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Towards a practical guide in nonstructural risk reduction: A tool for the KnowRISK countries

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Nonstructural buildings damages are often considered second order priority issues when modelling an earthquake scenario. While this is reasonable in major earthquakes, where structural damages mask nonstructural failures, it is not such when dealing with moderate earthquakes where, often, the nonstructural damages exceeds losses from structural damages. Nonstructural damages may in fact cause a reduction in the performance of the affected building, which becomes critical in facilities of social relevance like hospitals, schools or fire stations. Moreover, the failure of nonstructural building components can become a safety hazard or can hamper the safe movement of occupants evacuating or of rescue workers entering buildings [Filiatrault, 2016].

Thus, it is critical to raise in the citizens the awareness of potential nonstructural risks, the costly consequences of nonstructural failures, and the opportunities that exist to limit future losses.

The definition of nonstructural components include all of those components that are not part of the structural system; that is, all of the architectural, mechanical, electrical, and plumbing systems, as well as furniture, fixtures, equipment, and contents. Windows, partitions, granite veneer, piping, ceilings, air conditioning ducts and equipment, elevators, computer and hospital equipment, file cabinets, and retail merchandise are all examples of nonstructural components that are vulnerable to earthquake damage [FEMA E-74, 2012]. Most of these components can be easily secured with little money investment and a limited intervention of professionals.

However, in comparison to structural elements and systems, there is relatively limited information on the seismic design of non-structural elements and it is sometime difficult for the public to understand what are the sources of nonstructural earthquake damage and, as a consequence, to act to reduce the potential risks in simple terms.

The action E1 of the KnowRisk project aims at compiling a guide on how to reduce risks from non-structural components failure to be both handed as a printed version and made available on the internet.

The guide shares a few characteristics with those already available for other countries, like the (low) level of expertise of the readers and the facility of the suggested actions to fix potential hazards. Nevertheless it differs in that it is specifically designed on the results of others actions within the project (namely C1: review of non structural damage from past earthquake. C2: Identification of the most vulnerable non-structural components in the pilot study areas. C4: Portfolio: procedures for minimizing the risk of non-structural damages), it takes into account some peculiarities of the participating countries as derived from the inventories provided by task D (Approaching target communities) and, dealing with in-door vulnerability, it aims at mainly inform homeowners. In fact other actions of task E (Tools and strategies of risk communication and learning) take care of the community level (E2, E4, E5) and the schools (E3, E5).

The guide is designed as a handy, multilingual leaflet; great care is devoted to the impact of communication. Too often the messages from the scientific institutions are disregarded because the language is too technical or the communication style is not enough attractive and appealing. In order to improve the impact and the readability of the guide it will be made extensively use of graphics and cartoons. Pictograms proved to engage and be easily understood even by people that does not heed or particularly care about an issue.

The content of the guide is under definition because it finally depends on the availability of the results of the tasks above mentioned, but the skeleton is already defined. In fact the guide must be compiled and distributed soon in order to possibly check its efficacy in the E5 (Ex post survey on risk communication) action.

Each page of the leaflet deals with a different room of the house, the garden and the space outside the house. For each of these environments the weak points of the furniture, equipment or contents will be marked together with a possible solution to avoid damages.

It must be remarked that the safety suggestions must have a different power of education, and therefore of conviction, depending on both the seismic hazard of the area where they are applied and the time spent in

any environment. As an example, the bed room is probably the place where people spend most of their time and it is especially the one where they are more helpless. Actions for risk reduction must be carried out considering that none, or very few, protective actions can be done during the night or in the dark. Moreover, these are the rooms where often students spend most of their time studying or playing.
In bed rooms, potential hazards come by the presence of bookcase units used to divide a space or to create an additional room, shelves above the beds, glass lamps on the night tables, computers or TV on the desk, to cite only a few. These appliances may be easily fixed using Velcro strips, in case of a laptop or a lamp, and damages may be avoided by moving the tower case of a PC on the floor and fixing the monitor. Glass lamps can be substituted with plastic lamps. Bookshelves can be anchored to the wall, and to create a divider a curtain can be used instead of a bookshelf. Generally speaking, drawers are safer than shelves in that, if the dresser falls, the drawer may avoid the content to get out. However the best safety is reached when the dresser is anchored and the drawers are locked (with a key, for example) or using clamps. Of course showing these weak points may be of help also to people that are furnishing rooms by avoiding, if possible, potential failures when designing their space.

References

FEMA E-74 / December 2012. *Reducing the Risks of Nonstructural Earthquake Damage - A Practical Guide*
Filiatrault A., (2016). *Seismic design and analysis of nonstructural components*. http://www.sponse.eu/wp-content/uploads/2016/02/SDNBC-Spring-2016.pdf