

# A risk-based grading system incorporating tolerance against short-term and long-term risk posed by natural hazards

**Authors:** Anže BABIČ<sup>1</sup>, Matjaž DOLŠEK<sup>2</sup>

<sup>1</sup> University of Ljubljana, anze.babic@fgg.uni-lj.si;

<sup>2</sup> University of Ljubljana, matjaz.dolsek@fgg.uni-lj.si

Forum topics	<input type="checkbox"/> Energy in 21st Century	<input type="checkbox"/> Cultural Heritage in Digital World
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**Abstract:** (250 to 500 words: for each heading use the bullet points or narrative - the submission including graphics should not exceed one page)

Problems - Issues / Challenges-Needs	Although several methods for the estimation of risk of facilities against natural hazards have been developed in recent decades, they are not yet harmonized and are rarely used in practice. One of the reasons for this is the public's unawareness of natural hazards risks, which decreases the role of rational risk-based decision making.
Solutions - Methods / Results - Findings	In the study, a recently developed tool for the evaluation and communication of risk posed by natural hazards is used to evaluate seismic risk. The tool is formulated as a grading system, which considers both the long-term and short-term risk tolerance. Grades AA and A indicate that the facility is exposed to the long-term tolerable risk, grades B and C correspond to the risk which is acceptable only for a certain period of time, whereas grade D implies that the risk is not tolerable even in the short-term. The grading process is performed in two steps. First, the initial grade is determined based on the so-called risk criterion. In this step, only grades AA, A, B and C can be obtained. If the initial grade is AA or A, the grading process is concluded. However, if the initial grade is B or C, the second step is performed, in which the initial grade is gradually reduced to grade D based on the so-called cumulative risk criterion. In this way, the stakeholders are given some time to design and implement appropriate risk mitigation strategies before obtaining the lowest grade.  The grading system is applied to three precast reinforced concrete buildings with the same structure, but different type of non-structural elements. The influence of non-structural elements on the grades, which are assigned to the buildings, is investigated. It is shown that, although the seismic risk of all three investigated buildings is long-term intolerable, the time of obtaining the lowest grade differs due to the type of non-structural elements.
Novelty - Value / Relevance to ...	The recently proposed grading system, which combines together the concepts of long-term and short-term risk tolerance, is applied to a case study, in which three precast reinforced concrete buildings are analysed. The sensitivity of the grades to the difference in risk, which results from the selection of non-structural elements, is explored. The grading system allows the decision maker to prioritize which building to retrofit first and to determine the retrofitting schedule.
Forum statement	In order to enhance the role of risk-based decision making, the concepts of long-term and short-term risk tolerance should be distinguished and combined into a common system for the evaluation and communication of risk.

**Keywords:** (up to 5 keywords)

Grading system; risk evaluation; risk communication; cumulative risk; precast buildings

**Graphics:** (please use the gray area below for *representative graphics* or *graphical summary*: select the gray area below and paste your graphics)

