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Vulnerability of housing buildings in Bucharest, Romania

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The author participates to the World Housing Encyclopedia project (www.world-housing.net), an internet based database of housing buildings in earthquake prone areas of the world. This is a voluntary project run by the Earthquake Engineering Research Institute, Oakland, California and the International Association of Earthquake Engineering, financial means being available only for the website where the information is shared. For broader dissemination in 2004 a summary publication of the reports to date was published. The database can be querried for various parameters and browsed after geographic distribution. Participation is open to any housing experts. Between 2003 and 2006 the author was also member of the editorial board. The author contributed numerous reports about building types in Romania, and each one about building types in Germany and Switzerland.
This presentation will be about the contributed reports on building types in Romania. To the Encyclopedia eight reports on building types from Bucharest were contributed, while in further research of the author one more was similarly described regarding the vulnerability and the seismic retrofit. The selection of these types was done considering the historic development of the built substance in Bucharest from 1850 on, time from which a representative amount of housing buildings which can be classified in typologies can be found in Bucharest. While the structural types are not necessarily characteristic for the style, since the style has other time limits, often appearing before the type became common and then remaining being practiced also after another style gained ground, a historic succession can be seen also in this case. The nine types considered can be grouped in seven time categories:
- the time 1850-1880, for a vernacular housing type with masonry load bearing walls and timber floors,
- the time 1880-1920, for the type of two storey or multi-storey house with masonry walls and timber floors (in which stylistically the “national style” flourished),
- the time 1920-1940 for the type with reinforced concrete skeleton for gravitational loads only (in which the “interwar style” or Romanian Modernism flourished),
- the time immediately after 1940 (when a strong earthquake struck Bucharest), somehow 1940-1947, when the former structural type was continued, but with some improvements, for which a type with reinforced concrete diagonals was considered,
- the time 1947-1977, before the strong earthquake from 1977, when cast-in-situ reinforced concrete structural wall buildings were spread. Two types are considered, one which displayed low earthquake vulnerability and one which displayed high earthquake vulnerability,
- the time 1977-1989, after the strong earthquake from 1977 and before the fall on the communist regime, when taking as a reason the strong earthquake the regime started to implement another type of buildings, which structurally often were still reinforced concrete structural wall type, but prefabricated,
- the time after 1989, when for more flexibility moment resisting frame was built, and also some of the unfinished moment resisting frame buildings were completed.
To have such a complete description of all the building type in a country is not common for the World Housing Encyclopedia, and having them for Romania was due to a particular effort of the author. At the same time the database allows finding similar types in other parts of the world.
Broadly speaking, each report included two sections, the first one more extended, on the vulnerability of buildings and the second on the seismic retrofit. The reports contain completed check lists, descriptions of the structural system, photographs and drawings.
The accent in this presentation will be on the identification of seismic deficiencies and earthquake resilient features, and the connected typical damages, which all describe the vulnerability.