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Vulnerability assessment in avalanche hazardous areas

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Until a few decades ago, damages and human losses related to the avalanche risk represented only a small part of the destructive effects produced each year by natural events. Nowadays, on the contrary, the situation has considerably changed due to growing of the built-up areas and human presence in the mountain environment: this fact increases the current avalanche risk and puts snow avalanches and hydro-geological risks (floods, landslides, rock falls, etc...) at the same importance level. To mitigate the effects, Authorities provide both specific policies for urban development and mountain land use and simple but reliable methodologies to define the avalanche risk.
As is well known, risk can be defined as the product of three factors: the environmental danger P (probability that a given phenomenon with its catastrophic intensity occurs in a specific area and time), the vulnerability V (degree of loss of one or more elements by a natural phenomenon of a known magnitude) and the exposure E (measure of the exposed value for each vulnerable element).
A novel approach for the evaluation of the "Vulnerability factor" of a new or existing building under avalanche hazard by considering its structural (materials, strength and robustness, etc...) and architectural (shape, exposure, etc...) peculiarities is presented.
A real avalanche event occurred in December, 2008 in Aosta Valley, which caused the total collapse of a building is taken as an example for tesing the effectiveness of the proposed risk assessment. By means of photographical analysis on undamaged parts, local surveys and debris arrangement, the impact pressure and the collapse dynamics are back-analyzed. The results are commented and comparisons between the damages and Vulnerability factor are made.