

RISK ASSESSMENT OF THE LOSSES ON R/C BUILDINGS IN SEISMIC AREAS

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The paper presents a simplified procedure for the risk assessment of the consequences of a seismic attack on a r/c building. The procedure involves a process of knowledge acquisition and definition.

First of all the seismic hazard of the site is defined using the hazard defined in the context of national zoning or through specific studies on the site. The vulnerability of the structure is evaluated according to a multi-scenario view: the structure capacity is calculated with reference to various damage scenarios corresponding to which the consequences assessment is done according to a procedure leading to the evaluation of the risk.

The characterization of damage scenarios is based on the extent of structural collapses. The conventional “collapse” condition of a structural element does not match a situation of real collapse of the element itself. Damage associated to the “collapse” of a single element has consequences affecting only people in the immediate vicinity. Only when a group of aggregated elements (connected beams and columns) collapses, a partial collapse of building portions can occur producing serious consequences on the occupants.

The first considered scenario is the “Life Safety” limit state. This scenario matches the performance conditions of this limit state defined by the code for r/c structures, that is the “collapse” of the first structural element. This scenario is the one for which the vulnerability analysis is usually performed leading to the evaluation of the vulnerability index of the building. This condition corresponds to a very localized damage or “limited/local damage” with consequences of little importance on the occupants.

The second considered damage scenario is called “Extensive Damage” limit state. The scenario conventionally corresponds to the collapse of a significant percentage of structural elements. The “Extensive Damage” scenario is characterized by significant damage. There can be partial collapses of the building with a major effect on the occupants.

The third considered damage scenario is called “Extreme (or Real) Collapse” limit state. It corresponds to the collapse of a large portion of the construction and it can be assumed to correspond to the real collapse of the construction. This scenario represents an extreme performance condition of the structure subjected to the earthquake, that is a condition characterized by extensive collapse of the building with serious consequences on the occupants.

No damage scenario with consequences more severe than those associated with the maximum design earthquake at the site is considered. In practice the risk of consequences associated with earthquakes of intensity greater than the Maximum Design Earthquake expected at the site is not considered.

For the analyzed building the risk of expected losses is computed. Referring to the occupants, seriously injured and casualties are considered as expected losses. The quantification of risk is based on the evaluation of a damage indicator that

takes into account the collapse extension of structural and non-structural elements. Finally, a risk index expressed in terms of annual probability of expected losses is determined.

