CURRENT ISSUES IN SEISMIC RISK REDUCTION POLICY IN MONTENEGRO

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ABSTRACT

Seismic risk reduction policy is constituted through plans, rules, expertness, professional practices etc. acting to reduce human causalities, economy losses in case of future earthquake. Seismic risk reduction is a long-term oriented and continuous policy. The proclaimed principle "build back better" (*UNDRR, Sendai Framework for disaster risk reduction 20015-2030*) underlines the importance of learning through past experiences. Current issues in this risk governance are analysed from the point of its view of different constituting aspects: legislative, administrative, technical, economical, societal and political. State of governance in these spheres is influencing the overall success of seismic risk reduction/control policy. The major laws controlling the seismic protection in Montenegro are *Law on spatial planning and construction* (2018), set of European standards adopted by Institute for Standardization of Montenegro (ISME, 2015-2018) and *Law on Protection and Rescue* (2016). Administrative aspect of seismic risk managing in Montenegro is its' weakest point. Different sectors (e.g. construction, transport, spatial and urban planning etc.) have own missions in the task of controlling/reducing seismic risk in the state, but the level of coordination is insufficient. Additionally, there is a huge gap in capacities on different administrative levels – municipal vs. state. Trend of favouring risk preparedness measures over the preventive actions is highly present. Problems originating in technical aspects of seismic risk reduction policy are analysed from the point of view of the level of present risk specific knowledge, state of seismic hazard assessment, state of vulnerability classification, state of data availability and accessibility and the national state of seismic risk evaluation. Specific emphasize is on the presence of risk drivers e.g. in spatial and urban planning, illegal settlements, construction control. Mono-sectoral economic development, barely existing risk transfer policies are solely few examples seriously influencing consequences of a future earthquake in Montenegro. Although often neglected – societal circumstances such are risk perception and risk awareness, professional ethics, migrations, poverty and vulnerable groups are taking tool on present state of risk reduction. Finally,

political support to candidate and implement seismic risk reduction programs and policies should be clearly prioritized.
***Keywords*:** Risk reduction policy, Law on Spatial Planning and Construction, sectoral coordination, risk assessment, risk drivers, risk transfer

1. INTRODUCTION

Contemporary and historic data are revealing significant examples of losses caused by intensive earthquakes in Montenegro. In 1979, destructive earthquake of magnitude Mw 6,9 caused overall losses approximated to 4 times of national GDP (Pavićević, 2000). Earthquake caused damages to buildings, railway and roads, shipyards and ports, as well as historical towns situated along the Montenegrin coast. National economy, social and cultural settings of the affected region withstand lasting consequences.

Seismic risk reduction (RR) policy is constituted through plans, rules, expertness, professional practices etc. acting to reduce human causalities, economy losses in case of future earthquake. Being long-term oriented and continuous, seismic RR policy should reflect lessons from past experiences – as is proclaimed in the principle "build back better" (UNDRR, Sendai Framework for disaster risk reduction 20015-2030). It should integrate the different sectoral policies, different administrative levels. At the same time, RR policy ought to be public. Some of its aspects involves the particular knowledge and expertise – thus it is important to achieve coordination and understanding between the different stakeholders. Seismic risk should be managed in most economic manner and in synergy with risks' management caused by other natural and technological hazards - thus deliberately mitigating occurrence of cascading effects and systemic risk.

Seismic risk governance is executed through: creation of policies, planning process and realization of RR activities as schematically presented in the Figure 1. Overall government is conditioned by the existence of sufficient, accurate, available and accessible data. Its' success is directly linked to interoperability of disaster risk reduction data (Migliorini *et. al*, 2019).

This paper is the outcome of the recent analysis of seismic risk governance which the author carried out for the elaboration of Spatial Plan of Montenegro 2020-2040. Issues in seismic risk governance in Montenegro were analysed from the different perspectives of its governance: legislative, administrative, technical, economical, societal and political.

Fig 1: Seismic risk reduction governance (according to Pavićević, 2000).

LEGISLATIVE ISSUES

Law of general character majorly influencing seismic risk reduction policy in Montenegro is the *Law on Spatial Planning and Construction of Structures* (*Off. Gazette ME No. 64/17 and 44/18*). Law is stipulating content of the spatial plans of different levels. Location requirements (LR)- a set of data (limitations as well) necessary for the preparation of technical documentation and issuing of the construction permit, are set by this Law as well. General and nonspecific formulation directs that spatial plans should define the guiding principles for seismic RR refers. This is considered to be step backwards in respect to previous versions of this law. For instance, earlier municipal spatial plans were elaborated in accordance to seismic macro-zonation, while on the urban planning level LR reflected and cited seismic micro-zonation studies. At the current, LR do not have to enclose findings of micro-zonation studies, but may/not impose conducting of a particular geophysical study. Such a stipulation is in direct conflict to experts' constant appeals to broaden the extents of micro-zonation studies that were conducted in 1980-es (entitled "for the purpose of urban planning").

Particular chapter of the mentioned Law is referring to the status of illegal building stock (estimation of 100.000). Referring to the *Guidance Book* (*Off. Gazette ME No. 84/17),* there are two different procedures set to approve the structural stability and seismic safety of illegal building (conditioned by total area of a building). In both cases, a building owner ought to provide the relevant analysis conducted by business entity. If the total building area exceeds 500 m^2, additional declaration issued by certified review is obligatory. Exceptionally, for the households, a building owner may supply own certified declaration- as a substitute for structural analysis (owner is claiming the responsibility for any damages caused to third parties). This declaration is stated in the households' real estate records. The last stipulation

is questionable from the standpoint of human lives safety, and may have long-lasting harmful effects.

Regarding technical regulations concerning seismic design and safety of structures significant progress in adoption of European standards has been achieved (Table 1). In the time span of 2015-2019, following Parts (with National Annexes) of *Eurocodes 8 Design of structures for earthquake resistance* were standardized:

- *Part 1: General rules, seismic actions and rules for buildings and National Annex (NA),*
- *Part 2: Bridges and NA,*
- *Part 3: Assessment and retrofitting of buildings and NA*
- *Part 4: Silos, tanks and pipelines and NA*
- *Part 5: Foundations, retaining structures and geotechnical aspects and NA*
- *Part 6: Towers, masts and chimneys and NA*

Still, the challenge of training of all engineers and codes' implementation remains.

ADMINISTRATIVE ISSUES

Different sectors (e.g. construction, transport, spatial and urban planning etc.) have own missions in the task of controlling/reducing seismic risk in the state, but the level of coordination is insufficient. Lack of administrative centre (body) to prioritize, guide and synchronize these particular and marginal policies towards efficient management is evident. During the last decade (and in accordance with *Law on Protection and Rescue*, 2016), Directorate for Emergency Management imposed authority in risk management. Due to luck of its own (civil) engineering expertise, risk preparedness took over the preventive actions.

One of the most important problems in Montenegro is competency and capacity of human resources. There is a huge gap in capacities on different administrative levels – municipal vs. state.

ISSUES RELATED TO TECHNICAL ASPECTS

Technical issues might be stated for each of the risk assessment components: seismic hazard, exposure and vulnerability.

New seismic hazard map of Montenegro (IHMS, Glavatovic & Vucic, 2014) has been delivered for definition of the *National Annex Part 1: General rules, seismic actions and rules for buildings of Eurocode 8* (NA). Need to

scrutinize the NA statements and seismic action definition is crucial. This refers to:

- Identification of ground types: NA specifies that in cases when $V_{s,30}$ is not determined by the geophysical investigation, soil category might be determined by standard penetration test (NSPT) or soils' undrained shear strength of soil (Cu). When deep geology is unknown, NA recommends the soil classification scheme based on (averaged) results gathered in micro-zonation studies.

Having in mind current stipulations towards LR (and undermining the of micro-zonation studies), it looks that site specific amplification, near-fault effects, potentials for soil sliding and liquefaction etc. can be easily "lost" in current seismic action definition.

- Shape of adopted (recommended) elastic response spectra. Namely, number of available strong motion records for the earthquake Type 1 was small (20). For the earthquake Type 2, a records were dominantly small events (M<4.0); only 10% of analysed records were strong events (4<M< 5.8). No records for the soil types B, C, D and E were available (Janković and Glavatović et al., 2019).

Since the Montenegrin earthquake (1979, M_L 7.0) when 40 000 buildings were inspected, no further earthquake damage was systematically conducted. Recent Plav (2018, M5.1) earthquake (Mihaljević *et. al*, 2018) was the first one in almost 40 years to cause damages. Local commission of insufficient engineering competence assessed financial damage. In the absence of methodology and trainings to assess damage, there is a worrisome possibility that potential damage state of the constructions could be under or overestimated – having harmful consequences in both cases. With no systematic efforts to gather data, identify, categorize and research existing vulnerability (classes) of buildings - the overall statement would be that the vulnerability is a weakest link in seismic risk assessment.

Another issue is inefficient sectoral management of data related to exposures. INSPIRE directive implementation will be a huge challenge in Montenegro.

Related to national risk assessment - a national consensus on methodology, acceptable risk level, leading institution and partners involved, technical capacities etc. still had to be determined/assigned.

Important present technical aspects might be classified as underlying risk drivers: intensive urbanization, uncontrolled adaptations and reconstruction of buildings, inadequate transport infrastructure (jam prone), illegal settlements situated on unstable slopes/soil, etc.

OTHER ISSUES

State of risk governance is highly affected by the existing level of economic development. Resources attributed to RR policies are closely connected to political priorities and political will to strengthen the legal aspects of risk governance and to pursue risk control policies.

Some of the most influential economy issues are: a weakened economy, development oriented towards tourism and services (present in coastal area of highest seismic hazard), policy of natural resources management (hydropower plants and hydrocarbon extraction - both with potential to induce seismicity). There are very limited attempts towards risk transfer policy implementation – weak attempts in insurance policy and total absence of funds and incentives for seismic retrofit.

Last but not least, social aspects affect the current state of seismic risk safety. The state of risk perception should be upgraded to risk awareness (of decision-makers, practitioners and citizens). During last decades, Montenegro experienced intensive migrations (many of whom are unconscious of earthquake related risk). Education of specific professions is of utmost importance. The engineering professional ethics should be addressed in educational process, while controlled and verified in every day's practice. Poverty and inequity are the factors highly present in resolving of seismic safety of illegal settlements and buildings. Finally, the occasion of new national census should be taken as opportunity to gather risk-appropriate data (along with geographical one).

2. CONCLUSSION

Despite significant efforts to adopt new seismic design norms, common structural practice in Montenegro is showing worrisome examples of neglecting basic seismic design principles: irregularities of mass and stiffness, weak and soft story existence etc. In spite seismic risk prevention guidelines that are part land use planning, soil conditions are often neglected in favour of market demand. Rapid urbanization is present - even on unsuitable terrains. There is no law or economy mechanisms established to strengthen existing buildings.

It is of utmost importance to re-affirm the seismic RR policy as national priority: by re-asserting the tasks of existing stakeholders, strengthening human and technical capacities, redefining legal framework and assigning overall seismic risk government to recognizable national authority.

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