

# **The seismic vulnerability of the adobe buildings in Jojutla de Juárez, México, during the Puebla Earthquake on September 19, 2017**

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## **ABSTRACT**

The 2017 Puebla Earthquake on 19 September struck a big part of México causing the loss of historic buildings in several states, being the state of Morelos one of the most damaged in the whole country. Jojutla de Juárez was the most affected locality of Morelos presenting important structural damages or total collapse in the built heritage, being the traditional earthen buildings, made of adobe bricks, the most vulnerable buildings to seismic efforts.

Some of the causes which contributed to the bad behaviour of the buildings were the improper handling of the constructive systems and materials, the insufficient resistance of the structures and the problems derivate by the foundations [1]. The adobe houses of Jojutla presented a mixture between the traditional building techniques and industrial materials like concrete, cement and steel; also with irregular heights and plant layouts and inadequate connections between the walls and foundations and roofs, resulting into a higher seismic vulnerability when the earthquake [2].

There was conducted a study to determine the earthquake resistance off the adobe houses in Jojutla, considering that in this locality the damages were highly superior than all the immediate region of the state. The granulometry and composition of the adobe samples of the buildings were determined as well as the natural aggregates like straw and its proportion. Also the compressive strength of the pieces was tested in order to obtain the indicative values which can explain the performance of the adobe buildings during the earthquake.

It was observed that the construction materials and therefore the adobe bricks of Jojutla had different compositions which caused an unpredictable behaviour during the earthquake of September 19<sup>th</sup>. The loss of the traditional earthen construction techniques has provoked a poor manufacture of the adobe houses, creating new scenarios where the buildings can't respond to the seismic intensities.

## **REFERENCES**

- [1] R. M. del Campo, G. H. Ochoa and F. Álvarez, *Estudio Geotécnico de la Colonia Emiliano Zapata, Jojutla, Morelos, tras los daños de los Sismos del 19 de septiembre de 2017*, ITESO, Universidad Jesuita de Guadalajara, Departamento de Hábitat y Desarrollo Urbano, 2018
- [2] L. E. Yamín, C. Phillips, J. C. Reyes, D. Ruiz, "Estudios de vulnerabilidad sísmica, rehabilitación y refuerzo de casas en adobe y tapia pisada", *Apuntes: Revista de estudios sobre patrimonio cultural*, Vol. **20** (2), pp. 286-303, (2007)
- [3] M. Sunkar, H. S. Aksoy, "Adobe Buildings Damaged during Kovancılar (Elazığ) Earthquake on March 8, 2010 and their Earthquake Resistances", *KSCE Journal of Civil Engineering*, Vol. 19 (4), pp. 943-951, (May 2015), doi:10.1007/s12205-012-0400-8