'F' area is located in the riverbed along the Harrach River.



Roads: Less than 4 m wide (red), 4 m - 7.99 m wide (yellow), 8 m or wider (green); Borders of communes (cyan dashed line)

Figure 9-41 Existing Condition of the Selected Area in EL HARRCH and Adjacent Communes

Locations 'I', 'II' and 'III'

- Road bridges located at points 'I', 'II', 'III' shown above in Figure 9-41 have moderate to high potential to be thrown off their foundations in severe seismic shocks like those predicted by the Khair al Din model.
- If the roads were cut due to bridges collapsing, road traffic beyond the Haraach River will experience great difficulty.

3) Suggestions for Urban Development

Important points to be considered by future urban development projects or for disaster management are listed as follows:

'A' Area

- The area is already densely built-up. Therefore, it might be difficult to promote new urban development plans that have advantages for disaster management in the short term. This also applies to SIDI M'HAMED.
- In order to upgrade the safety of residents in evacuation/rescue activities, access to communal roads should be secured by measures such as restricting illegal car-parking on narrow roads.
- In addition to securing the safety of roads for evacuation/rescue activities, the number of sites where the road network could potentially be cut should be reduced. This can be done by improving the seismic-resistance of old buildings that have low resistance to seismic shocks.
- Existing facilities/buildings, e.g. schools that are not open spaces should have their seismic-resistance improved so that they can be used as temporary shelters for evacuees or as rescue operation bases in an emergency. This is because there are not enough open spaces for residents. For example, mosques might be usable as temporary shelters for evacuees in an emergency. However their seismic-resistance condition should be checked, and improved where required so that they can be safely used as evacuation sites.
- The area is likely to be isolated from the regional evacuation/rescue network, as mentioned in previous sections.
- An alternative by-pass road for this area might be needed as a long term measure. (Currently, only National Road R.N.05, which is located in the eastern portion of this area, is used as a bypass route. However, R.N.05 might be cut if any bridges are thrown off their foundations in a severe seismic shock such as is predicted by the Khair al Din model.)
- Accessibility to other areas should be secured by widening roads.
- Restrictions might need to be applied for new building construction in steeply sloping residential sites.
- Slope protection work is recommended for residential sites and communal roads.

‘B’ Area

- It is recommended that the stability of factory facilities during a seismic shock be checked as soon as possible.
- Toxic waste and substances used for industry should be secured against seismic shocks, so that such waste and substances do not pose a safety risk around the factory sites.
- Fire fighting training for employees might be required for large facilities.

‘C’ Area

It is recommended that the resistance of fuel storage tanks to seismic shocks be checked as soon as possible.

- Open spaces (buffer zones) around the tanks should be secured.
- Access roads to the fuel tanks must always be kept clear by restricting car-parking on these roads.
- New residential sites should be placed far enough away from NAFTAL’s fuel tanks.
- A new bypass road could be constructed, so that through traffic could avoid the NAFTAL site.

‘E’ Area

- The area has large open spaces for future development. In the short term, the area could be used for large scale disaster management, such as a regional evacuation point or a tent town for evacuees.

‘F’ Area

- The area also has large open spaces on one bank of the Harrach River. This area does not seem to be suitable for a tent town or use as an important temporary base. However, it might be usable as a community evacuation point. The area might be also used for car-parking, not only in an emergency but also under usual conditions. The area could also be used as a temporary heliport in case of need.

Locations ‘I’, ‘II’ and ‘III’

As mentioned in previous sections of this report, a stability assessment of the bridges within locations ‘I’, ‘II’ and ‘III’ is urgently required. If it is found that the stability is not sufficient to resist seismic shocks, repair work should be undertaken in the near future.

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 steering committee and study team, and then, descriptions of the members were collected and combined as shown in Tables 9-29 to 9-52.

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.

Table 9-29 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(1) Emergency headquarters

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	<p>Location of crisis cell has not been clearly defined in ORSEC Plan, Wilaya office is seriously damaged, and thereby, it takes a considerable time to fix the location of the crisis cell.</p> <p>Officers are summoned for emergency response, but initial response of some modules is delayed, because the chiefs of the modules are injured and there is no prescription on successors in ORSEC Plan.</p>	<p>The president declares a state of emergency, and crisis cell is established.</p> <p>Military helicopters are not available for clarifying damage situation during night, and system for collecting damage information from citizens has not been established beforehand, and therefore, the cell can not make quick decision for measures, based on actual damage situation.</p> <p>Exclusive wireless communication system of DGPC is reliable for transmission of information and instruction, but the exchange of information is difficult, because the DGPC system is installed into a few agencies only.</p>	<p>The crisis cell is getting well functioned, but confusion occurs in chain of order due to congestion of information.</p> <p>Although Wali and Ministers announce about damage situation, response of each organization is not systematic due to poor communication among the organizations.</p> <p>The crisis cell has a problem of shortage of assisting staffs because of 24 hours operation.</p>	<p>Since number of workable staffs and the whole picture of damage are known, staffs of crisis cell are redeployed. But, the redeployed staffs cause delay in dealing with suspending issues, because the procedure of response is not familiar to the staffs and not clearly expressed in the text.</p>	<p>Settlement of emergency situation is declared, and particular responsibility and administrative power are dispersed to concerned organizations as a process of dissolution of crisis cell.</p>
An improved case	<p>The building of crisis cell has been constructed in accordance with building code, and staffs who is not suffered gather there immediately after the building.</p> <p>Emergency lighting facilities and communication devices with backup power generators have been installed to the buildings and fixed properly against earthquakes so that the function of crisis cell can be secured.</p> <p>Successors for replacing unavailable chiefs of modules have been prescribed in revised ORSEC Plan beforehand, and there is no delay of initial response of all modules.</p>	<p>Together with declaration of a state of emergency by the President, Wali establishes crisis cell and modules.</p> <p>Commune office gathers damage information from citizens and communities and transfers the information to crisis cell in accordance with revised OESEC Plan distributed beforehand. The crisis cell makes instructions to modules, based on the collected information. The information collected by military helicopters is also utilized for the instruction.</p> <p>All related organization to the crisis cell can use exclusive wireless communication system, including track-mount mobile system operated by DGPC, and smooth communication is secured.</p>	<p>Based on collection information on damage, emergency response is commenced, leading by each module.</p> <p>Emergency rehabilitation work for damaged strategic buildings is commenced in order to restore function as bases of support.</p> <p>As a measure on shortage of manpower in crisis cell, assisting staffs are dispatched from other offices outside of Algiers.</p>	<p>Following prescribed guideline in ORSEC Plan, the formulation of rehabilitation/reconstruction plan starts in accordance with actual damage situation.</p>	<p>Settlement of emergency situation is declared, and particular responsibility and administrative power are dispersed to concerned organizations as a process of dissolution of crisis cell.</p>
Measures	<p>National delegation for major risks should promote the construction of building of crisis cell in accordance with building code.</p> <p>National delegation for major risks should install emergency lighting facilities and communication devices with backup power generators into the building of crisis cell.</p> <p>National delegation for major risks should prepare an emergency response plan, including the prescription of the successors of the chiefs of modules the operation procedure of crisis cell, and conduct training for the emergency operation.</p>	<p>In order to set up an emergency communication system (collection and dissemination of information), it is required to revise ORSEC Plan and install hardware (devices) and software (organization tree), together with training or drill for emergency response.</p> <p>Each commune should formulate an emergency response manual, establish a department specialized for disaster management, and execute training or drill for emergency response.</p>	<p>National delegation for major risks should prescribe in ORSEC Plan about the dispatching plan of staffs to crisis cell.</p> <p>National delegation for major risks should promote to conclude agreement among local governments on mutual support in an emergency.</p>	<p>A guideline for the formulation of rehabilitation/reconstruction plan should be prescribed in ORSEC Plan in consideration of long-term strengthening of comprehensive disaster management capacity.</p>	

Table 9-30 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(2) Base of supp

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	<p>Thirty (30) percent of public buildings is collapsed or heavily damaged, and the rest of the buildings are considerably damaged. Power supply is cut off, and the most of public agencies do not function due to black out, those which have emergency power generators. Most of staffs are in their houses and only about 10% of the staffs come to the office within one hour after the event.</p>	<p>Victims gather in public agencies, intending to have official support, but they can not receive support because few official staff comes to the office.</p>	<p>Without safety diagnosis, public buildings are occupied by victims, and official agencies can not function as bases of support. Necessary support is not provided properly, because of lack of official staffs and unclearly prescribed procedure on emergency response.</p>	<p>Although public agencies start reception of victims' request, the official staffs can not provide support properly, because responsible organizations on particular services and the method of communication are not well known to staffs. Although many people and groups arrive from peripheries, they can not provide support effectively, because tasks to be shared in an emergency have not clearly defined.</p>	<p>Victims, who can not receive official support, are looking for other support groups, but they can not find adequate supporters due to lack of information.</p>
An improved case	<p>Public buildings have been reinforced or reconstructed in accordance with new seismic regulation, and damage to the buildings is limited. Emergency power generating devices have been installed to the buildings and fixed properly against earthquakes in order to secure emergency communication so that each concerned agency can function properly at the time of emergency. More than half of staffs of the cell come to the office within one hour, according to ORSEC Plan that has been updated and distributed to all the staffs.</p>	<p>Official staffs whose family has not been damaged, come to the office immediately in accordance with ORSEC Plan which has been prepared in all related offices and well-understood by all staffs. Duty of other staffs who can not come to office is shared to successors as prescribed in ORSEC Plan. Official work for collecting/reporting damage information and assisting victims is done outside buildings, considering further damage to the buildings due to after shock.</p>	<p>Quick diagnosis of public buildings is carried out. Official work such as collecting information and support is done inside the buildings. Official staffs have well-understood the contents and procedures of ORSEC Plan through distributed manuals and training for emergency response, and therefore, the staffs can provide necessary support (including locating and introducing concerned module) to victims.</p>	<p>An emergency communication system, managed by information service module, has been prescribed in a revised ORSEC Plan and well-known to all the related agencies, and accordingly, representatives of refugee camps can make smooth and regular communication to responsible agencies for particular support. Using this system, information on shortage of manpower and materials and additional request are smoothly transferred to responsible agencies, and necessary supplement can be provided to the victims.</p>	<p>Information service module should prescribe an emergency communication system among related agencies in an ORSEC Plan, distribute the guidance to all related agencies for well-understanding, and execute training for practical application.</p>
Measures	<p>Public buildings to be used for emergency response should be reinforced or rebuilt in accordance with building code. Emergency lighting facilities and communication devices with backup power generators should be installed to public buildings and fixed against earthquakes in order to secure their functions.</p>	<p>All public agencies to be bases of support. should prepare an ORSEC Plan and all the official staffs should well understand the contents through attending training for emergency response.</p>	<p>Diagnosis module should prepare an ORSEC Plan. prescribing priority of quick diagnosis for important buildings and promote training for developing engineers' skill for the diagnosis.</p>	<p>Information service module should prescribe an emergency communication system among related agencies in an ORSEC Plan, distribute the guidance to all related agencies for well-understanding, and execute training for practical application.</p>	<p>Information service module should prescribe an emergency communication system among related agencies in an ORSEC Plan, distribute the guidance to all related agencies for well-understanding, and execute training for practical application.</p>

Table 9-31 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(3) Accommodation and shelters (Houses)

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	<p>Fifty six thousand lodgments (56,000; 36% of all lodgments) are collapsed or heavily damaged.</p> <p>EL MOURADIA, EL BIAR, and CASBA suffer serious damages.</p> <p>Six hundred fifty thousand (650,000) people lose their houses, and many other people stay outside due to fear about aftershocks.</p>	<p>Women and children of affected families stay in their car, using it as tentative shelter.</p> <p>Men of the families walk around for seeking missing family members, but hardly obtain information, and which situation causes spreading of irritation.</p>	<p>Based on ORSEC Plan, registration counters are set up, and after the registration, affected families are shifted to tentative evacuation areas.</p> <p>Evacuation module starts setting up tents in tentative evacuation areas, but many families are forced to stay without shelters (tents) because the number of tents stocked in Protection Civil offices and military bases are not enough.</p> <p>Some damaged buildings collapsed due to aftershocks. Because of delay of emergency diagnosis of buildings, citizens of damaged houses can not return their houses, fearing the collapse by aftershocks.</p>	<p>Tents for tentative shelter arrive from foreign countries, but the delivery and set-up of the tents are delayed because of lack of manpower in material support module and transport module.</p> <p>Some victims intend to stay in the vicinity of their house, and areas for tentative evacuation in densely built-up areas are not sufficient for all the victims. Some victims therefore are afraid of aftershocks and remain outside or on the street without shelter.</p>	<p>Accommodation module commences the installation of temporary dwellings and according to the preparation, victims move to the dwellings.</p> <p>Some victims complain about the order of moving and location of the dwelling.</p>
An improved case	<p>The number of collapsed or heavily damaged lodgments is reduced due to reconstruction or house moving in accordance with seismic regulation.</p> <p>The number of homeless is also reduced accordingly.</p>	<p>A meeting place has been decided beforehand in a family, the family can consequently confirm safety or missing members immediately, and then they can request definite support from official agencies.</p> <p>Citizens have been informed that reinforced commune office is a reception of request for emergency support, so that they can apply their request smoothly and official agencies can quickly identify necessary support to be provided.</p>	<p>Enough number of tents for emergency shelter are stocked and quickly set up in tentative evacuation areas, which have been determined in local ORSEC Plan and notified to the citizens, by the guidance of evacuation module. In cooperation with volunteers who have been trained beforehand. Affected victims can move to the tentative evacuation areas with their family.</p> <p>System for authorization and registration of construction engineers has been established and the engineers have been trained for quick diagnosis of damaged buildings in the system. The quick diagnosis is accordingly carried out promptly and victims can judge without confusion whether they can stay in their houses or move to tentative evacuation areas.</p>	<p>Moving of victims to temporary dwellings from evacuation areas, is well managed, based on guideline prescribed by dwelling module, and victims do not make a loud complaint.</p>	<p>Accommodation module should prescribe a guideline and guidance for procedure for moving to temporary dwellings in an ORSEC Plan and inform of the procedure to all citizens.</p>
Measures	<p>It is required to promote building diagnosis on seismic resistance, and implement necessary measure such as rebuilding or reinforcement in accordance with building code.</p> <p>It is also required to promote re-housing from inadequate buildings in densely built-up areas to new adequate buildings in peripheries.</p>	<p>Evacuation module should well inform of the importance that each family should decide a meeting place in an emergency beforehand.</p> <p>Commune offices should be reinforced for use of emergency reception base.</p> <p>The location of the reception of requests for emergency support should be well informed to the citizens.</p>	<p>Evacuation module should secure open spaces such as empty land and park for tentative evacuation areas in an emergency, and inform of the locations to all citizens beforehand.</p> <p>Material support module should store supporting materials, and inform of the locations and contents to all citizens beforehand.</p> <p>Each related agency and module should prescribe the task of each group on an ORSEC Plan and inform to all staffs for their understanding.</p> <p>Evacuation module should organize or supervise training or emergency drill, including setting up of tents.</p> <p>Diagnosis module should training for quick diagnosis of damaged buildings into the system for authorization and registration of construction engineers.</p>	<p>Evacuation module should secure open spaces such as empty land and park for tentative evacuation areas in an emergency, and inform of the locations to all citizens beforehand.</p> <p>Material support module should store supporting materials, and inform of the locations and contents to all citizens beforehand.</p> <p>Each related agency and module should prescribe the task of each group on an ORSEC Plan and inform to all staffs for their understanding.</p> <p>Evacuation module should organize or supervise training or emergency drill, including setting up of tents.</p> <p>Diagnosis module should training for quick diagnosis of damaged buildings into the system for authorization and registration of construction engineers.</p>	<p>Evacuation module should secure open spaces such as empty land and park for tentative evacuation areas in an emergency, and inform of the locations to all citizens beforehand.</p> <p>Material support module should store supporting materials, and inform of the locations and contents to all citizens beforehand.</p> <p>Each related agency and module should prescribe the task of each group on an ORSEC Plan and inform to all staffs for their understanding.</p> <p>Evacuation module should organize or supervise training or emergency drill, including setting up of tents.</p> <p>Diagnosis module should training for quick diagnosis of damaged buildings into the system for authorization and registration of construction engineers.</p>

Table 9-32 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
<p>(4) Rescue and fire fighting (Protection Civil)</p> <p>The worst case</p>	<p>Most of buildings of Protection Civil are seriously damaged, communication among the PC offices is not available, damage situation in Algiers is hardly clarified, and thereby, initial response for launching rescue and relief activities is delayed.</p> <p>Fire breaks out in several places and people confined in buildings are burned to death, although no serious spreading of fire occurs.</p> <p>Oil tanks in Algiers port are damaged and oil leakage occurs.</p>	<p>Although fragmented information is conveyed to PC or other official agencies, efficient support can not be provided, because ORSEC Plan has not updated and the priority of the countermeasures has not been shown clearly.</p> <p>Consequently, citizens have to carry out rescue activity without official support, but the activity is not efficient due to lack of tools for rescue.</p>	<p>Overall situation of damages is disclosed and full-scale rescue and relief activities are deployed, but the activities are not smoothly progressing because it takes much time for arrangement and deployment of heavy equipment.</p> <p>Although overseas support arrives in affected areas, the rescue activity is neither well organized nor efficient, because of insufficient orientation on sharing tasks due to lack of preparation.</p>	<p>Overseas support for rescue spends a time with a few achievements, and leaves from Algiers.</p> <p>Although several problems are pointed out, the problems are not summarized for improvement in the future.</p>	<p>Citizens highly appreciate big effort of rescue module.</p> <p>The details of the operation is summarized, evaluated, recorded, and announced officially to the public. Defects of the activities are utilized for improvement of future activity.</p> <p>Collaboration with overseas support has been done smoothly. Using this opportunity, agreements are made for further cooperation among several foreign agencies in official and private levels.</p>
<p>An improved case</p>	<p>Because buildings of PC offices have been reinforced and exclusive wireless communication system with back up power is installed, the function of Protection Civil is maintained, and information of damages is transferred to DGPC through offices of PC.</p> <p>Citizens extinguish fire immediately as they have informed and trained, and thereby, no serious fire outbreak has occurs.</p> <p>Since oil tanks, petrol stations, and other dangerous facilities have been reinforced, no serious damage occurs on the facilities.</p>	<p>Based on collected damage information and request for support, gathered PC staffs start rescue activity, following a revised ORSEC Plan, prescribing priority and tasks in an emergency.</p> <p>Citizens in the areas unable to have official support, start rescue activity by using tools stored in their houses or in their communities.</p>	<p>Based on information of damages collected and evaluated by the crisis cell, rescue and relief activities are conducted by PC staffs and volunteers, using equipment and materials stored and provided from associated companies.</p> <p>Overseas support for rescue can provide effective support, based on information from information module, in cooperation with rescue module.</p>	<p>Based on an ORSEC Plan, rescue module should conduct training on rescue in an emergency, in cooperation with all related agencies for capacity building of Protection Civil staffs as well as volunteers who joint the training.</p> <p>Equipment and materials for rescue and relief should be stored, registered, and maintained to be utilized anytime in an emergency.</p> <p>Each module should revise ORSEC Plan, which includes the outline of a collaboration plan with overseas support, and make necessary arrangement, according to the actual condition.</p>	<p>An evaluation report of the rescue activity, including improvement plan for the future, should be prepared and open to the public.</p> <p>Using this opportunity, it is recommendable to make agreement on international cooperation with overseas support arrived in Algiers.</p>
<p>Measures</p>	<p>Buildings of Protection Civil and dangerous facilities should be diagnosed on seismic resistance and reinforced according to the result of diagnosis.</p> <p>Exclusive wireless communication system with back up power should be installed in Protection Civil offices.</p> <p>Importance of immediate fire extinction at the time of earthquake should be well informed to all citizens through education and training on disaster management so that everyone can do so in an emergency.</p>	<p>All concerned agencies should update an ORSEC Plan of each agency every year, in order to meet actual condition.</p> <p>For the quick identification and evaluation of damage, it is required to prepare GIS database of resources and dangerous facilities.</p> <p>It is required to promote storing and maintenance of tools for emergency rescue and relief by citizens or communities as well as training on emergency response.</p>	<p>Based on an ORSEC Plan, rescue module should conduct training on rescue in an emergency, in cooperation with all related agencies for capacity building of Protection Civil staffs as well as volunteers who joint the training.</p> <p>Equipment and materials for rescue and relief should be stored, registered, and maintained to be utilized anytime in an emergency.</p> <p>Each module should revise ORSEC Plan, which includes the outline of a collaboration plan with overseas support, and make necessary arrangement, according to the actual condition.</p>	<p>Based on an ORSEC Plan, rescue module should conduct training on rescue in an emergency, in cooperation with all related agencies for capacity building of Protection Civil staffs as well as volunteers who joint the training.</p> <p>Equipment and materials for rescue and relief should be stored, registered, and maintained to be utilized anytime in an emergency.</p> <p>Each module should revise ORSEC Plan, which includes the outline of a collaboration plan with overseas support, and make necessary arrangement, according to the actual condition.</p>	<p>Based on an ORSEC Plan, rescue module should conduct training on rescue in an emergency, in cooperation with all related agencies for capacity building of Protection Civil staffs as well as volunteers who joint the training.</p> <p>Equipment and materials for rescue and relief should be stored, registered, and maintained to be utilized anytime in an emergency.</p> <p>Each module should revise ORSEC Plan, which includes the outline of a collaboration plan with overseas support, and make necessary arrangement, according to the actual condition.</p>

Table 9-33 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(5) Public Security (Military)

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	Buildings, facilities, and staffs of military are damaged, causing lowering of function. For the recovery of the function, equipment, materials, and manpower are spent.	Reorganization and deployment of troops for public security are delayed, because many casualties in military staffs caused by building collapse, and other damages of unimaginable scale.	Robbery of food and thief of money and goods occur in some areas that security persons and lightening at night are not enough, and the robbery and thief spread over. Some citizens, who are not informed of prohibitive matters in an emergency, are confined by security force due to insufficient dissemination of the prohibitive matters. Robbery and kidnapping occur at camouflage checkpoints in such areas where security force is sparsely deployed.	Opponents who are not satisfied with government's countermeasures raise threatening attempts.	
An improved case	Damage to buildings is limited because the buildings have been reinforced against earthquakes. Communication facilities have been reinforced, fixed against earthquakes, equipped with back up power, and thereby, there is no disconnection in communication among divisions and headquarters.	Troops for public security are reorganized and deployed smoothly and the activity immediately commenced, following prescribed procedure on the assumed worst scenario.	Robbery of food and thief of money and goods are prevented with immediate deployment of security force in accordance with prescribed plan, and sufficient lightening at night. Unnecessary confinement is avoided because prohibitive matters in an emergency well disseminated to the public. Comprehensive activity on public security is conducted in wide areas, and thereby, threatening attempts are suppressed.	Details and necessity of activity on emergency response managed by crisis cell and public security by security and safety module, are well informed to the public at all times through media, and consent of citizens on the activity contributes to prevention of the attempts.	
Measures	<u>Important buildings for military command should be reinforced</u> against earthquakes. <u>Emergency lighting and communication facilities with backup power generators should be installed and fixed against earthquakes.</u>	<u>An operation plan for public security should be prepared in advance</u> , based on the assumed worst scenario, and <u>training on emergency operation should be done</u> , according to the operation plan.	Public security module should <u>store and maintain a sufficient number of mobile lightening facilities</u> . Public security module should <u>notify clearly of prohibitive matters to the public</u> , using notice boards, wide speakers, and media. Comprehensive activity for public security should be conducted in wide areas, including surroundings of damaged areas.	<u>Details and necessity of activity on emergency response managed by crisis cell and public security by security and safety module, should be well informed to the public at all times.</u>	

Table 9-34 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(6) The injured and medical treatment (Hospital)

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	<p>Five hundred and thirty thousand (53,000) people are injured. The injury is mainly an external injury, a bone fracture, and damage to internal organs, caused by collapsed building and furniture.</p> <p>Many people are injured with furniture falling down.</p> <p>Many hospital buildings are collapsed or heavily damaged. Even in less damaged buildings of medical facilities, medical implements are broken due to fall-down without proper fixing against earthquakes.</p> <p>Interruption of water and power supply also leads to malfunction of medical facilities.</p> <p>As a result of fixing furniture against earthquakes, number of the injured due to the furniture falling down is decreased.</p> <p>Damages to hospital buildings are limited, because the buildings have been reinforced against earthquakes.</p> <p>Function of major hospitals is secured, because storage of medical supplies is available, medical implements are fixed properly, and emergency backup power and water tanks are installed.</p>	<p>Patients waiting medical care occupy space in hospitals, but no prompt action is made because of lack of doctors, nurses, medical implements.</p> <p>Since triage has not been applied, order for medical care can not be decided properly, resulting in many irremediable cases.</p>	<p>Patients are spilled over from hospitals and brought to mosques and schools, but little care is available due to lack of doctors and medical supplies as well as unsanitary conditions.</p> <p>Although doctors and nurses arrive from peripheries and other countries, reception system is not well established, resulting in poor organized activities and insufficient outcome.</p>	<p>Conditions of patients who can not receive sufficient treatment, is getting worse, and staffs of hospitals spend long time for the recovery, and thereby, many patients still can not have enough care.</p>	<p>The mode of medical care is shifted from emergency response to long-term treatment, and then, returns to ordinary mode.</p> <p>Supplementation of medical supplies continues from the outside, based on prior request from hospitals through medical module.</p>
An improved case	<p>Slightly injured victims are treated with first-aid kits prepared in houses and workplaces, resulting in alleviation of crowdedness in hospitals.</p> <p>In hospitals, emergency medical care manuals have been prepared, triage has been introduced, and priority treatment is carried out for patients in urgent conditions.</p> <p>Distribution of stored medical supply is commenced in cooperation with transport module.</p>	<p>Medical care is executed in hospitals, and medical support teams from the outside start their activities in the hospitals as well as in the vicinity of the affected areas such as in evacuation areas, mosques, and schools.</p> <p>Based on agreement, which has been made with medical facilities in the peripheries, seriously injured persons are transported to the major hospitals in the less affected peripheries.</p> <p>Transport module distributes medical supplies and implements, delivered from the outside or foreign countries, to hospitals being in high priority, in cooperation with medical module and assistance receiving module.</p>	<p>Medical module should make agreement among hospitals for regional operation of emergency medical system beforehand, and conduct training for the operation.</p> <p>As a preparation for an emergency, medical module should establish roving medical teams.</p> <p>Medical module should establish cooperation system with assistance receiving module and transportation module for well functioning of medical support from the outside such as other Wilayas or foreign countries.</p>	<p>Medical module should supervise about shortage of medical supplies and implements, and request support accordingly.</p>	
Measures	<p>Each family should take a preventive measure to fix furniture against earthquakes.</p> <p>Medical care module and hospitals should reinforce hospital buildings against earthquakes.</p> <p>Emergency backup power system and water tanks should be installed to hospitals.</p> <p>Preventive measures against fall down of medical implements such as fixing devices should be taken.</p>	<p>Medical care module should promote and assist for storing a first-aid kit in each house.</p> <p>Medical care module should prepare an emergency medical care manual in an ORSEC Plan, distribute the manual to hospitals, and conduct training of doctors and nurses for emergency medical care.</p> <p>Obligatory storage of medical supply should be prescribed in an ORSEC Plan, and medical module should establish its auditing system for the storage condition.</p>	<p>Medical module should make agreement among hospitals for regional operation of emergency medical system beforehand, and conduct training for the operation.</p> <p>As a preparation for an emergency, medical module should establish roving medical teams.</p> <p>Medical module should establish cooperation system with assistance receiving module and transportation module for well functioning of medical support from the outside such as other Wilayas or foreign countries.</p>	<p>Medical module should supervise about shortage of medical supplies and implements, and request support accordingly.</p>	

Table 9-35 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM
(7) Sanitation (Health centers)

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	Toilets and sewerage facilities are damaged together with building damages. Failure of water supply causes difficulty in maintaining sanitary circumstances.	Due to lack of attention to keep good sanitation condition, many places are littered with excreta.	Food is rotting, and sanitation condition is getting worse. Because toilets are limited in number, the aged and women intend to drink little water, and they are affected with dehydration.	Many evacuees, especially infants are affected with Diarrhea.	Bad sanitation condition causes outbreak of epidemic.
An improved case	Implementation of reinforcement of sewerage facilities contributes to reduction of damages to the facilities.	Evacuees staying outside can not use toilets and sewerage facilities, and they prevent scattering of excreta by means of making tentative toilet with digging ground together with family members or community members.	Sanitation module installs temporary toilets in tentative evacuation areas and temporary dwelling sites, and disposal of dirt is carried out properly, according to a distributed manual for usage of temporary toilets.	Temporary shower facilities are installed to tentative evacuation areas.	Disinfectant is spread or distributed as a preventive measure against epidemic.
Measures	Public work module and sanitation module should proceed with <u>the reinforcement of sewerage facilities against earthquakes.</u>	Sanitation module should <u>prepare a manual on sanitation in an emergency</u> such as installation of dug toilets for family and community beforehand, and conduct training with citizens, using the manual.	Sanitation module should <u>prepare a guideline for installation of temporary toilets</u> in an ORSEC Plan, <u>store necessary materials and equipment</u> , and <u>conduct training for the installation</u> of the temporary toilets with citizens.	Sanitation module should <u>prepare a guideline for installation of temporary shower facilities</u> in an ORSEC Plan, <u>store necessary materials and equipment</u> , and <u>conduct training for the installation.</u>	Sanitation module should <u>monitor sanitation condition</u> , and take <u>necessary preventive measures</u> accordingly.

Table 9-36 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(8) Missing persons

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	Citizens can not confirm the safety and whereabouts of family members: being away from home.	Although a family member returns from the outside of one's house, other members have evacuated due to collapse of the house, and the member can not locate other members. Citizens living in periphery rush to relative's house for rescue, but there is no way to find out the relatives.	The elders and children, who have no way to go, stand in front of collapsed house in a daze. Citizens, who have no information of missing family members, are moving around in hospitals and tentative evacuation areas, being in confusion.	Registration of missing persons starts, but confirmation of safety of the persons is not progressing well, because the procedure of the registration and information transmission is not defined clearly. Partly recovered telephone lines are crowded and congested with call for searching missing persons, and thereby, difficult condition on communication still continues.	Deceased persons, who were buried without body identification, still remain on the list of missing persons.
An improved case	As a meeting spot in an emergency has been confirmed among family members beforehand, separated family members can gather at the spot, and can exchange information of missing members.	According to an ORSEC Plan which contains a manual for the registration of missing persons for research, the registration of missing persons, evacuees, and injured persons in hospitals is commenced at commune offices following the manual.	Installation of temporary telephones start at tentative evacuation areas, free-call is available with some time limitation. Management of increasing list of missing persons and communication among support bases are operated smoothly with the help of volunteers.	A family who has confirmed safety of the all members starts support for neighbors in collection of information of the missing persons. Safety confirmation of safety of missing persons is progressing well with the help of volunteers for collecting and processing information.	Some of missing persons are confirmed dead with DNA analysis of things left behind such as hair of buried bodies. Information module arranges information of missing persons remaining on the list for uniform management, and makes an effort to collect further information through newspapers and television.
Measures	Meeting spot in an emergency should be confirmed among family members or commune members together with confirmation of safety of evacuation route through training such as evacuation drill.	Rescue module should prepare an ORSEC Plan, which contain a manual for the registration of missing persons , and the procedure of registration should be informed to all citizens.	Information module should prepare an ORSEC Plan, including the procedure of installation of temporary telephones in an emergency, store necessary materials for the installation, and conduct training for the installation.	Information module should prepare an ORSEC Plan so that the procedure of registration of missing persons and the system of information transmission for searching are clearly defined with citizen's and volunteer's cooperation. The module should conduct training for the citizens' well understanding .	DNA analysis will be introduced for identification of unknown deceased persons.

Table 9-37 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(9) Mortuary treatment

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	Around thirteen thousand (13,000) people are crushed to death with collapsed buildings.	Survived citizens start rescue of persons remaining buried under collapsed buildings, and find bodies. The bodies are forced to remain untreated on an open space nearby.	Buildings are collapsed due to aftershocks and number of crushed death increases. With rescue activity proceeds, many bodies are found. Although mortuary care module determines the locations of mortuaries, there is confusion because the procedure of body identification has not been clearly determined.	All the persons buried under collapsed buildings have died. Other lives are lost because many seriously injured can not have sufficient medical treatment. Bodies at mortuaries are getting rotten, and people are afraid of epidemic and send the bodies to burial places for mass burial without body identification.	Because many bodies were buried without identification, there are many missing persons whose life or death is unknown, and thereby, complaint and confusion arise from families of mission persons.
An improved case	Due to measures on buildings against earthquakes, such as retrofitting and rebuilding, number of collapsed buildings is reduced and number of deceased persons is reduced accordingly.	Mortuary care module start to be install tentative mortuaries, and inquests are dispatched to the places. Then body identification and registration of things left behind are started.	Bodies are successively transported to mortuaries, and procedure for burial starts in accordance with an ORSEC Plan, after body identification and inquest.	Unknown bodies are getting rotten, and the bodies are buried after the registration of thing left behind for identification afterward.	Memorial service is held for all fatalities, organized by mortuary care module. Death confirmation is done, based on registered left things, compensation to the family was made in accordance with prescribed criteria in ORSEC Plan, and thereby, little complaint or confusion arise from the families.
Measures	Reinforcement or reconstruction of buildings in accordance with building code should be implemented.	Mortuary care module should prepare mortuary treatment procedure in an ORSEC Plan, and prescribe the manner of inquest of body treatment in collaboration with concerned staffs in related organizations such as doctors, nurses, police, and military. Mortuary care module should conduct training , based on the plan, for proper application in an emergency	Mortuary care module and transportation module should prescribe the procedure of burial and transportation plan of bodies to burial places in an ORSEC Plan.	Mortuary care module should prepare an ORSEC Plan, prescribing the procedure for selection of burial places and the manner of burial in an ORSEC Plan.	The system and procedure of compensation should be prepared and well informed to the public.

Table 9-38 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(10) False rumor and panic

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	Citizens are threatened with violent vibration, run out from houses or jump off from a widow, and accordingly, number of injured increases.	Following to a false rumor that tsunami will attack, many persons rush from seaside areas to elevated areas, some are injured in the crush.	At the time of occurrence of aftershocks, false rumor, that much bigger earthquakes will occur, causes a panic among evacuees.		
An improved case	Citizens have been well informed and educated about importance of decision and action without panic through media and schools, and thereby, number of injured due to panic is limited.	CRAAG immediately identifies earthquake information such as the epicenter and magnitude as well as possibility of tsunami, crisis cell promptly announces the information to the public, and thereby, citizens can judge and act without panic.	Scientific knowledge, such as that bigger aftershocks are very rare, and importance of decision and action without panic are well informed and educated to the public, and thereby, no panic due to a false rumor occurs.		
Measures	Necessary judgment and action in an earthquake should be well informed and educated to all citizens through official announcement and training.	It is required to establish system and procedure that CRAAG immediately identifies earthquake information, and crisis cell promptly announces the earthquake information to the public.	National delegation of major risk should promote activities and campaigns for citizens' well understanding on scientific knowledge and know-how on disaster management , and all concerned organizations should conduct or organize the activities and campaigns.		

Table 9-39 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(11) Psychological care

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	Due to violent vibration which never been experienced, collapse of buildings and furniture, evacuation from debris, and separation from family, citizens are tormented by feeling of loneliness and fear remains in their mind.	Many survivals realize loss their parents or children, and suffer heartache. There are few specialists for psychological care, and mental trauma is getting serious.	Feeling of fear is evoked with every aftershock, victims can not sleep well, and the symptom is worsened. Many survivals rescued from debris are affected with crush syndrome. Evacuees staying in a car are affected with economy-class syndrome. The symptom is getting worsened due to lack of specialists for care.	Some leaders and staffs of crisis cell, protection civil, and police who conduct emergency response work without sleep and get more tired, resulting in death by overwork.	Due to weary soul in evacuation life and fear for instable life, some victims commit suicide. Victims who can not rescue their family suffer form neurosis. Some staffs of protection civil and police suffer form PTSD (posttraumatic stress disorder).
An improved case	Feeling of loneliness and fear calm down somewhat through conversation and cooperation with neighbors.	Together with emergency medical treatment for mainly life saving, specialists for psychological care are dispatched for initial treatment.	With the initiative of medical care module, consultation centers with specialists installed for psychological care into tentative evacuation areas and hospitals.	Psychological care should be taken for staffs being in charge of emergency response as well as victims, so that psychological stress can be released.	Based on the list of victims, long-term psychological care is arranged, and suicide victims, neurotics, and PTSD staffs are reduced.
Measures	Self support and mutual support activity before providing support should be created and promoted through training or drill for disaster management in communities.	Medical care module should establish organization or association for emergency psychological care and train psychologists , in cooperation of specialists of psychology.	Medical care module should formulate a plan for emergency psychological care in an ORSEC Plan, promote collaboration with concerned organizations, including NGO, and conduct training.	Medical care module should conduct psychological care for the staffs being in charge of emergency response.	Medical care module should prepare the list of victims and conduct psychological care , based on the list, especially for children who lost their parents.

Table 9-40 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(12) Education

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	<p>Many school buildings are collapsed or heavily damaged.</p> <p>Because citizens, particularly children, have not had education on disaster management at ordinary times, they can not take proper action in an emergency, and thereby, number of casualty increases.</p>	<p>School buildings with little damage and schoolyards are used for tentative evacuation areas, after unlocked by a guard, but the buildings and yards do not function well as tentative evacuation areas, because there is no stock of water, food, lighting facility.</p> <p>Few teacher or staff arrives in schools, and schools can not be functioning as educational centers.</p>	<p>Schedule for restoration of school function can not be prepared, because of delay of diagnosis of school buildings, and securing water and food is in higher priority for victims.</p>	<p>In some areas, teaching starts in barracks or tents with the help of volunteers and some teachers, but the activity is not well organized and teaching materials are not sufficiently provided.</p>	
An improved case	<p>Reinforcement or rebuilding of school buildings have been implemented in accordance with new building code, number of collapsed school buildings is reduced.</p> <p>As pupils have received education and training on response in an emergency in schools at ordinary times, the pupils can take proper action such as escaping under the desks, extinguishing fire, staying without panic.</p>	<p>Schoolyards of designated schools are provided to victims who lost houses, and can be functioning as tentative evacuation areas, since water, food, lighting facilities, etc. are stored.</p> <p>Teachers and staffs, who are not affected, gather schools and look after the victims, especially children.</p>	<p>Diagnosis module carries out quick diagnosis of school buildings. School buildings judged to be safe, are used as tentative shelters, and emergency assistant materials are supplied, until victims move to temporary dwellings. School buildings judged to be dangerous, are locked so that none can enter.</p>	<p>School function is restored in the areas of slightly damaged.</p> <p>In seriously damaged areas, staffs of schools start arrangement of chairs, desks, teaching materials for resuming class, using barracks or tents as tentative classrooms.</p> <p>Materials to be supplemented are provided from volunteers and other assistant organizations with arrangement of the education committee of Wilaya.</p>	<p>In seriously damaged areas, teaching starts in temporary classrooms. In addition to ordinary curriculums, special programs such as education on life of evacuation, and summarizing lessons and learnt for improvement for the next case.</p>
Measures	<p><u>Diagnosis of school buildings on seismic resistance</u> should be executed, and <u>the buildings should be reinforced</u>, according to the results.</p> <p><u>Education and training on response in an emergency</u> should be conducted in schools at ordinary times.</p>	<p>Evacuation module should <u>designate schools as emergency evacuation facilities</u> beforehand, and prepare plan of response for teachers and staffs, <u>store emergency supplies</u> such as water, food, lighting facilities, and those prepared condition should be <u>informed to citizens</u>.</p>	<p>Diagnosis module should prepare quick diagnosis manual, and define <u>priority order of the diagnosis for school buildings</u>.</p>	<p>Ministry of education and Wilaya educational committee should <u>prepare a plan and procedure for quick restoration of school function</u> beforehand, in cooperation with related modules.</p>	<p>For the improvement for the next case, <u>lessons and learnt of the earthquake disaster should be summarized</u> in class.</p>

Table 9-41 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(13) Reception of support

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	Since there is neither plan nor agreement on emergency support from the outside, items and contents of the support can not be assumed and expected.	People in the peripheral areas who are not damaged, do not intend to participate support activities, because they are neither informed nor educated about necessity and importance of volunteers' support.	Since many offers of emergency support arise from foreign countries, assistance reception module can not correspond properly. Much overseas support can not be received because the airport facilities have not restored yet.	Staffs of military force and protection civil support assistance reception module, reception of official delegations from foreign countries is getting smooth, but support of NGO, private company, and individual levels are neither well received nor well arranged, resulting in inefficient activities.	Overseas support groups and persons are not satisfied with their result, and feeling of tiredness and irritation is accumulated.
An improved case	Based on a damage estimation result, emergency response plan and agreements have been made, and contents of expectable support from the outside have been arranged for quick response.	Necessity and importance of volunteers have been recognized, and volunteers' organizations have been established, and thereby, volunteers are gathering in the affected areas from the outside. Since the procedure of reception of volunteers has been prescribed in ORSEC Plan, reception of volunteers is managed properly. Request for support to be provided from the outside is promptly announced, based on the situation of damages.	Assistance reception module can deal with the offers of emergency support from the outside, according to the manual prescribed in ORSEC Plan. Assistance reception module distributes necessary support, such as rescue, food, medical care, to requesting areas, based on damage situation provided by information module.	Reception management of NGO, Private companies, and individuals are handled by domestic NGO such as red crescent and labor committees in order to cover lack of staffs of assistance reception module, resulting in proper dispatching support to requesting areas. Assistance reception module should request necessary additional support to the outside, based on information of shortage through other modules.	Support related to emergency response is reduced in proportion, according to transition of situation, and other kinds of support such as identification of missing persons, mental care, and evacuation life continue. Outcomes of support from the outside are summarized and evaluated, and agreements are made with organizations for further cooperation in the future.
Measures	<u>Emergency response plan for reception of support should be prepared</u> , based on damage estimation result, and items and contents of expectable support from the outside should be defined in the plan. <u>Agreements on emergency support should be made</u> with peripheral areas and foreign countries.	Based on damage estimation result, <u>a collaboration plan with volunteers</u> should be prepared and <u>training should be done for cooperative activity</u> . Institution for prompt request for emergency support from the outside should be established beforehand.	Assistance reception module should <u>prescribe the procedure for reception of support from the outside and the procedure for information exchange</u> with other modules in an ORSEC Plan.	Assistance reception module should <u>make agreements or consent with NGOs and private companies about reception and management of support from the outside, prepare the plan, and conduct training</u> .	Procedure for transition from emergency response to long-term support should be prescribed beforehand, and the procedure should be adjusted in accordance with actual situation. <u>Agreements will be made with organizations</u> which have provided support for further cooperation in the future.

Table 9-42 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(14) Food	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
<p>The worst case</p> <p>Most of families keep a small amount of long life food in reserve. Due to collapse of many buildings, food in shops and families is lost. Official agencies keep a small amount of food for emergency.</p>	<p>Some families are in difficulty in ensuring food, particularly, lack of milk for babies are serious problem. Since official stock of food is limited and management system is poor, proper distribution of food is not available.</p>	<p>According to damage situation revealed, food is provided to families, suffered with loss of food, based on the list of stock prepared beforehand.</p> <p>Arrangement of food among Wilayas starts for providing food from peripheral Wilayas.</p>	<p>Because food distribution system has not been well prepared and does not function well, food is unevenly distributed and left without eaten, resulting in rotting.</p> <p>Lack of food cause rapid rise of the price and robbery.</p> <p>Due to biased nutrition, many people catch cold.</p>	<p>Food delivered from the outside is not distributed properly and left in storehouse.</p>	
<p>An improved case</p> <p>Most of families keep some amount of long life food in reserve. In case of loss of the food in some families, due to building collapse, official agencies keep some food stock to be provided to the families.</p>	<p>Food and materials supply module distributes food in stock and provided from the peripheries with the help of volunteers</p> <p>Information on food distribution is widely announced to the public and accordingly confusion and complaint are limited.</p> <p>Due to government order for food price control and prohibition of reluctant selling, sudden rise of food price is constrained.</p>	<p>Distribution of food delivered from foreign countries starts.</p> <p>According to evacuees' demand on food, hot meal is prepared by evacuees in cooperation with volunteers at tentative evacuation areas, and evacuees' fear of food subsidies.</p> <p>Considering nutritional balance, nutritional supplements such as vitamin drops are distributed.</p>	<p>Food and materials supply module distributes food in stock and provided from the peripheries with the help of volunteers</p> <p>Information on food distribution is widely announced to the public and accordingly confusion and complaint are limited.</p> <p>Due to government order for food price control and prohibition of reluctant selling, sudden rise of food price is constrained.</p>	<p>As an autonomous action of evacuees, perishable food is consumed earlier in order to avoid spoiling.</p>	
<p>Measures</p> <p>National delegation for major risks should promote campaign and official support so that every family keeps some food in reserve as a preparation against disasters. Food and material supply module should officially store and manage a minimum amount of food, and the contents should be informed to citizens and concerned official organizations.</p>	<p>Food and material supply module should prepare the distribution procedure of dried milk and emergency food beforehand.</p> <p>Food and material supply module should make agreement on securing emergency food with peripheral Wilayas, and information on food stock should be shared with other Wilayas.</p>	<p>Food and material supply module should prescribe the distribution plan of food with the help of volunteers, the way of dissemination of food, and the information on food distribution in an ORSEC Plan.</p> <p>Guideline for price control in an emergency should be prepared and well informed to the public.</p>	<p>System for feedback of evacuee's demand should be prescribed and evacuation areas should be managed according to the demand.</p>	<p>Autonomous actions of evacuees should be promoted.</p>	

Table 9-43 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(15) Drinking water (Water service)

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	Water supply pipes are damaged at about 4,000 points, and distribution pipes to houses are damaged at many points. Some water tanks are also damaged, and accordingly, water supply is suspended in a wide area.	Due to damage of water facilities, delivering from the Keddara dam, areas of no water supply is expanded. Although water facility module runs about for identification of damage situation, acquisition of information necessary for repair work is delayed, because of unclear procedure for damage inquiry and its reporting.	Although repair of water facilities starts, water supply is still suspended in wide areas of Algiers Some families, facing difficulty in securing water, raise requests, but drinking water distribution is not progressing well, because of shortage of water supply trucks. At the peripheries of Algiers, drinking water can be secured, being supplied from Bouroumi-Boukerdane-Ghrib dams that slightly affected, and from wells, although restriction of supply continues.	According to repairing of water facilities and detour of supply through Thénia, water supply is resumed at a part of the eastern area. At the central area, water supply lines are not quickly repaired due to heavy damages, and water distribution with trucks are also does not function well due to road blockage and lack of the trucks. Drinking water is barely secured through distribution of bottled water arrived from the outside, and evacuees' concern about drinking water rises high.	Installation of temporary supply lines mainly to the central area, but suspension of water supply still continues. Water supply to tentative evacuation areas relies on trucks, and thereby, available water volume is limited.
An improved case	Old supply pipes made of asbestos and grey cast iron have been replaced with polyethylene pipes, and which renewal contributes to reducing damages. Reinforcement of water tanks against earthquake also results in reduction of areas where water supply is suspended. Although water pipes are damaged, citizens have well understood necessity of securing water, and turn off water taps of small water tanks in their houses so as to secure drinking water.	Due to reinforcement of water supply facilities, delivering from Keddara dam, damages to the facilities are limited. Inspection of water supply facilities has been commenced by trained staffs of water facility module in accordance with urgent inspection procedure prescribed in ORSEC Plan in order to collect data for repairing facilities and resuming of water supply.	Even at the areas where water supply is suspended, no big trouble on drinking water has happened, because most of families keep water for three days which is 9 lit. per person. Emergency water supply with water supply trucks is arranged for the areas where water supply is suspended for a long time. Inspection results on water facilities have been processed, and rehabilitation of the facilities is commenced accordingly, using stocked materials and equipment.	Repairing work is progressing, and the areas of no water supply are gradually decreasing. In seriously damaged areas, drinking water supply with trucks continues and bottled water, arrived from the outside, is distributed in cooperation with volunteers.	Water supply continues through repaired supply lines, and full-scale rehabilitation plan of water supply facilities is formulated, and starts implementation.
Measures	Water facility module should replace old water pipes with polyethylene pipes . Water facility module should reinforce water facilities such as dams and water tanks against earthquakes. National delegation for major risk should promote campaign or education for raising awareness of citizens on securing water in an emergency.	Water facility module should prescribe the procedure for urgent inspection of water facilities in an ORSEC Plan, and train staffs .	Food and material supply module should store emergency water supply facilities such as water supply trucks, prepare an emergency supply plan, including way of collaboration with volunteers and other modules concerned . Water facility module should store materials and equipment for repair of the facilities, and conduct training of the staffs .		For prompt rehabilitation of water supply facilities, water facility module should prepare a guideline showing the procedure of rehabilitation plan in an ORSEC Plan.

Table 9-44 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(16) Electric power

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	<p>Most of all power stations in the vicinity of Algiers stop operation. Among them, a station in HAMMA EL ANNASSER and a station in Algiers port are seriously damaged. About 40 km-long sections of mid-voltage transmission lines are disconnected in total. Numerous sections of low-voltage lines are disconnected due to the collapse of buildings.</p>	<p>Due to suspension of power generation and disconnection of transmission lines, and damages to substations, power is not available in all areas in Algiers. Although urgent inspection is commenced in order to clarify the damage situation, objects to be inspected are too many, and the progress of the inspection is so low.</p>	<p>Because of low progress of urgent inspection, power-resumed areas are limited. Repairing work of power station and transmission lines is commenced, but the progress is so low, because of lack of materials, equipment, and manpower. Electric appliances left in vacant houses are heated and cause fire when power supply is resumed.</p>	<p>Repairing of heavily damaged buildings is not progressing well because of lack of materials, and thereby, power supply to resumed areas is affected and scheduled power-cut is obliged to apply. Replacement of damaged transmission lines is suspended due to shortage of wire.</p>	<p>Since energy module concentrates for resuming power supply, the module has no spare time for formulation of long-term rehabilitation plan.</p>
An improved case	<p>Due to introduction of redundancy for transmission lines to the areas where liquefaction and strong seismic motion are foreseen, disconnection rate is reduced. Since major facilities such as power stations and substations have been reinforced against earthquakes, the damage of the facilities is limited.</p>	<p>Damaged spots are limited in number, technical staffs have well understood the procedure of urgent inspection, and thereby, the inspection is progressing well and power supply is resumed at the areas where safety operation is secured.</p>	<p>Repairing work is progressing effectively, because materials and equipment have been kept in stock, and staffs for urgent repair work have been well trained. Citizens switched off electric appliances when they left home, and no fire happens at the time that power resumes. At the heavily damaged areas, power is secured in evacuation areas due to prompt installation of temporary transmission lines or installation of portable generators.</p>	<p>Power supply to place for living, including tentative evacuation areas. Energy module prepares an installation plan of capable power supply facilities for full-scale rehabilitation, especially for the heavily damaged areas, and starts implementation.</p>	<p>Power supply to place for living, including tentative evacuation areas. Energy module prepares an installation plan of capable power supply facilities for full-scale rehabilitation, especially for the heavily damaged areas, and starts implementation.</p>
Measures	<p>Energy module and power companies should reinforce major facilities such as power stations and substations against earthquakes. Energy module and power companies should proceed with reinforcement of transmission line towers and redundancy of transmission lines.</p>	<p>Energy module should prepare the procedure of urgent inspection in an emergency which has been estimated and never experienced, and conduct training of staffs accordingly.</p>	<p>Energy module should keep materials and equipment in stock for quick repairing, and conduct training of staffs for the repair work. Energy module should well inform to citizens of importance that electric appliances should be switched off to avoid fire when power is resumed.</p>	<p>Energy module should prepare the procedure for smooth formulation of full-scale rehabilitation plan.</p>	<p>Energy module should prepare the procedure for smooth formulation of full-scale rehabilitation plan.</p>

Table 9-45 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(17) Gas

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	<p>Gas pipes made of copper are disconnected at 78 points. Numerous sections of distribution pipes to houses are disconnected due to the collapse of buildings. Gas supply facilities such as gas transfer stations and depressuring stations are damaged.</p>	<p>Main valves are closed for suspension of gas supply, after lowering of gas pressure, but not immediately after the earthquake, and thereby, much gas leakage happen, leading to explosion due to careless use of fire.</p>	<p>Due to unclear procedure for safety inspection on gas facilities and lack of staffs for the inspection, identification of damage situation and confirmation of safety are delayed, and thereby, it is not possible to foresee when gas supply resumes.</p>	<p>Although gas supply resumes in the areas that safety is confirmed, the supply is suspended many times due to leak from broken gas appliances in houses.</p>	<p>Energy module concentrates for resuming gas supply, and the module has no spare time for formulation of long-term rehabilitation plan.</p>
An improved case	<p>Many of copper gas pipes have been replaced with polyethylene pipes, and damage to gas pipes is reduced. Since reinforcement of gas supply facilities such as transfer stations and depressuring stations has been executed, damage to the facilities is limited. Since automatic cut-off devices against earthquakes have been installed, gas leak is limited.</p>	<p>Since gas supply is suspended, closing main valves just after the first arrival of strong earthquake motion. Gas explosion does not happen because leak is limited and use of fire is strictly prohibited.</p>	<p>Gas supply resumes in the areas that safety is confirmed with inspection, such as the southwest of Algiers. In the areas that gas supply resumes, no more gas leak happen, because citizens have closed gas valves at the time of evacuation. In the areas that damage to gas facilities is serious, gas containers are distributed, and use of gas is secured for the moment. Repairing of damaged gas supply facilities are commenced by trained staffs with stored materials and equipment.</p>	<p>Energy module prepare a work plan for the areas where renewal of gas pipes is judged to be necessary as a result of inspection, and commences the work at the areas of high priority.</p>	<p>Energy module should <u>prepare a work plan for the areas where renewal of gas pipes is judged to be necessary as a result of inspection, and commences the work at the areas of high priority.</u></p>
Measures	<p>Energy module and gas companies should <u>replace copper gas pipes with polyethylene pipes</u> which damage ratio is lower. Energy module and gas companies should <u>reinforce gas supply facilities</u>, and <u>install automatic cut-off devices</u> against earthquakes.</p>	<p>Energy module should direct gas companies to establish system to stop gas supply just after the first arrival of strong earthquake motion. Energy module should <u>well inform to citizens of necessity not to use fire in confined space</u> after earthquakes.</p>	<p>Energy module should <u>prepare an ORSEC Plan, showing inspection manual for gas facility and gas leak</u> in an emergency, arrange staffs for the inspection, and <u>conduct training of the staffs</u>. National delegation for major risks and energy module should <u>well inform of the necessity that every family should close gas valves at the time of evacuation</u>.</p>	<p>Energy module should <u>prepare an ORSEC Plan, showing inspection manual for gas facility and gas leak</u> in an emergency, arrange staffs for the inspection, and <u>conduct training of the staffs</u>. National delegation for major risks and energy module should <u>well inform of the necessity that every family should close gas valves at the time of evacuation</u>.</p>	<p>Energy module should <u>prescribe the procedure for formulation of rehabilitation plan in an ORSEC Plan, and store materials and equipment, and conduct training of the staffs</u>.</p>

Table 9-46 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(18) Telecommunication (Telephone)

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	Optical fiber cables are disconnected at sections of 4% to 5% of total length. Lead-in cables of fixed telephones to houses are disconnected due to collapse of buildings. Many of antennas for mobile phones are damaged, and communication with mobile phones is not available. Switching devices in telephone offices fall down, and the switching system does not function.	Fixed telephones are disconnected in all areas of Algiers. Communication with mobile phones is hardly possible because of congestion, although some facilities and antennas function. Because of too many damage points, damage investigation for repairing is not progressing well.	Due to the low progress of the damage investigation, progress of repairing work is low, and thereby, fixed phones are still disconnected and congestion of mobile phones continues. Due to lack of stock of switching devices for replacement, restoration of communication is delayed.	Situation, that communication with phones is almost impossible, continues. Mobile units of wireless telephones are being installed, but the number of the units is limited, and many evacuees rushing to the units cause confusion.	Using mobile units of wireless telephones installed tentative evacuation areas, telecommunication is barely secured.
An improved case	Due to redundancy of telephone lines and reinforcement of buildings of telephone companies, switching devices, telephone poles, and antennas, damage to telecommunication facilities is reduced, and thereby, the disconnected areas of telecommunication is reduced.	Fixed telephones are disconnected in all areas of Algiers. Although communication with mobile phones is hardly possible, registered emergency lines are secured. Urgent investigation for repairing is commenced by trained staffs, following a manual which has been prepared.	Following the installation of temporary antennas, communication with mobile phones is getting easier. Priority repairing of fixed telephone lines to bases of support is carried out by trained staffs with stocked materials and equipment.	Telecommunication with mobile phones is almost resumed. Fixed phones are also getting available, except heavily damaged areas. Enough number of mobile units of wireless telephones is installed into tentative evacuation areas, and evacuees' communication means are secured.	A rehabilitation plan, including replacement of tentatively repaired facilities, renewal of heavily damaged system, is prepared, and priority work in the plan is commenced in order.
Measures	Telecommunication module and telephone companies should proceed with redundancy of telephone lines and reinforce buildings of telephone companies, switching devices, telephone poles, and antennas .	Telecommunication module and telephone companies should install a system which secures urgent communication by priority . Telecommunication module should prepare an ORSEC Plan, prescribing the procedure of urgent investigation and training of staffs .	Telecommunication module should about the procedure of rehabilitation of telecommunication facilities, including storage of materials/equipment and management of staffs, and conduct training of the rehabilitation. Telecommunication module should store temporary antennas and mobile units of wireless phones.	Telecommunication module should prescribe in an ORSEC Plan about the procedure for smooth formulation of a rehabilitation plan .	Telecommunication module should prescribe in an ORSEC Plan about the procedure for smooth formulation of a rehabilitation plan .

Table 9-47 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(19) Media (TV, radio, newspapers, magazines)

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	Buildings of media and broadcasting facilities are heavily damaged, and broadcasting function is disabled. Some of printing facilities are not damaged and some publishing function remains. Due to reinforcement of media buildings and measures against earthquake such as fixing of facilities, loss of function by the earthquake is reduced.	Since education for disaster management through media has not been sufficient, citizens are confused and have no idea what to do. Since knowledge on disaster management such as stock of emergency kits and location of evacuation areas, has been disseminated by media, and accordingly citizens can respond calmly.	Some media sustain their function, and the media focus in only seriously damaged situation in the reports. Consequently, pessimistic views spread over citizens, and support from the outside is distributed unevenly to the areas where media focuses. Due to over presentations or unfounded reports by some media, panic and unrest spread over citizens.		
An improved case	Information service module and media companies should reinforce media buildings and proceed with measures against earthquake such as fixing facilities.	Under the cooperation with authorities concerned, media should well inform of preparedness in an earthquake to the public on a routine basis.	Media faithfully distribute information on situation of damage and support, together with appeal for calm response. Citizens can get necessary information through media such as radio and extra publications. Official announcement is promptly transferred to the citizens through media. Information to the citizens who do not have receivers such as portable radios, is transferred with loudspeakers installed to tentative evacuation areas. It is recommendable that citizens should have portable radios to get information in an emergency.		
Measures					

Table 9-48 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM
(20) Air transportation (Airport)

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	<p>Although damage to new terminal buildings is not serious, navigation facilities in the control tower are fell down, resulting in malfunction.</p> <p>Due to damage to runway, takeoff and landing are not available.</p> <p>Fuel storage facilities are damaged and fuel leak occurs.</p>	<p>Suspending takeoff and landing, emergency checkup of runway is done.</p> <p>Due to delay of repairing of navigation facilities, the navigation function can not be restored.</p> <p>Due to damage to fuel storage tanks, fuel supply is limited, and thereby, number of operational helicopters using a part of runway is also limited.</p>	<p>Due to lack of stored materials and equipment as well as trained staffs, repairing of runway is delayed, and thereby, reception of international support in the airport is not available.</p>	<p>Although runway is repaired, navigation facilities have not been repaired due to lack of parts, airport operation is limited in visual flight operation.</p> <p>Because overseas support is received at other airports, a lot of time and energy are spent for transportation.</p>	<p>Most of airport function resumes.</p>
An improved case	<p>Since measures against earthquakes such as fixing navigation facilities have been done, there is no serious damage affecting navigation function.</p> <p>Due to damage to runway, takeoff and landing are suspended.</p> <p>Fuel storage facilities are not damaged, because reinforcement has been carried out against earthquakes.</p>	<p>Suspending takeoff and landing, emergency checkup of runway is done.</p> <p>Repairing work of runway is commenced by trained staffs, using stored materials and equipment.</p> <p>Helicopters are operational, using a part of runway which is not damaged.</p>	<p>Due to smooth repairing work of runway and replacement of damaged navigation facilities with stored facilities, most of the airport function is resumed so as to receive support from the outside.</p>	<p>Without disturbance of airport function, tentatively repaired facilities are replaced with new facilities.</p>	
Measures	<p>Transportation module and airport authority should <u>take measures against earthquakes such as fixing navigation facilities and reinforcement fuel storage facilities.</u></p>	<p>Transportation module and airport authority should <u>Plan about the procedure for emergency checkup, storage and quick procurement of materials for resuming.</u></p>	<p>Transportation module and airport authority should <u>prescribe in an ORSEC</u></p>	<p>Transportation module and airport authority should <u>prescribe the procedure for renewal and its procurement</u> so as to maintain airport function well.</p>	

Table 9-49 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM
(21) Marine transportation (Port)

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	<p>On the north of the Algiers port, some parts of quays are deformed.</p> <p>On the south, quays are tilted and loading facilities are damaged due to liquefaction.</p>	<p>Emergency inspection of facilities is done, and use of damaged facilities is prohibited.</p> <p>Because of quick repairing of the damaged facilities is difficult due to lack of materials, and thereby, loading capacity is seriously lowered.</p>	<p>On the north of the port, berthing of small boats is getting available due to temporary repairing.</p> <p>On the south, quick restoration of port function can not be quickly done because of lack of repairing materials and equipment.</p>		
An improved case	<p>Since foundations of quays and loading facilities have been reinforced against liquefaction, there is no serious damage to the port.</p>	<p>Use of facilities, which safety is confirmed through emergency inspection, resumes operation.</p> <p>Repairing work for damaged facilities starts, using stored materials and equipment.</p>	<p>Although repairing of some loading facilities is still on going, repairing work for the most of major facilities has been done, and port function for loading support materials is getting available.</p>		
Measures	<p>Transport module and port authority should carry out diagnosis on liquefaction of the foundation of port facilities and take necessary measures against earthquakes.</p>	<p>Transportation module and port authority should prescribe the procedure of emergency inspection, store materials and equipment for quick repairing, and conduct training.</p>	<p>Transportation module and port authority should prescribe the procedure for renewal and its procurement so as to maintain port function well.</p>		

Table 9-50 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(22) Land transportation - Bridges

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	Ten (10) bridges collapsed, and beams of 13 bridges are displaced.	Clearing of collapsed bridges starts, but the progress is low because of lack of heavy equipment.	Collapsed bridges blocking roads are removed. Although emergency inspection on safety of bridges is commenced, the progress is low because of insufficient number of trained staffs. Due to lack of materials and equipment, repairing work of damaged bridges is progressing slowly, causing heavy traffic jam.	Urgent repairing work continues for damaged bridges which beams were displaced, and also heavy traffic jam continues at the bridges under repairing.	Although urgent repairing work is completed, reconstruction of collapsed bridges has not started, and traffic control continues.
An improved case	Due to installation of preventive devices against beam displacement and preventive measures against liquefaction, the collapse of bridges is avoided. Some of bridge beams are displaced.	Emergency safety inspection is commenced by trained staffs of CGS and CTTT.	Emergency safety inspection result indicates that traffic control is required for a limited number of bridges. Repairing work for the damaged bridges starts in cooperation with private contractors which agreement on urgent repair has been made.	Although speed limitation or lane limitation remains, urgent repairing is almost completed, and function of bridges is resuming. Detailed investigation on damage is commenced for full-scale rehabilitation.	Civil work for full-scale rehabilitation is commenced.
Measures	Public works module and Ministry of Public Works should carry out diagnosis on seismic resistance of bridges and necessary reinforcement , including installation of preventive measures against bridge beam displacement. Public works module and Ministry of Public Works should carry out investigation on liquefaction of foundations of bridges and necessary reinforcement .	Diagnosis module and Ministry of Public Work should prescribe the procedure of emergency safety inspection for bridges, led by CGS and CTTT, and conduct training.	Public works module should prescribe in an ORSEC Plan about the procedure for quick repairing of bridges , including collaboration agreement with private contractors.	Public works module should prescribe the procedure for detailed investigation of bridges for full-scale rehabilitation .	

Table 9-51 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM

(23) Land transportation - Roads

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	In densely built-up areas, roads of less than 4 m wide are impassable due to collapse of buildings. Roads beside slopes such as Route 11 in RAIS HAMIYOU, are also impassable due to slope failure. Many cars cause traffic accidents, and drivers leave their cars on the roads.	Passable roads are occupied with cars for evacuation and rescue, and heavy traffic jam occurs. In addition, many abandoned cars block traffic. Most of all roads consequently are getting impassable.	Due to lack of heavy equipment for road clearance, the clearance work such as removal of debris and cars left behind is progressing slowly.	Although traffic on one lane of main roads is secured, many roads are still impassable.	Due to lack of equipment and tiredness of workers, clearance work is progressing slowly and blocked roads still remain.
An improved case	Due to reinforcement of buildings and protection of slopes, blocked sections of roads are reduced. Main roads have been widened or sidewalks are arranged as buffer zones on the main roads, traffic on the main roads is secured, although debris causes some interruption. The drivers of accident cars leave their cars with the keys.	Since citizens are well informed of prohibition on use of cars for evacuation, traffic jam on main roads are alleviated. Traffic control by police on designated strategic roads contributes to smooth transportation of emergency vehicles. Cars left behind are unlocked and easily removed.	Since a plan for road clearance has been formulated together with agreement with private contractors, installation of equipment for clearance is done smoothly, and thereby, clearance is completed on main roads and continued on other roads.	A plan for full-scale restoration of road function has been formulated and some works such as repairing sidewalks, roadside facilities, and traffic lights are commenced.	A plan for full-scale restoration of road function has been formulated and some works such as repairing sidewalks, roadside facilities, and traffic lights are commenced.
Measures	Transportation module and Ministries concerned should promote the reinforcement or protection of buildings and slopes facing to roads . Transportation module and Ministries concerned should proceed with widening main roads or adding buffer zones to the roads. Transportation module should educate drivers to leave keys into the cars when they leave cars in an emergency.	Police and transportation module should designate strategic roads for emergency, and prepare a plan for the road clearance and traffic control . Police and transportation module should well inform to citizens of prohibition of evacuation by cars, and conduct evacuation drill without using cars.	Transportation module should prepare a road clearance plan for emergency in an ORSEC Plan, including agreement with private contractors on procurement of equipment, and storage of materials and equipment .	Transportation module should prepare a road clearance plan for emergency in an ORSEC Plan, including agreement with private contractors on procurement of equipment, and storage of materials and equipment .	Transportation module should prescribe in an ORSEC Plan about the procedure of formulation of full-scale rehabilitation plan .

Table 9-52 Consequence Scenario (the worst case, improved case, and necessary measures) Khair al Din Scenario Earthquake at 8 PM
(24) Debris disposal

	0 to 1 hour later	1 to 24 hours later	1 to 3 days later	3 to 7 days later	7 days later or more
The worst case	Debris of 49 million ton (74 million cubic meter) piles up in a moment. Out of the debris, 1.5 million ton is required to remove for clearance of main roads.	In order to rescue victims from debris, citizens start removal of the debris. The removed debris piles up on roads, causing further difficulty in traffic.	Debris removal starts on main roads, but stockpile of the removed debris is not determined and the debris is dumped on open spaces without control. Debris dumped on road in residential areas, and impassable sections of roads are increase.	Corps of engineers is dispatched for debris removal, and removal work is progressing well. Since a plan for debris removal is not well formulated, the removed debris is dumped into sea and mountains without control.	There is no plan for removal of debris dumped in residential areas. Due to delay of removal of debris, installation of temporary dwelling is delayed accordingly.
An improved case	Due to reinforcement of buildings, building collapse which is source of debris is reduced, and, a amount of debris is reduced accordingly.	Clearance of strategic roads, removing debris, starts. In residential areas, debris is removed without equipment and piles up tentatively on roads. Transportation module starts requisition of heavy equipment for removal of debris.	Numbers of heavy equipment requisitioned are distributed for debris removal, and removal in residential areas starts after clearance of main roads. The removed debris is temporary dumped in primary stockpiles.	Debris dumped in primary stockpiles is roughly segregated, and transferred to secondary stockpiles. In the secondary stockpiles, the debris is segregated again for thermal disposal, landfill, and recycle.	Citizens, who intend to remove debris in their residential areas, apply to public works module for the removal, and the debris is removed by public works module.
Measures	Reinforcement of buildings should be carried out.	Transportation module should prescribe in an ORSEC Plan about the procedure of debris removal, including agreement of private contractors which possess heavy equipment for requisition in an emergency and storage of own equipment.	Public works module and transportation module should prescribe in an ORSEC Plan about location of primary and secondary stockpiles, and secure the spaces.	Public works module should prescribe in ORSEC Plan about the procedure for debris removal, including a plan for disposal in landfill and mountains.	

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 9-53) are categorized. In the result, 12 categories (a. to l.) are picked up as shown on the left portion of Table 9-53.
- 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 9-53. 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 9-53). 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 9-53). In this occasion that peoples' awareness is raised through the Bouterdes 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 10-2.

CHAPTER 10

SUGGESTIONS FOR REDUCTION OF SEISMIC DAMAGE

Chapter 10. *Suggestions for Reduction of Seismic Damage*

10-1 Clarification of Important Issues

In order to select important issues on seismic disaster management, several issues were picked up and assessed in the forms of three matrices. The contents of the matrices were compiled by the JICA Study Team based on the inputs from the Steering Committee members of the Algeria side in blank forms. The matrices are as follows.

(1) Damage scenario (see Chapter 9)

Twenty-four (24) functions necessary for emergency response were assessed along the 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 improvement case, together with recommendations for a realization of the improvement scenario. In so doing, important issues were extracted as shown in Table 9-40.

(2) Assessment of the present situation on preventive activities

For the assessment of the present situation on preventive activities or measures, the following (7) major categories were selected.

- Citizen
- Policy and planning
- Institution and organization
- Disaster management resources
- Information and communication
- Public awareness
- Education and training

In the seven (7) categories, sixty-two (62) sub-items were picked up for the assessment. Status quo on each sub-item was assessed, and summarized into strong points and weak points, together with recommendable points for improvement of the weak point as shown in Tables 10-2 to 10-10. Based on the assessment, forty-two (42) important issues were extracted as shown in Table 10-1.

Most of the issues extracted are to be addressed in decrees for the enforcement of Law n° 04-20. Implementation of measures on the issues will be realized, according to a series of decrees, which is expected to be formulated with coordination of the National Committee on Major Risk (DNRM) after its establishment. 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 with the above analysis, seventy two (72) matters to be addressed in the aspect of seismic disaster management in Algeria were picked up in a matrix of disaster management cycle (preparation, mitigation, emergency response, and rehabilitation/reconstruction) and participating entity (official support, mutual support, and

individual support) for assessment. The results of the assessment were summarized in terms of three elements (issue, the current situation, and responsible organization) as shown in Tables 10-11 to 10-18.

Each matter was further evaluated from the following viewpoints and classifications.

- Significance
 - A: High significance
 - B: Moderate significance
 - C: Low significance
- The current status of implementation
 - I: Not implemented, or slow progress
 - II: Implemented somewhat
 - III: Well implemented
- Urgency
 - a: High urgency
 - b: Moderate urgency
 - c: Low urgency

Since this evaluation directly concerns disaster management measures to be implemented, it is recommendable that Algerian stakeholders will conduct the assessment by themselves, 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 all the importance, the progress, and the urgency.

- Preparedness (official support):
 - 1) Formulation of the national strategy and plan for disaster management (1-5 in Table 10-12)
 - 2) Task sharing and collaboration among the organizations concerned (1-8 in Table 10-12)
 - 3) Consideration on risk reduction in land use (1-7 in Table 10-12)
- Preparedness (individual support):
 - 4) Understanding of the results of damage estimation and information on disaster management resources (9-1 in Table 10-11)
 - 5) Preparation for emergency response at each family (9-3 in Table 10-11)
 - 6) Acquisition of information on disaster management (9-7 in Table 10-12)
- Mitigation (mutual support):
 - 7) Education and raising awareness (2-9 in Table 10-14)
- Recovery and rehabilitation (official support):
 - 8) Preparation of rehabilitation and reconstruction plans (4-4 in Table 10-18)

The importance and necessity for measures on the above-mentioned issues have been prescribed in Laws n° 04-20 and n° 04-05 as priority issues. The conceivable flow for the realization of the measures on the issues is as follows.

- 1) Establishment of DNRM
- 2) Formulation of the national strategy and plans (guidance) on comprehensive disaster management with coordination of DNRM
- 3) Promulgation of decrees for implementation of the measures
- 4) Formulation of action plans for the implementation by Wilaya and concerned organizations
- 5) Implementation of the measures by all concerned entities

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 systematic plan for comprehensive DM, covering preventive measures – emergency response – rehabilitation and reconstruction	○	⊙	⊙
		Formulation of comprehensive DM plan at national, Wilaya, and Commune level	○	⊙	⊙
Institution and organization	Comprehensive DM	Formulation of decrees for implementation, managed by DNRM	⊙		
		Establishment of an organization, exclusively dealing with DM in Wilaya			⊙
	Risk reduction	Clarification of task and responsibility 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)	○	○	⊙
	Building	Installation of supporting system such as subsidy for adherence to building code	⊙		⊙
		Fostering agencies and engineers on construction	○	⊙	○
		Introducing of inventory book on registered buildings	○	○	⊙
		Installation of incentive system for promotion of retrofitting	⊙		○
	Emergency response	Improvement of modules, prescribing detailed procedure in ORSEC plan	○		⊙
		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 target and required actions	○	⊙		
DM resources	Budgeting	Securing and allocating budget for DM by DNRM	⊙		
	DM resources	Formulation of a guideline, including individuals, for storing emergency supplies	⊙		
		Storing emergency supplies by each implementing body, according to action plan		⊙	⊙
Information and communication	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 system, 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 a national-level guideline for education in DM	⊙		
Formulation of DM education programs in local such as schools			○	⊙	
Establishment of base of education in each Wilaya				⊙	
Citizen	Community	Promotion of self-activities of communities and citizen on DM	○	○	⊙
	Awareness	Determination of DM memorial day, and conducting campaign for raising awareness	○	○	⊙
	Cost sharing	Enhancement of official support for promotion of self-activity of 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 periodical training programs	○		⊙
		Fostering leaders of communities for promotion and assistance of local DM activities		○	⊙
		Preparation of materials for training and education on DM		⊙	○
	Installation DM memorial museum as a base of training and education		○	⊙	
Capacity building	Formulation of systematic capacity building programs	○	○	⊙	

Table 10-2 Assessment of the Present Situation on Preventive Activities and Measures (1) Citizens

Item	Sub-item	Strong point	Weak point	Recommendable point
1.1 Local groups (Communities)	Existence	None	Few local communities exist in urban areas due to historical reason and rapid urbanization.	- Official support (material supply, subsidy, training, etc.) is required for creation and promotion of activity of communities .
	Activity	None	Most of existing communities are for cleaning, sports, and culture, but very few groups for DM .	- For preparedness and raising awareness, community activities at ordinary times are important, and should be promoted and reinforced.
	Solidarity	At Boumerdes earthquake, good cooperative activities with communities were reported.	No good solidarity is seen at ordinary times.	- Creation of new groups for DM will be difficult, and thereby, it is recommendable to add function of DM to existing groups such as Islam scout.
1.2 Citizen	Awareness on risks	Damages of Bab El Oued flood and Boumerdes earthquake are fresh in memory in many people. Awareness of people has been raised , and people willing to do something for risk reduction.	The memory of the past disaster is going to dissipate gradually. Many people think that disaster is fate and some people seem to abandon effort for risk reduction.	- In order to keep high intention for risk reduction, it is recommendable to take measures such as making official detailed records, setting a national day for risk reduction, holding a ceremony or campaign . - Media has important role for education and raising awareness. It is recommendable to have periodic program with related official organization. - School program on risk reduction is also effective to raise awareness of the students. It is recommendable to regulate compulsory program for all schools.
	Intention for risk reduction	Many citizens concern about seismic resistance of their houses, and 2/3 of householders have intention to reinforcement (*social survey).	Many citizens seem to have insufficient information on method for improving houses and emergency response.	- It is recommendable to provide official support, considering local needs and intention. It is recommendable to improve legal framework and institution in order to reflect local intention to official support.
	Economic condition	Due to high hydrocarbon price and economic reformation, national economy is growing rapidly. Citizens' economic condition is accordingly getting better, and 1/3 of householders accept cost share for reinforcement of their houses.	Unemployment rate is still high, although it is improving rapidly (23.7% in 2003, and 15.3% in 2005; source ONS). Population below poverty line is estimated to be 25% in 2005.	- In order to support individual effort for risk reduction, it is recommendable to provide official support for preventive activities such education for raising awareness and financial assist (subsidy etc.).
	Educational Level	School attendant rate is reported as 91% for the Wilaya Algiers. Literacy seems higher than national average of 70%.	National statistics shows that female literacy of 61% is lower than male one of 79% (2003 estimation).	- Because of school attendant rate is relatively high, education and training for disaster management in school seem efficient. It is recommendable to introduce system for promotion of education on DM in school.
	Mutual aid	Many people seem to have spirit of mutual support, although activity of community for DM is not well established.	Solidarity is weakened, especially in urban areas. Many people rely on public service due to remnant of socialism.	- It is recommendable to establish framework in official support for promoting and enhancing community activities for DM or risk reduction such as providing information, training, material supply, etc.
	Elders	Elders have much experience of the past disasters, and the experiences can be utilized for future disaster management. Because number of family members is high, they can care the elders.	Population of elders in Wilaya Algiers is increasing (5.8% in 1987 and 8.0% in 1998). In general, the elders are physically weak and high rate of handicapped.	- Elders have many experiences and knowledge of the past disasters, and it can be utilized for improvement of DM system and raising awareness. - Special support for elders should be considered in planning on emergency response.
	Women	Many women (wives) stay at home for relatively long time, and they well know about family situation.	Many women (wives) stay at home for relatively long time, and they may have relatively little chance to get information on disaster.	- It is recommendable to consider that information on disaster should be reached to all the members of families.
1.3 Vulnerable people	Children	Some schools have introduced a class for disaster management. Students who attended the class can get knowledge and information on DM.	Children, especially infants, are physically and psychologically weak and require particular care in an emergency.	- It is recommendable to include special care for children in emergency response plan (ORSEC plan), from physical and psychological viewpoints.
	Handicapped	Because of large families of about 8 persons, the family members can care the handicapped.	Nearly half of households have the handicapped, and 1/3 of the handicapped require physical care.	- It is recommendable to include special care for the handicapped in emergency response plan (ORSEC plan).
	The poor	None	The poor generally live in vulnerable houses with little information and availability for DM.	- It is recommendable to proceed with new housing so that the poor can also acquire a house with seismic resistance.

Table 10-3 Assessment of the Present Situation on Preventive Activities and Measures (2) Policy and Planning

Item	Sub-item	Strong point	Weak point	Recommendable point
2.1	National policy and action plan	After El Asham earthquake, Bab El Oued flood and Boumerdes earthquake, DM is a priority issue of the nation.	There is no authorized documents describing policy or action plan in national and local level.	- The formulation of national policy and action plan for DM is one of the highest priority issues to be handled by DNRM to be established near future.
2.2	Systematic DM (risk reduction - emergency response - rehabilitation)	Law 04-20 prescribes risk prevention and crisis management, which is intend to realize comprehensive DM.	Existing ORSEC plans is mainly for emergency response, but risk prevention and rehabilitation/reconstruction are not included. New ORSEC plans have not been prepared yet. There is no integrated plan for risk reduction and rehabilitation.	- Establishment of DNRM is one of the most priority matters. - DNRM should prepare framework of comprehensive DM plan, covering risk reduction, emergency response, and rehabilitation.
	Integrated DM, covering all entities(government, community, and citizens)	Law 04-20 prescribes about formulation of ORSEC plan in national, inter-Wilaya, Wilaya, and Commune levels.	New ORSEC plans have not been prepared yet. There is no integrated plan for risk reduction and rehabilitation.	- New DM plans should be prepared in national, inter-Wilaya, Wilaya, and Commune levels.
	Consideration of risk reduction in development plan and sectoral plans	Law 04-05 prescribes about necessity of risk assessment and risk reduction plan for preparation of POS.	New PDAU is under preparation, and PPR (Plans of Risk Prevention) have not been prepared yet.	- Promulgation of a Decree on risk reduction and capacity building of officials for realization of PPR will be required. Responsible organization and detailed procedure will be clarified in the new Decree.

Table 10-4 Assessment of the Present Situation on Preventive Activities and Measures (3) Institution and organization (1/3)

Item	Sub-item	Strong point	Weak point	Recommendable point
3.1	Regulations	Decrees 85-231/85-232 and Law 04-20 provide legislative base for risk prevention and crisis management.	Law 04-20 does not prescribe about rehabilitation/reconstruction stage. New Decrees for implementation, following Law 04-20, are still under preparation.	- A new Decree for establishment of DNRM should be promulgated immediately for formulation of institutional base for comprehensive DM. - DNRM should take initiative in promulgation of new decrees for implementation of measures for comprehensive DM, following to Law 04-20.
	Organization	DNRM will be created for comprehensive DM in national level, following to promulgation of a new Decree.	Organization which exclusively deals with DM, has not been established in central/local governments and major public companies.	- DNRM should be established as soon as possible. - Local level organizations which exclusively deal with DM should be established in Wilaya, according to guidance of DNRM.
	Implementation and application	ORSEC plan was formulated for emergency response in accordance with Decree 85-231. Emergency response in Boumerdes earthquake was reported generally well-done, according to ORSEC plan.	Risk prevention activity following to Decree 85-232 is not so active, although several seminars are held by CGS. Implementation of DM measures have not been realized, because of no decree has been promulgated.	- Responsible organizations, collaboration in operation among concerned organizations, procedures, guidelines, etc. for implementation of comprehensive DM measures should be defined in decrees to be promulgated as prescribed in Law 04-20.
3.2	Regulations	Decree 85-232 prescribes on risk prevention. Law 04-20 also prescribes about importance of information and training for risk prevention.	Decrees for implementation of risk prevention activities, especially on information and training, have not been promulgated.	- DNRM should prepare a new Decree on risk prevention, covering all actors. - Task and responsibility of each actor should be defined in the new Decree.
	Organization	Decree 85-232 prescribes several responsible organizations for formulation and updating of plan, supervision, and implementation. MATE has a task on risk reduction.	A new Decree which will define responsible organizations for planning, supervision, and implementation in accordance with Law 04-20, have not been promulgated.	- In national level, MATE, MHU, CRAAG, DGPC, M_education, and M_Communicatin will be major organizations, being coordinated by DNRM. - In local level, it is recommendable to establish a permanent organization in Wilaya for promoting and enhancing preventive activities.
	Implementation and application	Some activities, such as seminars on buildings and education in schools are conducted.	Preventive activity prescribed in Decree 85-232 is not intense in national and local levels.	- In order to promote preventive activities, concerned ministries should prepare action plan or guidance for the activities, which will be included in DM plan.

Table 10-5 Assessment of the Present Situation on Preventive Activities and Measures (3) Institution and organization (2/3)

Item	Sub-item	Strong point	Weak point	Recommendable point
3.3	Regulations	Decree 85-232 prescribes on risk prevention. Law 04-20 also prescribes about importance of information and training for risk prevention.	<u>Decreases for application on risk prevention, especially on information and training, have not been promulgated.</u>	- <u>Technical guidance for preparation of POS should be included in PDAU.</u> - <u>Technical guidance for implementation of PPR should be prepared.</u>
	Organization	Wilaya takes initiative for preparation of PDAU through URBANIS.	<u>Detailed procedure and organization for implementation and supervision of POS/PPR has not been defined in PDAU.</u>	- It is recommendable that responsible organization on PPR should be defined in official regulation.
	Implementation and application	In the Wilaya of Algiers, more than 100 POS out of 500 POS have been prepared.	There is a case that preparation of POS took for relatively long time, which causes difficulty in prompt development. Some of POS might be revised, according to launch of new PDAU.	- For prompt preparation of POS, it is recommendable to formulate a guideline, showing procedure and items to be studied, should be prepared.
3.4	Regulations	<u>Building code was revised many times, and earthquake resistant regulation "RPA 99/version2003" has been enforced for all kinds of buildings.</u> Registered contractors carry out construction of official buildings.	There is <u>no qualification system</u> such as registration or license for contractors for private construction, and registration of personnel such as engineers, designers, and technicians. Regulation on retrofitting does not exist.	- It is recommendable to establish qualification system to secure technical reliability on private constructions. - It is recommendable to formulate a regulation and a guideline, including <u>supporting system such as subsidy</u> , should be prepared.
	Organization	Concerning new building construction, <u>building permit should be obtained</u> through Communes. <u>CTC is an authorized agency for inspection and auditing.</u>	Although new construction requires technical inspection and auditing by authorized organizations, there are limited number of organizations for the inspection and auditing.	- It is recommendable to <u>foster agencies and technicians on construction</u> for inspection and consultation on new construction through training with new qualification system on contractors and engineers.
	Implementation and application	<u>For all buildings to be newly constructed, application of building code is compulsory.</u>	Because of rush of construction and limited number of auditing organizations, there is some difficulty such as delay or insufficiency.	- It is recommendable to introduce standard design in order to minimize procedure for design check. - It is necessary to monitor the application condition on building permit, and to <u>introduce inventory of registered buildings.</u> - <u>For promotion of seismic design</u> , it is recommendable to <u>formulate incentive system</u> , such as housing tax reduction.
3.5	Regulations	For the Wilaya of Algiers, <u>ORSEC plan has been prepared</u> for emergency response, according to Decree 85-231.	Based on the experiences of the past disasters and the recent situation such as privatization of national companies, <u>ORSEC plan is scheduled to be amended, but it has not been done yet.</u>	- DRRM should prepare a guideline for the preparation of new ORSEC plan. - It is recommendable that ORSEC plan should be prepared in each Wilaya in order to reflect local conditions.
	Organization	<u>Modules stipulated in ORSEC plan are official bodies for emergency response.</u> CNAD is a body in national level mainly for coordination and decision support. In Wilaya, Direction of Civil protection is responsible for emergency response in corporation with DGPC.	<u>CNAD has not being functioning</u> ; only the general director was assigned. In Wilaya, there is no organization dealing with comprehensive DM full-time.	- The task and function of CNAD should be clarified in terms of collaboration with DNRM. - Based on experiences of the past disasters, it is <u>required to prescribe detailed procedure of the modules.</u> - It is recommendable to establish a permanent organization which deal with disaster management full time.
	Implementation and application	<u>Modules relatively well functioned</u> at the time of Boumerdes earthquake.	<u>Algiers has no experience of a catastrophic disaster</u> , threatening capital function, and thereby, there is possibility that emergency response may be in confusion, when suffered such a catastrophic disaster.	- <u>Countermeasures for securing capital function</u> , such as strengthening strategic building, training, and disintegration of capital functions, <u>should be taken.</u>

Table 10-6 Assessment of the Present Situation on Preventive Activities and Measures (3) Institution and organization (3/3)

Item	Sub-item	Strong point	Weak point	Recommendable point
36 Rehabilitation and reconstruction	Regulations	<u>Regulations with a term limit</u> such as Executive Decrees 03-314 and 03-227 were promulgated for the rehabilitation of damaged buildings by Boumerdes earthquake.	<u>There is no specific regulation fixing general procedure on rehabilitation and its planning.</u>	- It is recommendable that <u>DNRM should prepare guidelines for overall matters on rehabilitation and reconstruction</u> , such as planning, budget allocation, and collaboration among related organizations/actions.
	Organization	<u>Each organization concerned</u> , such as housing, infrastructures, schools, hospitals, <u>fulfilled a role on rehabilitation</u> at the time of the Boumerdes earthquake.	<u>There is no organization which has responsibility for overall matters on rehabilitation</u> , including collaboration.	- It is recommendable that DNRM will look after overall matters on rehabilitation, such as planning, budget allocation, and collaboration among related organizations/actions.
	Implementation and application	<u>Rehabilitation activities on the past disaster were conducted well</u> with strong initiative of the President.	<u>Neither overall plan (guidance) nor sectoral plans was formulated for the activities of rehabilitation.</u>	- It is recommendable to prepare guideline or a framework for rehabilitation for planning and activity.
37 Insurance	Regulations	Ordinance 03-12 and Executive Decree 04-270 stipulate <u>obligation to have insurance for all residents against natural disasters</u> .	<u>Insurance is not popular in Algeria</u> , and thereby, benefit of insurance holders should be clarified for promotion of the insurance system.	- It is recommendable to <u>introduce a system for promotion of insurance</u> , including presentation of the benefit of the insurance clearly to the public.
	Organization	Wilaya requests <u>the owner of a new house to submit evidence of insurance for registration</u> .	<u>For existing buildings, organization is not clear.</u>	- It is recommendable to <u>assign an organization for monitoring situation on having insurance for promotion</u> .
	Implementation and application	For new houses, most of owners have insurance, according to regulation.	Some of owners of existing houses do not have insurance, and there is no system for promotion to have insurance.	- It is recommendable to introduce incentive system for holders of insurance, such as tax deduction.
38 Research and studies	Regulations	<u>Law 04-20 mentions about improvement of knowledge, reinforcement of monitor, and information development for risk reduction.</u>	<u>There is no particular regulation for promotion of research and study on hazard and risk.</u>	- It is recommendable to <u>formulate regulations or plans to show the target and required actions</u> .
	Implementation and application	<u>CRAAG carries out academic research on earthquake. CGS carries out study on seismic hazard/risk and strengthening buildings.</u>	There is <u>no authorized organization to utilize the result of research and studies</u> for planning and activities on DM.	- It is recommendable that DNRM should coordinate for presentation of the results of research and studies to related organizations and to the public for preparation of particular disaster management plans and activities.

Table 10-7 Assessment of the Present Situation on Preventive Activities and Measures (4) Disaster management resources

Item	Sub-item	Strong point	Weak point	Recommendable point
41 Budget allocation	Regulations	Because of betterment of financial situation of the nation, <u>much budget is allocated to official organizations in general</u> . At the time of Boumerdes earthquake, there is no serious problem on budget for rehabilitation.	<u>There is no regulation and organization which deal with overall budgeting in DM.</u> Budget for DM of each organization is not clearly defined.	- <u>DNRM should coordinate budget for overall DM constantly</u> , especially for risk prevention, and concerned organizations should arrange the budget for DM activity, following to the DNRM's coordination.
	Organization	Law 04-20 stipulates about measures to secure transportation, communication, and strategic buildings. Law 04-20 also stipulates about strategic stocks of emergency supplies	<u>Decrees for implementation</u> on preventive measures and promotion of stocks <u>have not been promulgated</u> .	- It is required that DNRM should prepare Decrees for promote preventive measures, including allocation of responsibility and collaboration among organizations concerned.
42 Resources for crisis management	Implementation and application	DGPC keeps stocks of tents, food, etc.	Except for stocks by DGPC, <u>there is few plan and activity on stock and maintenance of the resources</u> .	- <u>DNRM should prepare guidelines for storing emergency supplies</u> , based on damage estimation results, and <u>each implementing body should have responsibility on preparation of a particular action plan and action</u> .

Table 10-8 Assessment of the Present Situation on Preventive Activities and Measures (5) Information and communication

Item	Sub-item	Strong point	Weak point	Recommendable point
5.1	Situation of media information	TV and Radio broadcasts are operated by Nation. There are many newspapers. There was <u>no serious problem on information dissemination</u> by media at the time of Boumerdes earthquake.	<u>There is no scheduled information program in national and Wilaya levels for DM, especially on risk reduction.</u>	- It is recommendable that DNRM and related organizations, including media companies should cooperate for <u>preparation of scheduled information programs in national and Wilaya levels, and implement the programs.</u>
5.2	Public information system	<u>Law 04-20</u> stipulates that access to information on risk reduction should be secured for all people. CRAAG and CGS provide information on earthquakes and DM on the websites.	Decree for the implementation what Law 04-20 stipulates has not been promulgated, and <u>few measures and activities for the implementation have done.</u>	- As stipulated in Law 04-20, information on DM should be shared among related organization and open to the public. - It is recommendable that <u>DNRM should prepare a guideline and action plan for the sharing and dissemination of the information.</u>
5.3	Dedicated communication system	For emergency response, <u>dedicated wireless communication system is operated by DGPC</u> connecting with CRAAG. Some evaluation reports on the past disasters are prepared by DGPC and Wilaya, but those are internal documents and not open to the public.	The existing network of DGPC is <u>limited for emergency response</u> , and agencies connected on the network are limited. Detailed records on the past disasters are not open to public. Responsible organization and procedure on the documentation is not clearly stipulated officially.	- Information network (hard and soft) should cover all the related organizations for all stages of DM. - It is recommendable to establish a organization in Wilaya which deal with overall DM matters, including preparation and storing detailed records of the past disasters. The records and documents should be in use for improvement of DM system. - The existing database should be updated and improved, adding detailed or new data such as inventory of stocked materials, equipment, manpower, etc. for preparation of realistic DM planning and its implementation.
5.4	Practical information systems	GIS database has been established in this study. MHU(CGS), Wilaya(URBANIS), and DGPC formulated a cooperative group for maintenance and updating of the database. MHU (CGS), DGPC, Wilaya (URBANIS), and INCT cooperate in maintenance and updating GIS database, which is a product of this study. None	Detailed data such as inventory of stocked materials, equipment, manpower, etc. for DM have not been collected and arranged in database. There are few networks among professionals, although cooperation among professionals is indispensable for DM. There is <u>no system for accumulation and dissemination of local knowledge and practice.</u>	- One of possible cooperation among professional can be made in special committees in DNRM in order to deal with important matters on DM in particular field. - Similar to the preparation of records on the past disasters, it is recommendable to keep the experience, knowledge, and practice of the past disasters for betterment of DM system, especially on preparedness. - It is recommendable to <u>establish a museum with library on the past disasters</u> for well utilization of the traditional and local knowledge.
5.5	Base of education	<u>The necessity of education is mentioned in Law 04-20.</u> Some schools have introduced a class for disaster management.	<u>Decree for implementation on education matters has not been promulgated.</u> There is no center and network for systematic education on DM.	- <u>DNRM should prepare national level guideline on DM education, and Wilaya should prepare local plan on the education</u> of implementation. - Wilaya will establish the center of education in a disaster museum.

Table 10-9 Assessment of the Present Situation on Preventive Activities and Measures (6) Public awareness

Item	Sub-item	Strong point	Weak point	Recommendable point
6.1	Programs and materials	CRAAG, CGS and Red Crescent have particular programs on raising awareness and provide materials such as booklet and seminars.	There is no system, including written policy and global plan, for promotion of raising awareness for DM.	- DNRM should prepare national policy and guideline for raising awareness, and Wilaya should prepare detailed action plan and implement the programs. - Campaign, training, proving materials will be included in the program.
6.2	Media involvement in DM	During Bourmerdes event, many media made good effort for providing information, mainly about damages with a few educational aspects. The activity of media is generally welcomed.	There is no agreement or consensus about role of media such as dissemination of information on DM among media agencies, or media agencies-official agencies.	- For raising awareness and education, it is recommendable that official agencies provide and exchange necessary information and materials to media. - For emergency response, it is recommendable that official agencies and media should make agreement for information dissemination.
6.3	Support for raising awareness	After Bourmerdes earthquake, public awareness has been raised, especially on strengthening of houses. CRAAG, CGS and Red Crescent provide materials for raising awareness.	There is few supporting/enhancing mechanism for raising awareness in terms of official support (creation of framework for the support).	- It is recommendable to formulate supporting/enhancing mechanism such as incentive or proving materials to communities which take action for DM. - It is recommendable that DNRM or concerned official agencies should organize or assist campaigns and training for raising awareness.
	Memorial days for DM	International day on the second of October for disaster reduction (UN/ISDR) is a memorial day.	Effect of the international day is not clear. National day for DM has not been determined.	- It is recommendable to set up a national day for DM or disaster reduction for raising awareness and increase social resilience, conducting campaign etc.

Table 10-10 Assessment of the Present Situation on Preventive Activities and Measures (7) Education and training

Item	Sub-item	Strong point	Weak point	Recommendable point
7.1	Inclusion of DM in all levels of education	Law 04-20 requires education program for all levels of education. Some schools have introduced a class for education on DM.	The plans for education have not been prepared in Wilaya and national levels, and, no particular program on DM for the education at all level has been implemented.	- DNRM and concerned official agencies should prepare a guideline for preparation of education programs on DM at all levels of education. - Education committee in each Wilaya should prepare education programs on DM for all levels of education.
	Training of trainers and key staff	CGS organizes technical seminars mainly for strengthening houses. DGPC carry out training in other field such as wildfire.	The training of key staff for all related fields of DM has not been planned nor implemented.	- It is recommendable to formulate periodical and overall training program on DM for key staff , covering all related specialties related to DM. - Each concerned official agencies should prepare a plan for the training and execute the training for trainers.
7.2	Community training programs	None	There is no official and private program for training for supporting or enhancing community activity.	- It is recommendable to establish a system to dispatch trainers to local groups (communities) which take action on disaster management for supporting and enhancing the activities.
	Materials and reference for training on DM	Some materials have been prepared by CGS, CRAAG, and Red Crescent.	Except material on the left, guidance on activity in community, hazard map, and utilization of evacuation center, have not been prepared.	- According to the training programs prepared by DNRM, Wilaya and concerned agencies should prepare necessary materials on training of officials, technicians, and communities.
	Base for training	CGS organizes seminars for training relating to strengthening of buildings.	For overall DM, such as for officials, technicians, and community, base of training has not been established.	- A museum of DM mentioned in 5.4 and 5.5 will be the base of training. - Wilaya should be involved in all training courses and promote the training programs to the public.
	Systematic programs	None	There is no systematic or overall program for capacity building on DM.	- It is recommendable that Wilaya will prepare overall program for capacity building and particular programs for officials, community leaders, children.
7.3	Good use of traditional/local knowledge	None	There is no mechanism for usage of traditional and local knowledge and experience.	- Responsible organizations assigned for DM, should prepare and store traditional and local knowledge together with detailed records of the past disasters. The records will be kept in library of a museum of DM for good use.

Table 10-12 Clarification of Important Issues, based on Cycle and Bodies of Disaster Management (1) Preparedness (2/2)

Official Support		Mutual Support		Individual Support	
1 Preparedness					
Disasters management (DM) strategy and regulations					
1-5	<p>A Formulation of strategy and plan for DM</p> <p>There is no integrated national strategy and plan for DM. For the preparation of action plans in local level, the national strategy and plan is also indispensable.</p> <p>- <i>Wilaya: Formulation of action plan</i></p> <p>- <i>DNRM: Formulation of national strategy and plan</i></p>	<p>5-5</p> <p>A Participation in local disaster management activity required to create framework of official assistance or incentives, for enhancing the participation.</p> <p>- <i>Wilaya and Communes: Formulation of realistic plans for the participation.</i></p> <p>- <i>DNRM: Formulation of national level strategy and guideline for enhancement</i></p>	<p>9-5</p> <p>B Participation in formulation of local DM plan</p> <p>It is important to inform individuals that they can obtain information or knowledge on disaster prevention as well as increase their social resilience.</p> <p>- <i>DNRM, Wilaya, and Communes: Prepare a guideline for the participation in the formulation of plan, and explain necessity of the participation to individuals</i></p>		
1-6	<p>C Feed back of disaster drill results to DM plan for improvement of the plan</p> <p>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.</p> <p>- <i>DGPC and Wilaya: Mechanism for feed-back or evolution of disaster management plan should be built up.</i></p>	<p>5-6</p> <p>B Table-top simulation (DIG) and in-situ training (evacuation drill) at local level</p> <p>For the selection/implementation of measures and raising awareness, DIG and the drill are very suitable tools, and should be spread for ordinary use.</p> <p>- <i>CGS and DGPC: Promote and spread DIG and the drill</i></p> <p>- <i>Wilaya and Communes: Introduce as a tool for ordinary use</i></p>			
1-7	<p>A Guidance on prevention in land use</p> <p>National-level guidance is available (SNAT 2020).</p> <p>Regional-level guidelines (SRAT and PAW) and local level plans (PDAU and POS) are under preparation. Local level risk prevention plan (PPR) should be formulated as soon as possible.</p> <p>- <i>Wilaya: Formulation of local POS integrating hazards zoning in land-use</i></p> <p>- <i>Special selection of specialized consultants or public services to formulate the PPR is necessary.</i></p>	<p>5-7</p> <p>B Participation in creation of local risk /resource maps</p> <p>In order to utilize the knowledge and raise awareness of local people, it is recommendable to create local risk/resource maps with the participation of local groups.</p> <p>- <i>Wilaya: Formulation of realistic plans for the participation</i></p> <p>- <i>DNRM: Formulation of national level strategy and guideline for the enhancement</i></p>	<p>9-6</p> <p>C Cooperation in relocation of houses</p> <p>Relocation of houses may be required in the course of urban renewal plan for increasing urban resilience. Cooperation to the relocation is important for the smooth implementation of the plan.</p> <p>- <i>MHU and Wilaya: Establish legal framework for the relocation, including compensation. Prepare relocation plan, based on urban plan such as PDAU and POS</i></p>		
Organization and institution on disasters management					
1-8	<p>A Allocation of tasks and collaboration among organizations, concerned DM</p> <p>The mode of the allocation of tasks and the collaboration should be clarified in disaster management plan to be prepared as mentioned in "1-5".</p> <p>- <i>Wilaya: Formulation of action plan</i></p> <p>- <i>DNRM: Formulation of national strategy and plan</i></p>	<p>5-8</p> <p>A Clarification of task of community and collaboration with other organizations</p> <p>In terms of comprehensive DM, all bodies are main actors. Task of community should be clarified, and activity should be in collaboration of all other bodies.</p> <p>- <i>DNRM, Wilaya and Commune: Clarify tasks of all bodies in consultation with local groups, considering collaboration among all the bodies</i></p>	<p>9-7</p> <p>A Receiving information on disaster management</p> <p>Receiving DM information are fully rely on individuals. Individuals should manage the way of receiving and their action, based on the information.</p> <p>- <i>DNRM and Wilaya: Disseminate and promote to possess the way of receiving and the ability for proper action</i></p>		
1-9	<p>B Collaboration between official organizations and private organizations</p> <p>In terms of preparedness on emergency and mitigation of damages, official organizations should arrange for collaboration with private or privatizing companies concerning lifelines, relief rescue materials, and dangerous stocks.</p> <p>- <i>Wilaya and each supervisory authorities: Prepare and update collaboration plans with each major companies or association of companies</i></p> <p>- <i>DNRM and DGPC: Prepare a guideline and arrange/monitor the collaboration.</i></p>	<p>5-9</p> <p>B Establishment of receiving/disseminating system of DM information</p> <p>Community should be a base of dissemination of information, such as warning and evacuation order, assistance, connecting officials with citizens. The receiving/disseminating system should be built in ordinary information system.</p> <p>- <i>DNRM and Wilaya: Prepare a guideline for the system and assist for the built-in</i></p>	<p>9-8</p> <p>B Understanding warning system for proper evacuation</p> <p>Understanding of the system itself and background of the system such as outline of technology and social condition, is important for proper evacuation and other action, following the warning.</p> <p>- <i>DGPC, CRAAG, and Wilaya: Disseminate explanation on the system itself, background, foreseeable condition, etc. to the public</i></p>		

Table 10-13 Clarification of Important Issues, based on Cycle and Bodies of Disaster Management (2) Mitigation (1/2)

2 Mitigation		Official Support		Mutual Support		Individual Support	
Disaster management (DM) resources							
2-1	B	Establishment of disaster management (DM) center in realistic scale	6-1	C	Stock and maintenance of disaster prevention (DM) materials in local groups	10-1	C
	II	Together with establishment of DNRM as an institutional base of DM, it is necessary to establish DM center as a physical base for before-, during- after disaster. The scale, equipment should be realistic for quick implementation.		I	It is recommendable to add some function on DM to existing local groups, such as storing DM materials. Some of camping goods such as tents, portable generators, cooking equipment and speakers, can be used for disaster.		I
	b	- DNRM, DGPC, and Wilaya: Full responsibility on management of the center		c	- Wilaya and Communes: Prepare list of recommendable stock materials and support for the stock by local groups		b
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 center. Installation and maintenance of those should be planned and controlled in urban plan.		I	For activity of a local group, initiative of a leader of a group is indispensable. In order to foster group leaders, it is recommendable to make fostering program, consisting of guidance, training, DIG, simulation, action plan.		
	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 storing materials should be determined, considering share with private companies, communities, and individuals.		I	It is necessary to enhance activities of NGOs, especially for education, raising awareness, preparedness/training for emergency response.		
	a	- Wilaya: Determine share among related bodies		b	- DGPC and Wilaya: Prepare and implement the enhancing programs		
2-4	B	Installation and spreading earthquake insurance	6-4	B	Promote insurance on natural disasters at local level	10-2	A
	I	The insurance has been compulsory for all residences. It is recommendable to monitor the holding ratio and make necessary measures for increasing the ratio.		II	It will be effective that promotion of insurance is done as a part of activities of local communities.		II
	a	- MHU: Prepare a guideline on the monitoring and measures		b	- DNRM, Wilaya, and Insurance companies: Prepare and implement local campaign of information and awareness for promotion of insurance		a
		- Wilaya: Monitoring and taking measures					
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 so far. It is recommendable to continue and update monitoring system for determination of location and magnitude of an earthquake immediately as it is done by CRAAG.		I	Area and route of evacuation should be clarified in communities for smooth evacuation with mutual support in ordinary time.		
	c	- CRAAG: Continue and upgrade the monitoring and announcing system		b	- DNRM, Wilaya, and DGPC: Announce evacuation area to the public, prepare guidance on evacuation route, conduct drill etc. for dissemination		
2-6	A	Installation of information collection/dissemination system on DM	6-6	B	Communication system connecting local group and administrations		
	I	DGPC has operated dedicated wireless communication system with mobile units. The system is connected with CRAAG or some other agencies, and it is recommendable to connect all related bodies for emergency response.		I	For not only emergency response, but also education and raising awareness in ordinary time, it is recommendable to install communication system, connecting local groups and administrations.		
	b	- DGPC: Maintain, improve, and expand communication system of emergency response		c	- Wilaya, Communes, and M Information: Examination, planning, installation, and maintenance of the communication system		

Table 10-14 Clarification of Important Issues, based on Cycle and Bodies of Disaster Management (2) Mitigation (2/2)

Official Support		Mutual Support		Individual Support	
2	Mitigation Construction				
2-7	<p>C Strengthening buildings and introduction of low-cost retrofitting. Providing enough number of new houses is a priority issue, rather than retrofitting. For new houses, proper application of building code is essential. Demand for strengthen own houses is relatively high, but there is not information on introduction of retrofitting and framework of official support.</p> <p>- CGS: <i>Technical guidance on retrofitting</i> - Wilaya: <i>Improvement of system of building permit for application of building code for all houses. Formulation of plan for retrofitting with official support.</i></p>		10-3	<p>A Retrofitting or renewal of houses</p> <p>I Retrofitting or renewal of houses is most essential for reducing damage to houses and human casualty. In order to promote the retrofitting, effective and economical method should be disseminate to individuals as well as contractors. Financial assist by officials is also recommendable for the promotion.</p> <p>b - CGS: <i>Examine and provide the retrofitting method</i> - MHU and Wilaya: <i>Establish subsidy system</i></p>	
2-8	<p>B Raising awareness of officials and capacity building of technicians</p> <p>I In order to fulfill the role on official assistance, the raising awareness and capacity building are indispensable. It is recommendable to introduce continual activities for those into ordinary work.</p> <p>b - GCS: <i>Capacity building of technicians being in charge of buildings</i> - MHU and Wilaya: <i>Raising awareness of officials being in charge of urban planning and construction as well as other official being in charge of DM</i></p>	6-7	<p>A Promotion of education and activities on raising awareness in local groups</p> <p>I Program for education and raising awareness on DM is not popular in local groups. School program is also limited. It is recommendable to install system for activating such program on education in local groups and schools.</p> <p>b - M: <i>National Education: Formulation of a guideline, indicating required contents of the program</i> - Wilaya, CRAAG, and MATE: <i>Preparation of education materials such as a booklet</i></p>	10-4	<p>A Participation in DIG and disaster drill</p> <p>I DIG and disaster drill are effective tool for raising awareness, selection of priority countermeasures, and expansion of circle for disaster management.</p> <p>b - CGS, DGPC, and Wilaya: <i>Disseminate DIG manual, execute DIG and the drill, and foster moderators</i></p>
2-9	<p>A Education and raising awareness</p> <p>I There is no particular plan or program on education in national level, although some official agencies such as CRAAG, CGS, and DGPC conduct education.</p> <p>a - DNRM: <i>Prepare guideline on the education and raising awareness</i> - MATE, DGPC, M_Education, and M_Communication: <i>Prepare national program</i> - Wilaya and Schools: <i>Execution</i></p>	6-8	<p>A Formulation and reinforcement of local groups on DM</p> <p>I It is recommendable to add a function or a role on DM into the present function of existing local groups.</p> <p>b - Wilaya and Communes: <i>Preparation of supporting system and incentive for the formulation and reinforcement</i> - DNRM: <i>Formulate strategy and basic plan for the reinforcement</i></p>		

Table 10-15 Clarification of Important Issues, based on Cycle and Bodies of Disaster Management (3) Emergency response (1/2)

Emergency response		Official Support		Mutual support		Individual support	
3							
Emergency response							
Implementation of emergency response plan (ORSEC Plan)							
3-1	B	7-1	B	11-1	B	11-1	B
<p>Launching a warning or evacuation order</p> <p>For quick and proper response against disaster, launching a warning and evacuation order are crucial. The criteria and procedure for the decision and releasing should be prepared before an event.</p> <p>- DNRM: Prepare the criteria and procedure</p>		<p>Rescue and relief activities by a community/volunteer group</p> <p>In case of catastrophic disaster, official support will not reach to all victims in short time. It is thereby necessary to manage rescue and relief activities by a community/volunteer. It is recommendable to promote preparation for the activities, including storing materials and train citizens for the activity.</p> <p>- Wilyaya and DGPC: Prepare guidance for promotion and facilitate the training</p>		<p>Decision whether evacuation or stay at home</p> <p>There are several matters to be considered for the proper decision on timing of evacuation. For clarifying items, evacuation drill and preparation of evacuation goods are recommendable.</p> <p>- Wilyaya and DGPC: Conduct evacuation drill and prepare guidance on evacuation</p>		<p>Search and rescue of family members and neighbors</p> <p>Before official support arrives for rescue, citizens search and rescue missing family members and the neighbors. For the activities, it is recommendable to prepare materials for rescue such as a jack, hammer, steel bar, etc. should be available in hand or in community stock as well as conducting training.</p> <p>- DGPC and Wilyaya: Prepare and disseminate a list of materials to be stocked for evacuation and rescue, and conduct training for rescue activity.</p>	
3-2	A	7-2	A	11-2	B	11-2	B
<p>Quick inventory of damage to buildings</p> <p>Training course of engineers should include capacity building on quick inventory. It is recommendable to establish the training course together with authorization and registration system on engineers.</p> <p>- MHU: Establish a system for registration, and authorization of engineers</p> <p>- CGS: Conduct the training</p>		<p>Transfer of damage information from communities/volunteer to official agencies</p> <p>In case of catastrophic disaster, it is 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 Module for information service.</p> <p>- Wilyaya, DGPC, and DNRM: Prepare guidance showing the procedure of the transmission and facilitate the training, in corporation with local groups</p>		<p>Search and rescue of family members and neighbors</p> <p>Before official support arrives for rescue, citizens search and rescue missing family members and the neighbors. For the activities, it is recommendable to prepare materials for rescue such as a jack, hammer, steel bar, etc. should be available in hand or in community stock as well as conducting training.</p> <p>- DGPC and Wilyaya: Prepare and disseminate a list of materials to be stocked for evacuation and rescue, and conduct training for rescue activity.</p>		<p>Search and rescue of family members and neighbors</p> <p>Before official support arrives for rescue, citizens search and rescue missing family members and the neighbors. For the activities, it is recommendable to prepare materials for rescue such as a jack, hammer, steel bar, etc. should be available in hand or in community stock as well as conducting training.</p> <p>- DGPC and Wilyaya: Prepare and disseminate a list of materials to be stocked for evacuation and rescue, and conduct training for rescue activity.</p>	
3-3	B	7-3	B	7-3	B	7-3	B
<p>Selection and regulation of strategic roads</p> <p>Road network is essential for emergency response. In order to secure main artery, selection of strategic roads should be done and disseminated. Plan for road clearing is also prepared, considering equipment available.</p> <p>- DGPC, Police, and Wilyaya: Selection of strategic roads, and formulation of emergency response plan, including regulation on use and preparation of road clearance</p>		<p>Collaboration among communities/volunteer groups</p> <p>For the extensive mutual support, collaboration among communities/volunteer groups should be promoted. The arrangement for collaboration will be done by Module for information service.</p> <p>- DNRM and Wilyaya: Prescribe the mode of information service for the collaboration in ORSEC plan, and assist the collaboration</p>		<p>Collaboration among communities/volunteer groups</p> <p>For the extensive mutual support, collaboration among communities/volunteer groups should be promoted. The arrangement for collaboration will be done by Module for information service.</p> <p>- DNRM and Wilyaya: Prescribe the mode of information service for the collaboration in ORSEC plan, and assist the collaboration</p>		<p>Collaboration among communities/volunteer groups</p> <p>For the extensive mutual support, collaboration among communities/volunteer groups should be promoted. The arrangement for collaboration will be done by Module for information service.</p> <p>- DNRM and Wilyaya: Prescribe the mode of information service for the collaboration in ORSEC plan, and assist the collaboration</p>	
3-4	A	7-4	B	7-4	B	7-4	B
<p>Establishment and operation of a crisis cell for management all relief activities</p> <p>As a center of all management activities for decision-making and coordination among related bodies, details on task and activity of CNAD should be prescribed in conformity to ORSEC plan.</p> <p>- DNRM and CNAD: Prepare the detailed prescription</p>		<p>Clarification of local needs</p> <p>Support to victims, especially material supply to evacuation camps, should be done, clarification of needs. Clarification of needs of the handicapped, children, and women is required in terms of adequate support to the weak.</p> <p>- DNRM and Wilyaya: Mode of clarification of local needs should be included in emergency support in ORSEC plan in corporation with local communities.</p>		<p>Clarification of local needs</p> <p>Support to victims, especially material supply to evacuation camps, should be done, clarification of needs. Clarification of needs of the handicapped, children, and women is required in terms of adequate support to the weak.</p> <p>- DNRM and Wilyaya: Mode of clarification of local needs should be included in emergency support in ORSEC plan in corporation with local communities.</p>		<p>Clarification of local needs</p> <p>Support to victims, especially material supply to evacuation camps, should be done, clarification of needs. Clarification of needs of the handicapped, children, and women is required in terms of adequate support to the weak.</p> <p>- DNRM and Wilyaya: Mode of clarification of local needs should be included in emergency support in ORSEC plan in corporation with local communities.</p>	

Table 10-16 Clarification of Important Issues, based on Cycle and Bodies of Disaster Management (3) Emergency response (2/2)

Emergency response		Official Support	Mutual support	Individual support
3	Emergency response Collaboration of all private organizations			
3-5	B In addition to collaboration among all official agencies, it is recommendable to prescribe about collaboration with private agencies and communities.			
	I - <i>DNRM, CNAD, and Wilaya: Prepare collaboration framework with private agencies and communities</i>			
	C Maintenance of public order.			
3-6	B The maintenance of public order is a matter of Module for security and safety. Important information and obligation of citizens such as prohibited matters in emergency will be disseminated to the public for smooth proceeding.			
	II - <i>DNRM, CNAD, and M_Defense: Select matters to be pre-informed to the public and disseminate the matters</i>			
	b Transportation of emergency supplies (medical/sanitary supplies and food)			
3-7	B Module for food supply and material support and Module for transportation will manage the supply and transportation, to be done by several organizations such as military, DGPC, Red Crescent, volunteer groups, etc. The system of management, especially information on available carriers and demand/supply balance, should be established in ORSEC plan.			
	II - <i>DNRM and CNAD: Prepare detailed management system for the transportation</i>			
	b External assistance			
3-8	C Establishment of system for reception of foreign assist			
	III For catastrophic disaster, Module for reception of foreign assistance will be established as it was in Boumerdes Earthquake. The procedure for reception, tentative stock, distribution, or dispatch should be prescribed in ORSEC plan.			
	c - <i>DNRM and CNAD: Prepare detailed management plan for reception of external assistance</i>			

Table 10-17 Clarification of Important Issues, based on Cycle and Bodies of Disaster Management (4) Rehabilitation and reconstruction (1/2)

Official support		Mutual support		Individual support	
4 Rehabilitation and reconstruction (R/R)					
Support to victims					
4-1	<p>A Continuous and long-term support to victims It takes long time for R/R, and support to victims should be provided continuously. It is necessary to prepare a list of victims for the continuous support.</p> <p>II</p> <p>a - <i>DNRM: Formulate long-term plan for supporting victims</i></p>	8-1	<p>A Psychological care of victims In order to relief psychological damage of victims through communication in community or by support of community, it is recommendable to formulate plan for psychological care, including the effort of community.</p> <p>II</p> <p>b - <i>DNRM, Wilaya, and M_Health: Prepare the plan for psychological care, including task of local groups</i></p>	12-1	<p>C Repairing own house In order to promote strengthening at the time of repairing, proper application of building code is required and incentive may be considered for the strengthening in addition to insurance and consolation payment.</p> <p>II</p> <p>c - <i>MHU, CTC, and Wilaya: Prepare and disseminate regulation or rule on repair, and incentive for strengthening</i></p>
4-2	<p>B Consideration of the weak in R/R In general, the weak suffers from serious damages and remains un-recovered for longer time. Their access to information of assistance, and their recovery in economic/financial situation, should be taken into account in R/R stages.</p> <p>II</p> <p>b - <i>DNRM and Wilaya: Formulation of R/R plan, including particular support to the weak</i></p>	8-2	<p>B Participation in reformation of community New communities will be reformed, especially in resettlement areas. Plan, design, facilities in resettlement areas should be prepared, considering reformation of community, through participatory process.</p> <p>I</p> <p>b - <i>DNRM, Wilaya, and MHU: Prepare the resettlement plan through participatory process</i></p>	12-2	<p>B Self-sustainability in terms of mental health and economy In addition to physical rehabilitation, mental and economical rehabilitation are important. Commercial or productive activity has good effect for both. Marketing and job training will be planned in consideration of revival of local industry and small company.</p> <p>II</p> <p>b - <i>DNRM, Wilaya, and M_small and medium enterprises and crafts: Prepare assisting plan for the revival and implement the plan</i></p>
4-3	<p>B Support for self sustainability For restoring ordinary life of victims with their own effort, continuous support to victims who are forced relocation of houses, job changing, etc.</p> <p>II</p> <p>b - <i>DNRM and Wilaya: Formulation of plan and implementation of particular support to victims who are forced relocation of houses, job changing, etc.</i></p>				

Table 10-18 Clarification of Important Issues, based on Cycle and Bodies of Disaster Management (4) Rehabilitation and reconstruction (2/2)

Official support		Mutual support		Individual support	
4 Rehabilitation and reconstruction (R/R)					
Planning and budgeting					
4-4	<p>A Formulation of R/R plan</p> <p>In addition to quick recovery to ordinary condition, improvement of urban vulnerability is a key issue on R/R. Major issues relating to R/R plan, such as strengthening buildings, securing open space and widening of roads especially in urbanized areas, should be pre-involved in the R/R plan.</p> <p>- MHU, MATE, and Wilaya: Clarify outstanding issues, especially on urban vulnerability to be considered in R/R plan</p>	<p>8-3</p> <p>C Participation to the formulation of R/R plan</p> <p>Local needs should be reflected in R/R plan. For the reflection, public consultation meeting or public hearing should be held in the course of formulation of R/R plan.</p> <p>- DNRM, Wilaya, MATE, and MHU: Prepare and disseminate a procedure for reflection of local needs in R/R plan, and conduct it.</p>	<p>12-1</p> <p>C Participation to the formulation of R/R plan</p> <p>Needs of each individual or family should be reflected in R/R plan. For the reflection, questionnaire or interview will be conducted, together with public consultation meeting or public hearing for community.</p> <p>- DNRM, Wilaya, MATE, and MHU: Prepare and disseminate a procedure for reflection of individual or family needs in R/R plan, and implement the plan</p>		
4-5	<p>B Securing budget for R/R</p> <p>Securing budget is an important issue on quick R/R. The budget should be estimated and allocated by a national level organization, based on damage inventory.</p> <p>- DNRM: Estimate, secure, and allocate budget in national level</p> <p>- Wilaya: Secure and allocate budget in local level</p>				
4-6	<p>C Special financial aids according to seriousness of damages</p> <p>Special financial aids will be made for all victims, and some consideration in weighting will be added, according to previous effort on mitigation such as owners of retrofit houses, holders of insurance, etc.</p> <p>- DNRM: Prepare rule of consolation payment, including benefit to mitigation effort</p>				
4-7	<p>B Monitoring, control, and guidance on reconstruction plan</p> <p>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 situation.</p> <p>- Wilaya and Communes: Establishing organization and procedure for monitoring, control, and guidance for implementation of R/R plan</p>				

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 Suggestions concerning Organizations, Systems, and Disaster Management Plans

10-2-1 Comprehensive Disaster Management

(1) Logical disaster management

Natural disasters are a hindrance to sustainable development and poverty reduction. Removal or alleviation of such obstacle requires activities on disaster management. The goals of disaster management can be set as follows.

- 1) to protect the human life
- 2) to secure the social and economic systems
- 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, because Algiers is the capital (political center) and also the center of the economy of Algeria.

Particularly, the estimated disaster in this study may inflict consequences on a large scale unprecedented in Algiers in recent times and paralyze the functions of the capital. Therefore, it is recommendable to promote disaster management efforts, not only based on the experiences of the past disasters but also by standing on a recognition that catastrophic hazards may occur beyond recorded scale.

(2) Systematic disaster management

Institution and organizations on disaster management in Algeria have evolved in many aspects through the Bab el Oued flood (2001), the Boumerdes earthquake (2003), and other major disasters, since the El Asnam Earthquake in 1980. To follow hereunder is a summary of such evolvments from the viewpoint of a disaster prevention cycle (see Figure 10-1).

- Before a disaster (preparedness and mitigation): In accordance with Decree n° 85-232 that prescribes about risk prevention, an earthquake observation system (CRAAG), seismic regulation on buildings (CTC and CGS), etc. have been developed. On the other hand, implementation of measures on preparedness and mitigation in the other fields and organizations is still limited to promulgation of laws and regulations concerning land use (Laws n° 04-05 and n° 04-06), information and communication (Decree n° 04-181), natural disaster insurance (Decree n° 04-268), etc. While Law n° 04-20 provides for preventive measures against natural disasters in connection with information, education and training, strategic storing, etc., decrees for the enforcement has not yet been established.
- Just after a disaster (emergency response): Decree n° 85-231 regulates crisis management, and the emergency action plan (ORSEC Plan) was formulated, based on the decree. In the events of the past large-scale disasters, emergency response was taken through launching modules in each filed in accordance with the ORSEC plan. The effectiveness and weaknesses of the ORSEC plan have been revealed through the activities, and the plan has been improved accordingly. Further improvement is planned in accordance with Law n° 04-20, such as detailed stipulation of procedure on actions of each module.

- After a disaster (rehabilitation and reconstruction): Rehabilitation and reconstruction of the past disaster was managed by concerned the ministry or agency that has the jurisdiction on each filed, according to regulations with a term limit such as (Decree n° 04-268). For overall management on rehabilitation and reconstruction, there is no comprehensive system or organization.

Since earthquakes are unavoidable natural phenomena, an important point of earthquake disaster management is to reduce the damages at the next event in the future. In this sense, disaster management cycle should be taken into account.

Just after a catastrophic earthquake, bearable condition should be secured through emergency response, which may be up to 72 hours after the event. Allowable condition should be realized through rehabilitation, which may be up to 100 days after the event. Normal condition will be restored through reconstruction which may be up to 10 years after the event. And, the important point is to create better condition through preparedness and mitigation before the next event, in terms of living condition and also resilience against the next event.

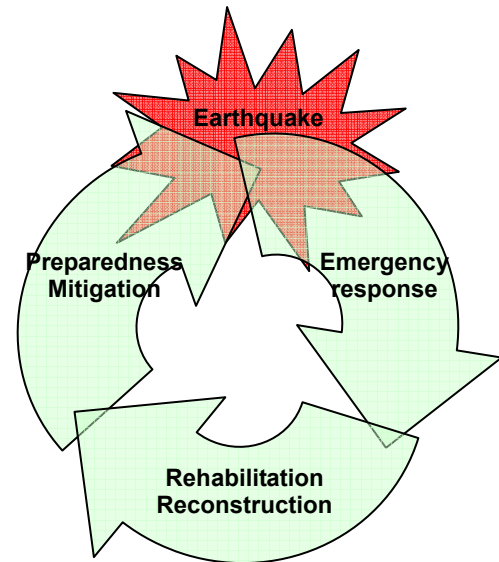


Figure 10-1 Disaster Prevention Cycle

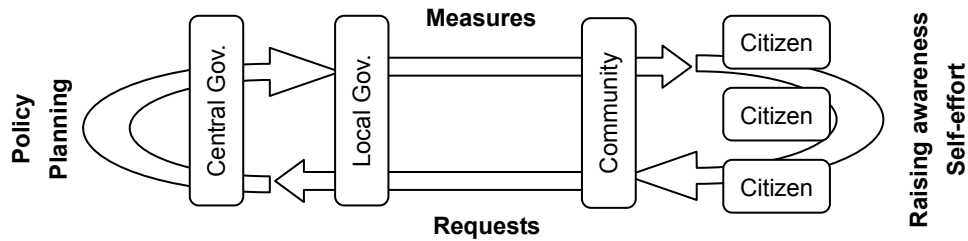
Cycle \ Time	72 hours	100 days	10 years	100 years
Emergency response				
Rehabilitation				
Reconstruction				
Preparedness and Mitigation				

It is therefore noted that all measures on disaster management should be realized, considering continuity of each measures in disaster management cycle. For example on buildings, seismic regulation and damage assessment procedures are stipulated as preparedness and mitigation before an event. Emergency assessment is carried out in accordance with the stipulated procedure as emergency response just after the event. Rehabilitation work is carried out, based on the assessment result, and reconstruction work is carried out in accordance with seismic regulation. Then, as feedback of experienced damage situation and assessment procedure, new seismic regulation and new assessment procedure will be formulated for betterment or preparedness/mitigation on the next event.

(3) Overall disaster management

It is essential that all the organizations and people should be involved to participate in disaster management activities as main actors. In Algiers, based on the experience from the

Bab el Oued flood and the Boumerdes earthquake, it has been recognized as vital to carry out disaster management activities with participation of communal groups and citizens. Further, Law n° 04-20 clearly states its importance (Article 9). The entities to be involved in disaster management are thought as 1) the central government, 2) the local government, 3) communities, and 4) citizens, all of which desirably constitute a system, as illustrated in the example below, to activate disaster management 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 management measures. In this regard, it is desirable that local governments prepare their own local disaster management plans as a scheme to implement disaster management measures and actually implement them accordingly.

A community is a core of mutual support, and it is expected to contribute to increasing social resilience through activities on disaster management. The activities include the dissemination of information for raising awareness in order to promote individual activities on mitigation such as reinforcing own houses, fixing furniture, storing emergency supplies, and having insurance. In terms of preparedness, communities will conduct training for emergency response, considering a situation where official support cannot reach to all the victims immediately after a catastrophic disaster. The training will develop knowledge on nature of disasters, life saving, first aid, evacuation, fire extinguishing, acquisition of information on support, etc.

Citizens are highly conscious of the necessity of disaster management due to their fresh memory of the Boumerdes Earthquake. Unfortunately, however, the solidarity of communities is rather weak today, owing to the chaos in the country in 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 this reason, an introduction of a system which supports self-activities on disaster management is highly needed. The activities of individual support should be well linked with mutual and official supports, and the activities include acquisition of knowledge and information on disaster management as summarized on the right columns in Tables 10-11 to 10-18.

(4) Realistic disaster management

In order to implement disaster management activities in an effective manner, it is important to know of the damage and risks, including vulnerability, and prepare a disaster management plan to mitigate the risks to reduce the damage, and then, the measures will be implemented in an actual situation, according to the plan. This study not only simulated damage but also collected data related to social vulnerability together with resources for disaster management.

It is hoped that specific plans will be prepared from viewpoints of mitigation and preparedness, utilizing these results. Points for the formulation of the specific plan are as follows.

- To refer the measures for realization of improved scenario, mentioned on consequence scenario in Tables 9-13 to 9-39
- To cover the recommendable points for enhancing the strong points and improving the weak points on the assessment of the present situation in Tables 10-2 to 10-10
- To consider the estimated number on damages such as casualty and damages on building and infrastructures for the mitigation of the damages, and for the preparation of necessary measures, materials, equipment, and manpower for emergency response
- To utilize and reinforce the disaster management resources, utilizing GIS database created in this study and transferred to Algerian for further improvement and updating

(5) Adequate disaster management

As far as earthquakes are concerned, it is extremely difficult at the level of modern science to predict when and where a disaster occurs on what scale that will bring what kind of damage. 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 estimation and risk assessment on the best-effort basis. Accumulation of such attempts will lead to construct a city resistant to earthquakes and reduce damage. Also, damage estimation and risk assessment shall be continually updated in accordance with accumulation of technology and information, while relevant plans have also to be reviewed accordingly.

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

(1) Establishment of the DNRM

Legal and institutional general framework described in Chapter 8, is summarized on Table 10-19. This table highlights, in the Law n° 04-20, the **need for an institution for the coordination of all the actions on prevention and crisis management** among national to local level (inter-Wilaya, Wilayas, and Communes). This coordination must be ensured by the creation of a “**National Delegation for Major Risks (DNRM)**”, which must be placed under the authority of the **Prime Minister**.

The realization of a comprehensive disaster management scheme mentioned in the previous section requires, among other things, establishment of a disaster management framework based on the Law n° 04-20. The DNRM is supposed to play a key role in this framework, and in fact a decree to set up the delegation is now underway. The DNRM is expected to formulate, as soon as established, several decrees for implementation stipulated Law n° 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 the harmony with the roles of the existing organization, CNAD.

Table 10-19 Summary of Current Legal Framework on Disaster Management

Major item	Content
PERIOD 1985-2005 (after the El Asnam earthquake)	
Decree n° 85-231: Crisis management and its organization	Implementation of ORSEC plans through emergency response by 14 modules: The ORSEC plans were launched at the time of the Bab el Oued flood and Boumerdes earthquake.
Decree n° 85-232: Risk prevention	Introduction of risk prevention plans, but little detailed description: Formulation and implementation of the risk prevention plans have not commenced.
Law n° 90-26: for implementation of Wilaya master plans and city land-use planning	Aspect on risk prevention was not included.
PERIOD 2001-2005 (after the Bab el Oued flood and the Boumerdes earthquake)	
Law 04-05: Land-use planning	In vigor: real application will be after the formulation of PDAU and POS.
Ordinance n°03-12, Decrees 04-268 and 270: Construction insurance	In vigor: The system is gradually getting effective in conjunction with planning permission for construction.
Regulation on 04/01/04: Construction rules	Effective: For further betterment, precise quality control of design and construction work is required.
Executive Decree 04-181: Communication	In vigor: Information campaign and educational action will be taken, following to promulgation of new decree.
2004: LAW n° 04-20 of 25 December 2004, Prevention of major risks and disaster management, in the framework of sustainable development	
Title I: Preface	Definition, Purpose, Basic principles, Field of application.
Title I: Information and training	Prescribing that access to information on risks should be available for all people.
Title II: Risk prevention	Prescribing about creation of comprehensive prevention plans for each of the 10 risks at national and local levels: the decree should include and detail risk prevention plans (PPR) at Commune level.
Title III: Crisis Management	Definition of "ORSEC Plans" at all levels (national, inter-Wilaya, Wilaya, commune, and particular sites). The creation of "National Delegation for Major Risks" (DNRM) under the authority of the Prime Minister.
The realization of decrees of application is in course (2006), and fundamental for the implementation and application of the law.	

It is expected that the DNRM will have tasks and function as mentioned in the succeeding section. As a reference, Japanese central organization on comprehensive disaster management (Central Disaster Prevention Council) is explained below.

1) Task

The Central Disaster Prevention Council in Japan has tasks mainly for formulation of framework on comprehensive disaster management, and detailed action plans are prepared in local disaster management plans. The major tasks of the council are as follows.

- Formulation of the Basic Plan for Disaster Prevention as guidance for preparation of local disaster prevention plans (action plans), and promotion of its implementation
- Formulation of Emergency Response Plan and promotion of its implementation
- Deliberation of key issues according to inquiry by the Prime Minister (or State

- Regulations concerning dissemination of information (organization, guidelines, overall plan)
- Regulations concerning education and training (education on disaster management through schools and mass media, program concerning popularization of seismic regulation, training on emergency response)
- Regulations concerning reinforcement or retrofitting of buildings (organizations, procedures, overall plans for general residential houses and strategic buildings)
- Regulations concerning a launch of an emergency response 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 the above, the following articles are also expected to be included in the series of new decrees.

- Guidelines for preparing a risk prevention plan (PPR) necessary for formulating a land use plan
- Guidelines for preparing rehabilitation and reconstruction plans
- Regulations for promoting academic researches
- Regulations for promoting self-activities for disaster management (subsidy program concerning reinforcement of buildings, program to encourage subscription to insurances, scheme to prepare/store/use disaster records, system to prepare/update databases, and program to enhance activities by communities including development of base for local disaster management and evacuation)

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

After the formulation the new decrees for implementation, several measures will be planned in local and sectoral disaster management plans, and then the measures will be implemented by many organizations or agencies concerned. For the smooth and effective implementation of the measures, it is expected that the Secretariat of DNRM should have the following tasks.

- Coordination among executing organizations and agencies
- Monitoring the implementation for confirmation of the progress and effectiveness
- Suggestion on improvement for better implementation, if 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 plans, and development of the communications network in relation to disaster management.

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

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

- Setting up mid- and long-term objectives
- Identifying short-term priority measures
- Maintaining role-sharing and collaboration among ministries and agencies concerned and other entities participating in disaster management activities
- Coordination on securing and allocation of budget (including securing personnel)
- Legal base and authorization for the implementation of the measures
- Preparation of regulations for reviewing and revising the plan

The national disaster management plan shall indicate the framework of and the contents to be included in local (Wilaya/Commune) or sectoral disaster management plans that act as action plans of disaster management for real implementation.

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

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

1) Institution for comprehensive disaster management

It is expected to set up a dedicated department, exclusively dealing with all matters for comprehensive disaster management at Wilaya level, which will also be responsible for coordination and monitoring of implementation of necessary measures, etc. at Wilaya level like the secretariat. The dedicated department will be established under the authority of Wali, since the department should have a task for coordination of all departments in Wilaya.

The department should have tasks in Wilaya as the secretariat as listed below.

- to set forth mid- and long-term objectives
- to identify short-term measures
- to secure task-sharing and collaboration among department concerned
- to coordinate for securing and allocating budget

- to promote self-activities of citizens and communities by setting a direct interface with citizens

2) Particular plans for preventive measures

Formulation of action plan on preventive measures and implementation of the measures are one of the most urgent issues for the Wilaya of Algiers. Proper implementation of the measures is a key of reduction of earthquake damages through reduction of physical and social vulnerability. Comparing to efforts on emergency response, there is much space to make efforts for disaster management in terms of implementation of preventive measures in Algiers. Following the setting up the framework for comprehensive disaster management as mentioned above, particular plans for preventive measures should be formulated as explained below.

- Urban development plan and land use plan: The land use master plan (PDAU) should provide a set of guidelines for preparing a land use plan (POS). A POS must include identification of risks and risk prevention plans (PPR) in accordance with the guidelines provided by the central government and PDAU. In addition, it is also important to include an urban renewal plan which covers securing open spaces and widening roads for the sake of earthquake disaster management.
- Building reinforcing plan: Reinforcement of buildings is the most crucial issue for reducing casualty due to earthquakes. For the reinforcement, it is significant to firmly fix the procedures for proper application of the building code, and to take root and certain measures for assuring quality of design and construction work. Moreover, the plan should describe about fostering of inspection organizations and design/construction engineers, development of a inventory book for registered buildings, incentive schemes for promoting seismic design and compliance with relevant standards. Technical matters on reinforcement of buildings are described in the next clause.
- Plan to develop and strengthen infrastructures and disaster management bases: It is important to carry out seismic diagnosis and necessary reinforcement based on the diagnosis results for infrastructures and disaster management bases. It is also necessary to examine about setting up of facilities, such as a disaster management headquarters, local disaster management bases, memorial halls for disaster management, etc. Suggestions from technical viewpoints for the reinforcement of infrastructures are described in Chapter 10-4.
- Plan to promote insurance scheme: It is critical to take actions to diffuse natural disaster insurances, which have been made compulsory, to existing buildings. An introduction of incentive schemes must expectedly be examined as a means to do so.
- Education and training plan: In accordance with the guidelines provided for by the central government, it is essential to formulate a plan to continuously provide programs on education training on emergency response through schools and mass media. Moreover, cooperation with various special organizations is vital in terms of the development of textbooks and manuals for this purpose. Especially, as for disaster management education in schools, it is indispensable to start with nurturing teachers by accumulating disaster management knowledge and training

how to educate students. Similarly, education and training on communities and citizens must necessarily start with training of trainers. Through these education and training, citizens can confirm evacuation areas and routes, communication methods to be connected with other family members, how to obtain necessary information, etc. It is imperative to facilitate preventive measures, such as strengthening houses and fastening furniture, and other self-activities of communities and citizens. In addition, it is desirable to conduct training of experts and engineers in each sectoral plan.

- Plan to provide information on disaster prevention: As stipulated in the Law n° 04-20, access to information on disaster management should be secured for all citizens equally. 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 procedure and mode of disclosure must be prescribed in the local disaster management plans 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 supplies: In line with the regulations stipulated by the central government, it is necessary to formulate plan for storing emergency supplies, including kinds, quantity, and maintenance/updating procedures for each entity such as Wilaya, Communes, and citizens.
- Plan for academic researches and studies: It is imperative to continue and improve the accuracy of seismic studies and observations by CRAAG, microzoning mapping by CGS, and data collection with regard to disaster management resources and society by DGPC and URBANS. Considering further advancement of technology, it is desirable to develop a seismic damage early determination system as well as seismic damage prediction system.

3) Emergency actions

Although an emergency action plan (ORSEC Plan) is already in place and has been revised to reflect the learning 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 9-40 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 9-40 and specific actions. In so doing, it is significant to maintain consistency with the preparatory measures, cooperation with citizens, and coordination among different modules, for the sake of efficient response.

4) Rehabilitation and reconstruction

Points to be noted in rehabilitation and reconstruction are not only restoration of the original state but also formation of better condition, creating a city more resistant to earthquakes. Accordingly, concerning infrastructures and other social stocks, it is expected to prepare a blueprint for rehabilitation and reconstruction efforts in linkage with a long-term development plan in each field, such as electricity, gas, communications, airports, ports, bridges, roads, hospitals, and so on, based on the guidelines provided for

by the central government. As for housing, it is desired to spread and fulfill insurances in place of the calamity funds.

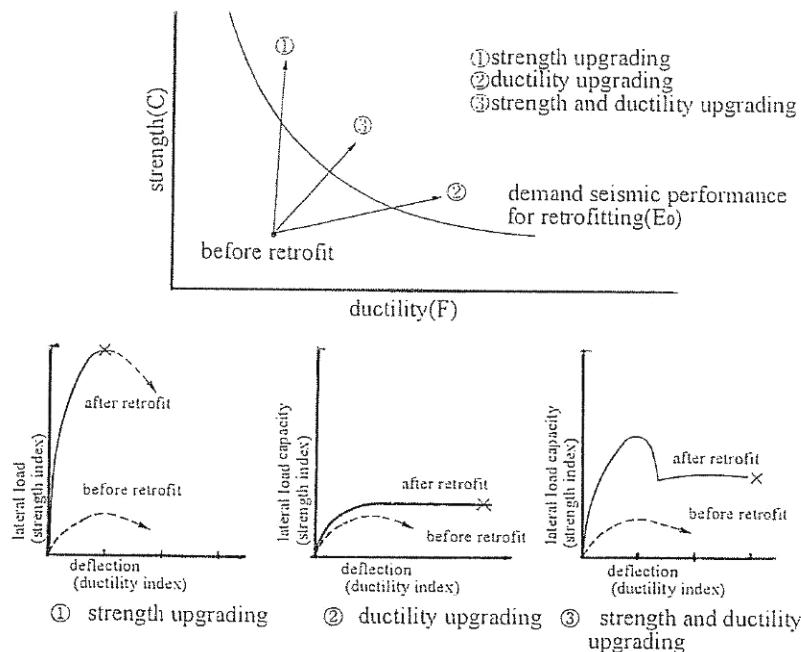
Further, long-term assistance is needed in various other aspects, such as maintenance of solidarity of communities, psychological care, keeping of disaster records, protection of local industry, and preservation of historical assets.

10-3 Buildings

The collapse of and/or heavy damage to buildings is the most serious source of human casualties in large earthquakes. Almost all of the existing buildings have seismic vulnerability due to the level of engineering and construction technology or non-engineered construction, degradation of material, old codes and standards, customary construction materials and methods, age etc. For that reason, JST and CGS have made recommendations regarding the methods of seismic retrofit for each type of existing building for reduction of earthquake damage.

10-3-1 Concept of Seismic Retrofit

The existing buildings vulnerable to seismic damage basically suffer from a lack of strength or lack of ductility. The seismic retrofit methods are designed to upgrade seismic performance by improving strength or ductility and/or both as shown in Figure 10-2.

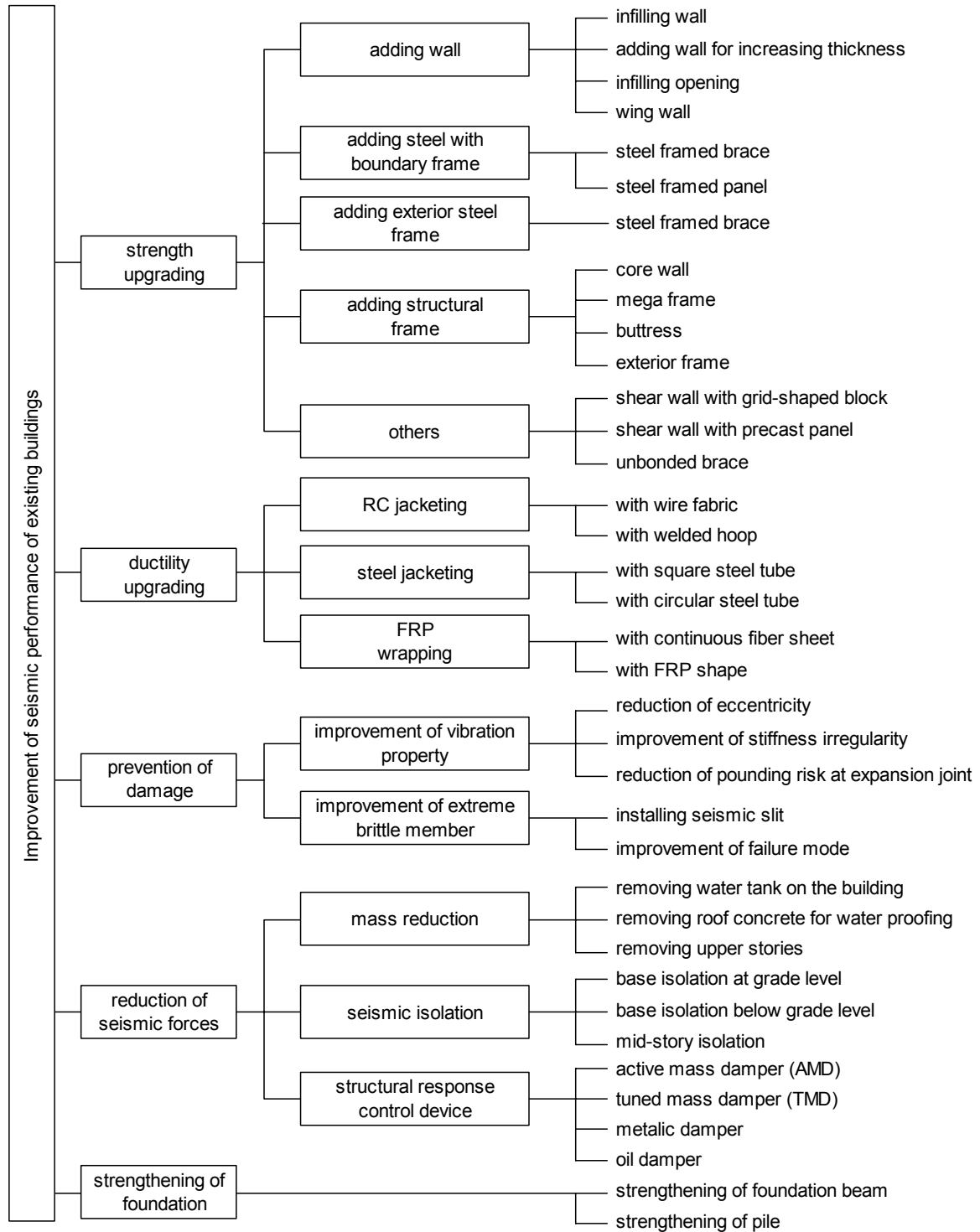


Source: Standard, Guidelines and Technical Manual for Seismic Evaluation of Existing Reinforced Concrete Buildings, 2001 Japan

Figure 10-2 Concept of Seismic Retrofit for Existing Buildings

When planning a retrofit, the subject building's seismic capacity must be accurately determined through a seismic evaluation i.e. whether it suffers from a lack of strength or lack of ductility. The results will indicate the choice of structurally effective retrofit methods, but a building has additional important properties. The engineer must take these properties into consideration in

order to select the most suitable and cost effective retrofit plan through discussion with building owner, building operator or user, and sometimes the original design architect and engineer. The technical purpose of the retrofit, retrofit method and construction techniques are shown in Figure 10-3.



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

Figure 10-3 Classification of Seismic Upgrading Methods