

## MODIFICATION OF RISK-UE INDEX USING MICROTREMORS FOR UNREINFORCED MASONRY BUILDINGS IN KERMANSHAH CITY

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**Keywords:** Microtremor, Nakamura, Risk-UE, Vulnerability, Unreinforced Masonry

The earthquake is one of the most important natural hazards that might have left annual social and economic consequences around the world. Side effects of the earthquake is one of the main concerns of metropolises in the country. Review of past earthquakes shows that most of the deaths are due to damaged buildings. So the vulnerability assessment of them in order to predict their performance in future earthquakes and disaster management programs is critical.

There are different qualitative and quantitative methods to evaluate the vulnerability of the buildings. Quantitative methods take more time and cost than the qualitative methods, so using the second one is more common for initial estimation and classification vulnerable buildings. In order to ensure the results of qualitative methods, they should be refined by the results of quantitative assessment.

One of the qualitative methods is vulnerability index named RISK-UE that is the result of extensive studies in Europe. As we know, in this method, an index considered for every type of buildings that is sum of various parameters such as number of stories, soft story, and so on. Also microtremors measurement is one of the most efficient techniques to determine the seismic vulnerability using Nakamura's relationship

$$K_{Tgj} = \frac{A_{sgj} - A_{sgj-1}}{4\pi^2 F^2 h_j} * 10^4 \quad (1) \text{ (Sato et al., 2008)}$$

Vulnerability research using RISK-UE method has been conducted for some type of structures in Iran and Kermanshah. To modify these indices, we select four unreinforced masonry buildings with one and two stories. After measuring microtremors in the buildings and adjustment their probability with fragility curves of Iranian structures, the RISK-UE index of each of them calculated.

$$\mu_d = 2.5 \left[ 1 + \tanh \left( \frac{I + 6.25V_I - 13.1}{2.3} \right) \right] \quad (2) \text{ (Lantada et al., 2010)}$$

The average index for these type of buildings is 0.8305, while values obtained from the RISK-UE project and research in Kermanshah are 0.704. Also Mostafaie et al. have obtained 0.8 for these structures that is approximately equal to obtained value in this article (Gatmiri et al., 2010). The index of qualitative method is only the result of structure observations and available data, so it's better to be modified by quantitative values. In addition to modification, microtremors measurement provides possibility to determine the weakness points of these buildings.

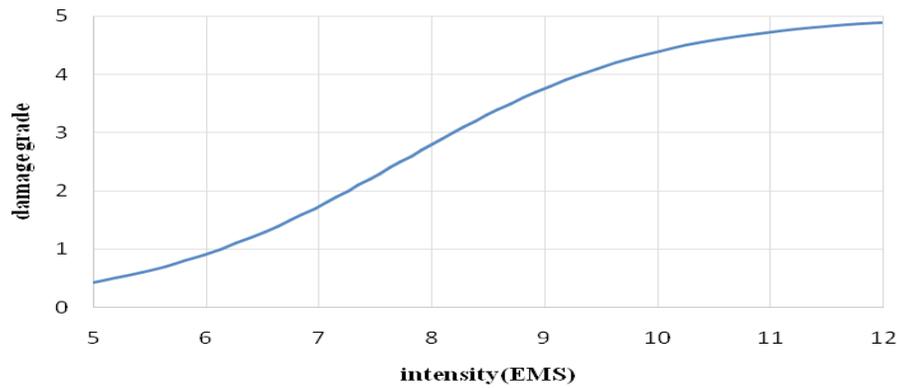


Figure 1. RISK-UE index for unreinforced masonry buildings

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