

# SEISMIC RISK REDUCTION AND DISASTER MANAGEMENT IN ALGERIA

by Dr Mohamed BELAZOUGUI\*

## INTRODUCTION

The major october 10<sup>th</sup>, 1980 Earthquake (M = 7.2) which stroke the town of EL ASNAM and its region, just 25 years after the 1954 earthquake (M = 6.7), has triggered a great awareness about the importance of seismic risk in Algeria.

Since this event, the efforts towards earthquake risk reduction, and more generally, all kind of disaster reduction, have begun to be undertaken and have been integrated in the framework of political and governmental awareness and action. Organisational, regulation, training and information countermeasures have been indertaken.

In this paper, the main countermeasures and actions are discussed.

## I. - NATIONAL POLICY IN THE FIELD OF SEISMIC RISK REDUCTION

These policies are sustained by many aspects of social, technical, managerial or administrative, political, legislative and regulatory, and finally economical order.

The government is providing great efforts for social developpement and welfare : more than 50 % of the yearly state budget is allocated for people education, training, health and lodging. The aspect of individual and wealth protection has been progressively but significantly taken into account only since the 10.10.80 EL ASNAM event.

The technical aspects of governmental politicly have consisted in the training of the concerned population (students, Engineers, researchers, disaster managers), development and dissemination of specific knowledge, monitoring seismic network installations, research equipment acquisition.

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(\*) Dr. Engineer in Civil Engineering  
President of the algerian association of earthquake engineering  
"AGS" and First Director of "Centre National de Recherche  
Appliquée en Génie Parasismique (C.G.S.), algiers

Administratively speaking, a national global and integrated organisation has not been yet definitely decided. Indeed, after a ministerial commission has discussed and made recommendations on 14 major disasters in 1984-1985, a national plan for disaster reduction and disaster management has been edicted and translated into regulatory documents (decrees). This contributed to increase the awareness vis-à-vis the responsibilities of all the regions and communes in the field of planning management and coordination of disaster reduction programmes. But the implementation is very diverse and globally not satisfactory. However, specialized technical institutions as earthquake engineering and seismology centers, civil defence department, etc... whose permanent mission of is risk reduction and management, have provided serious efforts, and preliminary actions and elements have been set up to support governmental actions at national, regional and local levels. In the other hand, national IDNDR Committee have been set up in decembre 1990 and works actively in the field of coordinating and works actively in the field of coordinating and impulsing the actions of all institutions acting in the field of national and technological disasters.

At the political level, funding for managing the actions and equipment acquisition in the framework of seismic risk reduction follows various paths. A yearly state budget is directly alloted to scientific and technical institutions working in the field such as seismological and Earthquake Engineering Centers or civil defence department. In the other hand, credits and aids are yearly given by state or local authorities for investigation, research, training or information programmes undertaken at different levels.

The legislation and regulation aspects are taken in charge by the two 1985 decrees concerning disaster reduction and emergency at global level. Concerning the particular case of seismic risk, specific resistant design regulations of bulduings (R.P.A. 88) have been edicted and are mandatory in their application. Specific seismic guidelines for individual houses and small buildings to be edicted in 1994 will complete these regulations.

In conclusion of this chapter, we may say that economic considerations have not yet hindered much in the programmes process, the authorities considering it as an investment with real income and results at a long term stage. But if the present economic crisis is lasting for a long time it may be of some negative influence especially for foreign currency allotment. Consequently, the national programme is concerned with the training and development of national teams and means to take permanently in charge the national politicly in this field in long term viewpoint.

## II. - SEISMIC RISK REDUCTION PLANNING AND PROGRAMMES

### II. 1. Global Disaster Reduction Programme

As stated before, following the conclusions of ad-hoc commission which made recommendations on various major disasters that can affect Algeria, the Government has on may 29<sup>th</sup>, 1985 adopted and edicted A "Disaster Reduction and Management plan" including preparedness and emergency aspects with short, mean and long term "action programmes".

The global legislation and regulation framework is taken into account by :

- Decree n° 85.231 of 08-25-1985 which deals with preparedness and Emergency organisation.
- Decree n° 85.232 of 08-25-1985 which deals with disaster reduction.

The "Action programme" includes various aspects whose objectives are :

- to set up plans at all levels (national, regional, local, units...) for risk reduction, preparedness, emergency
- to make an inventory of all documents, investigations, institutions and means that exist in this field at different levels
- to train, educate and inform the concerned people
- to perform hazard and risk mapping at national, regional and local (urban scale or site scale) level (macro and micro-zoning)
- to set up new institutions for investigations, research, training, information, preparation and emergency, in the field
- to strengthen human resources and equipment of existing institutions including communication networks
- to undertake vulnerability studies and evaluate the risk likely to threaten the population and economic potential
- to integrate hazard mapping and the results of vulnerability and risk investigations in the developpement and the urban planning with mandatory implementation.

## II. 2. Seismic risk reduction programme

The Algerian experience began after the catastrophic 09/11/1954 EL ASNAM earthquake (M = 6.7) which claimed 1243 deaths and destroyed 20.000, following this event, the French authorities at that time have enacted very succinct seismic building design regulations called "Règles A.S.55" which were used more or less in the stricken region.

The deficiencies of these regulations have been pointed out by the terrific 10.10.1980 EL ASNAM earthquake which has stricken the same region and claimed 2633 deaths, 8369 injured, 348 missing, 478948 homeless, and destroyed more than 20000 buildings + 2 billions of US \$ of direct damage to which 30 % to 40 % for indirect losses should be added.

Far before this latter event, the national authorities, aware of the risk, have prescribed for public programmes, the application of coarse seismic regulations inspired from modern French regulations "PS 69" (cf. 1973 circular of Algerian Ministry of Public Works).

But, to be more efficient on what concerns the seismic protection, the "Organisme National de Contrôle technique de la Construction" has contracted an agreement with STANFORD UNIVERSITY in 1976 in order to set up a new Draft code which takes into account more accurately the specific parameters of Algerian construction (macrozoning map, local construction techniques, etc...). This draft code was ready in 1979 and was in discussion and enrichment at the level of C.T.C. technical staff when the 10.10.1980 EL Asnam earthquake happened. This event provided many interesting lessons that have been taken into account in the new code. That is why the code have been enacted definitely only in 1983 ("RPA 81 - version 1983") after a transitional period 1981-1983 during which either "PS 69 + compléments" or "RPA 81 first version" could be used.

Another consequence of this major event was that Arab housing Ministry during their 1982 Algiers meeting have set up and adopted a special programme entitled "Assessment and Mitigation of seismic Risk in the Arab Region" (PAMERAR PROJECT) with an advantageous loan from "Social and Economic Development Arab Fund" (FADES). This Programme includes these four (4) points :

- Equipment of seven (7) Arab Countries (Algeria, Morocco, Tunisia, Jordan, Syria, Iraq and Yemen) with modern seismological and strong motion networks.
- Setting up of earthquake Engineering Center (C.E.S.) in Algeria which will radiate on Arab and Mediterranean regions,....).

- Specific training in the field so that an arab expertise will emerge as soon as possible.

- Seismic Hazard and microzoning study of EL ASNAM Region.

The ad-hoc National Commission which has worked on 14 major risks and the governmental programme above mentioned have integrated the PAMERAR Project in their Recommendations and Plan of Action which have been detailed by specialized institutions each dealing with what concerns its activities. The detailed programmes concern the :

- equipment of scientific, technical, and research institutions as well as the ones dealing with rescue operations (monitoring networks, laboratories, specific material)

- Performing of specific legislation, regulations and organisation

- Training of specialists in the field

- Education and information dissemination

- Regional seismic hazard and microzoning mapping (step by step following priorities and available means)

- vulnerability and risk studies of important buildings and exposed urban nuclei

### III. - IMPLEMENTATION OF PROGRAMMES OF ACTION

For the period 1981 - 1993 we can mention the following realisations.

1. - Setting up of "CENTRE NATIONAL DE RECHERCHE APPLIQUEE EN GENIE PARASISMIQUE (C.G.S.)" which has begun its activities since January 1987 and the missions and objectives of which are :

- to perform investigation and research activities in the field of seismic risk reduction
- to train its future researchers
- to build its specific research and testing laboratories
- to train and improve the Knowledge of specialists in seismic design at national level (seminar courses, conferences and symposia,..)
- to Educate and inform public and authorities
- to Aid and assist Engineering offices and concerned institutions.

2. - Regional seismic Hazard study and microzoning of nine urban sites of CHLEF (former EL ASNAM) region (performed in 1984-85). Microzoning of a tenth urban site (TENES) has been performed in 1991.

3. - Regional seismic Hazard of Algiers region study (will be finished at mid 1994)

4. - Regional seismic Hazard of AIN DEFLA region study (will be finished at mid 1995)

5. - Microzoning study of Algiers and four urban sites of AIN DEFLA region (will begin on January 1994 and be finished probably at the end of 1996)

6. - Vulnerability study of strategic buildings of Algiers - 1<sup>st</sup> phase (in hand - will be finished at the end of 1995)

7. - Equipment of "Centre de Recherche en Geophysique CRAAG" with modern seismological telemetered network (completely operational in 1994)

8. - Equipment of C.G.S. with national strong motion network :

- 90 accelerographs installed in 1984-85

- 120 accelerographs have been acquired in 1991 and progressively installed on free-field and special buildings (40 installed at the end of 1993, 40 in 1994 and 40 in 1995)

In the other hand, C.G.S. has integrated about fifty (50) accelerographs of various institutions (Dams office "A.N.B." and Electric and gas corporation "SONELGAZ") in its National Network with the responsibility of their maintenance and exploitation.

9. - actualization of seismic regulations (RPA 81 has become RPA 88)

10. - Introduction of seismic design and dynamics modules in normal cursus of all civil engineering institutes and high schools all around the country (and this since 1981-1985)

11. - The last 10.29.1989 Tipaza Earthquake has allowed consistent progress in post-seismic emergency and rehabilitation techniques and steps towards damage and vulnerability assessment of various structural types (masonry, reinforced concrete, etc...).