
Earthquake risk assessment of Blida (Algeria) using GIS

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Abstract

The seismic vulnerability of an urban area is of a great deal for local authorities especially those facing earthquakes. So, it is important to have an efficient tool to assess the vulnerability of existing buildings. Blida is located in the north part of Algeria, an area prone to seismicity. It is classified zone III according to the Algerian Seismic Code (RPA99 version 2003). The town is among the oldest cities in the north. Build especially during the colonial period, Blida is characterized by vulnerable urban conditions with dense buildings and narrow roads. Using geographic information systems (GIS), the seismic vulnerability of Blida is assessed. First the vulnerability indexes of buildings are calculated, then making seismic scenarios. Damage rates are determined taking into account the seismotectonic aspect of the region and the vulnerability curves of structures commonly found in Blida. The rates of damage caused by the earthquake considered in the scenario highlighted the high vulnerability of Blida. These results can allow elaborating strategic countermeasure plans for the earthquake risk mitigation in the city.

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1. Introduction

Human, economic and ecological costs and losses associated with earthquake disasters are increasing exponentially and these cost and losses pose a systemic risk to society’s political and economic bases. Even utilizing the most advanced technology, it is almost impossible, at the present state of knowledge, to predict exactly when and where an earthquake will occur and how big it will be [1]. An earthquake suddenly hits an area where people are

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neither prepared nor alerted. Hence, the earthquake often causes huge damage to human society. Different strategies may be taken to mitigate earthquake disasters, based on appropriate risk assessment. Throughout the last thirty years scientific and technical action has been oriented towards the definition of new building-methods that tend to increase buildings’ seismic resistance [2,3]. However, the old structures vulnerability that represent the majority of these buildings, is also quite worrying and its assessment is a considerable task [4,5].

In Algeria, the last earthquakes show that the seismic activity is important. In fact, this activity is linked to faults that illustrate compression movements along the limit of Algeria-Europe’s plates and which mostly touches the north of the country where the biggest towns are situated [8]. The city of Blida as regards its location in a high seismic activity region (south of the Mitidja’s seismogene basin), its high population’s condensation, its generally very old buildings and its administrative importance in the region requires a particular attention concerning its protection against that natural phenomenon that highly threatens it and that may hit the town at any moment [9].

In this study, we have assessed an earthquake risk in the city of Blida determined as a convolution of seismic hazard (in terms of the surface peak ground acceleration, PGA) and the vulnerability (due to building construction fragility).

To do this, the different data of the study’s zone have been structured under a geographic information system (GIS) [8]. In our study we have used the vulnerability index method to calculate the vulnerability index of the study area constructions, to deal with this a software called the Vulnerability Index Program (VIP) has been developed (Bensaibi & al. 2011) [10]. The damages provoked by the earthquake taken into account in the scenarios have been calculated by a GIS established program.

2. The Region under Study

2.1. Location of the study area

The situation of Blida, its geographic and tectonic context highly requires a vulnerability analysis of its existing buildings. The zone under study includes the historical center considered as the oldest district where most of the buildings date from the colonial era [6]. This area is mostly composed of single or two storied buildings of which most are in an advanced state of decay. We may find, in the same surroundings, some recent buildings and some others dating from the Ottoman era, Fig. 1 and Fig. 2.

![Fig. 1. Location of study area](image1)

![Fig. 2. Town center (Didouche Mourad Street)](image2)

2.2. Sectors division

To make the inventory draw up of the study-zone structures easier, we have divided the study zone into identified sectors inside the soils occupation plan as base-sectors composing the town center. In our case, we have chosen a sectors division including 20 analysis units (district), each representing one area identified with a number. Fig. 3 shows the map of the study area with its districts.
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