



## SOCIAL VULNERABILITY INFLUENCE ON THE SEISMIC RISK MANAGEMENT

Nacim YOUSFI<sup>1</sup>, Mehdi BOUKRI<sup>2</sup>, Samira SAADI<sup>3</sup>, Mounir NAILI<sup>4</sup>, Mohamed Naboussi FARSI<sup>5</sup>, Mounir AIT BELKACEM<sup>6</sup> and Omar AMELLAL<sup>7</sup>

### ABSTRACT

The natural phenomena, such as, volcanos, floods, tsunamis, landslides and earthquakes, for a long time preoccupied the national and international organizations like the United Nations, because of the disasters and the losses which they generate. The earthquakes belong to the more devastator phenomena. In fact, several initiatives of seismic risk reduction were carried out during the last decades, with the development of seismic damage assessments and quantifications, like RADIUS model developed within the framework of the IDNDR (International Decade for Natural Disaster Reduction), the HAZUS model developed in the United State and Risk-UE approach developed in Europe. These initiatives try to quantify the seismic risk and to give an estimate of the damage extent which can result. Preventive measures can be taken, in order to reduce this seismic risk and to minimize the human lives and infrastructures losses. Among these measures, there are the social vulnerability studies which constitute an important stage in the seismic risk reduction. In this work, we will study the case of Blida city, located in the north of Algeria where the seismicity is active, in order to study the population response with respect to the seismic risk, and to evaluate the influence of social vulnerability in the seismic risk management.

**Key words:** seismic risk, earthquake, social vulnerability, Blida, risk management.

### INTRODUCTION

In the present paper, the behaviour of population during an earthquake is analysed, in order to define the level of awareness to an earthquake. This analysis called “social vulnerability” can influence the seismic risk management. The case of the Great Blida (municipalities of Blida, Ouled-Yaich, Bouarfa and Beni Mered) was chosen to do this study.

The region of Blida, which is located in a high seismicity area within Algeria, is considered to have a strategic position, linking Algiers capital city to different regions in the country (Benelhadj-Said, 2010).

---

<sup>1</sup> Doctoral Student, National Earthquake Engineering Research Centre, Algiers, nacim\_yousfi@hotmail.fr

<sup>2</sup> Researcher, National Earthquake Engineering Research Centre, Algiers, mboukri@cgs-dz.org

<sup>3</sup> Researcher, National Earthquake Engineering Research Centre, Algiers, annousamira@yahoo.fr

<sup>4</sup> Senior Researcher, National Earthquake Engineering Research Centre, Algiers, mnaili@cgs-dz.org

<sup>5</sup> Research Director, National Earthquake Engineering Research Centre, Algiers, mnfarsi@cgs-dz.org

<sup>6</sup> Doctoral Student, National Earthquake Engineering Research Centre, Algiers, ait\_belkacem1@yahoo.fr

<sup>7</sup> Lecturer, Saad Dahlab University, Blida, amellalomar@gmail.fr

The social vulnerability study undertaken in this work was carried out on various categories and social classes of people by using a form elaborated for this purpose.

This sheet (see Fig.1) contains several parts: household; house characteristics; communication and information; preparation and perception to risk; perception to security. According to the density of the population of each town, the samples to ask people were chosen covering maximum of areas to have a representative global sample for the study. The social survey includes several parameters to do a social vulnerability analysis (OYO, 2006).

**Centre de Recherche Appliquée en Génie Parasismique (CGS)**

**FICHE D'ENQUETE SOCIALE DE LA  
VILLE DE BLIDA**

Enquêteur : ..... Date: ...../...../.....  
 N° de Fiche : .....  
 Commune : .....  
 Adresse : .....

**PROFIL DE CHEF DE MENAGE**

Sexe Masculin  Féminin

Niveau Educationnel Sans Education  Primaire  CEM   
 Lycée  Université

Profession Administration  Commerce  Agriculture  Bâtiment   
 Retraité  Industrie  Education  Libérale   
 Autres

**PROFIL DU CONJOINT**

Sexe Masculin  Féminin

Niveau Educationnel Sans Education  Primaire  CEM   
 Lycée  Université

Profession Administration  Commerce  Agriculture  Bâtiment   
 Retraité  Industrie  Education  Autres

**CARACTERISTIQUE DU MENAGE**

Nombre d'enfants Masculin  Féminin

Nombre de malades Chronique  Handicapé

Mode de transport Voiture individuelle  Bus   
 Taxi  Autres

Type de téléphone Fixe  Portable   
 Aucun  Tous les deux

Propriété de la maison Propriétaire  Copropriétaire  Location  Autres

Dépenses mensuelles  DA

Figure 1. Social survey sheet

The number of people in a household is a parameter during an earthquake, it allowed to manage first rescues of each area and to know how prepare refuges for disaster victims, provisions, etc., mean of transport used, allowed to know how we can classify transport network. Mean of communication the most used, indicates the most important network communication. This classement is necessary in the preservation of city communication installations. The state of buildings and application of seismic codes also is an important parameter in this analysis.

We find several questions on different life line (water; electricity; gas and sewage).

In the next parameter people are asked on majors risk information and their reduction. The last parameter of this survey is about houses insurances against earthquakes.

These parameters allowed identifying and classifying vulnerable areas in order to intervene after a natural disaster for different networks and infrastructures, and to know how people behave during an earthquake.

## HISTORY OF BLIDA POPULATION

The number of population in the studied area increased significantly since 1900. We can observe a little decreasing of Blida population after 1980 because of the new administrative division, where Tipaza city was created and was stopped to belong to Blida city. Also the creation of big Algiers governorate in 1998 where four towns have been belonged to Blida were linked with Algiers (Tessala el Merdja, Birtouta, Ouled-Chebel and Sidi Moussa), (see Fig.2).

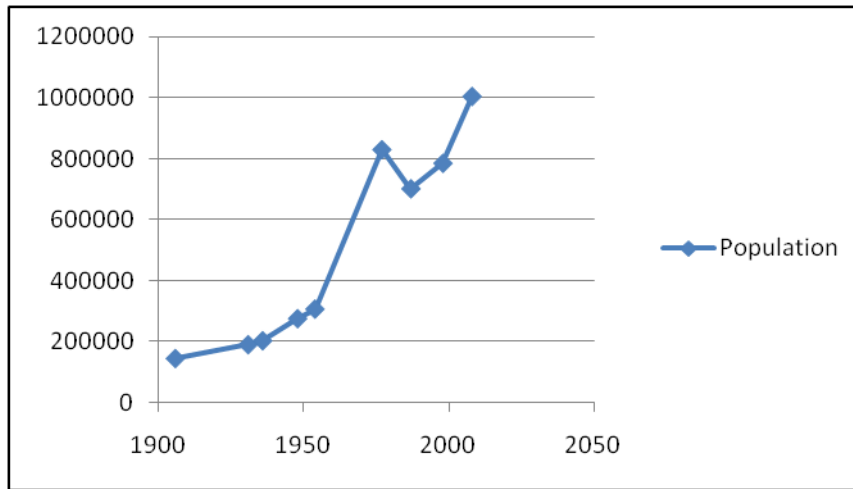


Figure 2. Blida population evolution during last 100 years (NOS)

On the figure 3, distribution of Blida population is shown; we can notice on the map that the four towns studied are among the most crowded towns in Blida.

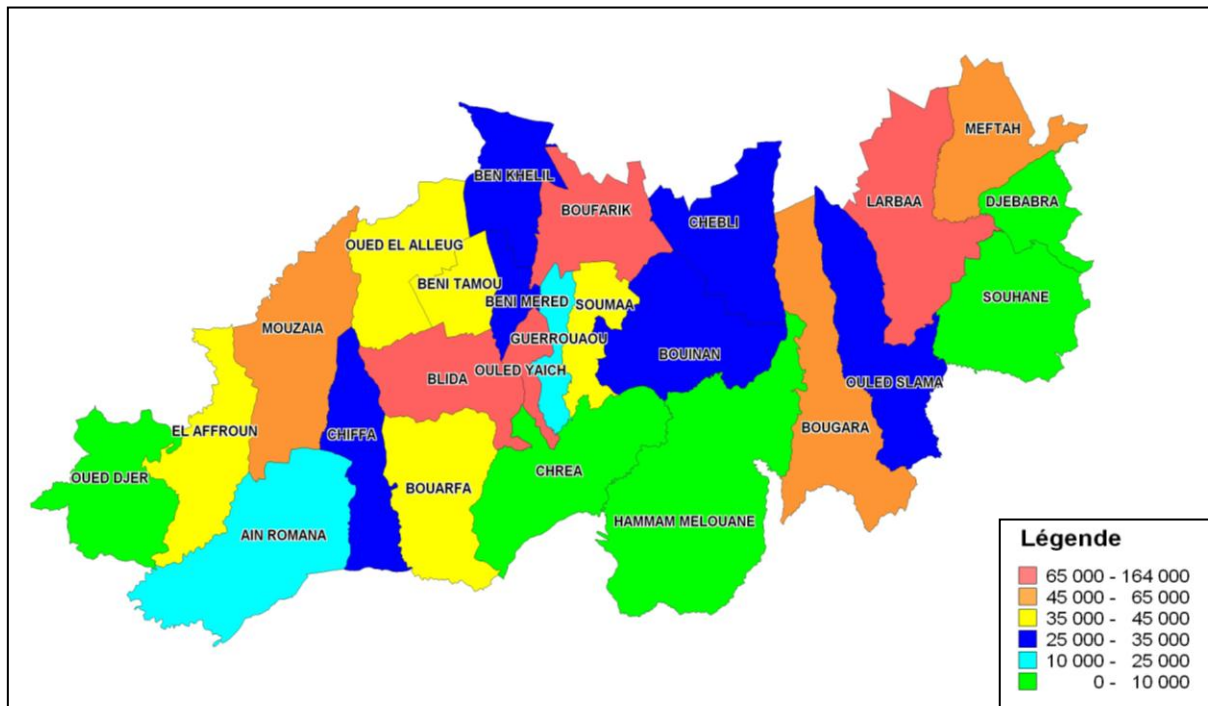


Figure 3. Demographic density of Blida NOS (2008)

## SOCIAL SURVEY

The objectives of the social survey are to clarify and characterize the level of consciousness and people activities, employees and others for the prevention to risk and management disaster, especially for earthquakes cases. Identify people needs employees and others for the prevention to risk and management disaster, especially for earthquakes' cases. Assess and characterize the social vulnerability, its causes and social capacities for the prevention to the risk and management disaster.

**TARGET AREAS**

The social survey have covered four towns of Great Blida (Blida, Ouled-Yaich, Beni-Mered and Bouarfa) and allowed to elaborate suggestions for the management disaster system of Great Blida. It has been realized for a sample of 100 household using a survey sheet developed by the CGS team.

**ELABORATION OF SOCIAL SURVEY SHEET**

In the form of the social survey elaborated by the study team of the National earthquake engineering research centre (CGS), several questions classified in five sections were made to establish an inquiry as follow:

- Household;
- House characteristics;
- Communication and information;
- Preparation and perception to risk;
- Perception to security.

**SAMPLES SELECTION**

The number of household chosen for the sample was determined according to the population of each town (Table.1). Targeted household was determined on site by the investigator in the case where two or more households shared the same building.

Table 1. Sample number of each town CGS (2013)

Town	Total population	Percentage (%)	Sheet/ town
Blida	163586	50.88%	50
Ouled-Yaich	87129	27.10%	27
Bouarfa	35910	11.17%	12
Beni-Mered	34860	10.84%	11

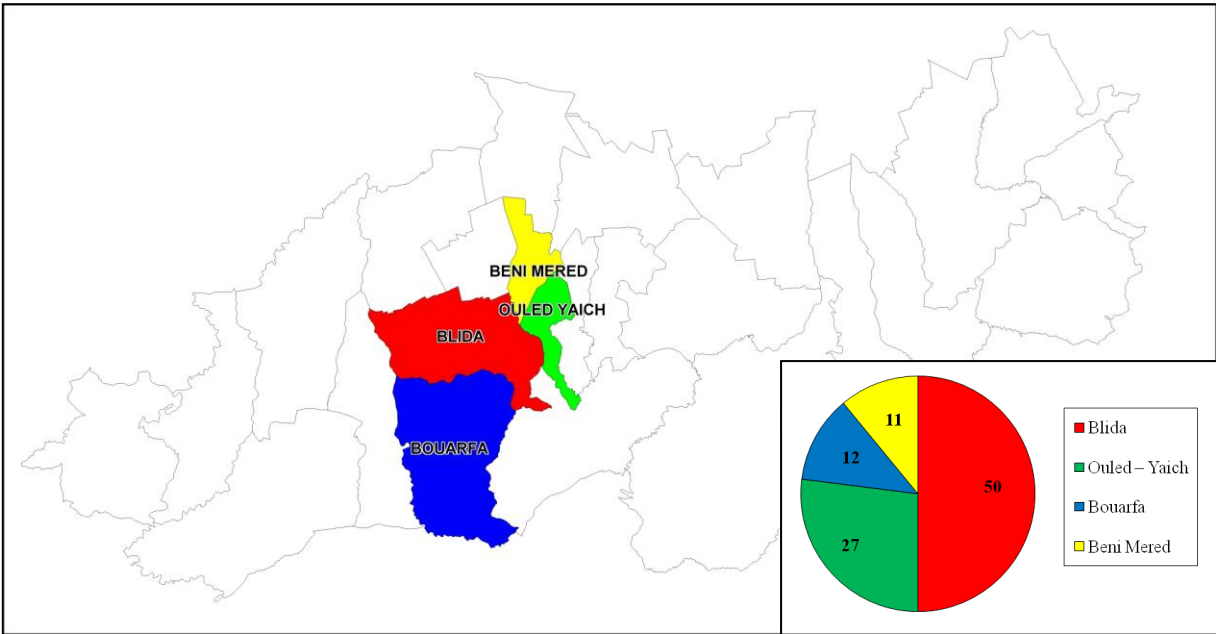


Figure 4. Social survey perimeter (Great Blida) CGS (2013)

**SOCIAL SURVEY RESULTS**

Population of the Great Blida was asked on several parameters judged very important in major risks management especially earthquakes. Results of each parameter studied are shown below.

**NUMBER OF PEOPLE IN HOUSEHOLD**

Number of people in a household is higher from 1 to 15 in some case as shown in figure 5. The average of number of people in one household is 4 to 7.

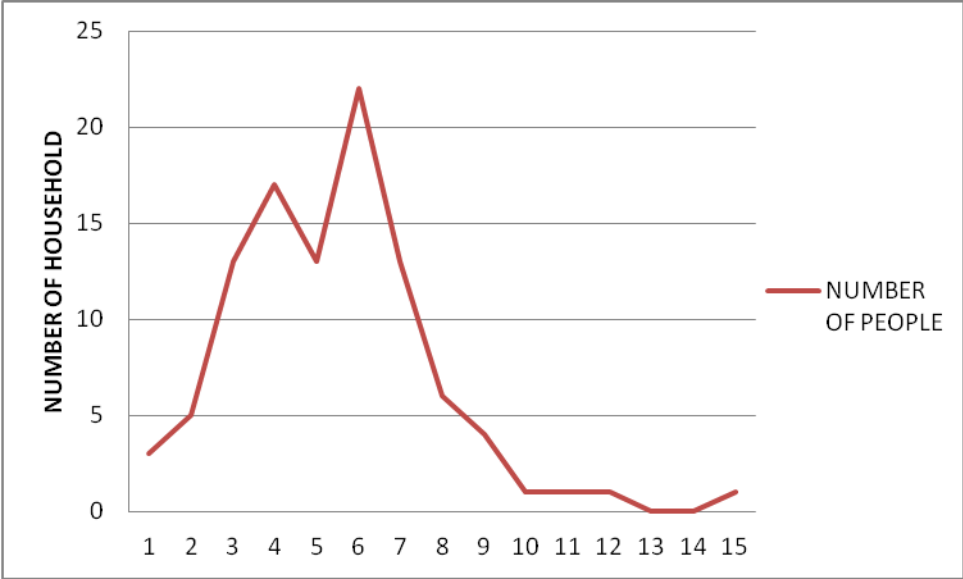


Figure 5. Number of people in household CGS (2013)

**MEAN OF TRANSPORT IN A HOUSEHOLD**

Means of transport most used in the study area of the big Blida are cars and buses. In the first position (46%) people use cars followed by public transports (42%), where taxis and other means of transport are in last position (see Fig.6).

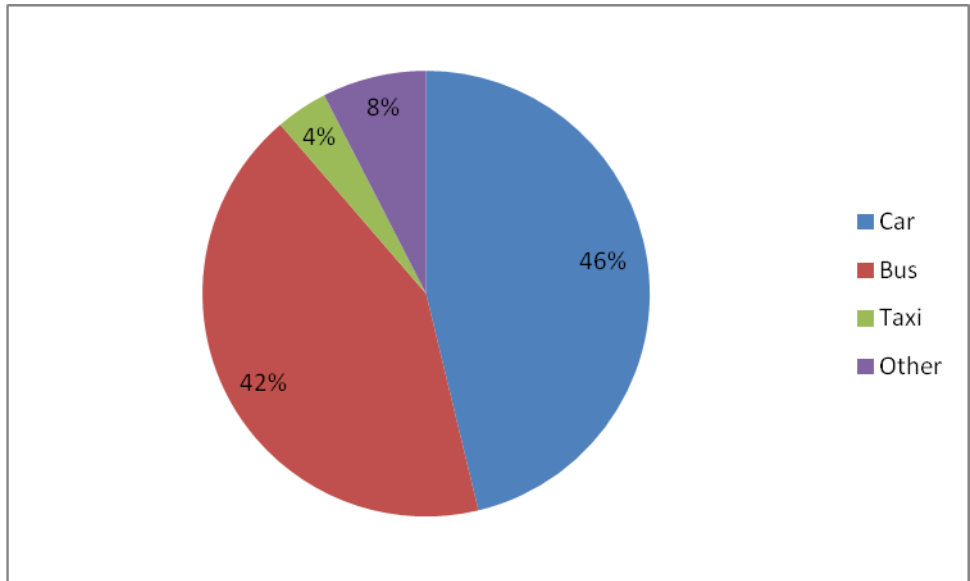


Figure 6. Household transport means CGS (2013)

**MEAN OF COMMUNICATION IN A HOUSEHOLD**

About 55% of the population interviewed use the mobile phone as a mean of communication while 38% use both mobile phone and landline. 7% of people do not use “no mean” to communicate.

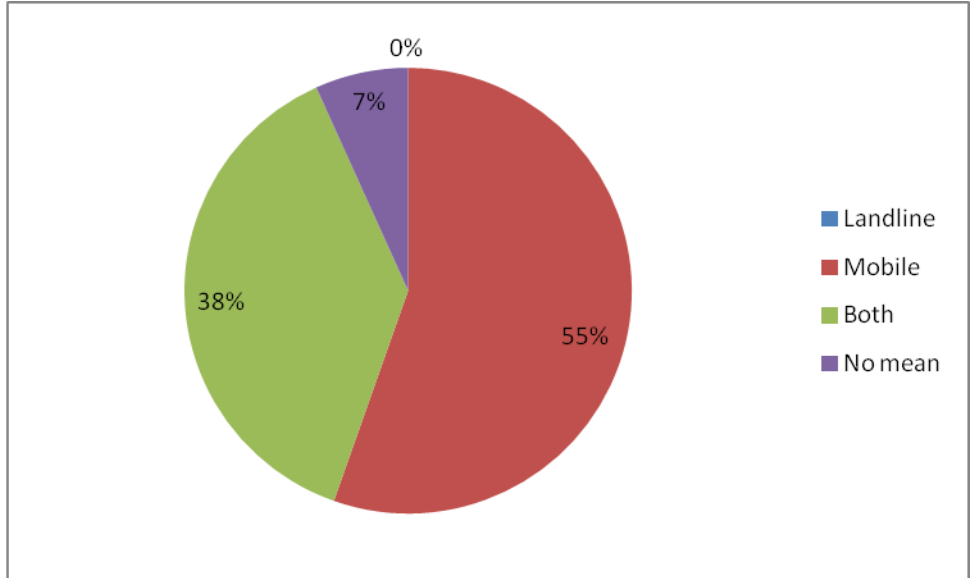


Figure 7. Type of phone used by household CGS (2013)

**STATE OF CONSTRUCTIONS AND THEIR COMPLIANCE TO THE SEISMIC CODE**

The state of houses and buildings according to head of household is judged middle at 47% and 45% good. No construction was judged excellent. We note also 60% of houses haven’t built according to seismic code (see Fig.8 and Fig.9).

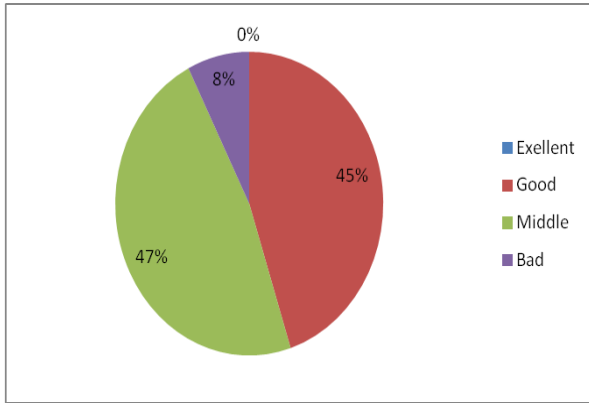


Figure 8. State of houses according to Head of household CGS (2013)

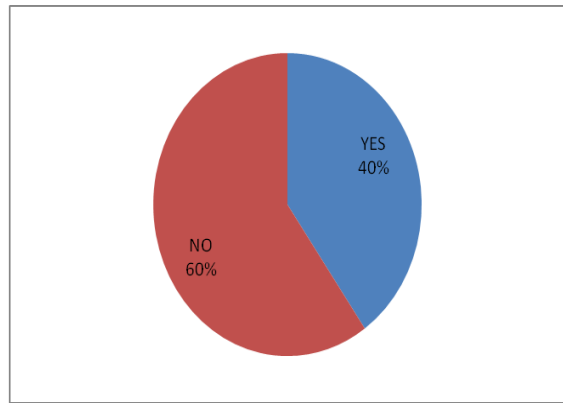


Figure 9. Application of seismic code CGS (2013)

### NATURE OF WATER SOURCES AND WATER TANKS

About 61% of household use public drinking water network (AEP), while 23% among people asked use at the same time public drinking water network and other resources like water tanks and drilling. We note that 11% use only water tanks as drinking water resources. The rest of people bring drinking water resources from their neighbors or drilling (see Fig.10). Concerning the water tanks, 37% of household head asked don't use them. The rest is divided between other types of water drinking as shown on figure 11.

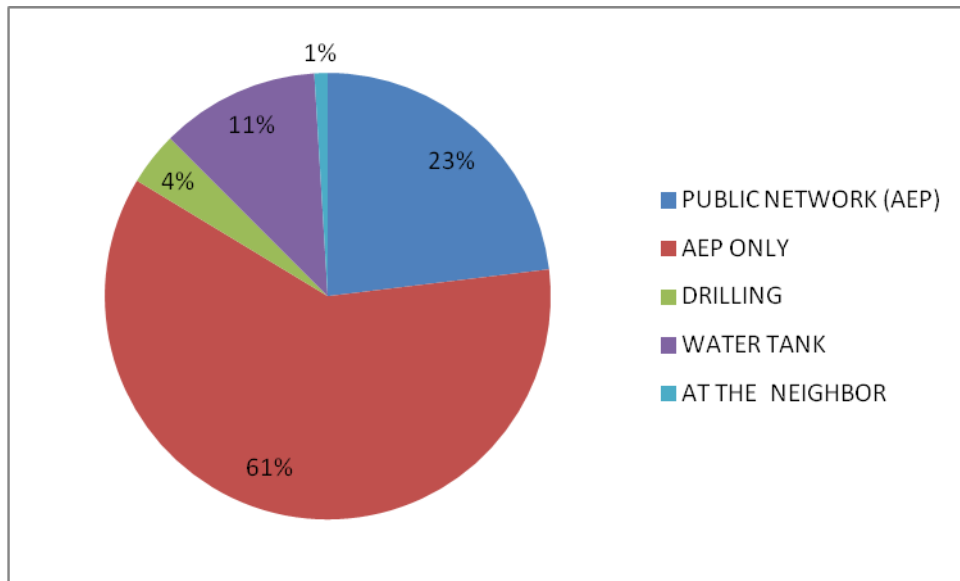


Figure 10. Water drinking repartition CGS (2013)

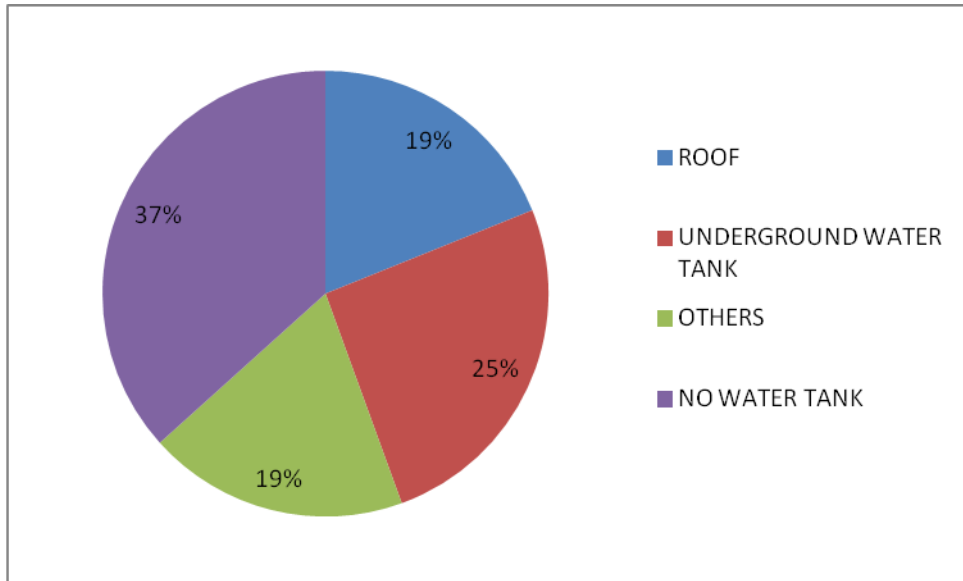


Figure 11. Water tank repartition used by household CGS (2013)

### CONNECTION TYPE TO DIFFERENT LIFE LINE NETWORK

Different types of life line (gas; electricity and sewage) are the most used by population of the big Blida (see Fig.12, Fig.13, and Fig.14).

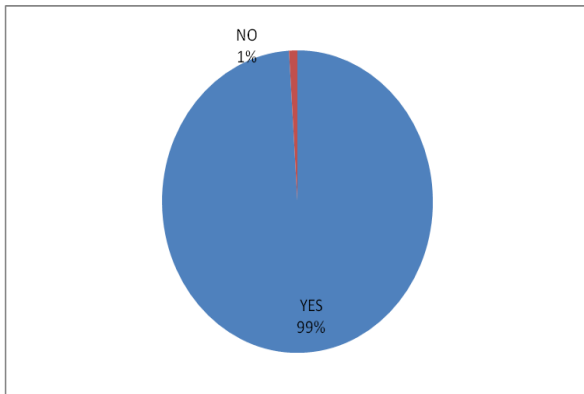


Figure 12. Connection to electric network CGS (2013)

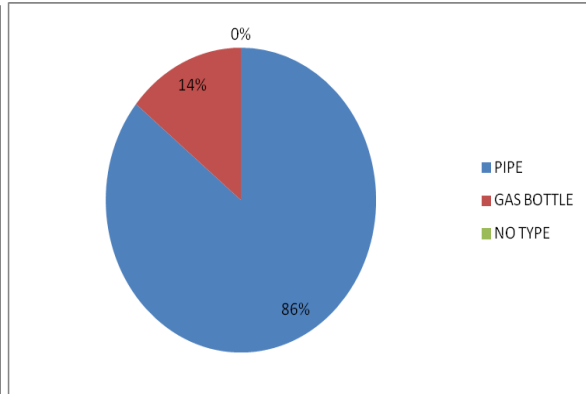


Figure 13. Connection to gas network CGS (2013)

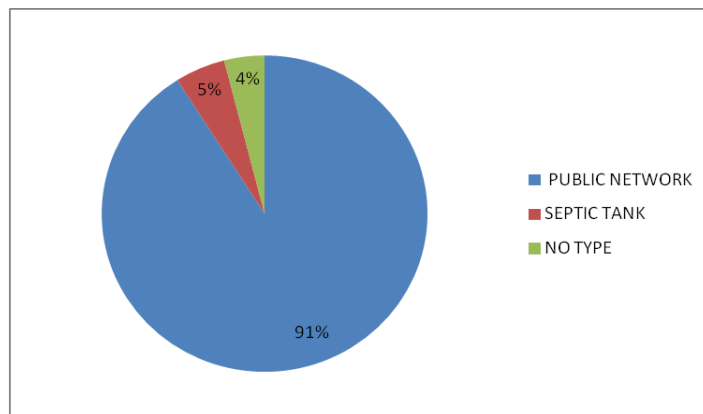


Figure 14. Connection to sewage network CGS (2013)



**APPREHENSION OF POPULATION ON RISKS AND THEIR REDUCTION**

Although most of household asked use different means of communication, it exist a lack on major risk information, where 52% among people asked answered by NO (see Fig.15). Also 66% of people don't be informed on seismic risk reduction (Fig.16).

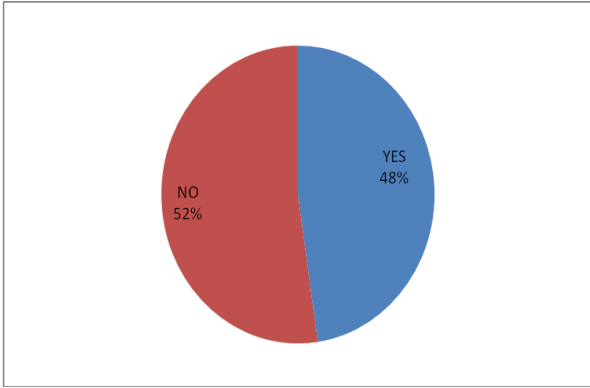


Figure 15. Information on major risks CGS (2013)

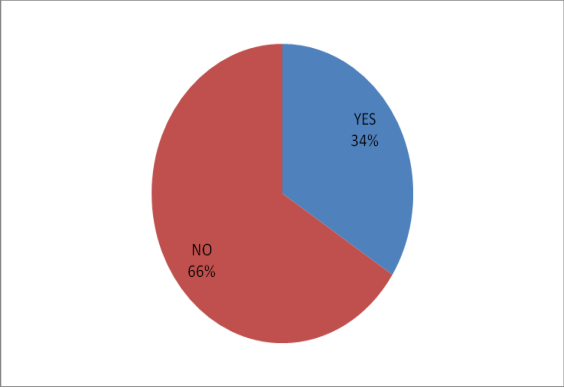


Figure 16. Information on seismic risk reduction CGS (2013)

**INSURANCE HOUSES AGAINST EARTHQUAKE**

Concerning the insurance against natural disasters, more than 80% of houses aren't insured; while 72% of head houses wish insure their houses in the future (Table.2).

Table 2. Insurance against earthquake CGS (2013)

Information	YES	NO
Insurance against earthquake	18%	82%
Insurance against earthquake in the future	72%	28%

**CONCLUSION**

In the present paper, a social study was elaborated in order to assess Algerian people knowledge on seismic risk. A social survey was led chosen as an example Blida city involving four towns (Blida, Ouled – Yaich, Bouarfa and Beni Mered). Population of Blida has not stopped increasing during the last 100 years, given today a number of people by household between 4 and 7. This average represents an important number for Blida city.

Asked on the state of their constructions; 47% among head of household answered by “middle”, where 60% didn't apply the seismic code to build their houses. It's clear that the state of buildings especially in the old city is decrepit and vulnerable to an earthquake; where most of people haven't insure their houses against earthquakes and wish do it in the future?

In a study of seismic risk it is necessary to assess the state of life lines as roads and highways; where most of people exploit roads network using cars and buses. Also most of Blida's population is connected to different life lines (electricity; gas; phone; drinking water and sewage). We note that half of the population does not be informed on major risks and the seismic risk reduction; where the authority should make an effort to educate people and establish a prevention culture on natural disasters.

## REFERENCES

- BENELHADJ-SAÏD Z (2010) Methods and tools for seismic vulnerability reduction in Blida, Ph.D. Thesis, Joseph Fourier University, Grenoble, France
- OYO, (2006), seismic micro-zoning study of Algiers, Japan International Cooperation Agency (JICA)
- National Earthquake Engineering Research Centre (CGS) (2013), Vulnerability and Seismic Risk Assessment Study of Blida City, Algeria
- Office Statistics (1966), General Census of Population and housing, Ministry of Housing and Urban Development, Algeria
- National Office Statistics (1977), General Census of Population and housing, Ministry of Housing and Urban Development, Algeria
- National Office Statistics (1987), General Census of Population and housing, Ministry of Housing and Urban Development, Algeria
- National Office Statistics (1998), General Census of Population and housing, Ministry of Housing and Urban Development, Algeria
- National Office Statistics (2008), General Census of Population and housing, Ministry of Housing and Urban Development, Algeria