

SEISMIC RISK PERCEPTION VS. SEISMIC RISK REDUCTION. RESULTS OF A JICA PROJECT IN ROMANIA

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ABSTRACT :

The paper evaluates the patterns, level and consequences of seismic risk perception in conjunction with a Project on Seismic Risk Reduction, financed by JICA and Romanian Government (2002-2008), in the framework of NCSRR. The intermediate depth Vrancea earthquakes affect over 50% of Romania, at each large event, while crustal (shallow) earthquakes may affect smaller areas. A strategy of earthquake risk mitigation, including public education, has been developed since 1990. Government Ordinance The Law O.G. no. 20 of 1994, provides public funding for risk evaluation, design and strengthening works of residential buildings, with pay-back in 25 years reimbursement term, free of interest. To increase the risk mitigation rate, the specifics of seismic risk and its communication, a social and personal perception, are all conditional upon the attitudes of subjects at risk. In order to reduce risks, the legal and technical measures must be associated with knowledge dissemination and risk awareness building, as follows:

- Short-term activities: for apartment owners in buildings in first class of risk and public danger, by way of NCSRR seminars and direct dialog / partnership for immediate strengthening;
- Mid-term activities: knowledge on protection rules for citizens, by way of leaflets and posters and positive media coverage;
- Long-term activities: for school students, by way of booklets and posters for primary, general and high-schools, jointly made by INCERC and JICA Experts in 2005-2006, as well as seminars and school curricula. Knowledge, paper models and seismic simulators from Japan proved to be useful.

KEYWORDS: *seismic risk perception, risk reduction, knowledge dissemination, preparedness*

1. THE SPECIFICS OF SEISMIC HAZARD, EXPOSURE, VULNERABILITY AND RISK IN ROMANIA

The seismic hazard of Romania is dominated by the Vrancea intermediate depth earthquakes in south-east of the country, that affect with high intensities ca. 50% of the territory at each strong event. Other crustal (shallow) earthquakes can generate locally high intensities in west and north. The exposure of elements to the highest risk is large, since the seismic areas cover 65% of the territory, including almost 75% of population (over 60% in strong seismic zones). Urban localities expose ca. 35% of the total population or 66% of the whole urban population to the seismic hazard of the Vrancea zone. In Romania, the earthquake design began in 1942, following the November 10, 1940 Vrancea earthquake, with some provisional rules between 1950 and 1963, and a first compulsory Earthquake Code in 1963. The tall buildings erected before 1940 and some structural types built between 1950 and 1977 proved to be highly vulnerable, and the Vrancea earthquake of March 4, 1977 was a national disaster, with over USD 2 Bln. in USD losses, numerous collapses and heavy casualties.

The 1940, 1977, 1986 and 1990 earthquakes pointed-out the necessity for the pre-code high-rise buildings (before 1940) to be strengthened, as a critical point in advancement of risk reduction programmes, first of all in down-town of Bucharest. (Georgescu et al, 1999, Georgescu, 2000).

Between the Vrancea Romanian earthquakes of 1940 and 1977 most of people did not think of a disaster escalade. The March 4, 1977 Vrancea earthquake was a great mental, scientific and socio-economic shock that lead to a major code change in 1978 and 1981. The institutional compulsory enforcement of earthquake code was the single way of risk reduction until 1977, while interventions upon existing and damaged buildings were accepted in 1977 only as local repairs and in limited number by the regime in force at that time.

A strategy of earthquake risk mitigation has gradually been developed in Romania by the Ministry of Development, Public Works and Housing - MDPWH, INCERC and other institutions after 1990 (Georgescu et al, 1999, Georgescu, 2000). The involvement of owners became possible only after 1990's real estate property restitution. There is a Law / Government Ordinance 20/1994 regarding provides for the mitigation of the seismic risk mitigation of existing buildings through a system of subsidies, with compulsory state-sponsored assessment of resistance and long-term loans for strengthening works, with some free-cost works for low-income families. Various administrative approaches have been used in order to increase the risk awareness, including the visible labelling of some 120 buildings of first class of risk in Bucharest with a "Red Dot" warning, in 1997. The public reaction was very negative, backed by the media, and this decision was dropped.

In 2007 the labelling was put again in force by under ministry and local authority order and in February 2008 in Bucharest were labelled 383 residential buildings were labelled. In the period 2005-2007, 10 high-rise buildings were strengthened. For 2008, the program included 57 buildings, out of which 7 had contracted works, 9 were in subject to bidding following design, 20 were in subject to bidding, having started design, 21 were under design bidding.

The design and strengthening works are rather difficult, time consuming and require a partial or total evacuation, since internal and external concrete jacketing of members was has been the main affordable solution to date. Paradoxically, even if the large majority of citizens recognize the risk, a number of relatively few owners in a building were able to block the strengthening, due to the lack of consensus and reluctance to individually apply for subsidized loans on long terms. This situation shows that risk communication is still a problem, because the speed of strengthening of buildings is so reduced, and other tools are necessary. A JICA Project represented an opportunity in this respect.

2. SEISMIC RISK PERCEPTION VS. SEISMIC RISK REDUCTION

All experts in social and psychological aspects of risk agree that risk perception and communication is decisive for risk reduction measures taken by a person and/or a group. Earthquake risk has some patterns that make it rather different of from the risk to of other extreme actions. It is difficult to say how much of the progress made in seismic risk reduction was due to a better perception among population. In the few local studies that claim to be hazard / risk perception surveys and psychometric evaluations, the issues that may help building a better perception are very reduced to date, as the investigated aspects were too general, social samples were not adequate, statistical processing is misleading and some terms wrongly used.

The risk perception assessment is in an incipient stage, at least in Romania. Some difficulties arise from the specific terminology, since hazard was has often been used instead of risk and vice versa. Little was transferred in international literature about behaviour in past earthquakes, seismic risk perception and/or earthquake education in Romania, and the cross-professional connections are weak (Georgescu, 1991, Vataman and Georgescu, 1992, Georgescu, Tojo et al, 2004, Georgescu et al 2006, Sjöberg L., et al, in Renn and Rohrmann, 2007).

Some questionnaire surveys have shown that the experience of past earthquakes, from 1940 to 1990, is reflected in the behaviour of citizens who lived through such events, since they are being aware of hazards and risks and for instance do not run out in the stairways at the onset of waves. However, according to the age, a ratio of 60% of population does not have a personal experience in earthquake. Cheval (2003), published a “hazard perception” survey made in 2001-2002, finding that the most frightening hazard is earthquake, as 50% of subjects live in Bucharest and 40% witnessed the March 4, 1977 earthquake.

In this framework, we want to review the best international and local research findings in order to emphasize the contribution of different factors in building a risk perception in Romania.

Sandman, 1994, a, b, introduced the equation: Risk = Hazard (technical assessment) + Outrage (emotional assessment), with a set of 12 principles or emotional variables that influence the outrage. Georgescu (2005) made an attempt to look into the nature of seismic risk perception in Romania, using local seismic setting and engineering arguments, starting from Sandman's approach. The present situation in Romania, and especially in Bucharest is a crisis situation that may become an emergency situation in case should a strong earthquake strike. At the first glance, some specific issues show a rather strange social behaviour of individuals / owners in Romania:

- The owners show apathy, they do not react to having their property at risk, labelled as “public danger”; it seems that the Sandman's statement about the apathy as a natural state of mankind is entirely true for Romania;
- The real estate — the buyers' apathy is reflected in the market price for such apartments, still high prices;
- The media vehiculates has raised the false wrong question, i.e. “when will the Big One will strike” and not “How buildings at risk will survive” at that quake. Some kind of “outrage” is present, but not as a vehicle of decision to solve the risks.

Some of the Sandman's risk categories can be evaluated in Romania as follows (Georgescu, 2005):

- Ownership is voluntary, and it includes the risk, but some people do not want to change home in old age; seismic risk is known, it looks natural, it has become familiar, as nothing wrong has happened since for 30 years, and some complacency has resulted after so many years since the last disaster.
- In Bucharest all people remember the 1977 disaster, but the risk of having problems caused by bank troubles with a loans is more dreadful; the seismic risk is anticipated with alarm in speeches, is both chronic and catastrophic, but that means for some people that there is not any solution.
- The vulnerability is known, strengthening looks complicated, but everyone may find excuses to let postpone taking a decision for tomorrow.
- The situation is unfair, but it seems to be have been caused by others, many years ago, damage was caused by the earthquake. During the communist regime the ownership and risk decision rested with the State, which is the one that is likely to be blamed.
- Apparently, few people consider the morality of exposure and the fate of family or of their inheritors in case of collapse.

Somehow alongon the same line, Slovic (1999) considered that “Risk is the socially constructed sum of hazard and public perceptions”, trust is a critical factor in risk assessment, and the risk has a sociopolitical nature and urges more involvement of citizens in risk management”. In the process of risk assessment and management Slovic and Weber (2002), include politics as a conditional factor, with risk perception as a first factor, together with values, decisions, power, trust and conflict / controversy. Indeed, in Romania seismic risk reduction is included in Government strategy and budget.

Fischhoff (1995) suggested avoiding the danger of non-communication from experts to the public, to provide a better interpretation of data and compare the impending risk with other known risks, explain cost and benefits, respect public's opinions and emotions, provide a partnership for human relations. In Fischhoff's terms, the risk perception management was not the most appropriate one in Romania, as we did not have in the 1990's experts in the field of seismic risk communication. It is well known that the risks that were assessed by experts are not

necessarily the same as those that are perceived by individuals. In Romania, mistrust occurred when experts did not discuss or did not contact owners to an appropriate extent during the design stage of strengthening. This remark is consistent with the opinion that risk management should involve more citizens (Slovic, 1999) and be performed with the population and not for the population (Quarantelli, 2002).

Sjöberg (1999), has found some correlation between perceived risk and knowledge, warning that the difference between experts and public does not necessarily rely on a high level of knowledge. The experts themselves play a different role and their typology seems to be conflicting, as:

- Protectors – who insist on warning people about risk and the need of for more protection, and here earthquake is a recognized field;
- Promoters – who tend to moderate the threats below acceptable limits, especially when related to new technologies.

In this respect, using in Romania according to the typology given suggested by Sjöberg, we can say that civil engineers (NCSRR and JICA Experts, INCERC researchers) involved in the dissemination of knowledge on risk reduction acted as “protectors” in a long-term process.

Tatsuki (2003) described a multi-component working model for the prediction of risk aversive behavior (measured by the degree of personal level earthquake disaster mitigation and preparedness practices), including risk perception (as a root of attitude), measured by subjective probability and consequence estimates of major disasters including earthquakes. In principle, it may be adequate in Romania.

Renn (2004) described the so called risk management “ladder” or “escalator”, with four steps/regimes, from routine risks (simple) to complex risks, uncertain or ambiguous risks, increasingly detailed approaches. On the Renn’s ladder, the risk reduction by strengthening in Romania was in our opinion treated as for a the first step, because the risk evaluation was decided only by technicians, by public agencies, while owners were just asked to agree at the end of assessment. Since the actual willingness of owners to proceed to contracting for strengthening is so reduced, we may need also to use Renn’s ladder steps 2 to 4. This would imply more risk balancing and tradeoff analysis, with a larger input from social groups (apartment owners, NGO, social scientists etc).

Concerning the role of media in risk debates in Romania, the information age patterns have a strong influence. It proved to be difficult to explain things in simple terms and to keep information along a sound line, more frequent being the catastrophic view and the need of spectacular news. As significant predictors for media interest, there are number of casualties and level of damage. The media take the risk data from scientists or authorities and rephrase them towards the spectacular and dramatic, often without care about technical terms used (Wahlberg and Sjöberg, 2000).

In Romania we have remarked a strong tendency for a voluntarily biased data in press coverage, up to be fully incorrect, but highly sensational, as for instance about Bucharest earthquake scenarios results, wrongly citing some figures about possible casualties, just to arouse interest. The media staff is frequently changed and does not have a technical background for reporting risk issues. Sometimes, the aggressive approach is used under the excuse of defending the public interest. A quite permanent “intoxication”, using a mix of statistical and false predictions / rumors on the next Vrancea “Big One” is released in Romanian media. On the other hand, quite the same newspapers, report the press communiqués about strengthening of by the officials in charge. What is specific is the catastrophic view without pointing out the feasible solution for the benefit of owners, i.e. accepting the public subsidy and starting the strengthening works.

Amazingly, false myths and even some contradictory data come from professionals with background in other fields, attracted by earthquake risk issues. There is a mixture of terms and false cause-effect relationships, misunderstanding of micro-zonation meaning etc. They even wrote that “The term “risk” refers to the possible hazard...”, “vulnerability to seismic risk”, when, to be correct, the risk is the result of convolution of hazard, vulnerability and exposure; there is a wrong understanding of ground predominant periods or of return periods

meaning and values etc. Authors are aware that the participants to in their surveys are not representative of the Bucharest population but publish such data, while recognize weak correlations between variables and the fact that “little can be asserted in terms of reliable and quantifiable results...” (Armas et al, 2008).

3. THE JICA PROJECT SURVEY ON THE SEISMIC RISK PERCEPTION OF BUCHAREST OWNERS IN VULNERABLE BUILDINGS

The Technical Cooperation Project on the Reduction of Seismic Risk for Buildings and Structures was agreed for 2002-2008 between MDPWH and the Japanese International Cooperation Agency - JICA, with the National Center for Seismic Risk Reduction – NCSRR as implementing agency, INCERC and UTCB as partners. The main activities in this respect were as follows:

- Study and issuance of new technologies for retrofitting buildings, new codes for seismic resistant design, post-seismic building inspection, soil testing, seismic instrumentation.
- Transfer of state-of-the-art knowledge on earthquake protection to specialists;
- Education of the population and knowledge dissemination for preventing risks;
- Development of technical knowledge by training, studies and documentation, seminars, courses and lectures in Romania and Japan, promotion of international cooperation and publications.

A questionnaire survey was made in 2003 by NCSRR and JICA experts, with the purpose to evaluate the knowledge of residents who live in vulnerable buildings. The questionnaires have been distributed to some 340 apartment owners and to other 115 chairmen of owners associations in class I risk high-rise buildings in the central area of Bucharest. The return ratio was 44.8% (a number of 204 out of 455). The detailed results were presented elsewhere (Georgescu, Tojo et al, 2004). It must be mentioned that this sample was chosen especially, as they belong to a social category that was under pressure to proceed to strengthening following a decade of intensive public campaign on seismic risk reduction in Bucharest. This pattern may have advantages but also disadvantages. The questionnaire had 6 basic questions with multiple answer possibilities and a question on general data, as follows:

Question C 1. State of mind of apartment owners - residents - concerning knowledge about earthquake disasters : 89.2% to 98.5% have the experience or knowledge about Bucharest collapses, deaths etc.

Question C 2. Preparedness of apartment owners for earthquake disaster prevention: 51.47% to 69.60% are concerned and worried about predictions, threats to life, disasters and intend to be more careful to prevent earthquake disasters.

Question C 3. Knowledge and recognition of residents of the vulnerability and risk level of their buildings: 51.96 % to 61.76% know well and very well that there is a Seismic Evaluation Report of their building, this is ranked in a category of maximum collapse risk at earthquake and are interested to take measures, influencing also others. There are also other 20.59 % that know something about and want to know more, thus the ratio of concerned people is 82.35 %.

Question C 4. Response of residents to retrofitting work:

- a significant majority – 61.28 % consider that strengthening works will increase the safety of buildings;
- a significant majority – 63.24 % consider that a 51% ratio of owners votes is necessary for deciding upon strengthening.

Question C 5. Knowledge level of residents on laws in force and financial incentives concerning retrofitting program of buildings in class 1 of risk that presents a public danger. The answers are surprisingly positive (at least 69.60%), as the large majority declare to know the laws in force, OG 20/1994 system of seismic risk reduction, obligation of owners associations, incentives, system of long-term loans, exemption from monthly payments for low-income families. Concerning the involvement of owners association in citizen’s’ information system of risk reduction and incentives, 52.45 % were positive, but also 37.75 % consider its role insufficient.

Question C 6. Negative factors against retrofitting works. On this issue, it is significant that 26.47 % disagree with mortgaging, 43.63 % agree and totally agree that duration of works is too long, 72.55 % agree and totally

agree that urgent measures are necessary.

Question C 0. General data on age, gender, education background, profession, working/retired and income situation of apartment owners. The positive answers are very well correlated to the age and professions structure as well as with the experience of living in the area of major damage at the March 4, 1977 earthquake. The large percentage of higher education situation - a share of 69 % - and a good percentage of owners having at least high-school, may be correlated to a rather good understanding of risk and protection measures. The correlation between gender and C4 shows that men have more trust more in future safety measures, while women (possibly older housekeepers) declare some lack of knowledge. Men are much more in the favor of 51% vote rule, thus being more in the favor of an authoritarian rule!!! The age, even in case of retired people, has a positive influence on citizens' experience and attitude towards seismic risk reduction, but their reduced income explains the reluctance to apply for loans.

4. PUBLIC EARTHQUAKE EDUCATION FOR CITIZEN AND SCHOOL STUDENTS

Fostering and building risk perception has been a mid-term and long-term activity in Romania, since 1990's. Means of education from Japan were adapted to Romanian conditions, since earthquakes have other patterns, while structures vulnerability and citizen knowledge are different. Seminars with citizens involved mostly heads of owners associations from buildings that were in the first class of seismic risk.

The knowledge dissemination seminars for earthquake education in schools were provided under a partnership of MDPWH - INCERC with Ministry of Education, Research and Youth - MECT, Ministry of Administrative Reform and Interior - MIRA and NCSRR-JICA Experts, and later on with Red Cross of Romania and the Institute for Science of Education. In 2005-2006, INCERC prepared specific texts of small manuals - color booklets and associated color posters for schools, addressing 3 age categories. The daughter of a Japanese expert in Romania working with NCSRR – JICA Project, made some beautiful drawings. The knowledge is of gradual complexity, according to the age and learning capacity of students. These materials are posted on Web Sites of concerned ministries.

In all age groups, students are advised to prepare an emergency sack for earthquake situations, at home and/or at school, according to Japanese examples. The manuals indicate what a family plan contains and show children how to draw maps on their daily way to school and identification of hazards.

For classes 5 to 8, the booklet starts with knowledge about origin and patterns of earthquakes, specific scientific terms, scales of magnitude and intensity. More attention is given to active identification of hazards at home and in the neighborhood, to a family plan, while the rules of behaviour are more detailed. For high-school students, the basic content is enlarged; some photographs of 1977 Romanian earthquake damage and more technical explanations are included. Some seismic didactic simulators „Bururu” (oscillating house models) were purchased from Japan in 2006 from JICA Project budget and were used by NCSRR Japanese and Romanian Experts in seminars with citizens and students.

5. CONCLUSIONS

Since 1990's, in Romania, MDPWH has initiated and supported risk perception enhancement by drafting earthquake education and preparedness materials. But the progress of strengthening has proved to be a difficult task because of slow reaction to risk of citizens and difficulty of works. The NCSRR-JICA survey results denote that citizens are very concerned about their situation at risk, based on some consistent risk perception. We were able to understand a part of the process. On the other hand, even if citizens have a risk aversive behavior, the prediction of their future actions and decisions is strongly influenced by many social, economic and personal factors, highly depending on their personal risk perception and other goals within family.

The contradiction is between the remarkable knowledge about the seismic risk and the attitude of owners - postponement of strengthening. However, residents explained their reasons of reluctance and suggested many improvements to the legal framework, quite the same with as those promoted by MDPWH (Georgescu, Tojo et al., 2004).

Decrypting of the mental pattern of population that lived in a controlled regime before 1989 also represents a difficult task. Risk perception building is long-term process. Should we suspect a mental bifurcation contradiction in Romanian owners thinking? They answer rationally but then behave as if they wanted to remain at risk, still preserving an apparently convenient life...From 2003 to 2007 MDPWH promoted improvements under the Law OG 20/1994, as buildings that represent a first class of risk with criteria of public danger and require compulsory strengthening were to be subjected to urgent City Major Decision. This become a Court ruling against bad-will owners who obstruct strengthening works. Other legal penalties are addressed to employees and/or owners for delay of decisions, or deadlines of 2 years for design and 2 years for works. Would they obey much more when facing an administrative obligation, as the legal changes amendments put in force in 2008 will do? Since during the JICA Project there was not a change in any basic data, we renounced the idea of a second perception survey. It may become necessary in the future, as much as the works will go further to a due extent.

Since under O. G. 20 there are steps of decisions with a chain of communication to the owners, these must be treated with other tools than purely administrative ones. Formal legal aspects of bidding, contracting and surveying are a source of delays. A lot of time is spent by the associations of owners to reach a decision and again until all owners sign contracts. Some are afraid of apartment mortgaging, many are rather old, low-income, absentees or just do not want to be disturbed by evacuation and noisy works.

Some owners and even some lawyers and court judges are confused in their decisions concerning the balance between private property apartments inviolability and risk reduction needs in condominiums.

Mass-media showed a contradictory behaviour. There was a lot of criticism to authorities and sometimes to engineers for the slow pace of rehabilitation, but on the other hand they published numerous unreliable seismic predictions, that are misleading for citizens' behaviour. On the other hand, most television and radio companies were eager to invite experts from Japan, taking in to account the earthquake experience and the scientific prestige acquired; seminars and demonstrations with Japanese experts always attracted mass-media, proving that a change of behaviour is possible.

School students represent a specific audience target for earthquake education that was considered in JICA project. Public awareness for risk reduction must be kept alive. There is need of a further knowledge transfer about risk mitigation from specialists and authorities to the citizens and school students. The JICA - MDPWH Project of Seismic Risk Reduction in Romania is a very good example of international cooperation within the UNO-ISDR framework. IAEE Conferences, EU, EUR-OPA Major Hazards strategies, NATO Programs, World Bank Projects, EAEE Conferences etc. may enhance and help further developments in Romania.

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