

# Investigating the Impacts of Earthquakes on Ethnic and Religious Groups: Bucharest, Romania



**WPI**

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# Investigating the Impacts of Earthquakes on Ethnic and Religious Groups: Bucharest, Romania



# WPI

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# Abstract

Bucharest, the capital of Romania, experiences a major earthquake every 30-80 years, with the most recent in 1977. Through archival research and interviews with earthquake survivors and experts from Romania, Croatia, Albania, and the United States, this project aimed to explore correlations between social identity and earthquake preparedness in Bucharest. Our results indicate that Bucharest is extremely vulnerable in comparison to other countries. Interviews revealed limitations of Bucharest's earthquake preparedness, specifically the government's lack of building assessment and citizens' deep-rooted mistrust due to communist era policies. Despite these challenges to preparedness, NGOs have begun to make progress to improve citizens' awareness and Bucharest's disaster response efforts.

# Executive Summary

## Introduction and Background

Since 1990, earthquakes have claimed an average of 27,000 lives worldwide each year (Guha-Sapir, 2011). Beyond loss of life, earthquakes have lasting economic and emotional impacts (Armaş et al., 2017) and can cause major structural damage, weakening or destroying buildings and infrastructure. Damage to roads, power grids, and plumbing can hinder relief efforts, and leave affected populations without necessary utilities indefinitely (Magda, 2019).

The Balkan Peninsula is particularly susceptible to powerful earthquakes as it sits between the African, Indian, small Cimmerian, and Eurasian tectonic plates (Bala et. al, 2015). Throughout their history, countries within the region have experienced major earthquakes, with earthquakes occurring as recently as 2018 in Romania, 2019 in Albania, and 2020 in Croatia (USGS, 2021). Within northern Romania, the Vrancea region experiences frequent seismic activity that produces major damaging earthquakes throughout the Balkan Peninsula (Bokelmann, 2014). Experts have identified Bucharest, the capital of Romania, as “the most earthquake prone capital in the European Union” (Armaş et al., 2017).



*Figure E.1: The Carlton building before and after collapse from the 1940 earthquake in Bucharest. Georgescu and Pomonis (2012).*

Two major earthquakes have hit Bucharest in the last 100 years. On November 10th, 1940, an earthquake originating in Vrancea county caused one building to collapse and killed over a hundred people (see Figure E.1). On March 4th, 1977, another earthquake struck, this time causing 33 buildings to collapse and killing over 1,500 (see Figure E.2). Experts expect more than 200 buildings to collapse in the next major earthquake (M. Sumbasacu, personal communication, April 22, 2021).



*Figure E.2: Nicolae Ceaușescu (front left), President of Romania from 1965 to 1989, walking past the remains of a building after the 1977 earthquake in Bucharest. (Santora et. al, 2020).*

Previous studies have examined how specific characteristics of Bucharest contribute to its high earthquake vulnerability. The city’s historical and outdated infrastructure is the most significant factor. Many of Bucharest’s buildings are aging, with buildings constructed prior to 1940 accounting for over 20 percent of the city’s building stock as of 1992 (Lungu, 2000). Moreover, approximately 50% of the city’s structures originated from systematization plans during the communist regime (1947-1989), with the government strengthening few after the fall of communism to meet current standards of quality and safety (Bachman, 1989; Lungu, 2000).

Corruption is an additional contributor to seismic risk to buildings in Bucharest. During the communist regime, the lack of funds for construction due to the Romanian government’s national policies of paying off external debts (Mungiu-Pippidi, 2010) led to bribery and corruption within the construction industry which yielded construction that was unnecessary, unsuitable, or defective, or dangerous (Sohail & Cavill, 2006). Without economic incentives or the necessary capital, the communist government built many high-rise apartment complexes that were not seismically stable (Sumbasacu, Interview).

This lack of funds continues to limit current government analysis of buildings after earthquakes to evaluate seismic risk. While the

government currently has marked 358 buildings in Bucharest as at a high risk of collapse in the event of another earthquake, they have not done a comprehensive analysis of the city's buildings. The close proximity of these structures to other buildings due to high population and building density increases the potential for damage from collapse (Schlumbohm, 2020; Cavoli, 2017).

While there exists research that considers socioeconomic factors and their impact on earthquake vulnerability, there is limited research that draws links between areas of higher risk and the social identities of the people that populate these areas. The original goal of this project was to evaluate the earthquake vulnerability of specific religious and ethnic groups within the city of Bucharest to determine the extent to which preparedness varies across these different groups. The objectives to achieve this goal were as follows:

1. To examine current earthquake preparedness practices in Bucharest and the Balkan Peninsula.
2. To establish which societal and infrastructural components are most at-risk in the event of an earthquake.
3. To characterize the ethnic and religious groups of Bucharest and evaluate the earthquake vulnerability of these groups.

## **Methodology**

The team proposed the following methods to achieve these objectives: interviews with experts from Romania, Albania, Croatia, and the United States, interviews with survivors of the 2019 Albanian and 1977 Romanian earthquakes, and analysis of 2011 Bucharest census data. In total, the team interviewed ten experts from Romania, Croatia, Albania, and the United States, and six earthquake survivors from Romania and Albania.

To achieve the first objective, the team performed archival research, interviewed experts from each country, compared preparedness measures taken in Bucharest to other vulnerable cities, and compiled the results of these interviews into a chart depicting the use and efficacy of each preparedness measure.

The team compiled the types of infrastructure and demographics that seismologists and engineers in the Balkan Peninsula identified to be at risk to complete objective two. For this

purpose, the team looked to the same expert interviews. The team then spoke with Bucharest community and NGO leaders to identify local societal components at risk.

Finally, to achieve the third objective, the team extracted data regarding socioeconomic status, ethnicity, and religion from the most recent (2011) census data available in Bucharest. The team organized and graphed the extracted data using a customized software tool. However, the data that the team collected was insufficient for the team to support many correlations. Data regarding ethnicity and religion was incomplete, with many residents evasively answering as unknown.

Originally, the team anticipated that there would be differences in vulnerability and preparedness across minority demographics within Bucharest. However, the team was not able to find data supporting some of these claims from any of the methods. Instead, the team shifted focus to examining factors that increase Bucharest's vulnerability, and current actions by organizations to reduce this vulnerability.

## **Results**

### Government-Funded Earthquake Preparedness Measures

Expert interviews and archival research revealed that the governments of Bucharest in Romania, Tirana and Durrës in Albania, Zagreb in Croatia, and the United States generally employ many of the same preparedness. The team determined this by asking experts what preparedness measures are prominent within their respective countries. The measures that experts identified were building codes, public education, assessment of buildings, maintenance and retrofitting of existing structures, utility shut off prior to earthquakes, and early warning systems. This list is in order of the frequency with which experts referenced these measures in the team's interviews.

This revealed that both the United States in general and Bucharest, Romania utilize all of these measures. Zagreb employs all of these measures except for an early warning system, which is not possible due to the proximity of the local fault lines to the city. Tirana and Durrës do not employ regular school drills, early warning

systems, or electrical and gas shutoff mechanisms, making Albania the country with the least number of preparedness measures in place.

While these findings suggest that the US and Bucharest are the most prepared of these four regions, with Zagreb next and the cities in Albania the least prepared, this is not the full story. As experts described, nearly every preparedness measure within each country had limitations in efficacy and lack of uniform application due to specific conditions within the regions. While experts from many countries provided similar explanations as to why their preparedness measures are not effective, experts in Romania identified two reasons unique to Bucharest: the mid-depth earthquakes generated by the Vrancea fault line which have a larger impact on taller buildings, and the lasting implications of Romania's communist past.

#### Influence of the Communist Past on Earthquake Preparedness in Bucharest

Even though 30 years have passed since the fall of the communist regime, its effects still loom large on Romanian society. In all four interviews with Romanian experts, the interviewee brought up communism, revealing that this part of the country's history still influences aspects of modern-day Romania.

Under Ceaușescu's regime, citizens lived in constant fear of their neighbors turning them in for breaking autocratic communist rules. Since disagreeing with the communist regime was punishable with jail time, citizens rarely dissented. The communist government attempted to "positively influence" anyone who acted against the regime. First, dissidents were subtly threatened by members of the government in an attempt to make them conform. If they continued to raise issues, the government exiled, imprisoned, or even executed them. Furthermore, the communist government organized a series of disinformation campaigns to erase any sense of panic in its citizens (M. Sumbasacu, personal communication, April 22, 2021).

Through secret police, "positive influence," and disinformation campaigns, the communist regime created a climate of distrust and misinformation. This history of distrust has left citizens of Bucharest feeling entirely

disconnected from one another. As Georgiana Ilie, a senior editor at the Romanian magazine *Decât o Revistă* (DoR), put it, "*there's no way out of this...other than together. The more...energy you spend defending yourself from others, the more you will not be okay because then instead of growing, all you'll do is just protect yourself and stay away from other people and that's, that's something that I think really affects our ability to be prepared for [an earthquake]*" (G. Ilie, personal communication, April 28, 2021). This feeling of disconnect stands in the way of true progress to improving Romanian earthquake preparedness.

#### Bucharest's Building and Infrastructure Earthquake Vulnerability

Through interviews with experts, the team identified buildings as the type of infrastructure most at risk in the event of an earthquake. One major contributor to this risk is the building codes that the communist regime implemented. Romania's earthquakes happen deep under the earth's surface, but the building codes the government developed under communist rule were based on data collected from regions that experience surface earthquakes, instead of deep earthquakes. This data led the government to construct taller buildings under the impression that they were more resilient to earthquakes, when in reality shorter buildings are more suited to withstand the type of earthquake Romania is likely to experience (M. Sumbasacu, personal communication, April 22, 2021).

Another factor contributing to the vulnerability of buildings is the lack of seismic risk classification for buildings. Due to a combination of underfunding and a lack of interest, the government has not classified thousands of buildings in the city for seismic risk (G. Ilie, personal communication, April 28, 2021). As a result, the true scale of building vulnerability in Bucharest is unknown, leaving the residents of Bucharest unaware and the government ignorant of this vulnerability. Additionally, the communist regime made cosmetic repairs to buildings damaged in the 1977 earthquake without actually addressing the structural damages. While these alterations feigned safety, this practice has exacerbated the issue with Bucharest's building stock

vulnerability by making it more difficult to assess buildings. Unfortunately, many of these buildings are still in disrepair with no current mechanism to identify the true damage hidden by the insufficient repairs (A. Kasprovschi, personal communication, April 23, 2021). Progress on repairing these buildings cannot occur until the government completes an assessment of their vulnerability.

The team utilized census data to estimate the scale of this problem. This census data showed that 55% of residents in Bucharest live in buildings that survived the 1977 earthquake. These buildings are at an especially high risk because of damage caused during the 1977 earthquake (M. Sumbasacu, personal communication, April 22, 2021). These findings highlight the need for more thorough building assessments in Bucharest since it is not feasible to repair every building in the city. Instead, the city must complete assessments to find which buildings are most vulnerable and proceed with repairing or retrofitting buildings based on this assessment.

#### NGO Involvement in Earthquake Preparedness in Bucharest

The level of vulnerability and insufficient preparedness in the past has resulted in NGOs becoming involved with earthquake preparedness in Bucharest. NGOs' involvement in earthquake preparedness gained momentum in 2017 when the Romanian magazine *Decât o Revistă* (DoR) published an article by Georgiana Ilie, a senior editor at DoR, titled "Earthquake in the vulnerable city". This article was a wakeup call for many organizations in Bucharest. Kasprovschi described it as, "a moment in which everybody, at least everybody in our team [Bucharest Community Foundation], definitely not everybody in our community [Bucharest], realized that we haven't discussed much about the earthquake."

Since 2017, NGOs have met every 2-3 months to coordinate resources, and have established a connection with the Romanian Department of Emergency Situations (M. Sumbasacu, personal communication, April 22, 2021; G. Ilie, personal communication, April 28, 2021; A. Kasprovschi, personal communication,

April 23, 2021). The Bucharest Community Foundation raises funds and gives grants to "grassroots" NGOs in Bucharest such as Re:Rise and the Clubul Câinilor Utilitari which are working on projects such as training rescue dogs (see Figure E.3), educating citizens and first responders, implementing checklists and alert systems, and running awareness campaigns (M. Sumbasacu, personal communication, April 22, 2021; G. Ilie, personal communication, April 28, 2021; A. Kasprovschi, personal communication, April 23, 2021).



*Figure E.3: The NGO, Clubul Câinilor Utilitari training search and rescue dogs. Clubul Cainilor Utilitari (2020).*

Matei Sumbasacu, the co-founder of Re:Rise, describes the organization as "**one of the NGOs with the broadest and narrowest scope, because we... only work for seismic risk reduction and nothing else, it's the broadest because we do anything to reduce seismic risk**". Re:Rise is currently working with institutions and authorities in Romania to inspire legal, procedural, and systematic changes (M. Sumbasacu, personal communication, April 22, 2021).

#### Data Collection and Analysis Limitations

Coming into the project, the team anticipated that combining existing census data and conducting a survey of residents in Bucharest would be sufficient to draw links between different demographics and their earthquake vulnerability. However, the data that the team collected was inadequate to draw these conclusions. The most recent census data is from 2011, which may no longer be representative of

Bucharest. Furthermore, data regarding ethnicity and religion was incomplete, with a large portion of respondents choosing not to identify their ethnicity or religion on the census. The team faced significant difficulties in distributing the Bucharest resident survey, which were in part because of the remote nature of the project due to the COVID-19 pandemic. The team reached out to religious organizations, restaurants, and NGOs in Bucharest to assist with survey distribution, but this did not provide the team with responses to analyze.

These limitations meant that the team cannot draw strong conclusions regarding differences in vulnerability across ethnic and religious groups in the city. Moreover, experts identified that the baseline of preparedness across the city remains unknown, meaning that research into differences across ethnic and religious divides is premature. This is especially true given that overall vulnerability across the city is so severe. As such, the team utilized building age data across demographics to suggest that there may be differences in earthquake vulnerability.

### Conclusions and Future Work

After completing interviews and research, the team found that the government has not collected sufficient data within the city of Bucharest regarding vulnerability to earthquakes. Thousands of structures within the city are likely at risk to collapse during an earthquake, but the government has marked only 358 buildings as such. The original classification of buildings includes another 1,600 that should fall within this risk class, but due to inconsistent legislation and the lack of funds to reclassify buildings, the government has ignored these vulnerable buildings.

Even though the city is at a very high seismic risk, many residents ignore the reality of the situation. As Kasprovschi said, “*In order for them not to go completely crazy, they have to just deny the fact that their building is not safe.*” While this may protect citizens’ mental state, it also prevents them from taking action to prepare

themselves. The communist regime under Ceaușescu effectively misinformed the public by silencing dissidents that spoke out about the high vulnerability and lack of government action to protect buildings in the city. This induced decades of skepticism towards the government, and an overall lack of understanding of the city’s vulnerability by both the government and citizens. Furthermore, it has been a long time since the last major earthquake in 1977, and many have forgotten the serious impact earthquakes have while the younger generations have never experienced an earthquake (M. Sumbasacu, personal communication, April 22, 2021; A. Kasprovschi, personal communication, April 23, 2021; E.S. Georgescu, personal communication, April 3, 2021).

Across all of our interviews, experts made it clear that there are two main hurdles to overcome in preparing Bucharest for the next earthquake. First, addressing the lack of building evaluation is critical. Without knowledge of the at-risk buildings, it is not possible for the government to accurately discern the city’s vulnerability, and where to direct resources to have the most impact. Second, informing residents of the city’s current risk level and the preparedness measures they should take is very important. This will mitigate the impact that a future earthquake will have and may save lives.

The team was not able to draw any definitive conclusions about whether some minority groups may be more at risk due to earthquakes. The team was unable to find research linking demographic information to earthquake vulnerability, and the data the team did analyze was inconsistent due to missing entries and potentially outdated.

Although the team was unable to link religious and ethnic groups to varied levels of earthquake preparedness, this project has laid a solid groundwork for achieving this goal in the future. Through analysis of data from Bucharest’s 2021 census and in-person interviews after the COVID-19 pandemic, researchers will be able to attempt a similar approach to accurately assess the preparedness of these groups.

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3.1 Objective 1: Examine Current Earthquake Preparedness Practices in Bucharest and the Balkan Peninsula	Eileen Piombino	Eli Benevedes, Owen Lally
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# Table of Contents

Abstract .....	ii
Executive Summary .....	iii
References .....	ii
Acknowledgements .....	iv
Authorship .....	v
List of Figures .....	xi
List of Tables .....	xii
1.0 Introduction .....	1
2.0 Background .....	7
2.1. The Balkan Peninsula, Romania, and Bucharest .....	7
2.2. Earthquakes and Seismic Potential in the Balkans .....	10
2.3. Communist History of Romania .....	14
2.4. Politics and Corruption in the Balkans .....	17
2.5. Non-Governmental Organizations .....	18
2.6. Historical Earthquakes in Bucharest .....	19
2.7. Earthquake Preparedness in the Balkans .....	22
2.8. Bucharest Earthquake Preparedness .....	24
2.9. Socioeconomic Impacts of Earthquakes .....	29
3.0 Methodology .....	33
3.1. Objective 1: Examine Current Earthquake Preparedness Practices in Bucharest and the Balkan Peninsula .....	34
3.1.1. Expert Interviews .....	35
3.1.2. Archival Research .....	36
3.2. Objective 2: Identify Societal and Infrastructural Components Most At-Risk in the Event of an Earthquake .....	37
3.2.1. Expert Interviews .....	38
3.2.2. Romanian and Albanian Earthquake Survivor Interviews .....	38
3.3. Objective 3: Characterize the Ethnic and Religious Groups of Bucharest and Evaluate the Earthquake Vulnerability of these Groups .....	40
3.3.1. Survey of Residents in Bucharest .....	40

3.3.2. Vulnerability Calculation.....	42
3.4. Interview Analysis.....	43
3.5. Summary .....	45
4.0 Results.....	46
4.1. Government-Funded Earthquake Preparedness Measures .....	46
4.2. Influence of the Communist Past on Earthquake Preparedness in Bucharest.....	53
4.3. Bucharest's Building and Infrastructure Earthquake Vulnerability .....	57
4.4. NGO Involvement in Earthquake Preparedness within Bucharest .....	60
4.5. Correlation Between Minorities and Earthquake Vulnerability.....	64
5.0 Conclusion .....	68
6.0 Future Work .....	74
References.....	77
Appendix A: Prof. Aaron Sakulich, Civil Engineering, Worcester Polytechnic Institute, Interview Transcript .....	87
Appendix B: Prof. Leonard Albano, Civil Engineering, Worcester Polytechnic Institute, Interview Transcript.....	106
Appendix C: Prof. Naser Sharifi, Civil Engineering, Worcester Polytechnic Institute, Interview Transcript .....	129
Appendix D: Dr. Emil Sever Georgescu, Senior Researcher, URBAN-INCERC Institute, Interview Transcript.....	146
Appendix E: Matei Sumbasacu, Co-Founder, Re:Rise, Interview Transcript.....	170
Appendix F: Alina Kasprovschi, Executive Director, Bucharest Community Foundation, Interview Transcript.....	199
Appendix G: Georgiana Ilie, Senior Editor, Decât o Revistă, Interview Transcript .....	225
Appendix H: Gent Gjuta Interview Transcript .....	250
Appendix I: Mirian Bllachi, Cultural Heritage without Borders, Interview Transcript .....	268
Appendix J: Prof. Marija Mustać, Geophysics and Seismology, University of Zagreb, Interview Transcript .....	290
Appendix K: Prof. Robert Hersh, Interdisciplinary, Worcester Polytechnic Institute, Interview Notes .....	308
Appendix L: Rachel Kinicki Interview Notes .....	316
Appendix M: Prof. Bogdan Vernescu, Office of the Provost, Worcester Polytechnic Institute, Interview Transcript.....	321

Appendix N: Interview Confidentiality Statement .....	333
Appendix O: Common Interview Questions.....	334
Appendix P: Earthquake Survivor Interview Questions.....	335
Appendix Q: Expert Interview Questions.....	336
Appendix R: Survey Confidentiality Statement .....	337
Appendix S: Bucharest Resident Survey .....	338
Appendix T: Expert Interview Coding Themes.....	343
Appendix U: Earthquake Survivor Interview Coding Themes.....	344
Appendix V: References Frequencies of Coding Themes from Expert Interviews.....	345
Appendix W: References Frequencies of Coding Themes from Earthquake Survivor Interviews .....	348

# List of Figures

Figure 1.1: Bucharest housing stock according to period of construction. (Lungu, 2000).....	2
Figure 1.2: Normalized vulnerability assessment for residential buildings. Armaş et al. (2017)...	4
Figure 2.1: Map of the Balkan Peninsula. Allcock et al. (2020). .....	8
Figure 2.2: Topography of Romania. Adapted from Banc et. al (2020).....	9
Figure 2.3: Sectors of Bucharest. Adapted from Statistics and Demographics of Bucharest Sectors (2020).....	10
Figure 2.4: The Carpathian mountains. Adapted from Climate ADAPT (2006).....	11
Figure 2.5: European Seismic Hazard Map. Giardini (2013). .....	12
Figure 2.6: Seismicity of the Northern Balkan Region [Map]. Musson, R. (1999).....	13
Figure 2.7: Young Romanians riding in a military vehicle, waving the flag of Romania with the communist insignia removed during the Romanian Revolution. Paun, (2019). ....	15
Figure 2.8: Romanian officials transporting Securitate files to a CNSAS warehouse. Barberá (2019). .....	16
Figure 2.9: The Carlton Block before collapse (left) and after collapse (right). Georgescu, E & Pomonis, A (2012). .....	20
Figure 2.10: Chart of the territorial distribution of destroyed dwellings in 1977. Georgescu, E & Pomonis, A (2008). .....	21
Figure 2.11: Chart of the territorial distribution of dwellings requiring strengthening in 1977. Georgescu, E & Pomonis, A (2008).....	21
Figure 2.12: Land use and building age in Bucharest. Marin (2018). .....	25
Figure 2.13: Red dot building in Bucharest, Simpson, Pomonis, & Georgescu (2020).....	26
Figure 2.14: Red dot buildings within the city of Bucharest. Symbols that are not a red dot indicate damaged buildings from previous earthquakes, INFP (2020).....	28
Figure 2.15: Vulnerability map of Bucharest. Armaş et al. (2017).....	31
Figure 3.1: Flowchart of the objectives and tasks to accomplish the project goal. .....	34
Figure 3.2: First page of the team's resident survey, question prompts respondents to select their language of choice for remainder of survey.....	41
Figure 4.1: Percentage of citizens agreeing that “most people can be trusted.” Our World in Data, (2014). .....	54
Figure 4.2: Percentage of citizens who trust their national government. Our World in Data (2018). .....	55
Figure 4.3: Number of responses by experts for all infrastructure themes.....	58
Figure 4.4: “Bucharest Ready” Grassroot NGO Initiatives in Bucharest..Bucurestiul Pregatit. (2021). .....	62
Figure 4.5: NGO Clubul Câinilor Utilitari training rescue dogs. Clubul Cainilor Utilitari (2020). .....	63
Figure 4.6: Building age distribution by demographic.....	66

## List of Tables

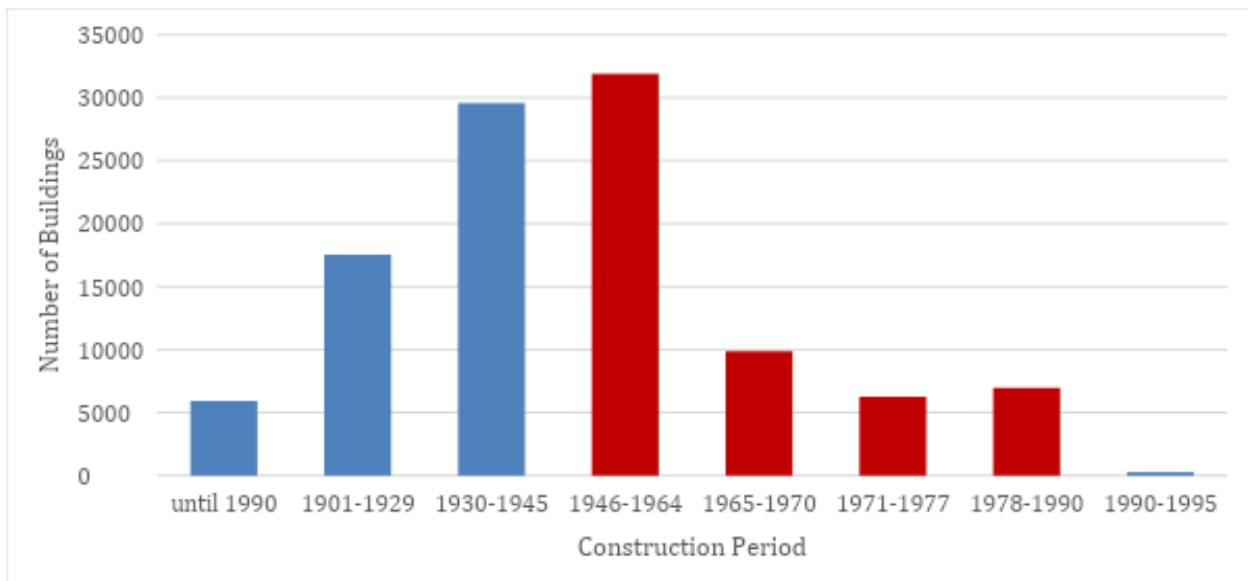
Table 3.1: Interviewee information for the team's ten expert interviews.....	35
Table 3.2: Interviewee information for the Romanian and Albanian earthquake survivor interview.....	39
Table 3.3: Image of the frequency tracking Excel sheet for expert interviews. ....	44
Table 3.4: Image of the frequency tracking Excel sheet for earthquake survivor interviews. ....	45
Table 4.1: The preparedness measures used by governments, referenced by interviewees, and considered effective by experts in Romania, Albania, Croatia, and the United States..	47

## 1.0 Introduction

Since 1990, earthquakes have claimed an average of 27,000 lives worldwide each year (Guha-Sapir, 2011). Beyond loss of life, earthquakes have lasting economic and emotional impacts (Armaş et al., 2017) and can cause major structural damage, weakening or destroying buildings and infrastructure. Damage to roads, power grids, and plumbing can hinder relief efforts and leave affected populations without necessary utilities (Magda, 2019). The term earthquake hazard refers to the physical phenomena that result from seismic activity, and the term risk refers to a region's vulnerability to these hazards and capacity to recover from them. While all individuals within a region may experience a similar earthquake hazard, the ability for individuals to prepare for and recover from earthquakes depends upon social and economic factors.

The Balkan Peninsula is particularly susceptible to earthquakes as it sits between the African, Indian, small Cimmerian, and Eurasian tectonic plates (Bala et. al, 2015). Throughout their history, countries within the region have experienced major earthquakes, with earthquakes occurring as recently as 2019 in Albania and 2021 in Croatia (USGS, 2021). Within northern Romania, the Vrancea region experiences frequent seismic activity that can result in major earthquakes throughout the Balkan Peninsula (Bokelmann, 2014), with a magnitude 5.2 earthquake occurring in January, 2020 (USGS, 2021). Earthquake risk across the peninsula varies based on the vulnerability of the natural environment and man-made structures. Several areas within the Balkan Peninsula have high earthquake risk, including cities where higher population and building density, expansive infrastructure, sub-standard construction and corruption during periods of expansion, and socio-economic and political variables increase susceptibility to loss.

Located 150 kilometers southwest of the Vrancea seismic zone, experts have identified Bucharest, the capital of Romania, as “the most earthquake prone capital in the European Union” (Armaş et al., 2017). Previous studies have examined how specific characteristics of Bucharest contribute to its high earthquake vulnerability. The city’s historical and outdated architecture and infrastructure are among these factors. Buildings that citizens constructed prior to 1940, before the first modern major earthquake in Romania, account for over 20 percent of the city’s building stock as of 1992 (Lungu, 2000). As Bucharest has experienced two major earthquakes since 1940, it is likely that these buildings have accumulated damages from past seismic activity that make them even more vulnerable (Sumbasacu, see Appendix E for full interview transcript). Moreover, approximately 50% of the city’s structures originated from systematization plans during the communist regime (1947-1989) with few being strengthened after the fall of communism to meet current standards of quality and safety (Bachman, 1989; Lungu, 2000). Figure 1.1 shows the distribution of buildings in Bucharest according to their period of construction with buildings constructed during the communist regime shown using red bars.



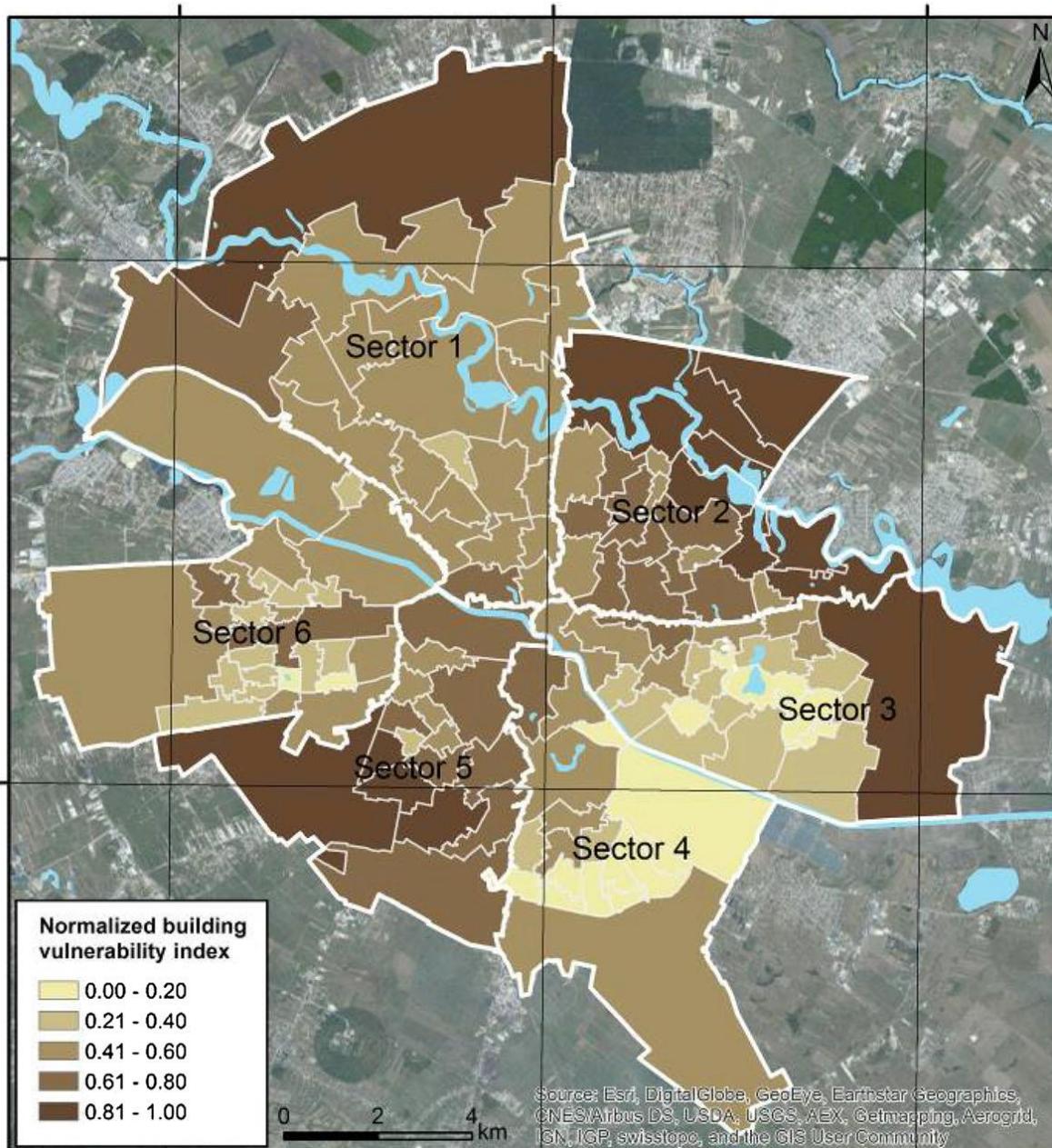
*Figure 1.1: Bucharest housing stock according to period of construction. (Lungu, 2000).*

Corruption within the construction industry was also a contributor to seismic risk to buildings in Bucharest. During the communist regime, the Romanian government lacked funds for construction due to national policies of paying off external debts (Mungiu-Pippidi, 2010). The lack of funds led to bribery and corruption within the construction industry which often led to construction that was unnecessary, unsuitable, defective, or dangerous (Sohail & Cavill, 2006). Without economic incentives or the necessary capital, the communist government constructed many high-rise apartment complexes that were not necessarily seismically stable. The close proximity of these structures to other buildings due to high population and building density increases the potential for damage from collapse (Schlumbohm, 2020; Cavoli, 2017).

Past earthquakes have demonstrated this vulnerability. Specifically, Bucharest experienced major earthquakes in 1940 and 1977, both of which originated in the Vrancea region and reached magnitudes upwards of 7 on the Richter scale. These seismic events resulted in massive losses of life and property, as well serious damage to buildings across the city (Georgescu & Pomonis, 2012). Since the 1977 earthquake, the Romanian government has identified 358 buildings in Bucharest at high risk of collapse in the event of an earthquake (Ivanov, 2021). However, the city has not assessed a significant percentage of its building stock, so the city officials do not directly know the overall building vulnerability.

Historic earthquakes provide valuable information for future vulnerability and preparedness analyses, giving researchers the opportunity to identify patterns of building destruction and damage within Bucharest's city limits (Armaş, 2012). Armaş' findings serve as groundwork for future estimations by demonstrating which components of the city have been vulnerable in past earthquakes. Further research has built upon this work by taking the socio-economic and societal characteristics of Bucharest into account in vulnerability assessments.

Researchers calculated an overall vulnerability for regions of the city using indicators such as socioeconomic status, average income, population and building density, and building and infrastructure fortitude. This research concluded that vulnerability is not uniform across Bucharest (Armaş, 2012; Armaş et al. 2017). Figure 1.2 clearly illustrates this variability. Darker regions on the map are at a higher vulnerability than the lighter areas.



*Figure 1.2: Normalized vulnerability assessment for residential buildings. Armaş et al. (2017).*

These studies reveal uneven preparedness for earthquakes across Bucharest. However, there is limited research that draws links between areas of higher risk and the social characteristics of the people that populate these areas. While research shows that individuals of certain ethnic and religious identities tend to reside in higher concentrations within different regions of cities (Rampton, 1995), further exploration can characterize this phenomenon in Bucharest and therefore determine the implications of earthquake preparedness within these groups.

The goal of this project is to evaluate the earthquake vulnerability of specific religious and ethnic groups within the city of Bucharest to determine the extent to which preparedness varies across these different groups. The objectives to achieve this goal are as follows:

1. To examine current earthquake preparedness practices in Bucharest and the Balkan Peninsula.
2. To establish which societal and infrastructural components are most at-risk in the event of an earthquake.
3. To characterize the ethnic and religious groups of Bucharest and evaluate the earthquake vulnerability of these groups.

To accomplish these objectives, the team completed archival research and conducted interviews with seismic experts and earthquake survivors from Romania, Albania, Croatia, and the United States. These interviews allowed the team to identify factors such as earthquake preparedness, historical influences, and structural assessment, and explore how these factors have an impact on social trust and overall earthquake vulnerability within Bucharest.

The team attempted to remotely distribute a survey to residents of Bucharest and to conduct an analysis of data from the 2011 Romanian census but did not receive sufficient survey responses to analyze as a representative sample. Furthermore, the census data was outdated, inconsistent, and

incomplete. Experts emphasized the city's aging buildings, which will be significantly vulnerable in the next earthquake. This is due to damage sustained in the 1977 earthquake, as well as the current government's lack of building assessment. This, in combination with a misinformation campaign during the communist regime, has led to uncertainty regarding the true number of vulnerable buildings and decades of mistrust between citizens and the government. The continuation of mistrust remains a barrier for NGOs focused on reducing seismic risk in Bucharest. Overall, experts in the city agree that a combination of thorough analysis of the current building stock and public education is needed to reduce the impact of Romania's next major earthquake. In recent years, NGOs have helped address these problems by running programs for the community and raising public awareness regarding these vulnerabilities (Sumbasacu, Kasprovschi, Ilie).

## 2.0 Background

This chapter introduces the Balkan Peninsula, Romania, and Bucharest and contextualizes seismic activity within these regions in order to elucidate their earthquake hazard. This chapter then discusses historical earthquakes in Bucharest, analyzes the political changes that have occurred in the years since, and identifies lasting impacts on earthquake preparedness. Finally, this chapter identifies socioeconomic factors and impacts of earthquake preparedness and emergency response.

### 2.1. The Balkan Peninsula, Romania, and Bucharest

The Balkan Peninsula (see Figure 2.1) is a geographic area in southeastern Europe consisting of Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Kosovo, Montenegro, North Macedonia, Serbia, and Slovenia, the European part of Turkey, and Romania. This project focuses on Bucharest, the capital city of Romania.

The word “Balkan” originates from the Turkish word for “a chain of wooded mountain” (Allcock et al., 2020). The Balkans lie within the mountain ranges known as the Alpine orogeny (Bala, 2015), which include the Rhodope Mountains along the Greek-Bulgarian border, the Dinaric range down the Adriatic coast to Albania, the Julian Alps from northeastern Italy to near the capital of Slovenia, and the Carpathians from Slovakia and southern Poland to southwestern Romania.

Many ethnicities live within the Balkans (Allcock et al., 2020), including Albanians, Ashkali and Balkan Egyptians, the Sarakatsani, South Slavs, Balkan Turks, and the Eastern Romance people. The South Slavs are the largest ethnic group in the Balkans with a population of around 30 million, while the Eastern Romance people are the second largest ethnic group,

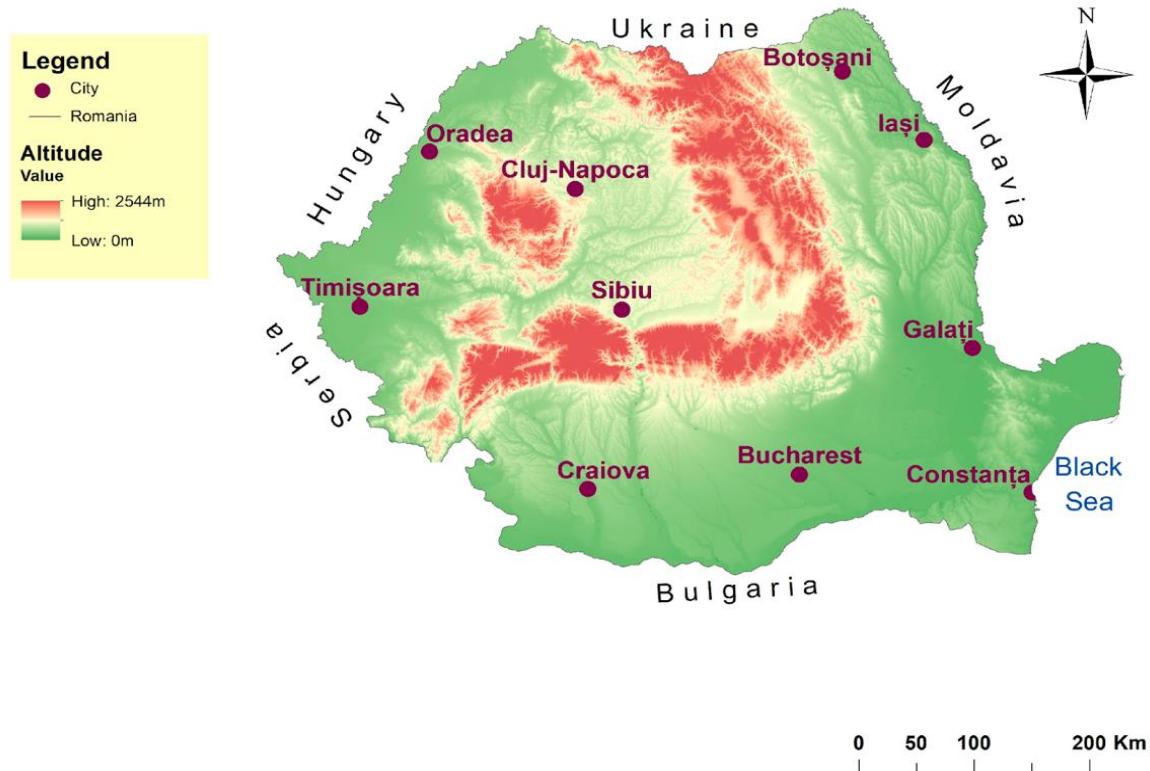
consisting of Romanians, Aromanians (Macedo-Romanians), Megleno-Romanians, Istro-Romanians, and Moldovans (Allcock et al., 2020).



Figure 2.1: Map of the Balkan Peninsula. Allcock et al. (2020).

Romania, like much of the Balkan Peninsula, has areas of mountainous terrain. Figure 2.2 shows the topography in Romania, with areas of higher elevation in red and lower elevation in green. The Carpathian Mountains form a semicircle around the Transylvanian Basin which then

transitions into fertile plains in southeast Romania, along the Danube River and its tributaries (Latham et al., 2020).



*Figure 2.2: Topography of Romania. Adapted from Banc et. al (2020).*

As of 2020, the population of Romania is approximately 19 million with a population density of 84.6 people per square kilometer (Schlumbohm et al., 2020). Romania is home to many ethnic groups, including Romanians (~87%), Hungarians (6.5%), Romani (~3%), Germans, Jews, and Dobrujan Muslims (~0.4%) (Latham et al., 2020).

The Romanian capital of Bucharest is home to 9.3% of the country's population. Bucharest became the capital of Romania in 1862 and is the center of Romanian media, culture, and art (Zamfir & Corbos, 2015). Like the rest of Romania, the Romanian ethnic group makes up most of the population at 89.9%. According to the United Nations Department of Economic and Social

Affairs (2019), other ethnic groups living in Bucharest include Hungarians (6.6%), Romanians (2.5%), Ukrainians (.3%), Russians (.2%), Germans (.3%), and Turks (.2%).

Bucharest is currently divided into six sectors. Each sector contains a portion of the city center and radiates outward. As of 2011, sector three was the largest population-wise at 385,000 residents, while sector one was the smallest at 225,000 residents. Sector three is also the most densely populated with 11,336 residents per square kilometer (IPUMS, 2020). Bucharest is the 19th most densely populated city in the European Union, although sectors two and three alone would rank 15th and 14th respectively. Figure 2.3 depicts these six sectors.



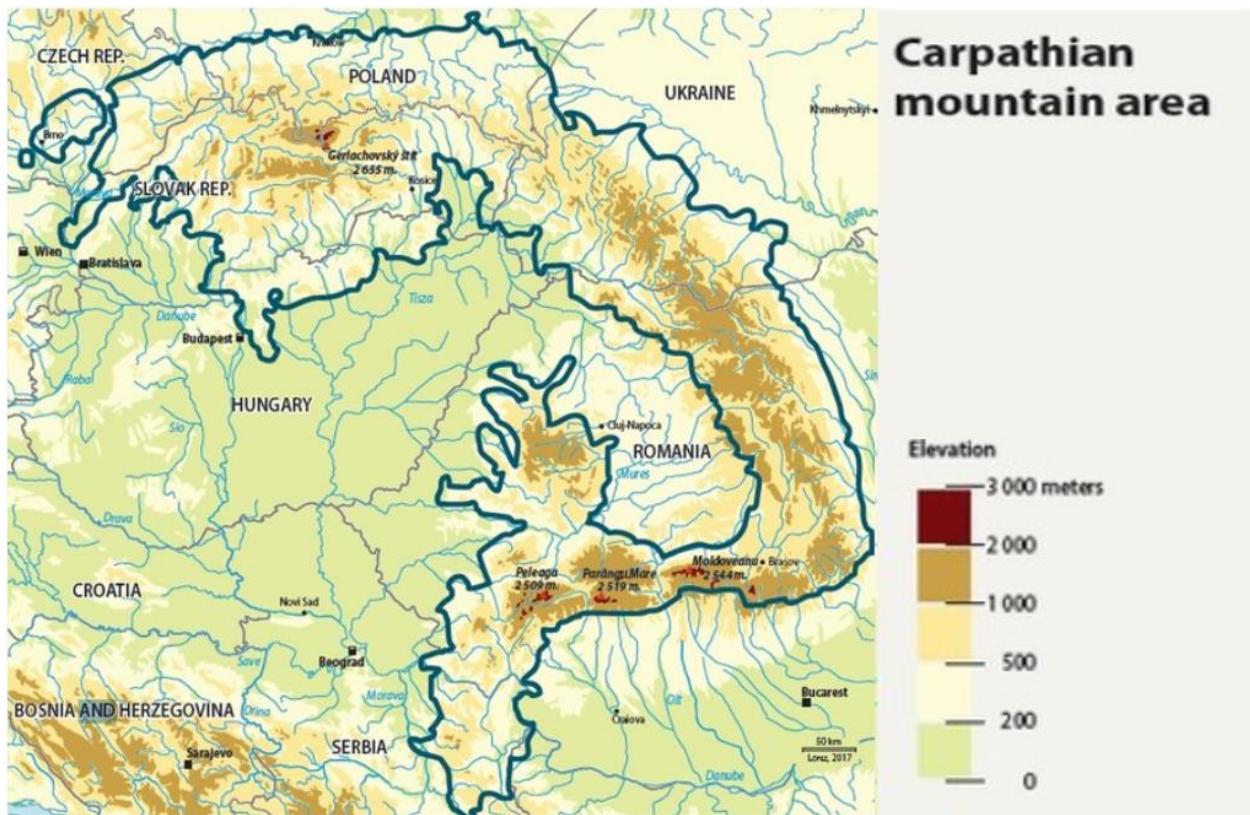
*Figure 2.3: Sectors of Bucharest. Adapted from Statistics and Demographics of Bucharest Sectors (2020).*

## 2.2. Earthquakes and Seismic Potential in the Balkans

Earthquakes occur when two tectonic plates, or pieces of the Earth's crust, move past each other causing violent shaking of the Earth's surface (USGS, n.d.). The Richter scale is one of the most common methods of measuring the magnitude of this shaking (Rafferty, 2020). The Richter scale is logarithmic, meaning that a 5.0 earthquake has a magnitude over 30 times greater than a

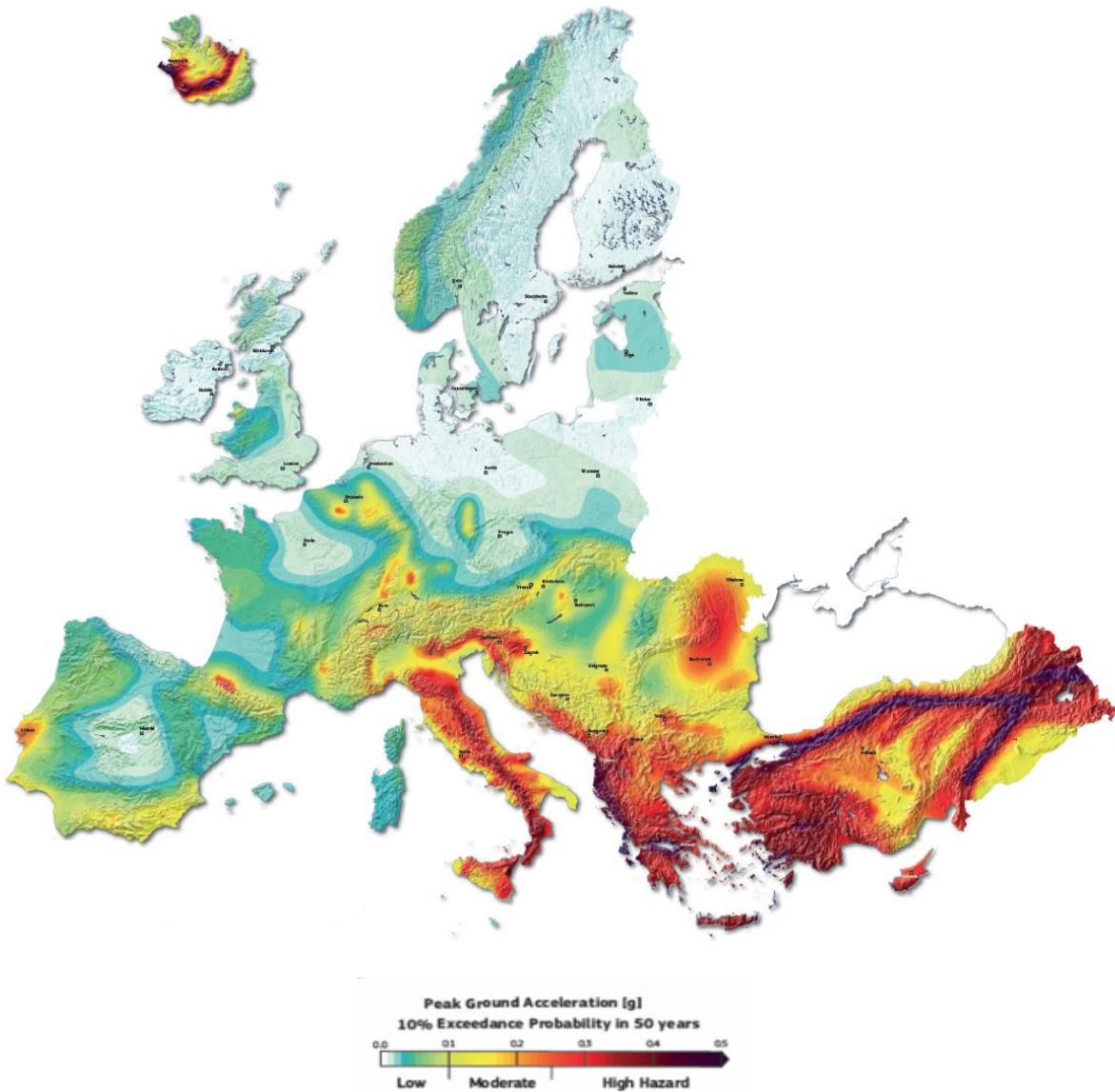
4.0 earthquake. Earthquakes can range from minor (3.0 to 5.0 on the Richter scale) to moderate (5.0 to 7.0) to major (above 7.0).

The Balkan Peninsula is a high seismic hazard area due to numerous fault lines throughout the region. The tectonic activity in the Balkans has a close relationship with its mountain chains in the Alpine orogeny. Figure 2.4 shows the Carpathian Mountain range, which stretches from Poland to Serbia.



*Figure 2.4: The Carpathian mountains. Adapted from Climate ADAPT (2006).*

The collision of the African, Indian, and small Cimmerian plates from the south with the Eurasian plate in the north formed these mountain chains (Bala, 2015). The sliding of these plates causes most earthquakes in the Balkans (Musson, 1999). The city of Bucharest is an area of high hazard because the Carpathians and Balkanides that form the Carpathian Mountains surround the city of Bucharest to the North and West (Gorshkov, et al., 2000).



*Figure 2.5: European Seismic Hazard Map. Giardini (2013).*

The Balkan Peninsula has around ten regions that seismologists classify as moderate to high hazard zones, or areas with a 10% or greater chance of experiencing an earthquake of magnitude 5.0 or greater in the next 50 years (Du Brulle, 2014). Figure 2.5 is a European seismic hazard map that highlights regions of high hazard in red. Countries in or near the Balkans that have high hazard cities include: Albania, Austria, Bulgaria, Croatia, Greece, Hungary, Romania, Serbia, Slovakia, Slovenia, and Turkey (Bala, 2015).

In Romania, most seismic events originate from the Vrancea Seismic Zone. Bucharest's proximity to Vrancea County makes seismic activity a necessary consideration for city residents and officials. This region is 150 kilometers northeast of Bucharest. Bucharest is one of the only cities in Europe at significant risk of "deep" earthquakes (Houseman, 2018). Deep earthquakes occur more than 60 km below the earth's crust, while "shallow" or "surface" earthquakes occur at depths less than 60 km. Shallow earthquakes are often more intense, but felt over a much smaller area (Chang, 2016). The Vrancea Seismic Zone produces deep, strong earthquakes that can be felt long distances from their epicenter. These deep earthquakes also produce long period vibrations and amplifications which "resonate with taller buildings, because those are more flexible," structural engineer Matei Sumbasacu said (Appendix E).

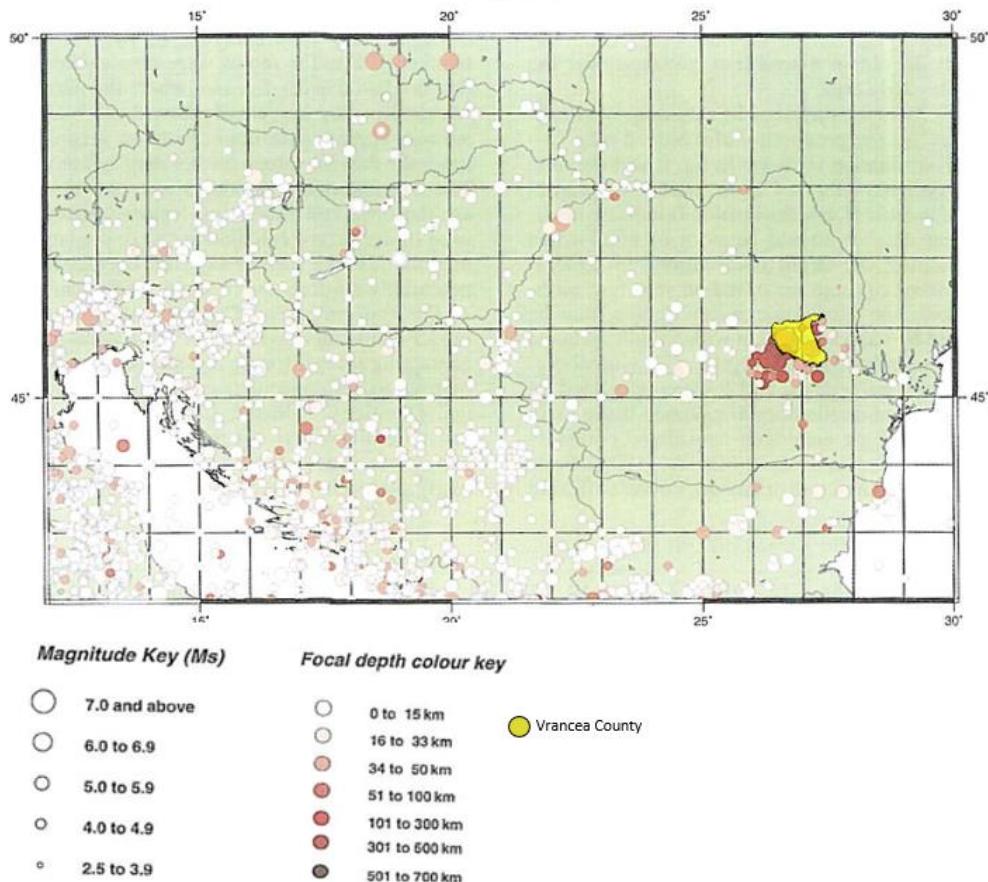


Figure 2.6: Seismicity of the Northern Balkan Region [Map]. Musson, R. (1999).

Figure 2.6 depicts dots varying in size and color based on focal depth and magnitude. These dots represent past earthquakes, and the figure plots them on the location of their origin. Vrancea County, highlighted in yellow, has experienced several earthquakes of high magnitude and focal depth, with four major earthquakes occurring in the past century: November, 1940 ( $Mw = 7.7$ , Depth = 160 km); March, 1977 ( $Mw = 7.2$ , Depth = 100 km); August, 1986 ( $Mw = 7.2$ , Depth = 140 km); May, 1990 ( $Mw = 6.9$ , Depth = 80 km) (Wenzel et. al, 2002).

### 2.3. Communist History of Romania

Between 1948 and 1989, Romania was a communist state in the Eastern Bloc. During this period, Romania rapidly shifted its focus from agriculture to industry. Oil production in particular exploded, as the country became one of the first major exporters in the world (Topan, 2018). Before communism in Romania, 77% of Romanians worked in the agriculture industry. By 1980, this number had dwindled to only 29% (Mazower, 1999) with many citizens moving into large urban centers to find industrial jobs. Bucharest was one of the cities in Romania to see drastic population growth, increasing from 650,000 people in 1950 to two million in 1989. To accommodate this growth, the communist regime built hundreds of multistory residential buildings (Odobescu & Bird, 2018). However, during this period the Romanian government lacked funds due to the combined effects of dictator Nicolae Ceaușescu's policy of paying off external debts (Mungiu-Pippidi, 2010) and the creation of many structures that were more ornate than practical (Odobescu & Bird, 2018). Without economic incentives or the necessary capital, the Romanian government constructed many high-rise apartment complexes that were not seismically stable.

In addition, the communist regime implemented building codes that were not specific to Romania's particular earthquake hazard. Structural engineer Matei Sumbasacu said, “[The government] basically copied the Russian code, which basically had copied US code, which was

calibrated on an El Centro Californian earthquake, which is a surface earthquake...and produces short period effects.” Romanian earthquakes tend to be deep earthquakes and produce long period effects, which in turn devastates taller buildings. These codes did not adequately protect the building stock of Bucharest, as taller buildings were not subject to the strict codes that were needed.

The buildings the communist regime constructed are not the only lasting impact of this era. Ceaușescu’s regime ran one of Europe’s most brutal secret police forces, the Securitate. The Securitate constantly ran surveillance on all citizens in a massive attempt to remove dissidents from the nation. The secret police employed upwards of 500,000 informants in a country of only 22 million people (Barberá, 2019). The communist party even used young children to report on family and friends (Matei, 2007). Through fear and repression, the Securitate held a tight grasp on the population of Romania.



*Figure 2.7: Young Romanians riding in a military vehicle, waving the flag of Romania with the communist insignia removed during the Romanian Revolution. Paun, (2019).*

The Romanian Revolution of 1989 led to the demise of the communist regime. Following the austerity policy of the 1980s, living standards in Romania were on the decline (Michelson & Georgescu, 1991). The Hungarian minority began protesting when Ceaușescu attempted to remove pastor László Tőkés from his position. Soon after these protests escalated, the Romanian military turned their back on the communist government. Figure 2.7 shows a group of young Romanians waving the flag of Romania with the communist insignia removed throughout Bucharest. This opened the floodgates for full revolution, and in less than 10 days, the communist regime collapsed. On December 25th a military tribunal executed Nicolae Ceaușescu and his wife, Elena.

The communist regime has a significant impact on modern day Romania. To date, Romania has held no criminal trials to prosecute the atrocities Ceaușescu's regime committed. Recently, various news outlets have made public old Securitate files detailing the surveillance of citizens (Ursachi, 2015). Figure 2.8 shows Romanian officials transporting Securitate files to the National Council for Studying the Securitate Archives (CNSAS) in 2005.



Figure 2.8: Romanian officials transporting Securitate files to a CNSAS warehouse. Barberá (2019).

Despite the CNSAS making these files public, Romanian citizens still have little closure with regard to the cruelty of the regime. This has resulted in an extremely low trust in the government. In one study from 2018, less than 23 percent of Romanians trusted their national government. This is a considerably low trust index when compared to other countries, with the United States and Switzerland registering that 47.43 percent and 81.47 percent of their populations trust the national government respectively (*Share of people that trust their national government, 2018*).

## 2.4. Politics and Corruption in the Balkans

Corruption within the communist government in Romania is a large factor in the instability of buildings. A 2015 report titled “The Presidential Commission for the Analysis of the Communist Dictatorship of Romania” identified corruption as one of the key pillars of this era (Vasile, 2015). Bribery and corruption within the construction industry often leads to construction that is unnecessary, unsuitable, defective, or dangerous (Sohail & Cavill, 2006) placing buildings at increased risk of catastrophic failure during an earthquake.

Corruption continues to exist in the Romanian government. In 2015, the National Anticorruption Directorate (DNA) arrested the mayor of Bucharest, Sorin Oprescu, on charges of corruption. The Bucharest tribunal sentenced Oprescu to five and a half years in prison for taking bribes in exchange for public work contracts, though Oprescu is still appealing the sentence today (Romania Journal, 2019). That same year, the DNA charged Prime Minister Victor Ponta with 19 acts of corruption. According to the 2020 Corruption Perceptions Index, which ranks countries from 0 (entirely corrupt) to 100 (little to no corruption) based on “their perceived levels of public sector corruption according to experts and businesspeople,” Romania scored 44/100. For

reference, New Zealand and Denmark each scored 88/100, the United States scored 67/100, and Albania scored 36/100 (Transparency International, 2021).

There is significant evidence that corruption exists within Romania's industry sectors. Between 2007 and 2013, the nation dedicated around 6.6% of its GDP to the construction sector. However, as a source investigating corruption states, "the end results in terms of project finalization and quality did not match this investment" (Doroftei & Dimulescu, 2015). This paper suggested that two main factors are indicative of corruption: contracts that the government awards to a single bidder, and contracts it awards to companies with political connections. About 40% of contracts valued at over €1 million that the Romanian government awarded between 2007 and 2013 matched at least one of these two factors. On average, the paper estimated that the private construction industry pockets €200 million per year through these contracts (Doroftei & Dimulescu, 2015). Corruption in the construction industry is not harmless to residents of a region. Researchers have shown the quality of buildings to decrease in regions with unchecked corruption (Tanzi & Davoodi, 1997). In a region of high seismic hazard, this can be disastrous.

## 2.5. Non-Governmental Organizations

Corruption in Romania has led to a rise in non-governmental organizations (NGOs) getting involved in local initiatives. NGOs are groups that have no affiliation to any local or national governments, and typically champion humanitarian goals (Folger & James, 2021). These non-profit organizations rely on outside sources of funding to promote anything from medical aid in impoverished regions, like Doctors Without Borders, to ending the abuse of human rights, like Amnesty International.

The Romanian Chamber of Deputies lists 225 active NGOs. The oldest organizations in Romania date back to 1990 with the Chamber accrediting new ones as recently as 2019. NGOs in

Romania support causes like promoting young artists, defending the rights of Hungarian Students, and promoting environmental awareness around the Danube Delta. Earthquake awareness has been a major focus of NGOs in recent years. One organization, Re:Rise, is focused on reducing seismic risk in Romania. Re:Rise is working on multiple initiatives, including a Quick Drone Mapping System to identify areas of significant damage, the Savior's WiFi Mesh to expedite communication between victims and first-responders, as well as numerous public information campaigns. Another NGO, Clubul Câinilor Utilitari, has been working on training rescue dogs to intervene in emergency situations. These dogs have been trained to track the scent of humans through crumbled buildings and areas of low visibility.

## 2.6. Historical Earthquakes in Bucharest

Bucharest experienced major earthquakes in 1940 and 1977. On the morning of November 10, 1940, fault planes located in Vrancea produced an earthquake registering between 7.6 and 7.7 on the Richter scale. Reports from the 15<sup>th</sup> World Conference on Earthquake Engineering estimated 593 deaths and 1,271 injuries, with 140 and 300 occurring within Bucharest city limits respectively (Georgescu & Pomonis, 2012).

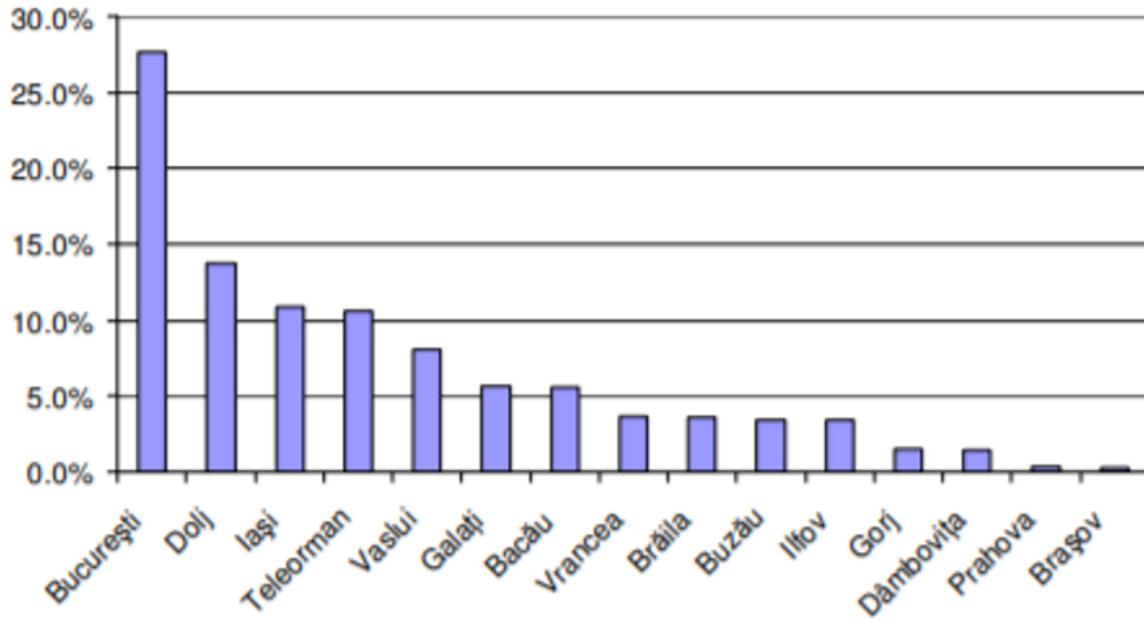
Beyond loss of life, Bucharest suffered significant impacts to society, including the collapse of the Carlton Building. Figure 2.9 displays the building before the earthquake, and the remaining rubble afterwards. This building was 12 stories in height and was the city's largest concrete-reinforced building. The complete destruction of the Carlton Building was a public illustration of the failure of Bucharest's construction. The earthquake called into question the advancement of architecture in the city as well as the lack of security of housing and businesses in the face of potential natural disasters, which prompted the government to change construction

practices and building codes (Georgescu & Pomonis, 2012). However, the inability to uniformly apply these measures decreased their efficacy (Georgescu & Pomonis, 2012).



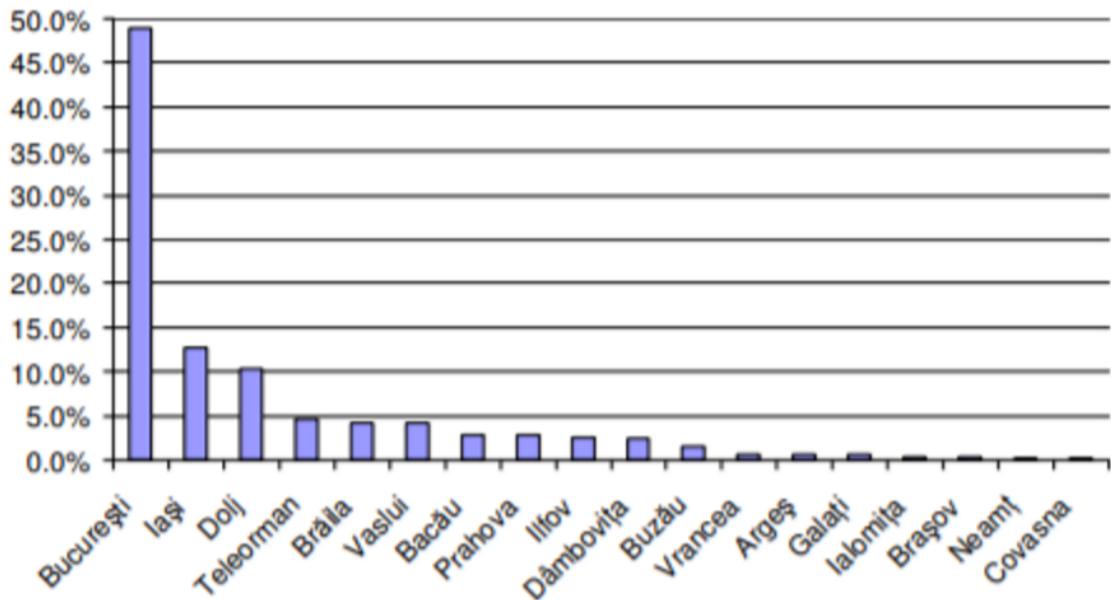
*Figure 2.9: The Carlton Block before collapse (left) and after collapse (right). Georgescu, E & Pomonis, A (2012).*

In 1977, Bucharest experienced yet another large magnitude earthquake originating from the Vrancea Region. Occurring on the evening of March 4, 1977, this earthquake registered at 7.2 on the Richter Scale. The earthquake resulted in 1,578 deaths and 11,321 injuries, with 1,424 and 7,598 occurring in Bucharest respectively. This data shows that more than 90 percent of total deaths occurred within the city limits. This is largely due to the collapse of “19 high-rise apartment buildings (of 7 to 14 storeys) that were constructed in the inter-war period as reinforced concrete frames designed only for gravity loads” (Georgescu & Pomonis, 2012). While there was damage in multiple cities in Romania, most of the damage happened within the city of Bucharest. Figure 2.10 depicts the distribution of buildings the earthquake destroyed, with more than 25 percent of the total destroyed dwellings located within Bucharest. Similarly, Figure 2.11 indicates the distribution of dwellings requiring consolidation, or the strengthening and repairing so as to restore structural characteristics of that building, following the 1977 earthquake. Researchers claimed that nearly 50 percent of dwellings located in Bucharest required modification to address damages.



Percentage of Dwelling Stock Destroyed in 1977 Earthquake by County

Figure 2.10: Chart of the territorial distribution of destroyed dwellings in 1977. Georgescu, E & Pomonis, A (2008).



Percentage of Dwelling Stock Requiring Strengthening after 1977 Earthquake by County

Figure 2.11: Chart of the territorial distribution of dwellings requiring strengthening in 1977. Georgescu, E & Pomonis, A (2008).

Researchers consider this earthquake among the most economically taxing natural disasters to occur in Romania to date. The 1977 earthquake was responsible for losses equivalent to 8 billion US dollars today, which constituted more than 6% of Romania's GDP at the time (Simpson et al., 2020). To alleviate the monetary cost and loss of life associated with natural disasters, governments must establish and follow preparedness measures. These measures shift time spent recovering from a disaster to time spent preparing for a disaster, and reduce the funds governments and municipalities must devote to disaster recovery (Anderson, n.d.).

## 2.7. Earthquake Preparedness in the Balkans

Researchers can compare and analyze the current status of Romania's earthquake preparedness by investigating the success and potential shortcomings of earthquake preparedness plans in other Balkan countries. In 2012, the United Nations and the World Meteorological Organization started an initiative called "Building Resilience to Disasters in Western Balkans and Turkey." This project aimed to assess and improve the preparedness of the Balkans for all types of disasters including fires, floods, landslides, and earthquakes. The project identified high-risk locations and made suggestions to local governments to improve disaster preparedness. The final stage in the project was a follow-up review of the Balkan region to assess the effectiveness of these suggestions. This subsequent study revealed significant progress in earthquake preparedness. Most of this progress was in public awareness and in regulations for new construction (Gencer, 2014).

Despite this progress, there still remains a serious lack of preparedness for almost all of the assessed regions. The largest remaining problem identified in this study is a lack of compliance with building regulations. City officials in this region indicate a serious shortage in their financial ability at a city level to proactively address these problems, as governments normally only provide money for disaster relief. Fortunately, the study identified one outlier: the city of Dubrovnik in

Croatia. They have created a building code policy for all new construction to increase safety during a major seismic event. Additionally, they have developed an innovative response plan in the event of a disaster that includes 22 government-funded shelters to house anyone displaced during a natural disaster (Gencer, 2014). After implementing these plans, Dubrovnik has also seen a large increase in tourism in recent years which has positively contributed to their economy (Marinova, 2020). The preparedness plans and subsequent financial growth in Dubrovnik are an example of how government investment in preemptive measures, although requiring immediate funding, does not necessarily mean the region will experience net economic loss.

Albania, like many Balkan countries, shares multiple similarities with Romania. The countries are geographically close, and have similar political backgrounds, with both countries transitioning from communism to capitalism within the last century. Due to this similarity, Albania's 6.4 magnitude earthquake in November of 2019 is relevant to modern-day Romanian earthquake preparedness. This earthquake killed 51 people and injured over 3,000, highlighting the shortcomings of the country's earthquake preparedness plans. Almost all of Albania's earthquake plans focus on relief for victims after an event, instead of preemptive action to save lives. After this earthquake, the Albanian government found temporary housing for over 6,300 displaced citizens (Freddi et. al, 2021). There was also an extensive financial relief plan which allocated 63 million US dollars (7 billion leke) for the rebuilding of homes across the country. This quick response from the Albanian government was an effective reaction to the crisis (World Bank, 2019), but the earthquake had already done its damage. The World Bank Post-Disaster Estimation identified insufficient building codes and lack of adoption of Eurocodes as major reasons for much of the damage. The reactive nature of Albania's earthquake preparation is an example of why reactive measures to earthquakes are important, but not sufficient by themselves (Dorka, 2015).

Directly following the earthquake in 2019, the Albanian government deployed a team of engineers to identify which buildings were safe to occupy and which warranted condemnation due to structural damage. These engineers suggested changes to the current building codes to prevent structural failure. Their first suggestion recommended architects take seismic risk into account when designing new structures. Secondly, the engineers recommended eliminating the practice of removing walls to create retail space on the first floor of buildings. Finally, they recommended that structural changes to a building require approval from a structural engineer (Blagov, 2020). Although these engineers suggested solutions for Albania specifically, similar measures in Romania would likely improve earthquake preparedness.

## 2.8. Bucharest Earthquake Preparedness

Since the fall of communism in Romania in 1989, residential development in Bucharest has expanded into surrounding rural communities. This is partially due to law 1/1989, which repealed communist-era laws limiting urban development and city sprawl (Suditu, 2009). After the government passed this law, their role in the production of housing decreased, and construction of residential housing shifted to the private sector. In the 90s, private investors turned agricultural land in the city outskirts into new residential buildings, expanding city limits. This trend continued in the early 2000s, as “the lack of comfortable alternative dwellings at accessible prices led to the research of solutions in the rural areas around” (Suditu, 2009).

Although private developers have constructed many new buildings in Bucharest since 1989, a significant number of older buildings still remain within the capital that are highly susceptible to earthquake damage. Figure 2.12 shows how building age varies throughout Bucharest, indicating that older buildings cluster near the city center and buildings tend to get newer as the distance from the city center increases. New building codes aim to hold modern

structures to higher standards of earthquake resistivity by incorporating stronger materials as well as improved methods of construction. Despite this, corruption in Romania often results in property owners and construction companies circumventing these codes to save money. This means regardless of current building requirements many new structures may be highly vulnerable to damage in the event of an earthquake.

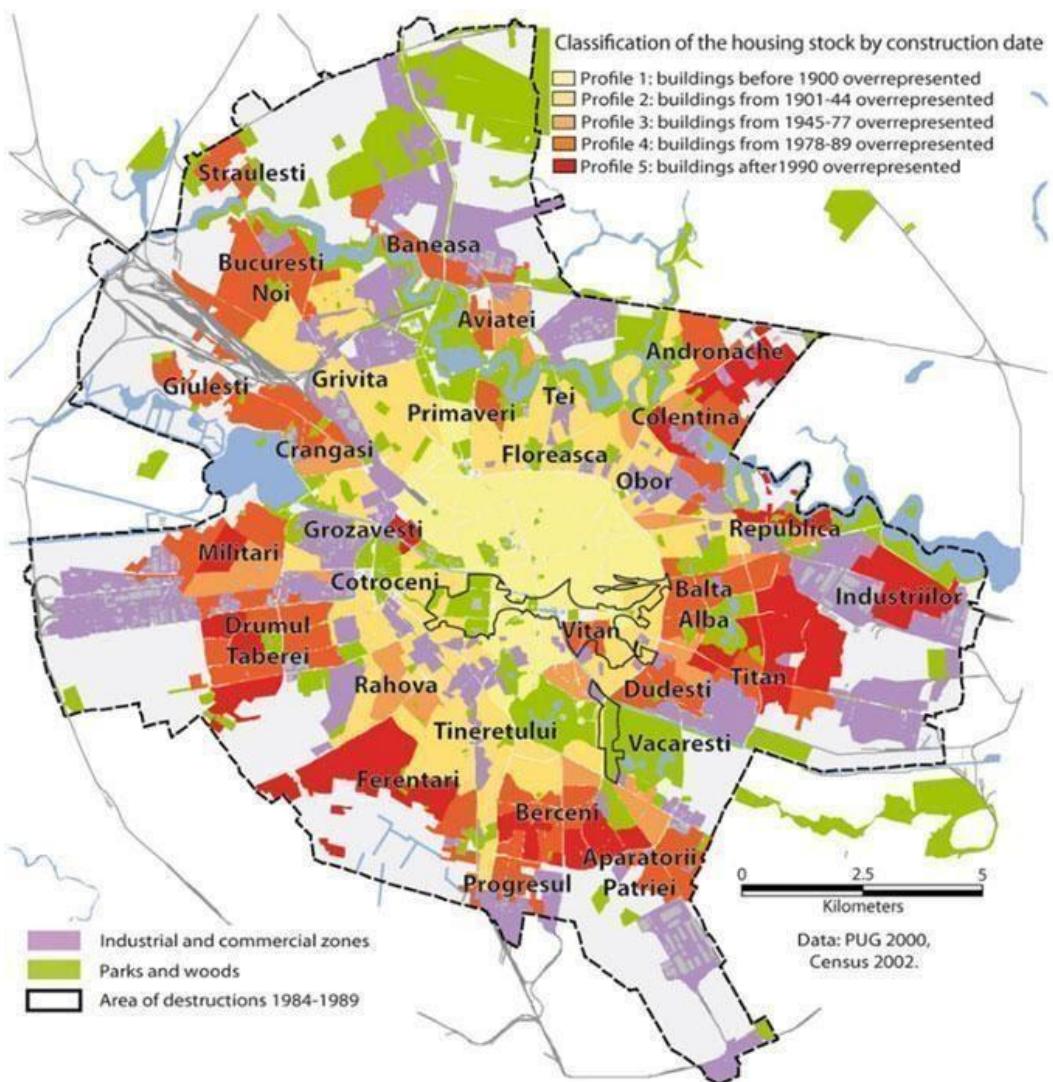


Figure 2.12: Land use and building age in Bucharest. Marin (2018).

Laws regarding seismic building codes have evolved over time in Romania. The 1963 Romanian Building Code (P13-1963) was the first major building code that dealt with seismic restrictions, with minor updates in 1970. After the major earthquake in 1977, the government

updated the code to incorporate portions of the American Concrete Institute codes, with minor updates in 1990 and 2006. These updates changed concrete ductility requirements, which is how much a structure can move before it permanently deforms (Vacareanu, 2004). However, these newer codes apply to only a fraction of buildings currently in Bucharest, as the government does not actively enforce changes landowners must make for older properties (Suditu, 2020). The Technical University of Civil Engineering in Bucharest processed building data from the 1992 census (Lungu, 2000). According to this data, in 1992, construction after 1977 accounted for only 6.7% of the 108,821 buildings in Bucharest. In comparison, construction before World War II accounted for at least 21.7% of building stock in 1992. Therefore, even with these improved building codes, most buildings in Bucharest are at the same or higher risk as they were in the 1977 earthquake.



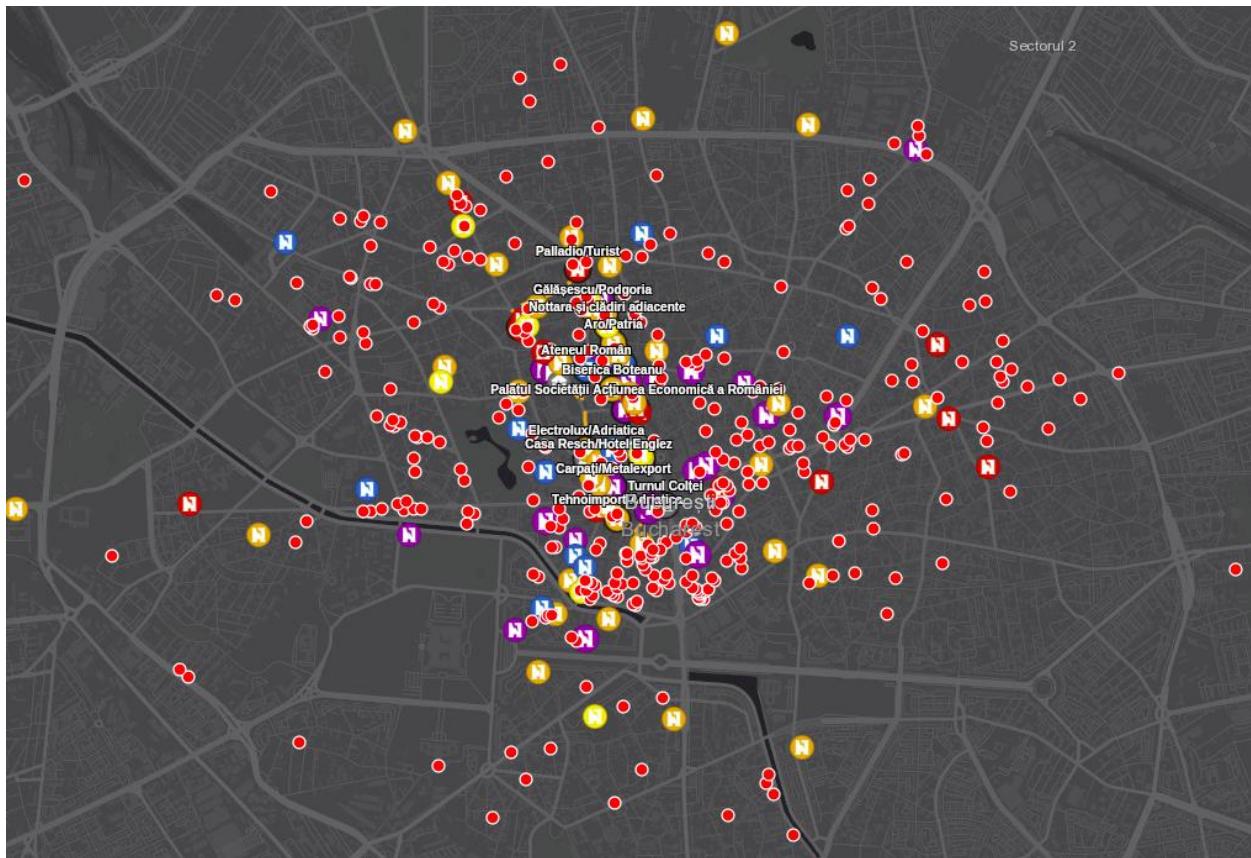
Figure 2.13: Red dot building in Bucharest, Simpson, Pomonis, & Georgescu (2020).

In 1991, the post-communist government developed plans to identify and reduce the number of buildings at risk of collapse from an earthquake. This program began the process of identifying “red dot” buildings, which are “constructions with a high risk of collapse on seismic designing force” (Suditu, 2020). Figure 2.13 shows one of these red dot buildings.

Between 1992 and 1997, the government evaluated almost 1,600 buildings based on the P100/92 design standard norms. These norms identified different emergency categories, depending on the urgency of repairs: U1 at a max of 2 years, U2 at 5, U3 at 10, and U4 with 15-20 years. In 1997, Romania’s government reclassified buildings into “seismic risk classifications,” and classified buildings based on their risk of collapse. These categories are buildings with high risk of collapse during an earthquake (RsI), buildings for which earthquakes are likely to present major structural damages (RsII), buildings which may present structural damage but do not significantly impact structural safety (RsIII), and buildings that met modern seismic code standards (RsIV). As of early 2020, around half of the 1600 buildings the government had classified did not meet new seismic codes. Of those 800 buildings, 358 buildings have a RsI classification, shown in Figure 2.14 below, while the government has marked more than 500 others as RsII or RsIII. The government hopes to analyze the risk of at least 400 more buildings within the next two years (Ivanov, 2021). The team attempted to identify a pattern or trend regarding which buildings the government analyzed for seismic risk, but the team did not find any sources explaining these decisions.

There are multiple public and private entities that are responsible for disaster risk management within Bucharest. The Ministry of Public Works, Development and Administration is the main building regulation authority in Romania. They approve “technical intervention solutions” to repair important buildings such as hospitals and shelters directly after an earthquake.

They also approve solutions to repair existing buildings classified in the highest risk category. The mayor of each sector of Bucharest is responsible for identifying buildings that an earthquake may damage, and notifying residents who are in vulnerable buildings within their sector. Finally, private owners and public property administrators must receive technical expertise from certified experts for repairs regarding buildings they own that do not have protection against seismic risks. Unfortunately, public and private actors have not completed or documented these actions, further increasing Bucharest's vulnerability (Suditu, 2020). While one source claims that "a new National Seismic Risk Reduction Strategy is under preparation at the Ministry of Public Works... to be enforced in 2021-2050," the project team was not able to find any supporting documentation for a new risk reduction strategy (Georgescu, 2020).



*Figure 2.14: Red dot buildings within the city of Bucharest. Symbols that are not a red dot indicate damaged buildings from previous earthquakes, INFP (2020).*

Edmond Niculușcă, the current city director in charge of repairs and upgrades of buildings at seismic risk in Bucharest, has said that in practice the lack of transparency, coherence, and predictability led to the blockage of many repair projects. Furthermore, laws regarding repair require that all property owners agree for repairs to be done. If a single owner declines, the government is not allowed to begin plans for repairs. This often delays repair efforts especially for buildings with many owners. In addition, the government does not provide housing for tenants of buildings under repair, further discouraging property owners from allowing the city to make repairs (Ivanov, 2021).

## 2.9. Socioeconomic Impacts of Earthquakes

High magnitude earthquakes produce long-lasting economic effects. Generally, economic losses due to earthquakes are direct or indirect losses. In this classification, direct losses indicate damages to structures and property sustained during the seismic event. The cost to repair structures depend on existing value estimations and rebuilding costs. While varying levels of architectural and engineering consistency across regions introduce some uncertainties into these calculations, “reasonably sound loss-estimation methods currently exist to project direct damage to buildings...” (National, 1992). For non-structural losses, estimates vary between regions and the researcher who is evaluating the cost.

Although earthquakes alone are non-discriminatory, striking without regard for race, ethnicity, or religion, one source suggests that lower-income and minority groups face significantly higher losses (National, 1992). These groups tend to reside in concentrated areas within a city. These neighborhoods often have the poorest construction and maintenance of housing (Van Kempen, 1994), resulting in disproportionate structural and property damages during a natural disaster. Additionally, they generally receive the smallest proportion of disaster relief relative to

the general public, resulting in lower-income groups “consistently bear[ing] a disproportionate share of the losses” (National, 1992). While this is true in general, researchers have not yet identified this correlation within Bucharest.

Indirect economic losses are difficult to quantify. This is because business interruption, economic stagnation, and changes to day-to-day life depend highly upon societal aspects that researchers cannot easily factor into estimations. For example, earthquakes may result in transit interruptions. In regions that rely on public transportation as a “lifeline service”, interruptions would induce larger long-term economic losses than those seen in a region that is less reliant on transportation systems (National, 1992).

In 2012, Iuliana Armaş published a study titled “Multi-criteria vulnerability analysis to earthquake hazard of Bucharest, Romania.” This study combined five variables to create a map of the different levels of vulnerability in Bucharest by using 2002 census data. First, the researchers calculated environmental vulnerability by using ground acceleration values of recent earthquakes, a measure of how violent the shaking is. Second, they calculated social vulnerability through multiple factors including ratio of elderly population, housing density, and average number of persons per household. They then used unemployment rate, income inequality, and population density to calculate the economic vulnerability of the population. Armaş’ group calculated building stock vulnerability by using the age and average height of buildings, type of buildings, and residence density in those buildings. Finally, they used the term “capacity” to indicate a specific area’s ability to respond to disaster. To calculate capacity, the group used factors such as distance to hospitals, fire stations, and police stations to define the area’s preparedness level. Finally, Armaş combined this research into an overall vulnerability map. In 2017, Armaş updated the original

vulnerability analysis using census data from 2011 to create an up-to-date vulnerability analysis (Armas et al., 2017). Figure 2.15 illustrates this updated vulnerability analysis of Bucharest.

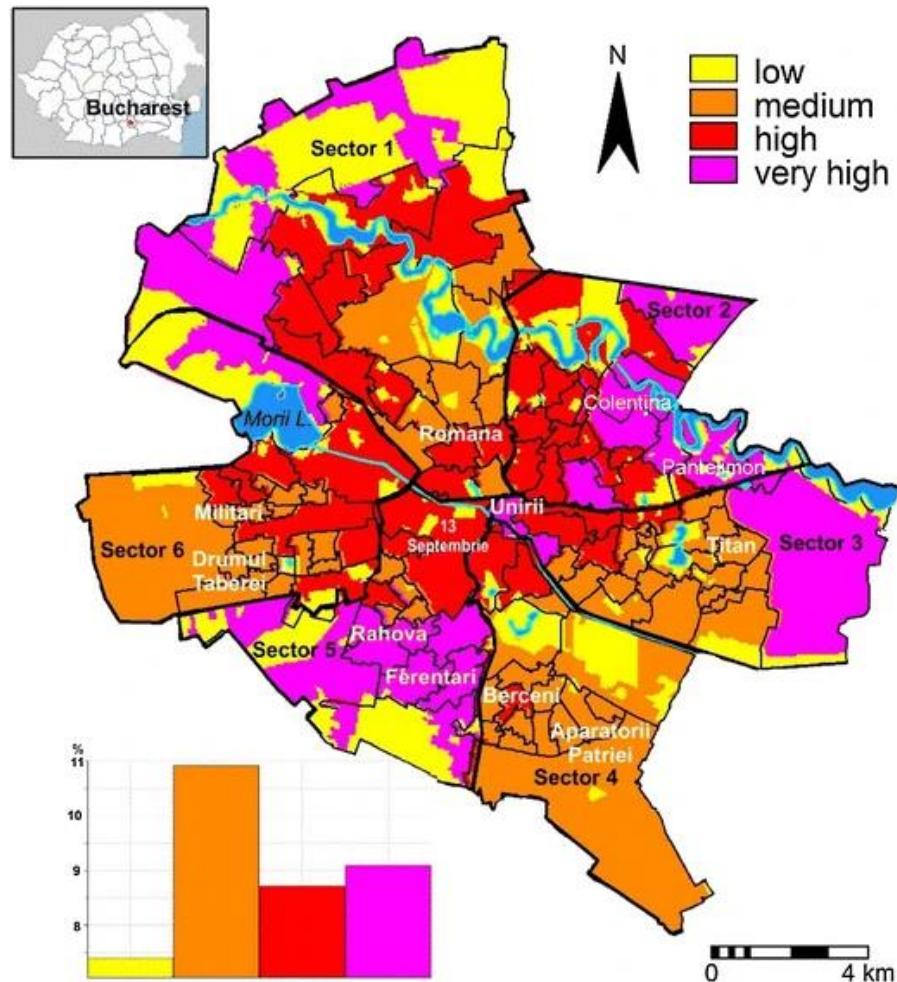


Figure 2.15: Vulnerability map of Bucharest. Armaş et al. (2017).

Figure 2.15 displays an interesting trend with regards to regions of high and very high vulnerability. This figure shows that a large proportion of regions categorized as highly vulnerable are concentrated in the center of the city. Figure 2.12 shows that the age of buildings in the center of the city is often greater than that of those on the outskirts. This is the main reason Armaş' report deemed these regions as high risk. In contrast, nearly all regions the researchers labeled as very high risk reside towards the outskirts of the city. Studies have shown that poorer citizens and

minorities tend to live outside of the center of cities (Van Kempen, 1994). While this holds true for many cities, researchers have not yet established links between earthquake vulnerability and different ethnic and religious groups in Bucharest, Romania.

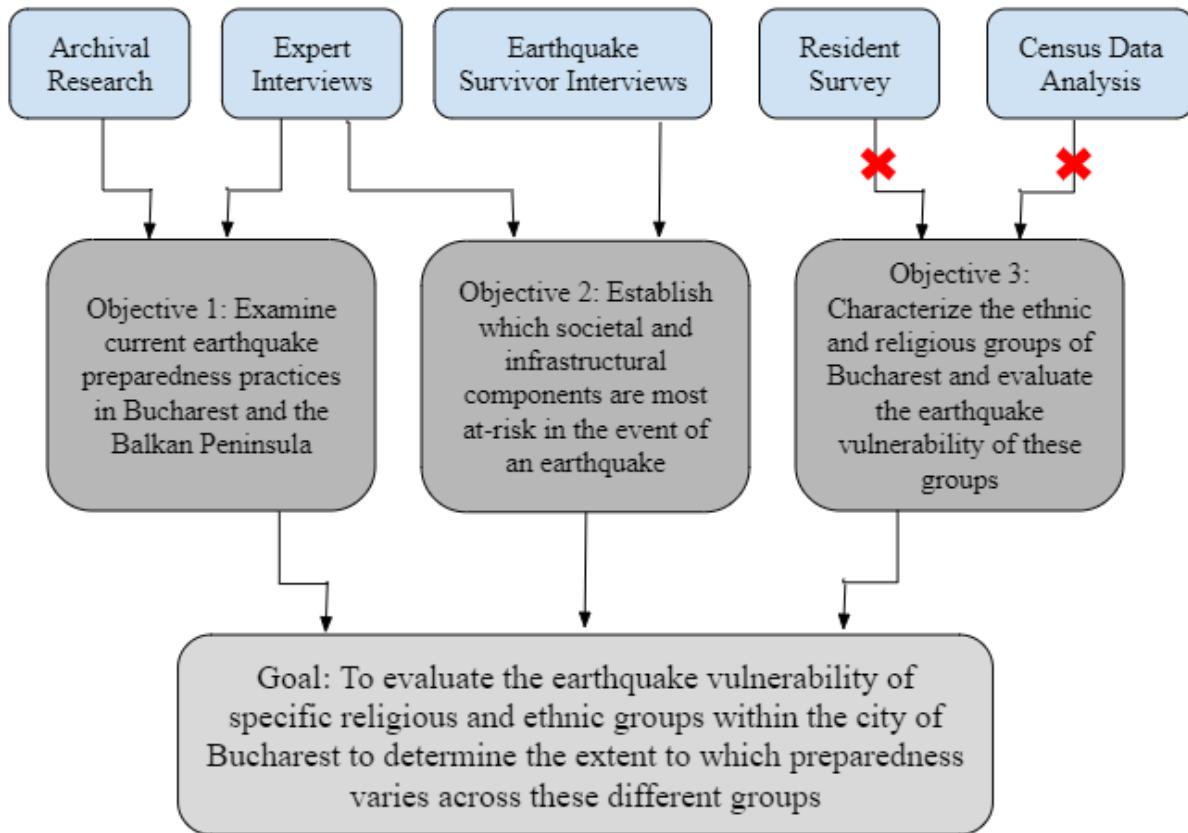
Many individuals and groups within Bucharest have a direct stake in this project because the effects of earthquakes directly impact them. In the initial stages of the project, the team gauged relative preparedness within the Balkan Peninsula. Due to time constraints, the team reduced the scope of this objective to compare Albania, Croatia, and Romania. This information is relevant to residents and officials of the region as it provides useful insight into effective practices across the peninsula. The ethnic and religious groups the team studied stood to benefit had this project revealed that they are at a higher risk for loss in the event of an earthquake. Had this been the case, these individuals would have the opportunity to take further personal action or advocate for improved governmental practices. City officials also have a stake in this project as the onus is now on the city of Bucharest to adjust its earthquake preparedness plans to protect its minorities. Future researchers and experts in the field of seismology will be able to apply this method of analysis to other earthquake-prone cities, allowing them to identify larger trends that exist. Finally, experts in the fields of engineering and seismology also have an important stake in this project as it is their work that seeks to characterize the effects of earthquakes and improve preparedness measures, as well as inform new research such as this report.

### 3.0 Methodology

The goal of this project was to evaluate the earthquake vulnerability of specific religious and ethnic groups within the city of Bucharest to determine the extent to which preparedness varies across these different groups. The objectives to achieve this goal were as follows:

1. To examine current earthquake preparedness practices in Bucharest and the Balkan Peninsula.
2. To establish which societal and infrastructural components are most at-risk in the event of an earthquake.
3. To characterize the ethnic and religious groups of Bucharest and evaluate the earthquake vulnerability of these groups.

The team accomplished these objectives over the seven-week period from March 24 to May 13, 2021. The focus of this project was within the Balkan Peninsula and specifically within the city of Bucharest, Romania. While the team initially expected to spend the project term in Bucharest, the Worcester Polytechnic Institute administration issued a decision restricting international travel amid the COVID-19 pandemic. With this in mind, the team pursued all objectives remotely in compliance with WPI mandates to ensure the safety of the team, collaborators, and study participants. The team established a set of methods to accomplish these objectives. In Figure 3.1, these methods are in blue boxes with arrows indicating which objectives they correspond to. An X across an arrow indicates that the team employed the method, but it was not successful. Through these objectives, the team examined the societal impacts of earthquakes within Bucharest relative to other regions in the Balkan Peninsula and the United States, assessed the current state of preparation within Bucharest, and explored the extent to which this preparedness varies for religious and ethnic groups within the city.



*Figure 3.1: Flowchart of the objectives and tasks to accomplish the project goal.*

### 3.1. Objective 1: Examine Current Earthquake Preparedness Practices in Bucharest and the Balkan Peninsula

The first objective of this project was to examine current earthquake preparedness practices in Bucharest and the Balkan Peninsula. To achieve this, the team built a working knowledge of the measures currently in place within Bucharest as well as Zagreb, Croatia, and Durrës and Tirana, Albania. The team compared these practices to measures generally in place across the United States. This objective focused on comparing practices with several countries that have similar political climates and earthquake potential as well as to the United States because of its advanced earthquake engineering. These comparisons enabled the team to contextualize preparedness within Bucharest by revealing whether it is more or less prepared than other cities, and what specific measures the city currently employs to yield this preparedness.

### 3.1.1. Expert Interviews

The team conducted interviews with experts and professionals in earthquake-related fields from the United States, Bucharest, Tirana and Durrës, and Zagreb. These included seismologists, civil engineers, non-government organization leaders, and journalists who have published work focusing on earthquake preparedness. The team identified experts to interview in several ways.

Interviewee Name	Location	Area of Expertise
Prof. Aaron Sakulich	United States	Civil Engineering, Worcester Polytechnic Institute (WPI)
Prof. Leonard Albano	United States	Civil Engineering, WPI, focus on buildings codes
Prof. Naser Sharifi	United States	Civil Engineering, WPI, focus on retrofitting
Dr. Emil-Sever Georgescu	Bucharest, Romania	Structural Engineering, URBAN-INCERC Institute, PhD in seismic risk reduction
Matei Sumbasacu	Bucharest, Romania	Civil Engineer, Co-Founder of Earthquake Preparedness NGO
Alina Kasprovschi	Bucharest, Romania	Executive Director, NGO funding preparedness initiatives
Georgina Ilie	Bucharest, Romania	Journalist, research in emergency response and earthquakes
Gent Gjuta	Tirana and Durrës, Albania	Civil Engineer, working in post- earthquake building reconstruction
Mirian Bllachi	Tirana and Durrës, Albania	Program Manager, NGO doing post- earthquake monument restoration
Prof. Marija Mustać	Zagreb, Croatia	Geophysics and Seismology, University of Zagreb, working in seismological surveying

*Table 3.1: Interviewee information for the team's ten expert interviews.*

First, the team connected with professors in earthquake-related fields at various universities. This resulted in several interviews with WPI professors, who served as US experts and helped shape the team's interview process. This approach also yielded an interview with an expert from the University of Zagreb in Croatia. Next, the team contacted individuals whose names appeared repeatedly during research in the preparation term of this project. Since WPI has project centers in Romania and Albania, the team also reached out to individuals in both countries who had worked with WPI students in the past. Finally, the team used snowball sampling wherein interviewees identified other experts who would be willing to speak with the team. Table 3.1 above lists interviewee information including name, location, and area of expertise.

The team conducted expert interviews in groups of three with one primary interviewer, a secondary interviewer, and a note taker. These interviews took place over Zoom, and officially began once the team read each interviewee a standard confidentiality statement (see Appendix N) and received consent. Moreover, if the interviewee allowed, the team recorded audio and video.

The interview questions for experts are listed in Appendix Q. The team specifically crafted questions Q.9-Q.12, Q.19-Q.20 for the purpose of this objective, which covered preparedness measures and the role the government plays in earthquake preparedness. While the team went into each interview with a series of questions prepared, the team quickly found that many of the individuals were both passionate and eager to talk about their work. As such, a combination of semi-structured and unstructured interview styles facilitated more fluid and thorough conversation.

### 3.1.2. Archival Research

While expert interviews were the main method for objective 1, variations in the numbers of interviewees and areas of expertise in each of the four countries the team explored led to some

inconsistencies in topics discussed. The team realized this while comparing the results of the three interviews from the US, which focused on civil engineering, to the interview out of Croatia, which focused on geophysics. The US interviewees provided more technical information regarding building codes and assessments than the interviewee from Croatia, but this did not necessarily mean that building codes and assessment practices were not in place in Croatia. Following interview analysis, the team identified gaps such as this in the interviewee-provided information. Utilizing database search engines and simple searches, of which Google and Google Scholar were most fruitful, the team supplemented interviews with research sourced from reputable websites, articles, and journals.

### **3.2. Objective 2: Identify Societal and Infrastructural Components Most At-Risk in the Event of an Earthquake**

The next objective was to investigate and identify which societal and infrastructural components are most vulnerable to earthquakes in Zagreb, Durrës, Tirana, US cities, and Bucharest. The team worked to uncover the rationale behind preparedness measures employed by local governments in these regions to determine which aspects of these cities' physical and social environments are vulnerable to earthquakes. True preparation requires action on the part of both the government as well as individuals. Thus, the team needed to build a comprehensive knowledge of societal vulnerabilities within Bucharest and target cities by gauging education and individual agency in minimizing earthquake risk. Interviews with both experts and residents of these cities provided the information needed for this objective.

### 3.2.1. Expert Interviews

Similar to objective 1, objective 2 relied heavily on expert interviews to provide information regarding vulnerable components of cities. The team obtained this information in the same interviews outlined in section 3.1.1. Questions Q.5-Q.8 explored the buildings and infrastructure at risk within the target cities and questions Q.13-Q.18 explored the social and socioeconomic constructs at risk within these cities, allowing the team to identify the components of a city that are vulnerable and why (Appendix Q). While the team prepared these questions before interviews, the team again utilized a mixture of semi-structured and unstructured interview styles to garner information regarding this topic.

### 3.2.2. Romanian and Albanian Earthquake Survivor Interviews

The team conducted interviews with six individuals who experienced earthquakes in Romania and Albania. The team identified several of these individuals through WPI's project centers in Romania and Albania. This resulted in interviews with individuals who experienced the earthquake in Albania in 2019, which occurred while WPI students and faculty were in Tirana for research. The team used the WPI Department of Integrative and Global Studies to obtain an interview with the Romanian project site director, who is well-connected in both the Bucharest and WPI communities. Finally, at the end of each expert interview, the team asked interviewees if they experienced major earthquakes in their respective countries. If these individuals responded yes, they were asked both the expert questions above as well as questions targeting personal experience. Table 3.2 below lists earthquake survivor interviewee information including name (grouped by country, listed alphabetically by last name in these groups), location of the experienced earthquake, and year of the earthquake.

Similar to expert interviews, the team conducted the earthquake survivor interviews in groups of three and began by reading the standard confidentiality statement and asking consent to record audio and video. These interviews took place over Zoom, and officially began once the team read the interviewee the confidentiality statement and received consent.

The interview questions for earthquake survivors are in Appendix P, which details a semi-structured interview guide. The team specifically crafted questions targeting personal experiences with earthquakes (P.1-P.2), lasting impacts of earthquakes (questions P.3, P.9), reactions to earthquakes (P.4-P.8), earthquake preparedness (questions P.13-P.23), and perceived effects of earthquakes (C10). The team prepared these questions in advance but found that many respondents spoke about their experiences in a story-like manner. As such, the team again decided to utilize a combination of semi-structured and unstructured interview styles.

Interviewee Name	Location of Earthquake	Year of Earthquake
Mirian Bllachi	Tirana, Albania	2019
Gent Gjuta	Tirana, Albania	2019
Prof. Robert Hersh	Tirana, Albania	2019
Rachel Kinicki	Tirana, Albania	2019
Dr. Emil-Sever Georgescu	Bucharest, Romania	1977
Prof. Bogdan Vernescu	Bucharest, Romania	1977

*Table 3.2: Interviewee information for the Romanian and Albanian earthquake survivor interview.*

### 3.3. Objective 3: Characterize the Ethnic and Religious Groups of Bucharest and Evaluate the Earthquake Vulnerability of these Groups

The final objective was to characterize the Ethnic and Religious Groups of Bucharest and Evaluate the Earthquake Vulnerability of these Groups. The team hoped to determine the distribution of these groups throughout the city. Since existing research stated that preparedness is uneven throughout the city (Armaş, 2012; Armaş et al., 2017), this objective sought to assess the preparedness of ethnic and religious groups. Bucharest is mostly comprised of Romanians, and the majority religion is Orthodox Christians, but the team's expectation was that these methods would identify pockets of the city wherein minority ethnic and religious groups reside in high concentrations. The methods for executing this objective were surveying residents, mapping local churches and ethnic organizations, and applying an existing vulnerability evaluation to specific groups within the city.

#### 3.3.1. Survey of Residents in Bucharest

The team prepared a survey for residents of Bucharest to collect data regarding several key social elements within Bucharest (see Appendix S). The survey focused on ethnic and religious groups with a goal of investigating how infrastructure, transportation, residencies, and access to resources such as groceries and healthcare shape their experiences with earthquakes and earthquake preparedness. The team designed this survey to identify trends across these groups and assess to what extent variations of living experiences due to religious and ethnic identity influence earthquake preparedness in Bucharest. The team assembled these questions into a Google survey for distribution to residents in both English and Romanian. Figure 3.2 below shows an image of

the first page of the survey, which asked respondents which language they would prefer to take the rest of the survey in.

Many of the groups the team sought to distribute the survey to were not easy to contact, and the remote nature of this project further exacerbated the difficulty to contact ethnic and religious groups. This forced the research team to rely heavily on the assistance of locals and organizations in Bucharest. First, the team reached out to various places of worship and different ethnic organizations in Bucharest to aid in distribution. The team identified these organizations using a simple search in the Google Search engine. The team also researched several restaurants within Bucharest, including several that cater to ethnic and religious groups, and asked owners of these businesses to distribute the survey. Finally, the team reached out to interviewees the team spoke with in prior methods and personal contacts in Bucharest and asked these individuals to distribute the survey. Despite the extensive measures the team took to distribute the survey, the team did not receive enough results and analysis was not possible.



# WPI

Bucharest Earthquake Preparedness Study --  
Studiul de pregătire a cutremurului din  
București

\* Required

In what language would you like to take the survey? În ce limbă doriți să participați la sondaj? \*

English

Română

Figure 3.2: First page of the team's resident survey, question prompts respondents to select their language of choice for remainder of survey.

### 3.3.2. Vulnerability Calculation

The team's final method for this objective was to use census data to quantify how earthquakes may disproportionately affect different ethnic and religious groups within Bucharest. The team initially proposed addressing this objective by using data from the 2011 census for specific religious and ethnic groups in a spatial vulnerability analysis established in existing research (Armaş, 2012). This prior research utilizes an analytical technique to calculate a numerical score that represents the earthquake risk of a given area using a series of indicators. These factor into overall vulnerability, or the measure of how likely a person or place is to sustain loss from an earthquake hazard.

While the team had originally proposed adapting this analysis method to achieve this objective with the data available in census data, other methods revealed that this technique had many limitations. Specifically, multiple experts the team interviewed suggested that several of the indicators that Armaş' analysis includes are not actually significant in comparison to the vulnerability of the city's buildings and infrastructure (Sumbasacu, 2021; Ilie, 2021). Similarly, the city needs to assess the building stock and other serious vulnerabilities to establish a baseline of preparedness within the city before future research can consider differences across social divides. As such, the team shifted focus from providing an overall vulnerability index to instead look at some of the more relevant indicators and compare these across different ethnic and religious groups.

To complete this analysis, the team used data provided through the Integrated Public Use Microdata Services (IPUMS, 2020), specifically the IPUMS international branch. This dataset represented 10% of the total population within Romania, containing about 2.2 million entries. To analyze all of this data, the team built a software tool in python to process this dataset, parse it to

only include entries from the city of Bucharest, and analyze variables such as unemployment rate, education level, and age (Benevedes, 2021). Overall, the total dataset for residents within Bucharest contained approximately 220,000 entries. However, the team quickly ran into more issues. A majority of respondents (89%) had marked their ethnicity as Romanian and their religion as Christian. However, almost all of the remaining respondents (10%) marked their ethnicity and religion as “Unknown.” The final 1% did not represent the rest of the minorities well. Furthermore, the team was not able to identify research that linked these variables to earthquake vulnerability. For these reasons, the team decided to focus instead on interviews and research to determine vulnerability within Bucharest, as the census data would not strongly support claims we might make about minority vulnerability.

### 3.4. Interview Analysis

The team coded the expert and earthquake survivor interviews to identify common trends across interviewees and countries. The team used deductive coding to first establish two preliminary sets of expected themes, with one for expert interviews and the other for earthquake survivor interviews. The team then transcribed each interview from the corresponding Zoom recording and parsed through each interview in groups of two, highlighting important words, phrases, and quotes. Depending on the personnel, the team divided highlights into the themes. Although the team established some themes prior to coding, the team added other categories as necessary, making the process a mixture of inductive and deductive coding. Moreover, the team reassessed prior classifications every time we added a code, making it an iterative process.

For expert interviews, the team organized highlighted sections into one of six themes: religious and ethnic correlations to earthquake vulnerability, socioeconomic correlations to earthquake vulnerability, social impacts of earthquakes, building and infrastructural impacts of

earthquakes, preparedness measures and their limitations, and historical impacts on earthquake vulnerability (see Appendix T). Several of these themes included subcategories that allowed the team to better organize results and compare across countries. In some cases, quotes could fit under multiple themes, and the team classified them under each accordingly. The team then recorded the frequencies with which each interviewee referenced each theme in an Excel spreadsheet. The team filled this sheet with formulas that summed references of each theme to track frequencies across countries and across all experts. Table 3.3 below is an image of the Excel sheet, which shows the frequencies for referencing different government preparedness measures. Preparedness Measures is the code, and the following eight columns are different preparedness measures that experts mentioned.

Interview/Code	Preparedness Measures	Gov.	Existing Codes	Assessment	Maintenance/Retrofitting	Public Education	Early Warning Systems	Utility Shut Off	Other
Romania	94	34	4	5	6	11	1	1	6
Georgescu	23	14	2	2	3	5	0	0	2
Ilie	33	8	0	0	0	4	0	1	3
Matei	15	4	2	2	0	0	0	0	0
Kasprovschi	23	8	0	1	3	2	1	0	1

Table 3.3: Image of the frequency tracking Excel sheet for expert interviews.

For earthquake survivor interviews, the team organized highlighted sections into one of the two themes: reactions people had during the earthquake, and what interviewees observed about damages and the social atmosphere after the earthquake (see Appendix U). After organizing the highlighted phrases, the team again input the frequencies of references into a spreadsheet that tracked these values for each interviewee as well as across countries and in total. Table 3.4 below is an image of the Excel sheet that displays the references the team entered for the theme “In the moment responses.” This theme had two subcategories “Emotional Responses” and “Physical

Responses,” the former of which was further broken into positive, neutral and negative responses. The table displays all of these subcategories for all earthquake survivors interviewed from Albania.

Interview/Code	In the Moment Reactions	Emotional Response	Positive	Negative	Neutral
<b>Albania</b>	<b>49</b>	<b>34</b>	<b>4</b>	<b>20</b>	<b>10</b>
Kinicki	9	8	1	5	2
Gent	16	14	3	7	4
Hersh	12	7	0	4	3
Bllachi	12	5	0	4	1

*Table 3.4: Image of the frequency tracking Excel sheet for earthquake survivor interviews.*

### 3.5. Summary

After the team coded expert and earthquake survivor interviews, we calculated counts and frequencies for each interview based on our coding categories. These provided valuable insight into similarities and differences in preparedness and vulnerable infrastructure across countries. While these were important for the team to determine the relevance of certain preparedness practices within the different cities, the team found that these were further strengthened by quotes that interviewees provided. For this reason, the team combined the quantitative data in the form of counts and frequency with qualitative insights from experts to produce a thorough and structured narrative of results.

## 4.0 Results

This chapter details the results obtained throughout this project regarding earthquake vulnerability and preparedness in the Balkan Peninsula and Bucharest. Section 4.1 discusses the preparedness measures that are in place within Bucharest, as well other cities within targeted countries in the Balkan Peninsula and the United States. Section 4.2 discusses the lasting impacts of Romania's communist past on earthquake preparedness in Bucharest. Section 4.3 discusses types of infrastructure that interviewees have identified as highly vulnerable to earthquakes within Bucharest. Section 4.4 discusses the role of NGOs in the preparedness movement in Bucharest. Each section combines data such as reference counts and frequencies with qualitative insight from research and interviews to convey a structured and supported narrative of earthquake preparedness and vulnerability within Bucharest. Interviews referenced or quoted in the results can be found in Appendix A through Appendix M respectively for each interviewee. The final section addresses the limitations of drawing conclusions on the correlations between ethnic and religious identity and earthquake preparedness.

### 4.1. Government-Funded Earthquake Preparedness Measures

The team originally set out to determine the most prominent earthquake preparedness measures that governments utilize in Bucharest and other cities within the Balkan Peninsula, but quickly found that the project could not explore these measures without also addressing their limitations. As the research evolved, this objective also expanded to include a comparison to practices in the US, which the team dubbed a "gold standard" in earthquake engineering and preparedness.

Interviews with experts on earthquakes in the US and the Balkan Peninsula made it clear that the existence of a given measure within a city is not a straightforward indicator of

preparedness. This is evident in the responses of expert interviewees, who often identified preparedness measures within their cities and the limitations of these measures within the same thought. Table 4.1 below consolidates the team's findings into a chart, where each row is a government-funded preparedness practice mentioned in at least one expert interview from cities in Romania, Albania, Croatia, and the US. The resulting list corresponding to row labels in the table are: building codes, school drills, information campaigns, assessment of buildings, maintenance and retrofitting of existing structures, early warning systems, and electrical and gas shutoffs prior to earthquakes.

Practice	Bucharest, Romania			Tirana and Durrës, Albania			Zagreb, Croatia			United States*		
	Used	Interview Reference (n=4)	Effective/Uniform	Used	Interview Reference (n=2)	Effective/Uniform	Used	Interview Reference (n=1)	Effective/Uniform	Used	Interview Reference (n=3)	Effective/Uniform
Building codes	Yes	4	No	Yes	4	No	Yes	1	No	Yes	19	No
Information campaigns	Yes	11	No	Yes	7	N/A	Yes	3	No	Yes	6	N/A
Assessment	Yes	5	No	Yes	10	No	Yes	0	No	Yes	2	No
Maintenance /Retrofitting	Yes	6	No	Yes	3	No	Yes	1	No	Yes	6	No
Early Warning System	Yes	1	No**	No	0	N/A	No	1	N/A	Yes	0	N/A
Utility Shutoff	Yes	1	No***	No	0	N/A	Yes	2	Yes	Yes	0	N/A

\* The team did not look at a specific city within the US, but rather experts in academia commented on the general practices within vulnerable cities in the country

\*\*Interviewee has described instance wherein someone hacked the system and false alarm induced panic, less trust in this measure now (Kasprowschi, Appendix D)

\*\*\*Experts considered this measure a work-in-progress within Romania, will likely be a practice that saves lives if the city fully implements it

Table 4.1: The preparedness measures used by governments, referenced by interviewees, and considered effective by experts in Romania, Albania, Croatia, and the United States.

The table columns for each of the four regions explored include subcategories of “Used,” “Interview Reference,” and “Effective/Uniform.” The “Used” column indicates if the government of each region uses each measure, the “Interview Reference” column indicates the total number of times that experts referenced each measure for each region. If this column is “0” that measure was

not referenced. This frequency is influenced by the number of respondents within each country and the areas of expertise of these experts. The “Effective/Uniform” column indicates if experts the team interviewed considered this practice effective and uniformly applied within the given region. If this column is marked “N/A” it means that no experts commented on the efficacy of the measure. For instances wherein experts did not reference a specific measure, the team utilized archival research to determine if that practice is in place within vulnerable cities.

Governments employ many of the same preparedness measures across the four countries. More specifically, the United States in general and Bucharest, Romania utilize all of the measures in the table while Zagreb, Croatia employs all of these measures except for an early warning system. The data indicating that Tirana and Durrës in Albania do not employ regular school drills, early warning systems, or electrical and gas shutoff mechanisms suggests that Albania is the Balkan country in this study with the least number of preparedness measures in place. While these findings suggest that the US and Bucharest are the most prepared of the four regions examined, with Zagreb slightly less prepared, this is not the full story. As experts described, nearly every preparedness measure within each country had limitations in efficacy and uniform application based on specific conditions within the regions, reducing the overall preparedness of the cities within these countries.

In some cases, country-specific conditions directly impact preparedness. For example, Prof. Marija Mustać explained that earthquakes originate from fault lines located beneath the city of Zagreb. This makes an early warning system impossible to implement, as the delay between the slipping of the fault lines and effects on the city is not long enough to prepare. Like this example, respondents across the Balkans and the U.S. identified a number of reasons why preparedness measures are ineffective within their regions. This is evident in a cross-regional examination of

the most common preparedness measures, which are existing laws and codes, maintenance/retrofitting, and assessment in that order.

Experts referenced existing laws and regulations 28 times across 10 interviews, more frequently than any other government-implemented preparedness measure at over 24 percent of the expert references tabulated by our coding process. The US is an outlier, with 19 references of existing codes, likely in part due to the fact that all three of the experts from this region were civil engineers. According to expert references, the topic of existing codes is less prevalent across the Balkans, but still appears in the responses of five of the seven experts from these countries. In their responses, two of the three experts from the US and three of the four experts from Romania acknowledged that although laws and regulations are government-mandated, uniform application of these codes is difficult to enforce because the government is not directly responsible for repairing privately owned structures. This leads to varying levels of accountability when renovating buildings. Leonard Albano, a civil engineering professor in the US, stated “State-level building code requirements, I think, help to level that playing field, but in the end though it comes down to the property owners...” (Albano, see Appendix B for full interview transcript).

In speaking with experts, the team confirmed that circumventing regulations may save money. Because experts in Bucharest have identified significant price tags associated with code application and consolidation efforts, this may mean it is economically attractive to take advantage of the lack of accountability for code enforcement. However, this means many buildings within Bucharest do not meet code. Alina Kasprovschi, Executive Director of the Bucharest Community Foundation, inferred during her interview that the government is not responsible for paying for private consolidation efforts and stated, “Because the codes and regulations of buildings have not been respected... we expect that many of the buildings which are considered to be new are not

actually as safe as people want to believe..." (Kasprovschi, see Appendix D for full interview transcript). This line of thought that Kasprovschi presents suggests that the high costs, limited government funding, and lack of enforcement results in property owners bypassing regulations and buildings not reaching standards of earthquake resistivity within the city.

Interviewees across all four countries mentioned the assessment of existing structures as another preparedness measure, but experts again identified limitations to this measure. Albano indicated that a major challenge to the successful assessment of the US building stock is that property owners can make renovations to structures, but are not necessarily required to have authorities reassess buildings during and after alterations depending on the degree of change within these structures. This means that properties may undergo alterations that impact their earthquake resilience and yet remain unassessed. Despite this limitation, Albano also cited recent improvements to assessment methods, including a recent shift of responsibility in code development and application from the state level to a centralized government effort that has aided in more consistent assessment practices within the US.

Experts also noted inconsistencies in assessment practices as roadblocks to preparedness in both Albania and Romania. Mirian Bllachi, a program manager of a Tiranian NGO specializing in the promotion and preservation of cultural heritage, stated, "There were no forms for assessing damages and... institutions that were involved with assessment of damages was going according [to] their own... formats of assessing damages" (Bllachi, see Appendix I for full interview transcript). Bllachi provided this quote while discussing attempts to assess damage following the 2019 earthquake centered near Durrës, Albania, and described these inconsistencies as the product of an unprepared government within Albania.

In contrast, experts from Bucharest suggested that the government may have intentionally introduced inconsistencies to evade responsibility and veil the true extent of building vulnerability within the Romanian capital. Matei Sumbasacu, a civil engineer and co-founder of a preparedness-focused NGO within Bucharest, described how the Bucharest government has employed a number of plans for assessment and classification of vulnerable buildings throughout history, but at no point in time has the government attempted to reconcile outdated classifications with the most current practices. There are currently 358 buildings classified under the highest risk classification, but this value does not include buildings that the government had previously deemed extremely vulnerable under older assessment methods. As such, Sumbasacu suggests that there are closer to 2000 extremely vulnerable buildings within the city. This practice has perpetuated an extremely misleading account of the vulnerability within the city and undermines the need to enhance the structural integrity of classified buildings.

Experts identified maintenance and retrofitting as a measure that each country utilizes, and while explanations varied slightly from region to region, at least one expert from each country cited underfunding as a major roadblock to effectively implementing this practice. Within Romania specifically, it is not surprising that experts acknowledged the difficulties of maintaining and retrofitting existing structures due to an unclear perception of building stock vulnerability and severely lacking funds. Kasprovschi described the cost of ensuring the safety of existing structures while discussing the expenses of consolidation, stating, “It's huge [amounts of] time, huge amounts of money that needs to be invested in this.” Simply put, maintaining and retrofitting existing buildings is an undertaking that neither government nor personal budgets can accommodate in many cities, including Bucharest.

The team identified many important practices that aim to minimize earthquake losses in the four regions the team explored, but each of these can only do so much. In addition to the limitations the team presented above, experts also stated that how individuals react in the moment can be just as important as preparedness. The personal experiences of individuals, including past earthquake experiences and differences in earthquake education, influence these reactions. This is clearly exemplified in a quote from Mustać, who when asked about preparedness in Croatia stated, “It also mostly depends on people's experience. So in the southern part [of Croatia], earthquakes are a lot more frequent. And people remember their crisis happened before and occasionally feel some smaller earthquakes. And they are much more aware of the danger of this..” Georgescu reflected a similar sentiment in the quote, “we have now, full... generations of younger people, which didn't have the opportunity to feel an earthquake, even a medium one... but when this will happen, [the] next one, the big one... the people will be quite disarmed.” Responses from earthquake survivors further strengthen the point experts made that personal experience impacts preparedness.

Gent Gjuta, who is both an expert in civil engineering and a survivor of the 2019 Albanian Earthquakes, stated, “And [some of my family members] just, you know instinctively went out of the house. I personally, I wasn't scared of the first earthquake... maybe because of what I do.” In this quote, Gjuta confirms that experience shapes how individuals respond, with members of his family panicking and exiting their buildings in the first major earthquake they experienced, while his line of work and exposure to earthquakes kept him calm. In one interview with an individual who survived the 2019 Albanian earthquake, the interviewee indicated that they had known to hide under heavy furniture, but, having never personally experienced a major earthquake before, could not get out of bed in the moment (Kinicki, see Appendix L for full transcript). Professor Bogdan

Vernescu, who lived in Bucharest during the 1977 Vrancea earthquake, informed the team that the reason he knew what to do in the earthquake was “because both of [his] parents were civil engineers” (Professor Bogdan Vernescu, see Appendix M for full transcript). In all earthquake survivor interviews, respondents described their experiences, and each reacted differently to their earthquakes. These powerful descriptions of experiences underscored the important point that experts made across all of the countries explored: that experience informs preparedness.

#### 4.2. Influence of the Communist Past on Earthquake Preparedness in Bucharest

Despite 30 years having passed since the communist regime fell, its effects still cast a shadow on Romanian society. The five Romanian citizens whom the team interviewed spoke frequently of how Romania’s communist past shapes earthquake preparedness, mentioning communism 52 times during our interviews. Through these discussions, the team learned for the first time about how communism continues to directly influence many aspects of modern-day Romania.

In our interview with Georgiana Ilie, she introduced the social trust index of Romania. This index shows the results of a survey distributed throughout Romania in 2017 that asked questions about citizens' trust in each other and in their government (Ortiz-Ospina & Roser, 2017). Ilie said, “only about 7 or 8% of the population believes that the other people are trustworthy.” She attributes this distrust directly to the lingering effects that communism has on the country. Figure 4.1 shows the study Ilie was referencing.

This percentage is the sixth worst of the 60 countries the survey studied. The idea that speaking out against anything could land you in jail prevented citizens from voicing their opinions. In communist Romania, “everyone could be an informer, everyone could tell on you and your life

would be ruined" says Ilie. Ilie also points out that this lack of trust is difficult to overcome as an individual or as a country. Equating it to trauma, she explained how this distrust remains in society today despite the demise of the communist regime.

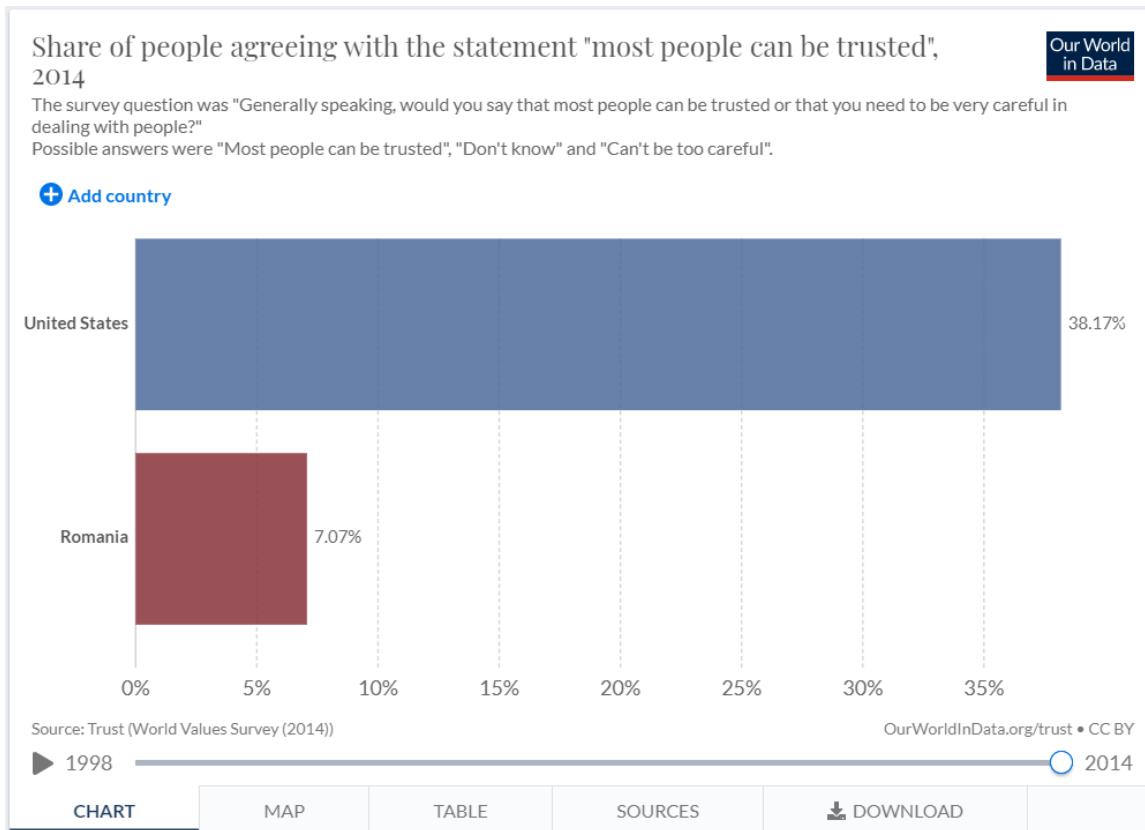
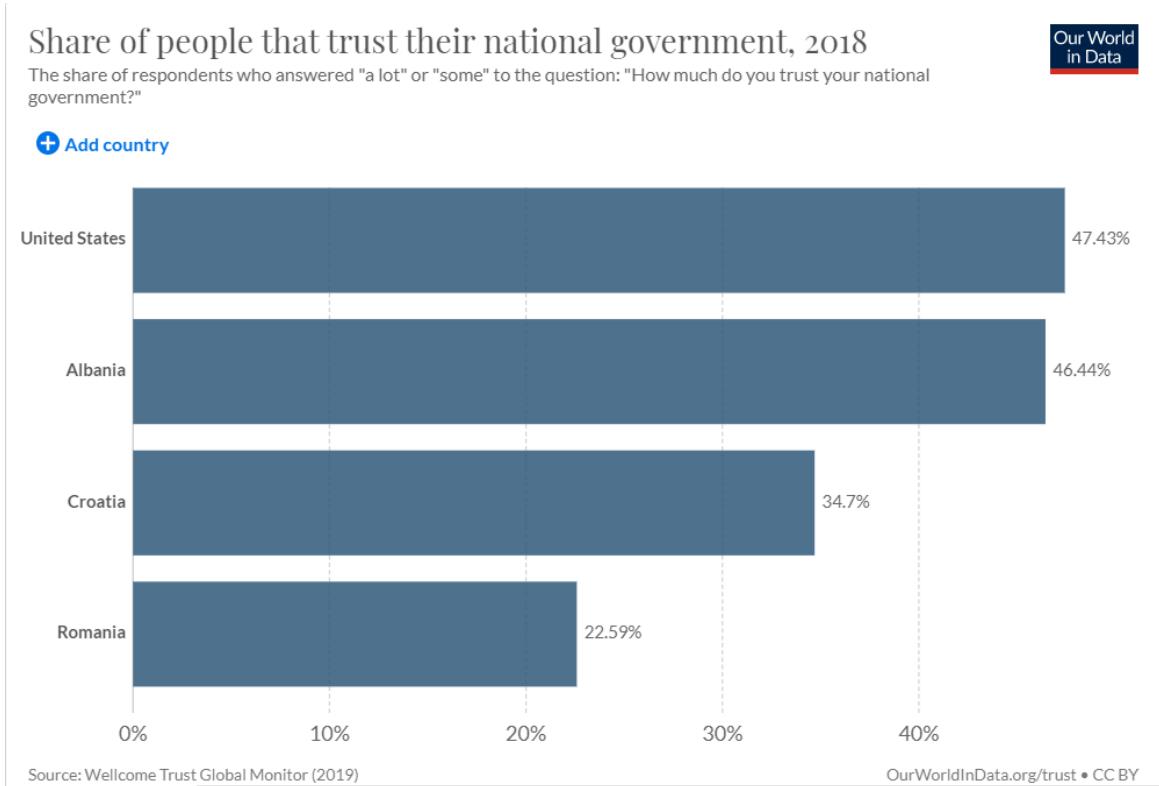


Figure 4.1: Percentage of citizens agreeing that "most people can be trusted." Our World in Data, (2014).

Alina Kasprovschi also expanded upon the idea of trust lacking in contemporary Romanian society when she discussed the corruption that has existed in Bucharest since communist times. Kasprovschi said, "There's definitely a lack of trust in the government. We've been having [a] corrupt government for 30 years now." Kasprovschi connected this lack of government trust directly back to earthquake preparedness. When asked about informational campaigns in Romania and why they have been ineffective, Kasprovschi said, "It's a trust problem." Ilie echoed these sentiments, saying "It is very hard for people to believe that when other people give them advice

or try to help them prepare for something as abstract as an earthquake or any kind of disaster, it's hard for people not to think that they have a hidden agenda and that they're manipulating them." Thus, even when organizations attempt to create informational campaigns to educate citizens, the citizens may not trust the NGOs. Figure 4.2 shows a graph with the percentage of citizens who trust their national government. Less than 23% of Romanian citizens claim to trust their national government. This percentage is ahead of only six other countries, at 128th out of 134.



*Figure 4.2: Percentage of citizens who trust their national government. Our World in Data (2018).*

The second aspect of communism that still lingers today is the disinformation campaign the government conducted after the most recent major earthquake in 1977. In the years following this earthquake, the communist regime was "basically calming the population when they had nothing to be calm [about], no reason to be calm," says Matei Sumbasacu. He followed this by saying, "this is a very, very difficult inheritance that we need to deal with right now." One of the

ways the communist regime attempted to calm the public was by putting on the appearance of fixing the damaged buildings. Kasprovschi explained to us the regime's practice of "just paint[ing] over the cracks in the walls, and the people were lied [to] that the painting was seismic painting." The communist government pushed the idea that this paint somehow had an impact on the structural integrity of these buildings. Sumbasacu referred to them as "resin injections" and explained how citizens did not fully believe that simply plastering over these cracks would fix the problem. Because of the fear citizens started to voice, the communist government began a process of systematically silencing anyone who was spreading "false alarms" using the secret police (Sumbasacu). Additionally, the communist government used the singular TV station and state-run newspapers to run propaganda campaigns praising the safety of Bucharest's buildings.

While these campaigns took place 40 years ago, their effects on Romanian society are still noticeable today. In particular, after years of the government telling citizens that their buildings are safe, many citizens are quite reluctant to accept that this is not reality. Under the communist regime, it was essentially illegal in Romania to voice fears about your building to anyone. Consequently, citizens remain reluctant to discuss this topic. Sumbasacu explained the issues his organization has run into, saying "we are trying to tell the truth to people, and a lot of people don't want to accept it." Kasprovschi provides an explanation for why individuals take this route, explaining it as a psychological defense mechanism, and without it "they would have gone crazy by now." Professor Bogdan Vernescu discussed another argument for taking this approach, which is that "if the earthquake happens, it happens. It is something that you can't really prevent." (Professor Bogdan Vernescu, see Appendix M for full transcript). While this is undoubtedly true, older Romanian citizens who lived through the communist regime use this as justification for not talking about earthquakes. Three of the four experts the team interviewed from Romania identified

this generational divide between residents who did or did not live through the communist regime. Two experts from Albania and the Croatian expert also discussed this generational divide.

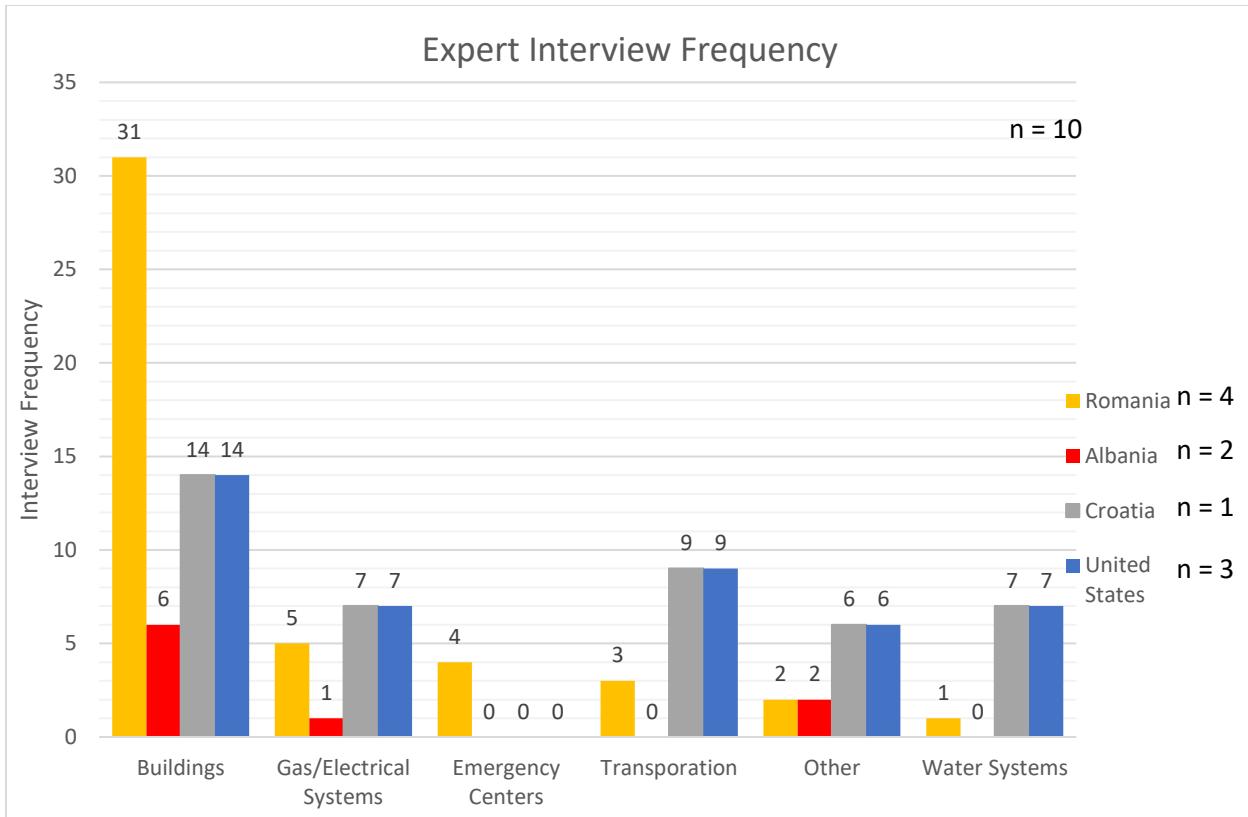
Through secret police, “positive influence,” and disinformation campaigns, the communist regime created a climate of distrust and misinformation that, to this day, has left citizens of Bucharest feeling entirely disconnected from one another (Ilie, Appendix C). As Ilie put it, “there's no way out of this...other than together. The more...energy you spend defending yourself from others, the more you will not be okay because then instead of growing, all you'll do is just protect yourself and stay away from other people and that's, that's something that I think really affects our ability to be prepared for [an earthquake].” This feeling of disconnect stands as a barrier to true progress to improving Romanian earthquake preparedness.

#### 4.3. Bucharest’s Building and Infrastructure Earthquake Vulnerability

In addition to talking with experts about preparedness measures in their regions, the team also spoke with them about the components of a city’s infrastructure that are at high risk. Figure 4.3 shows that experts mentioned buildings, utilities (electric grid, gas lines, water supplies), transportation (roads, bridges), and other components (historical monuments, dams, schools) as types of infrastructure that are most at-risk.

During interviews with experts, we discovered that the majority of responses to this question focused on building collapse and damage. As Figure 4.3 shows, 51 of 98 coded responses fell into the building category. This relates back to the team’s previous finding that building codes, assessment practices, and maintenance and retrofitting are inconsistent. Given this lack of preparedness regarding buildings, it is not surprising that experts have identified buildings as both the most vulnerable components of their cities, but also the largest threat to the public. Additionally, all ten interviewees mentioned building collapse or damage at least once. These

findings demonstrate that experts believe that buildings are at high risk in the event of an earthquake. Moreover, experts across all four countries expressed this concern, with a reference frequency approximately proportional to the number of interviewees per country for the US, Romania, and Albania. Croatia was an outlier to this trend, likely due to the interviewee's area of expertise.



*Figure 4.3: Number of responses by experts for all infrastructure themes.*

This report discussed building codes, one common preparedness measure, in the Balkan countries and the US extensively in section 4.1. Romania has established building codes in order to ensure the safety of new construction. During the communist era, the government updated its building codes to reflect the building codes of the United States government. The U.S. government designed these codes to protect against surface earthquakes; however, Romania can experience deep earthquakes (Sumbasacu, Appendix E). This led to Romania constructing many buildings

that cannot withstand the type of earthquake the Vrancea county is likely to experience. This is especially true for taller buildings, those over seven stories (Sumbasacu, Appendix E). Surface earthquakes have a short resonance, meaning that even though they are very damaging to shorter buildings, they do not do as much damage to tall buildings. Deep earthquakes on the other hand are especially damaging to taller buildings. Sumbasacu described why this is true saying, “the long period vibrations mean basically that they resonate with taller buildings because those are more flexible”. The government’s method of implementing the building codes during the communist era created this structural problem which remains today. Sumbasacu described this by stating, “We basically copied the Russian code, which basically had copied US code, which was calibrated on an El Centro Californian earthquake, which is a surface earthquake”. According to Dr. Emil-Sever Georgescu, since the end of the communist regime, the city has updated these codes to meet current seismic standards (Georgescu, see Appendix D for full transcript). However, many buildings built under the outdated codes still remain in the city of Bucharest and are vulnerable to earthquakes.

Additionally, Romanian experts are concerned with the lack of a classification of the buildings in Bucharest. Three out of the four experts from Romania mentioned the lack of classifications. During her interview, Kasprovschi said, “most of the buildings in Bucharest, I think it's more than 100,000 buildings. Most of them have never been assessed. So, we don't know [their vulnerability].” As is noticeable in Kasprovschi’s quote, the exact number of vulnerable buildings is entirely unknown. Additionally, a change in the classification system helped to hide the true number of vulnerable buildings. In 1997 the Government made major changes to the classification system. These changes removed buildings from the records that engineers had classified as dangerous under the original system. Sumbasacu described the scale of this problem stating: “in one night, right, Romania had zero vulnerable buildings, because the rating system changed.”

These findings highlight the need for the continuation and completion of building assessment in Bucharest since it is not feasible to repair every building in the city. Instead, the city must assess which buildings are vulnerable and proceed with consolidation based on this assessment.

To help determine key variables that may indicate a higher vulnerability to earthquakes, the team asked experts in the city of Bucharest about identifying vulnerable buildings. Sumbasacu spoke about the building vulnerability within Bucharest stating that “socialist buildings... built before 1977... are disasters waiting to happen.” While some buildings may be fine, many sustained damages during the 1977 earthquake.

#### 4.4. NGO Involvement in Earthquake Preparedness within Bucharest

The level of vulnerability and insufficient preparedness in the past has precipitated NGOs becoming involved with earthquake preparedness in Bucharest. The involvement of NGOs in earthquake preparedness gained momentum in 2017 when the Romanian magazine, *Decât o Revistă* (DoR) published an article by senior editor Georgiana Ilie, titled “Earthquake in the vulnerable city.”

Ilie’s article depicts a fictional, post-earthquake scenario of the damaging consequences if an earthquake, similar in magnitude to the one in 1977, were to occur in modern-day Bucharest. This account described the Seismic Alert project, the first civil initiative of its kind in Romania. The significance of this article results from how it challenged the beliefs the residents of Bucharest held about the safety and earthquake preparedness of Bucharest, stating that, “all the while people were lied to, told their buildings were safe and that they had nothing to fear. The next earthquake will fall on these lies” (Ilie, 2017). Ilie identified the lack of citizens’ awareness on how to act during an earthquake by discussing the panic and confusion that occurred during an incident in 2017 when 200,000 people in Romania received a notification from a news application called

Biziday. The notification incorrectly warned citizens of a non-existent magnitude 10 earthquake in Vrancea. During the incident, people “boasted on Facebook that they had made it from the fifth to the ground floor in 20 seconds... they used the stairs, the most fragile part of a block, and the first to collapse. If the warning had been real, many would have died for not knowing how to proceed” (Ilie, 2017).

This article served as a wake-up call for many organizations in Bucharest and encouraged more collaboration between them. Kasprovschi described it as, “a moment in which everybody, at least everybody in our team [Bucharest Community Foundation], definitely not everybody in our community [Bucharest], realized that we haven't discussed much about the earthquake. And... we know quite little and we know it abstractly.”

Since 2017, the World Bank has assisted NGOs in collaborating with the Romanian Department of Emergency Situations. NGOs have also met every 2-3 months to coordinate resources (Sumbasacu, Appendix E; Ilie, Appendix G; Kasprovschi, Appendix F). While the level of collaboration between organizations has increased, NGOs can still improve the effectiveness of their work at an organizational level. Kasprovschi stated in her interview that NGOs in Bucharest want ownership of the projects they develop. This desire for ownership has made it difficult for the small, fragmented initiatives of NGOs to flow into a bigger stream and strategy (Sumbasacu, Appendix E; Kasprovschi, Appendix F).

The Bucharest Community Foundation believes that NGOs cannot fulfill their mission to help the community of Bucharest if they don't make the resilience of residents against earthquakes a priority. The Bucharest Community Foundation raises funding and gives more than 200,000 euros each year in grants to “grassroots” NGOs in Bucharest such as Re:Rise and the Clubul Căinilor Utilitari (Sumbasacu, Appendix E; Ilie, Appendix G; Kasprovschi, Appendix E). NGOs

spend grant money on projects focused on preparing the community for actions to take before, during, and after an earthquake to increase the awareness and resilience of the people in Bucharest. NGO projects include establishing radio communications (shown in Figure 4.4), training teachers in CPR (shown in Figure 4.4), creating education programs (shown in Figure 4.4), and training search dogs (shown in Figure 4.5) (Ilie, Appendix G; Kasprovschi, Appendix F).



*Figure 4.4: “Bucharest Ready” Grassroot NGO Initiatives in Bucharest..Bucureștiul Pregatit. (2021).*

Matei Sumbasacu, the co-founder of the Romanian NGO Re:Rise, describes Re:Rise as “one of the NGOs with the broadest and narrowest scope, because we... only work for seismic risk reduction and nothing else, it's the broadest because we do anything to reduce seismic risk”. According to Sumbasacu, Re:Rise is currently working with institutions and authorities in Romania to try to inspire some legal, procedural, and systematic changes. One change Re:Rise seeks is a shift in a deeply rooted paradigm from the communist regime in Romania where citizens expect the state to do everything to prepare them for an earthquake (Sumbasacu, Appendix B;

Kasprovschi, Appendix D). Re:Rise has employed methods including infographics explaining the ramifications of an earthquake in Romania, sharing the history of earthquakes in Romania, and informing residents of actions they can take to prepare. These measures attempt to prepare citizens until the government assumes responsibility for addressing large-scale issues with earthquake vulnerability.



*Figure 4.5: NGO Clubul Câinilor Utilitari training rescue dogs. Clubul Cainilor Utilitari (2020).*

Organizations such as the Bucharest Community Foundation and Re:Rise recognize their limitations in the community. The NGOs in Bucharest cannot realistically assess and consolidate the estimated 2,000 buildings at risk in the city, especially when each building takes years of work and costs millions of euros to consolidate. Recognizing this situation, the Bucharest Community Foundation and the NGOs it supports are focused on reducing what Kasprovschi calls “preventable

losses" so that "after an earthquake, which is inevitable, we will build the city better starting from the citizens' resilience [ability to survive during an earthquake]." Kasprovschi provided the team with a vivid example of a preventable loss during the 1977 Vrancea earthquake where "a famous actor who died because he didn't know what to do in case of an earthquake... he died on the stairs, while in his home, the glasses were still intact on the table after the earthquake, so if he knew what to do... [he] might not have died." A similar lack of knowledge of how to act during and after an earthquake occurred during the 2017 Biziday incident. During this incident, Kasprovschi recounted, "I told [my husband], don't take the stairs, the stairs will fall, and he kept on saying, 'I have to, I have to go to my son, I cannot not climb the stairs up.' He just didn't care. He wanted to get to his son." While her husband knew that it was dangerous to be on the stairs during an earthquake, he did not make the rational decision in the moment. In crisis, people are more likely to make decisions based on emotions rather than logic. However, Kasprovschi believes this tendency can be reduced by training.

Earthquake awareness and personal preparedness are not yet widespread among residents of Bucharest. While NGOs have started to address earthquake awareness and resident resilience in a coordinated effort, there is still a lot of work to be done by not only NGOs, but also the government, and the residents of Bucharest to improve preparedness in the vulnerable city.

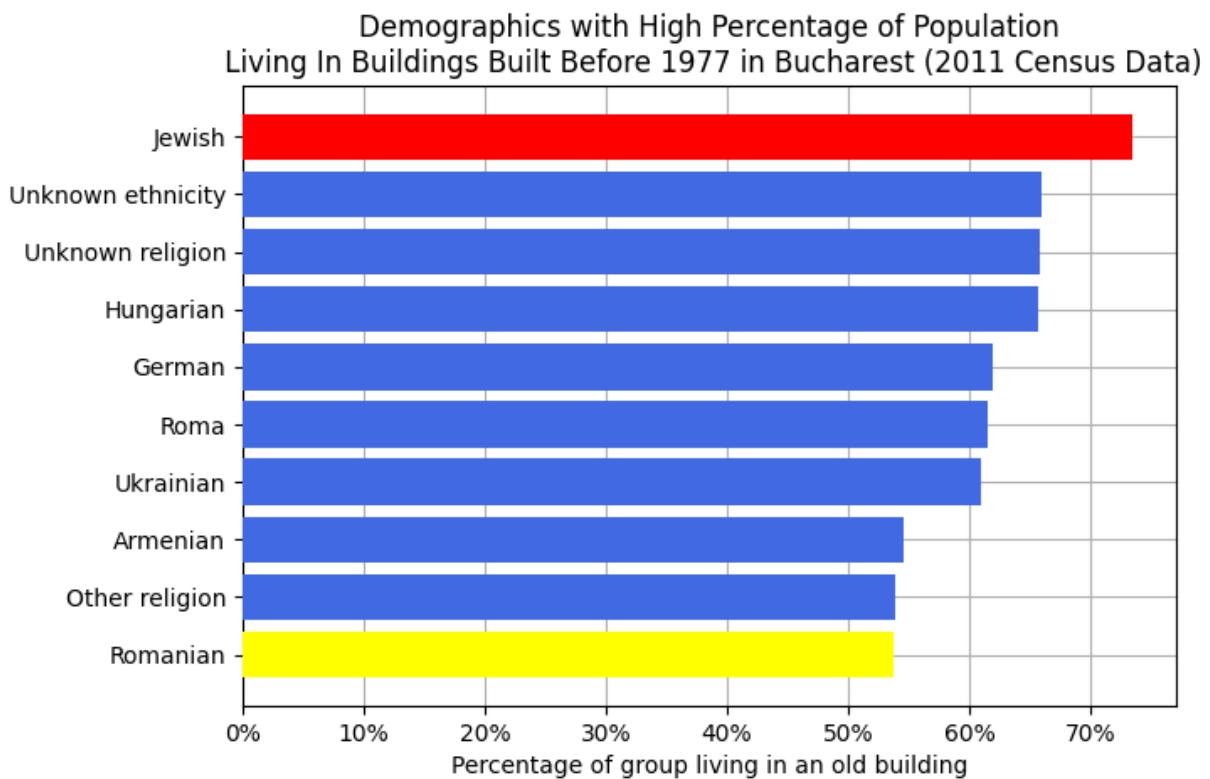
#### 4.5. Correlation Between Minorities and Earthquake Vulnerability

The team originally intended to analyze 2011 census data to determine whether earthquake preparedness or vulnerability may differ across different ethnic and religious groups within Bucharest. However, the data that the team collected was insufficient for the team to support most of the correlations. The most recent census data is from 2011, meaning it may no longer be representative of Bucharest. Furthermore, data regarding ethnicity and religion was incomplete,

with many residents answering as unknown. The team also intended to support this data with resident demographics and vulnerability data from a survey. For this survey, the team faced many roadblocks, and was not able to distribute the form to a sufficient number of residents to create a representative sample. This was because the team adapted to the COVID-19 pandemic by conducting the research project remotely.

Even if more recent and complete data were available for a comprehensive analysis, the team learned that this may not be a valuable technique to apply to Bucharest. Initially, the team intended to analyze data in a way similar to multiple reports that Iuliana Armaș conducted. This technique would demonstrate how different factors regarding vulnerability may be different across different demographics. However, one interviewee who was familiar with this analysis technique indicated that the method overemphasizes criteria that are not as crucial to vulnerability as building stock vulnerability. For this reason, the respondent suggested shifting focus from this analysis method. In the team's interview with Matei Sumbasacu he said, "We are basically playing with some very limited data and we are really, really exploring them in depth, instead of enlarging our scope and gathering more data, and simplifying our analysis, because we [Bucharest experts and NGOs] are not there yet." This further convinced the team that biases towards ethnic and religious groups in building preparedness, while still useful, only address a much smaller problem in Bucharest. Earthquake preparedness in Bucharest has much larger issues in the form of insufficient assessment, preparedness, and awareness, all of which impact more people and deserve more attention first. As such, an analysis of census data as we originally proposed would not address the larger issue at hand in Bucharest. This analysis technique would apply to various socioeconomic factors but would not be able to describe the structural vulnerability and how it may vary across different demographics.

There is some data that the team used to find discrepancies in vulnerability across different minority demographics. Many buildings in Bucharest sustained damage during the 1977 earthquake. Sumbasacu said that “around 30,000 buildings only in Bucharest, deemed to need, to be in need of repairs” following the earthquake. However, even with all of this damage, “these buildings, these thousands of buildings have not been strengthened, not been repaired, they basically have been made to look as new but actually they were heavily heavily damaged” (Sumbasacu, Appendix E). According to the 2011 Romanian census data, 55% of citizens within Bucharest live in buildings built prior to 1977, meaning that hundreds of thousands of citizens are living in these vulnerable buildings. Figure 4.6 below shows what percentage of each demographic lives within one of these buildings.



*Figure 4.6: Building age distribution by demographic.*

Since Romanians are the majority of the population, they are very close to the overall percentage of 55% across all residents (shown in yellow). However, there are a few demographics

with a higher percentage. The highest is the Jewish population in Bucharest (shown in red). The team was not able to determine why this is, but many of the entries in the census data had a high building age. The next two groups are the unknown religions and ethnicities that we discussed at the beginning of this section. While it is impossible to identify the social identities of individuals who responded this way, the team postulated that low levels of trust in society may be an underlying reason why these groups are unwilling to mark their religion or ethnicity. Twelve percent more of this group live in these old buildings than Romanians, suggesting a higher earthquake vulnerability.

Even with this correlation, the team did not collect enough data to fully connect any links between earthquake vulnerability and preparedness and different demographics in the city. The main issue in Bucharest is a lack of seismic analysis to understand building vulnerability, and this is not an issue the team could tackle remotely.

## 5.0 Conclusion

This project focused primarily on earthquake preparedness in the city of Bucharest, Romania. Due to the location of the city, Bucharest is at high risk for major earthquakes, so preparedness is essential to the safety of the public. The original goal of this project was to evaluate the earthquake vulnerability of specific religious and ethnic groups within the city of Bucharest to determine the extent to which preparedness varies across these different groups. To achieve this goal the team conducted interviews with experts in relevant fields as well as earthquake survivors in Albania and Romania, and analyzed Bucharest census data.

Due to the limitations of our census data and unsuccessful survey distribution via remote measures, the team was unable to draw strong conclusions about the disparities in preparedness based on religious or ethnic groups. Instead, the main conclusion of this project is that while religion or ethnicity may have an impact on preparedness, the situation in Bucharest is sufficiently dire to make it a low priority for researchers to determine these particular vulnerabilities. The city of Bucharest is not prepared for a major earthquake. Although the personal status and area of expertise may influence the opinions of the experts, in nearly every instance the team asked an expert about ties between religion or ethnicity and earthquake preparedness, the answer was the same: the effects of religion and ethnicity are not a significant driving factor, and while socioeconomic status likely has a small effect, the overall lack of adequate preparedness in Bucharest is so severe that the consequences due to social identity are not the highest priority. While it is likely that an earthquake would not impact all groups in Bucharest the same, the preparedness situation in the city is so dire that the team believes this is not the biggest problem at hand. Moreover, since the baseline of preparedness across the city remains unknown, it is not

possible to determine differences across ethnic and religious divides without first capturing this baseline data.

The team has identified two main issues that contribute to this insufficient preparedness. The first is that many citizens simply ignore the problem in hopes that it will not affect them. Namely, many individuals in Bucharest push thoughts of another major earthquake out of their minds as best they can. We were able to garner that a lack of acknowledging the problem can lead to insufficient preparedness measures and a lack of accountability for the government to protect its citizens.

Romanian society has also stigmatized discussion of earthquakes within Romania. The author of the story “Earthquake in the Vulnerable City,” Georgiana Ilie, informed us of the mentality of many residents of Bucharest. Ilie said, “it’s not appropriate to talk about earthquake risk because this will bring bad luck, so we never talk about earthquakes.” In fact, she emphasized that if she were to bring up earthquakes in casual conversation, people would “freak out, they would think [she is] a very weird person.” To some degree, the desire to avoid the problem or pretend it does not exist is understandable. As executive director of the Bucharest Community Foundation, Alina Kasprovschi, said “in order for them not to go completely crazy, they have to just deny the fact that their building is not safe. They just don’t think about it. It’s a psychological mechanism.” This quote depicts the resident’s perspective of the situation quite well: if individuals feel there is nothing they can do to protect themselves from the inevitable, the intuitive solution is to carry on as if the problem did not exist.

This mindset displays a clear misrepresentation of the current situation. While natural disasters are unavoidable, the government and its citizens can reduce the damage disasters cause through preparedness measures. Bucharest can learn lessons from nearby nations that have recently

experienced major earthquakes, particularly Albania and Croatia. Experts from Albania have pointed out the lack of preparedness before the November 2019 earthquake as a major factor for much of the damage that occurred. One of the major problems after this earthquake was the panic of citizens who did not know how to react and the ineptitude of the government's response plan. Mirian Bllachi pointed out that the Albanian government had “zero preparedness when it [came] to...handling the situation,” citing specific examples such as a disjointed assessment method as well as an understaffed emergency response team. A structural engineer from Albania, Gent Gjuta, described a series of informational and assessment campaigns that the Albanian government should have undertaken before the disaster occurred, going so far as to say, “if they had done that then maybe a lot of people would be alive today.”

Preparedness within Bucharest, however, is not as simple as our team initially believed. Instead, our project has revealed that preparedness is complex, and optimizing it entails a balance between personal and government responsibility. Currently, Bucharest citizens need to take measures to educate themselves and enhance self-sufficiency in the event of natural disasters, but the government and local authorities must aid in facilitating this by providing platforms to build public awareness and resources for citizens that wish to adopt preparedness measures. In addition, the government needs to accurately and thoroughly assess its building stock, and take appropriate preemptive measures to prepare for a major earthquake. While there is still a need for future work to understand and optimize preparedness within Bucharest, the lesson that Romania can learn from our project is clear: preparedness saves lives.

Our second conclusion is that much of the city of Bucharest’s lack of preparedness is rooted in Romania’s communist past. As this report has previously mentioned, the last major earthquake in Bucharest was in 1977, in the middle of the communist regime. After this earthquake, the

communist government needed to take action. Instead of addressing the problem, they took a series of actions to cover up the true extent of the damage. There were minimal repairs to damaged buildings, and many of these repairs were merely cosmetic and did not provide any structural reinforcement. Two of the interviewees from Bucharest mentioned the communist government simply painting over exterior cracks on buildings to ensure they did not appear damaged (Sumbasacu; Kasprovschi).

Angered by the power the government initially gave to engineers in the aftermath of the 1977 earthquake, Nicolae Ceaușescu, the leader of the communist government at the time, ordered that the government must approve all repairs to buildings and infrastructure. Ceaușescu even said “the engineering assessment commissions and strengthening work had produced more damage than the earthquake,” (Simpson, Pomonis, & Georgescu, 2020). This essentially stopped any repair efforts and even made it illegal to make repairs to your own home. Matei Sumbasacu, told the story of an engineer trying to make extra repairs to his home. Once Ceaușescu’s regime found him, Sumbasacu says “he was arrested, and he was beaten to death by his colleagues, his cellmates” (Sumbasacu). As for the assessment of buildings, the government identified buildings based on the necessary timeline for improvements to be made: U1 meaning the city must repair the building in the next two years, U2 in five years, and U3 in the next ten years. Those deadlines came and went without anything happening. Consequently, in 1991, two years after the fall of the communist regime, the government switched from classifying buildings by urgency, and instead classified them by seismic risk. Essentially, the Romanian government changed the name of these classifications in order to appear less vulnerable, as well as to avoid criticism that they had not held true to past assessments.

To this day, the government has evaded responsibility for the lack of earthquake preparedness within Bucharest. While the project team has always been aware of the vulnerability of Bucharest's buildings, the team discovered that the problem is much worse than we originally expected. While there are currently around 300 buildings deemed seismic risk class I in Romania, many experts estimated that this number should actually exceed 2,000 buildings (Matei; Ilie; Kasprovschi). The reason for the discrepancy is that no one has made a concerted and unified effort to create an accurate picture of the current vulnerability in Bucharest. Sumbasacu said "I don't see how Bucharest will get away with less than...200 collapsed buildings" in the next major earthquake. Interviewed experts were critical of the government's inability to prepare for the coming earthquake. Financial limitations seem to also be a barrier to improving Bucharest's earthquake preparedness. Kasprovschi pointed out the financial burden of consolidating thousands of buildings, saying "We are not raising funds to consolidate the buildings, one building costs millions to consolidate, multiply this with hundreds or thousands of buildings, and you get the amount which is definitely not sustainable from private sources."

At the start of our research, it was not clear to our team just how influential a political system that fell over 30 years ago could be in a country today. Aside from the construction of unstable buildings and lack of assessment post-earthquake under the post-communist governments found in Albania, Croatia, and Romania, severe lack of trust in government persists in these countries. Ilie cited a survey that indicated that "Romania has one of the lowest social trust indexes in the world" at only 7%, compared to countries like Sweden at upwards of 70%. Ilie points out the communist regime's history of trying to keep people afraid of one another has ensured and weaved that distrust into the fabric of society. This distrust makes it very difficult for public

information campaigns to have their intended effect. Overcoming this initial mental roadblock is one starting point for bettering Bucharest's earthquake preparedness.

While in recent years several NGOs have stepped in and facilitated earthquake preparedness (Ilie, full transcript is presented in appendix G), Bucharest is still far from prepared for its next major earthquake. Due to both a distrust in the government as well as an unwillingness to accept the reality of Bucharest's seismic risk, citizens are wholly unprepared for what is certain to come. There is an impetus upon the government of Bucharest to take responsibility for the safety of its citizens, and time is running out.

## 6.0 Future Work

Earthquake vulnerability and preparedness is both an extensive and complex issue within the city of Bucharest. Given the 14-week time frame the project team had for planning and implementing this project, the team adopted a narrow scope that addressed many of the base-level issues regarding earthquakes, but much work remains necessary to better understand the condition of Bucharest's vulnerability and effectively enhance preparedness for the next major earthquake. Due to the importance of the topic, it would be valuable for future WPI students to perform follow-up work based on the findings of this report. This section suggests possible continuations of this work and areas of study the team believes could greatly benefit the city of Bucharest.

To begin, the team conducted an analysis of 2011 census data. While this method had the potential to reveal correlations between religious and ethnic identity and earthquake vulnerability, it presented several limitations which the team documented in previous sections. These limitations, as well as the possible obsolescence of data from ten years ago, inhibited this method from establishing a thorough and accurate representation of the city of Bucharest and drawing strong conclusions. In June of 2022, Romania will conduct its first-ever online census. Once this census is complete, it may provide the data to accurately represent the city of Bucharest via the analysis method our team proposed. Thus, a future team could re-attempt the analysis the team attempted to perform this year, possibly establishing a more credible link between religion or ethnicity and earthquake preparedness. In addition, 11% of respondents marked their ethnicity and religion as unknown. Future teams could research why so many individuals were reluctant to mark their religion or ethnicity.

Throughout the IQP term, the team conducted thirteen interviews with experts, residents, and survivors of earthquakes in Bucharest. A recurring topic in these interviews was the reasons

that preparedness measures are not sufficient within the city. One reason interviewees frequently cited was a lack of accountability in the government. This has allowed city officials to evade responsibility in assessing and consolidating the city's building stock, leaving a significant percentage of buildings vulnerable to damage or collapse in the event of an earthquake. While the team documented this and several other limitations of current preparedness, more work is necessary to establish a deeper understanding of this issue and provide detailed recommendations for addressing it.

Similarly, interviewees spoke of the remnants of a communist past impacting Bucharest's ability to prepare for earthquakes. We were told by interviewees that during the communist regime, nearly anyone could be an informant for the government and have another individual thrown in prison. This resulted in a lack of trust between not only individuals and the government, but also among individuals and their neighbors. As interviewee Georgiana Ilie discussed, this skepticism of the intentions of neighbors remains prominent in Bucharest's social atmosphere despite the 30 years since the fall of communism. This civic state of distrust severely impedes the development of earthquake preparedness since it means citizens are wary of the motives driving the NGOs that are trying to raise awareness of Bucharest's vulnerability and enhance preparedness. Future IQP groups that will be on-site in Bucharest for the seven-week IQP term would have the opportunity to explore this divide and derive a plan to help NGOs establish credibility amongst the public.

Finally, interviewees from Bucharest mentioned the unwillingness to even talk about earthquakes. Many citizens use it as a type of coping mechanism to ignore the problem. Ilie mentioned that people would think she was crazy if she tried to bring up earthquakes and earthquake preparedness (Ilie). The inability to have an open and honest discussion about Bucharest's earthquake risks greatly hinders improving the individual preparedness of the city's

residents. An IQP that seeks to address this issue would be incredibly valuable and likely have tangible results within the city.

While our IQP did not discover the findings that the team anticipated at the start of the project term, this does not devalue the work of our team. Instead, this project provides a basis for future researchers to truly make a difference in a community that needs it. We also encourage future IQP groups to reach out to members of this project team to ask questions that could be helpful. One common thread of every interview with the citizens of Romania was their excitement and appreciation that people outside of themselves are aware of Bucharest's earthquake preparedness problem and want to help. Future IQPs on earthquake preparedness in Bucharest presents an opportunity for student researchers to use their resources and knowledge to address a problem that has real-world ramifications.

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## Appendix A: Prof. Aaron Sakulich, Civil Engineering, Worcester Polytechnic Institute, Interview Transcript

Owen

All right. I believe you are doing recording. Good to go right. Oh, awesome. I see it now. Perfect.

Okay. So the first kind of question we have was this was about your current field of research. What are you working on? Now? What are some of the projects you're doing?

Prof. Aaron Sakulich

So at WPI, I am in the Civil and Environmental Engineering Department. But my degree is actually in material science. So all of the research I do is in cement and concrete chemistry. Basically, if you have a waste product that you can turn into ashes, we can add it to cement, it'll be no problem. presuming it doesn't have too much phosphorus or metals, or you know, there's some chemistry involved. But that's what most of my research is in at WPI, I also run the Iceland and Panama project centers. So I'm always involved in a little bit of kind of, I guess, like educational research, getting projects together. And there's a lot of paperwork involved with these sites. And to be fair, I was actually supposed to be your advisor for Romania this year. But last year, I did Armenia, and they decided to switch me back to Armenia, because why not have the same person do it? Two years in a row, they're already familiar with the sponsors and doing things remotely, etc, etc.

Owen

So that's really, that is interesting. We did not know that you were so sure. advisor. That's amazing.

Prof. Aaron Sakulich 1:35

I felt so bad, because Bogdan and Rodica, I think are the, the site directors, and they're such cool people to work with. And then can't, the people that IGSD, were like, why don't you do Armenia? Again, I was like, Ah, that does make sense. Like, that is what's best for the students. But I was really looking forward to it.

Owen

Yeah, from our experience with them, they seem very, very interested in the project. And when we give a presentation to them, they had a lot earlier, not ours, because we were last, but they had a lot of comments about Romania and seemed super interested in it. So they definitely seem like they're on the ball. And how long have you been researching at WPI now?

Prof. Aaron Sakulich

In August, it was eight years. I started August 20, of 2012. I don't... not that I want to be precise or anything but

Owen

More precise to better, of course. So now we do have questions about kind of like infrastructure and earthquakes as the main topic of our project. So just to start off with what types of infrastructure are generally the most heavily affected when it comes to earthquakes.

Prof. Aaron Sakulich

So, and please remember, earthquakes is not my primary area. So this is just kind of my understanding of it. All infrastructure is affected by earthquakes. If there's an earthquake, it can

affect just, you know, buildings, and obviously, like roads and bridges and tunnels, the infrastructure that is also very important that I think a lot of people forget about is like the electrical grid, sewage, water distribution, water treatment plants, and even things like dams, or I guess you would call them retention ponds. So one example is when you burn coal, the ashes that are left over are called fly ash. And so what they do is they have these giant open air landfills, where the, they put the fly ash in it, and then they add water to keep the fly ash from blowing away. But that makes the inside of the day very, very heavy. So if there's an earthquake and it splits open the edge now you've got all this toxic schmutz, you know, all over your farmland and in your rivers. I don't know that that happens often. But that's an example of the type of you know, retention pond that might be affected. So yeah, it's not everything.

Owen

I'm not sure if you would necessarily notice but are those like retention ponds? Or are they located, are they generally found at certain places throughout the city? Are they usually on the outskirts of the city, are they located in the middle, are they way outside?

Prof. Aaron Sakulich

They are almost always located on a river. Because when you're transporting something that has an enormous volume, but doesn't like actually weigh all that much. transporting it by barge is basically free. It takes very little energy once a ship is moving, to keep it moving doesn't cost hardly anything at all. Of course, if it was me, I would not be storing toxic metal sludge directly next to a river, but what do I know?

Owen

Absolutely. So it, so I guess that could be obvious in a lot of ways. But how would this generally affect kind of just the public of a city or of the area where it had the earthquake, what would be the main effects that the public would possibly notice?

Prof. Aaron Sakulich

So I mean, it would depend on the size of the earthquake, and also the preparedness of the city. But there should, there are sort of short term problems and then long term problems. So presuming the earthquake is large enough to, to cause noticeable damage, you might have buildings collapse, and people be trapped inside, or something like that. That would be the I think the, you know, in bridges falling into the ocean, that would be kind of the immediate thing that people think of when they hear of earthquakes. But the disruption to things like drinking water, and sewage and electricity, and even roads, those can last, depending on the area, and how much damage and blah, blah, blah, they can last for months and months. So even if everybody survives the initial earthquake, but then they don't have water, and they can't get out of the area, because all the roads and bridges are smashed. A lot of people can end up dying that originally survived the event itself.

Owen

Yeah, so I'm not sure maybe your, your, your experience as a site director and kind of looking at the social aspect of a lot of these things that might come in. But it seems to make sense to me that it would be possible that, you know, people who live on the outskirts city, or people who are in possibly minority groups, groups that don't have as much access necessarily to, you know, that clean drinking water in the first place, it seems like they would possibly be at a greater

disadvantage. Do you? Would that at all be true? Do you believe? Or is there any reason to believe that

Prof. Aaron Sakulich

this is not something I can back up quantitatively with statistics, but qualitatively, whoever has the least money always suffers the most. So that portion of the population is probably living in buildings that they might not be up to the building codes, they might not have the... be constructed in such a way as to mitigate the damage caused by an earthquake. And you know, poor people are not likely to have a pantry full of canned food, that they can ride it out for a couple of weeks, if things are busted, they are more likely to be part of the informal economy or to have to travel long distances for work. And if bridges and roads are disrupted. Also, I mean, historically, rich people don't live in the areas that are most disaster prone, right. Like, with the exception of building along like the coast where you could have hurricanes or flooding. Like know, if there's a part of town that's going to be smashed by an earthquake, the rich people live on the other side of town from that, like, it's the poor people that are living up on the side of the mountain or in the floodplains or in areas where avalanches might occur, things like that.

Owen

Yeah, that definitely makes sense. And in Bucharest, it's a it's tough, because that entire area is entirely, you know, the entire Balkan Peninsula is susceptible to earthquakes,

Prof. Aaron Sakulich

Right. And I know so like I'm advising in Armenia this term. And obviously, I mean, Armenia is on the other side of Turkey, from Romania, but it's the same general neighborhood. But in 1988,

they had an earthquake that wiped out whatever 10% of the population or something in the country is never. There's a lot of variables, but in some ways the country has never recovered from that. And I know, my, my old student, Nasir Sharifi, who agreed to talk with you. He's originally from Iran, and Iran is like a world leader in earthquake technology, because that entire country is apparently just on top of fault lines, like left to right, top to bottom. Oh, and Japan too if you can find any engineers from Japan, they're pretty well prepared.

Owen

So, I see. So when it comes to specifically cities, and again, this is kind of a question that, you know, maybe there's not an answer to necessarily maybe you're not positive, but the cities seem to follow any patterns in terms of infrastructure where, you know, spots or spots within the city might have the weakest infrastructure might have the best infrastructure, whether that be spatially distributed, you know, whether that be toward the outside of the city or the center or possibly just depending on the city where certain groups live, are there any kind of patterns that cities tend to follow?

Prof. Aaron Sakulich

So it will, it will depend to the extent of my knowledge, it will depend one on the local building codes so for instance, Worcester, this is not a seismically active area like There will almost certainly never be a 9.0 earthquake in Worcester. And so because of that, when buildings are built, they're not really built for like, for blizzards, absolutely high winds. Yes, but earthquakes not so much. In places like California, where there are building codes that are related to earthquakes, it's not necessarily a geographical question like on the east side of town, they do a better job than on the west. But it's a question of money, the people that have a lot of money, or if there is a building,

that's going to be like a bank headquarters or something and produce a lot of money. The people working inside it will produce a lot of money. And I'm saying that very clumsily. But you know, what I'm getting at this is really not time for a discussion of communism. But the point is like, the more money that is involved, the more money you have to spend on earthquake mitigation strategies, like a bridge that connects to wealthy parts of towns is going to be built a lot more differently than, like Low Income Housing on the outskirts of town. And so there might be that like base building code that everybody adheres to, but I would assume that the rich people throw in a little bit extra, just to be on the safe side, and they're in a position to do so.

Abby

Do you think that if building codes are like, kind of forcing a ceiling. So that would mean that older buildings that were maybe built before those building codes would be like, way less prepared?

Prof. Aaron Sakulich

It would depend? It would depend. So it would depend on how strict the previous building code was. But also, I mean, people do not just blindly follow building codes, even if there's an area where there's no code, but people know it's earthquake prone, they probably take some steps for accounting for that. But I mean, it'll vary, but by how earthquake prone it is, how much money the people have, how much they know about engineering, how much this than that? I understand in some places. Um, like, I guess I'm thinking specifically of like Southeast Asia. Some of the poorer districts actually survive earthquakes better because they're all made out of like, bamboo, and like scraps of garbage and whatnot, so they can flex, whereas the rich people go out and build like a

concrete house, which can be ductile when the Earth moves. But I'm not sure I would say that is a significant effect.

Owen

Yeah, so I think that we're not sure necessary, like what countries you've traveled to, or seen or been able to look at the construction. But we were kind of curious, if you do just to kind of look at the United States as a whole. How would the preparedness of the United States compared to some other countries you seen in terms of infrastructure, in terms of being ready for it? I know, there's actually been a lot of talk recently about investing money in the United States infrastructure I've learned in the past couple days, especially today, that's more relevant now.

Prof. Aaron Sakulich

So I've been everywhere. I've been all over the world with the exception of Europe, other than Iceland. And then two weeks in Italy one time years ago, I've never been to any, I'm saving the countries with indoor toilets for when I get older, frankly, like, why would I want to do that when I'm relatively young and not accustomed to luxury? But I do, I do remember I did a lot of reading about earthquakes. When I lived in Morocco and Morocco. When there's an earthquake, the mosques are usually undamaged. And all of the people are like, Well, clearly, I mean, their mosques, God shows up and he's like, Okay, this building gets to stay. But the thing is, the mosques are built by the whole community to a higher standard than like, just a regular house. You know what I mean? It's more money went into building them than just some dude's house. Because frankly, like nobody lives in a mosque, if Allah was going to save a building, you would think it would be like the children's hospital or the nunnery or something the, the orphanages. So that that's the one kind of anecdotal story I do remember. It's a lot of times kind of the community

infrastructure is a lot better regarding the United States is infrastructure. Because I haven't been to any country of similar wealth and demographics. I'm not sure I can really compare it to other countries. But I will say I am not optimistic. I mean, we're the biggest, wealthiest, smartest, greatest country in the world. And we can't keep people from coughing in each other's mouths and have half a million people dead. Like if we, if we can't get people to wear masks, like keeping a bridge from falling down is much more complicated, right? And the thing is, like in the fifth, most of our infrastructure is old as hell like it was, after World War Two, everybody was like, why don't we build all these highways and bridges? And how are we going to maintain them in the future, that's, that's not our problem, we'll just build, we'll just coat everything in concrete. So Frankly, I blame my father's generation they have, they have stolen your future by building infrastructure that they cannot maintain. I do think me, I'm a little bit older than you all, I will probably sneak out of this dump before to doo doo really hits the fan, but you guys gonna have a real interesting last, like 15 years to your lives. And that, of course, you know, climate change, and everything else. I think we could update our infrastructure and have, you know, the best infrastructure in the world and be able to to bounce back from earthquakes really easily. I just think that we're a bunch of dysfunctional dinguses. And, frankly, I really would not bet a horse at this point.

Owen

That is definitely fair.

Prof. Aaron Sakulich

I hope that's not too bleak, but yeah, like, I--

Owen

I think we're used to it, I think we're we know, we've got some challenges ahead of us. But, um, you mentioned...

Prof. Aaron Sakulich

If anything over the last year has given anybody anything to be optimistic about in the future, we must read different newspapers.

Owen

That's for sure. You mentioned that a lot of this infrastructure came from after World War II. So that was kind of like a big, booming time, you know, the economy just gets back online? Would you say that a lot of kind of poor infrastructure comes from times, right after like, where we just kind of massively expand and really start to, we're gonna, is there any correlation, you think, between the quality of that infrastructure that comes during that time period, versus when it's just kind of steady and average?

Prof. Aaron Sakulich

I think that there is more of a correlation between quality and age. So after World War Two, the economy was booming. And it's fascinating. We had also built all of these factories, just turning out tanks and airplanes and stuff. And what were we going to do, close them? So instead, every family's got to own 12 automobiles to get any place in the country. If you see pictures of Worcester from the 30s, in the 40s, there's trolleys everywhere, you could get go from WPI to any place in Worcester on just a streetcar. And what ended up happening was all of the automobile companies ended up buying the streetcar companies and then destroying them so that everybody would have

to buy cars. And as part of that, well, now everybody's got a car, time to build highways, time to build bridges to build this and that, and with very little attention being paid to how to maintain them. So I'm sure there are bridges that were built in the late 40s and early 50s, that have been maintained and are just as good now as they were when they were built. I'm sure there's stuff that we built in the early 2000s that is just rusted all the hell because we haven't maintained it.

And I guess I guess I'm thinking specifically of like the Worcester, the new minor league ballpark that's going in, everybody loves building new things. Because then the mayor gets to like, oh, we're opening the bridge or like, here's the ballpark or like, I'm going to name this tunnel after myself. As for actually maintaining it 20, 30, 40 years from now, they see that as the problem of like the next mayor. So it really does not incentivize as a society. Our system of government really does not incentivize taking care of things that have already been built. That you don't get your face on the newspaper like Mayor Sakulich applied a rust proof coating to the bridge over like Quinsigamond bridge.

Owen

So could that be considered like just as useful? Like main maintenance, as you know, just entirely knocking something down and building a new Can you basically get the same preparedness by just simply updating it like with like, what you said, a rustproof, coding something like that?

Prof. Aaron Sakulich

Yeah. I would think most of the time if something was built in the past and it's well maintained. It is just as good as something we would build today. For the most part, I mean, bridge designs do evolve over time. And there's new technology and construction techniques and things like that.

But I think a lot of the infrastructure in the United States, particularly the bridges, the rail infrastructure, and the maritime infrastructure, like canals and things like that, which are super useful, especially long like the Mississippi, they just haven't been maintained. And so as soon as there's any stress on them, they're gonna fall apart. Like the power grid in Texas a couple of weeks, whatever, a month ago, there was one snowstorm and then suddenly all of these wires that were laid in the early 1900s, everybody was shocked when they didn't work anymore. No, and that gets into a whole separate, there's other things going on. But I could really easily see some minor earthquake wiping out all of California.

Owen

Yeah, that does make sense. I believe. For me, that's all the questions I had. I don't know if Eli, Abby if you guys have anything?

Abby

Oh, I had just one last question. So we talked a little bit about how like the richer neighborhoods are usually more prepared, do you think I can know that, like, you don't have any numbers for it. But they would maybe receive aid faster like that, when we're rebuilding bridges, we rebuild those bridges.

Prof. Aaron Sakulich

Right, and for a couple of reasons, I mean, one, the more money you have, the easier it is for you to be real friendly with somebody in the government. There's a lot of social factors, I guess. I just remember at the beginning of the pandemic, and not the beginning of the pandemic, but in like December, when they first rolled out all the vaccines. I remember all of the Congress people getting

their vaccines and taking photos and being like, we're just doing this to illustrate how safe it is like, no, you jerks, like you're the ones who gets to decide who has the vaccine, and you chose yourself, like don't, like half of the bad things going on in the world, if people would just be upfront and admit they were bad, they'd be so much easier for me to deal with mentally. But anyway, so yeah, like if a richer neighborhood is damaged, you'll have a tiny little bit of damage in a rich neighborhood gets repaired a lot more quickly than significant damage in a poor neighborhood, because the rich have people to advocate for them. And also, in certain countries, poverty is correlated pretty directly to race. So the people in power might prefer somebody from their own ethnic group over a different ethnic group. I know that definitely never happens anywhere in the US. Oh, no, no.

Abby

No, the US would never do anything like that. That would be crazy.

Prof. Aaron Sakulich

I mean, all you have to do is look at like the response to Hurricane Katrina, or like any hurricane Kane, even a pandemic, any natural disaster of any kind, I think really illustrates this point pretty well. But I mean, I guess To be fair, even in places like Morocco, there's differences between the Arab population and the, the indigenous North African Amazigh population, and is the indigenous ones that really get dumped on every time something bad happens.

Owen

A trend that we see,

Prof. Aaron Sakulich

I feel as though I've only given really depressing answers to your questions. I think in your lifetimes, you will see half of the country flattened by an earthquake.

Owen

It's not the best outlook. But I think it gives us a challenge to a project like this to try to kind of address some of these issues.

Prof. Aaron Sakulich

I think the main challenge is going to be that the, the most effective solutions are going to be the least I guess, like attractive, like everybody wants to, "we're going to develop new technology, we're going to build a new bridge," like, just take care of the one you already have, like this is not the most effective solutions are almost always the least exciting and therefore they get the least attention and we're all doomed, like.

Owen

Yeah, it does make sense. Well, we don't want to take up too much of your time. We know you're busy. Although it sounds like today you have a, not too many meetings, which is nice today.

Prof. Aaron Sakulich

It's chill. So I'm advising the IQPs for Armenia. So I have all of my meetings on Monday there from like 8am to 5pm. And then for the rest of the week, like I have a little bit here a little bit there. But every day I wake up and I see like, I only have one meeting on my schedule, today's the day

I'm gonna like, just play hooky and not do any work. And I always end up doing eight hours of paperwork like where do all these emails come from?

Eli

I'm curious if you don't mind me asking, what kind of projects are you advising right now?

Prof. Aaron Sakulich

So, so for our media last year, this is the fourth year of the project center. And normally we have 16 American students from WPI. And we have eight students from the American University of Armenia, and they come over here to take ID2050 and everybody goes back to Armenia to do the project. So last year, all of the Armenians went home and then travel was cancelled. This year, no Armenian signed up for it, because I think the trip to the US was like the actual interesting part. So we have one project with the Armenian Eye Care Program, which is an organization of like volunteer doctors that go into rural areas to give eye care, because it's very poor. parts of it are a very poor country. And so they're trying to develop like an app that you can use to screen for the most popular, most popular, most common eye diseases. We have one team working with the American University of Armenia, there's a lake called Lake Sevan. That is apparently really polluted for a variety of reasons. And you can grow a plant called duckweed that, apparently the way it grows is by absorbing pollution and then just turning it into a plant. And then you can either use that to as animal feed or you can, like burn it for fuel or something. So they're looking into the duckweed in like Sovann. Oh, we have one program working with the Armenian tree project, which is an organization that tries to reforest Armenia. It's very mountainous and hundreds of years ago, it was like 100% forest. But particularly after the dissolution of the Soviet Union, when the electricity supply was really disrupted, everybody just cut down every single tree to use as

firewood. So now there's no trees in Armenia. So the ATP wants the students to design a greenhouse that will improve the ability of rural farmers to grow like little seedlings that can then you know, once they reach a certain stage, they can be transplanted. Oh, and then one organization, one's team of students is working with the American University of Armenia to create a database of active learning methodologies that can be paired with specific targeted learning outcomes. So that a professor could be like, I want students to learn engineering design, and just type that in and then it's like, try one of these eight activities. That one is probably the most esoteric and philosophical of home

Eli

That's super interesting, thank you.

Prof. Aaron Sakulich

I'm of the opinion. I mean, my degrees in material science. When I came to WPI, I thought my whole job was going to be like, down in the laboratory doing chemistry and advising grad students. IQPs are so much more interesting than anything else I do with WPI. This is really, it's the one thing WPI has that nobody else has.

Owen

Yeah, they definitely are pretty fascinating as we, we've been finding out recently, it picked up a lot once we got to the IQP term after ID2050. That's when it really started to become real, I think.

Prof. Aaron Sakulich

Oh, and I think your project is a great one to illustrate the fundamental idea of the IQP like technology does not completely by itself, solve problems. Like there's always people involved. If nobody invented anything new from this point onwards, we could still live in like absolute heaven. We have enough technology. It's just people being jerks to each other is the problem.

Abby

Yeah, we definitely, like ran into at the beginning where all of us were like, let's just engineer an answer to earthquakes. And that's not the problem.

Prof. Aaron Sakulich

And like, that'll work for the rich neighborhoods because they can buy your product but but then they're gonna buy your product and not like oil it every month or whatever, and it's gonna seize up when an earthquake hits.

Owen

And then a WPI IQP in 25 years, will have to fix our problem,

Prof. Aaron Sakulich

Yeah, exactly. There'll be like this technology looked great when it was developed, but all these unintended consequences and it never was really effective. Yeah.

Owen

Well, I believe that is all we have. For this show. We definitely want to thank you so much for your time. I know as a professor I'm sure you're super busy. So we thank you for taking the time. We also want to huge thank you for recommending us to Professor Rahbar, professor Albano. And Dr. Sruthi. They and we've contacted all three of them. We've heard back from I believe Dr. Sruthi.. And Professor. Yes, yes. Professor and Professor Rahbar. So we have interviews scheduled for those. I don't know them off the top of my head because we have so many scheduled but they're there in the next few days. So thank you so much for those contacts. They were super helpful.

Prof. Aaron Sakulich

I know that in graduate school, Nasar did some actual research on what how to retrofit a building to not be damaged by earthquakes. And Len Albano is like the big code guy. I had one project years ago in Panama that they wanted to know about earthquake sounds like so Len, earthquakes, and he was like, blah, blah, blah. Yeah, can I ask at the end of the term? Will you send me a copy of your your final report and an invitation to your presentations if possible?

Abby

Oh, absolutely.

Prof. Aaron Sakulich

Sweet. I look forward to seeing how all this works out.

Owen

Absolutely, we will definitely do that. Eli you want to jot that down. Great. And yeah, so I believe that's it for me. I don't know if you have anything else you wanted to mention to us but, but thank you so much for your time.

Prof. Aaron Sakulich

And it was my pleasure. This is much more interesting than anything else I do with WPI so I'm happy to do it. I think I'm going to do the monster mash on a meatball sub. Good luck with your project. And I hope that this was at least kind of useful.

## Appendix B: Prof. Leonard Albano, Civil Engineering, Worcester Polytechnic Institute, Interview Transcript

Eileen

OK, so we were actually recommended to reach out to you by professor Sakulich who said that you have a pretty decent knowledge in building codes and structures. And so I guess could we start by knowing a little bit about your work. Some of your research, your career path a little bit.

Prof. Leonard Albano

OK so I started, I got an undergraduate degree and in civil engineering it interested more in the structural aspects. And then I went and got my Masters degree and my Masters thesis actually looked at what's called seismic soil structure interaction, so that's looking at the effects of ground motion on the response of the building structure, and in the nuclear industry, it was a major area of research because of the concerns for siting nuclear reactors and the consequences of large-scale earthquake in accommodating. Depending on the local soil characteristics you could actually have a zone of soil acting together with the nuclear reactor as a large body and actually going into an oscillating mode. And similar provisions now are in building codes associated with building construction. Uh, my PhD is actually in structural engineering, so it's it's not a. It's a doctor of philosophy in structural engineering. And so I teach in addition to undergrad class of mechanics, I teach classes and graduate undergraduate level and steel design as well as graduate level classes and building structures. Advise MQPs in that area. And I also have a, uh, associate appointment in Fire Protection engineering, structures in fire. So that's kind of my career path if you will, over the past.

Eileen

And so, how long have you been working as a professor at the WPI?

Prof. Leonard Albano

Yeah, right. So I started in the fall of '92 so this August will be my 29th.

Eileen

Wow.

Prof. Leonard Albano

Yeah, yes.

Eileen

Congratulations, that's a--

Prof. Leonard Albano

Yes, thank you.

Eileen

An incredible career, and so I guess now we can get into some of the questions specifically about earthquakes and what types of infrastructure are heavily affected by earthquakes.

Prof. Leonard Albano

Well, it would be everything right? I guess now is because of President Biden. Infrastructure bill people are complaining infrastructure's everything and I think infrastructure is everything right.

You know, you think about highways and highway bridges. We had the Oakland, the earthquake in the Bay Area during the World Series and you know the bridge structure or the highway just collapsed and cut off transportation right? We often see images sadly of buildings and other parts of the world just fall over sideways and these could be municipal type buildings or actually residential apartment type buildings. Uhm, you've got the Fukushima nuclear plant you have, uh, an earthquake triggers a tsunami, right? So, it's just very, very widespread, just depending upon the level of energy that's there and what's what structures are at risk. I mean, we've learned a lot about design for earthquakes, so I mean, we've made a lot of progress in that regard. It's interesting even with MQPs. Students oftentimes assume that if they're looking at a building project in Massachusetts or the Northeast, they don't have to think about earthquake loads, but actually we do have some seismic activities here and it's there. Had there was a significant effort. Late 80s, early 90s to update school buildings to provide adequate seismic resistance because it wasn't it, you know you're dealing with old or older part of the country. If you will. So you're dealing with older buildings that don't have adequate... that weren't properly designed for seismic because at the time it was being built it was. It was considered to be, wind was more the concern.

Eileen

Right, so you mentioned that, that there should also be seismic activity. Take into account building here. Do you ever like notice infrastructure that's vulnerable specifically in Worcester?

Prof. Leonard Albano

No, I'd haven't. You'd really have to look at the details of the construction, right? That's the hard part. To know exactly how the building goes together and what's the load path. And so, so that's why, for instance, with the schools' program, structural engineers would go in and actually review

old drawings, inspect the buildings, look at how they were actually built, and try and determine whether there was adequate load path for seismic come. You know when you look at Gateway, the first building that was renovated down there. It's an old mill building. Part of that process involved making sure the floors are properly secured to the exterior masonry walls. So, there's an example of something that... as part of the rehabilitation of in in establishment of that is WPI site, part of the campus. Having research and lab space, they actually had to do some updating of details in order to make sure there was a proper load path.

Eileen

And could you talk a little bit about some of the codes that are in place to ensure that all these buildings and structures are being made up so far?

Prof. Leonard Albano

So we now pretty much rely on what's called the International Building Code, and so there's this large organization called the International Code Council that's a mix of various aspects of the industry. As well as, uh, as well as engineers and trade groups to establish minimum building requirements for construction, and so the notion, the idea is to provide safe construction and to try and build upon the years of research and study. And actually, all the years of successful building and learn from things that were not so successful to update the system. And so consequently the International Code Council produces the International Building Code as a model document and then individual states either adopt it as in whole or they adopt it and then add their own local amendments to it to better reflect the construction in their state. And so now we have a system in place where there's essentially. A central clearinghouse, if you will, to provide baseline code language on the requirements for earthquake design. Now alongside that is the issue of predicting

or establishing what types of loads can be anticipated in a structure of, due to earthquake? And so American Society of Civil Engineers has a standard on loads for buildings, and it includes everything. It addresses dead loads and live loads and wind loads, but Earthquake is a large section of that document. That's standard ASCE 7. So that feeds into the International Code Council and the IBC. The language in the IBC either refers directly to ASCE 7 or actually takes the language and directly applies it in their regular in, in their model code and then individual states then adopt that or modify it appropriately. There's that. There's also been at the national level. We have what's called the National Earthquake Hazard reduction program. And so that involves structural engineers that involves seismologists, experts in earth science and they look at creating, for instance, earthquake hazard maps as a sense of getting, you know, you can kind of think about wind for instance near coastal region in the United in the Eastern Mass and eastern part of the United States. You know you can envision hurricanes, and so the types of wind speeds you'd see through the Carolinas, for instance may be very much different than what you might see in Missouri. Because of the hurricane issue, you know, so they do a similar type of mapping to look at seismic vulnerability. And so the NERP, The National Earthquake Hazard reduction program. The output from NERP gets fed into these other documents as a base. So it all kind of ties together like a like, a three-legged stool. You know, there's these different aspects that all come together in and work together. And so one of the things. I have to impress upon students is sometimes they want to use they're using a reference, but the problem is the reference is out of date. You know they find it online and it's actually out of date with another reference. And so, for instance, the level of earthquake activity that we consider now in in the latest NERP Maps maybe say the one in 5000 year event. That is different than what we used back in you know 1995 or 1999 or something, so if they find an old document and they go with it, they may not be using the most up

to date. Earthquake information and then consequently the way that information is treated in today's modern design codes. Is different than what we did back in 1995.

Prof. Leonard Albano

So sometimes we get the, I get these little things happening when I look at MQP calculations and things that they Googled but they didn't realize they got a copy of something that's actually out of date and consequently inconsistent because there are some stuff we design, you know the design loan for office is the same as it was 50 years ago. That hasn't changed in the way we treat it in terms of looking at floor loads. Things like earthquake, things like wind and now even snow is going under considerable amount of change. Then you just got to be careful you're using the right editions of all these documents to be consistent.

Andy

And how often would you say these documents are typically revised or updated?

Prof. Leonard Albano

They try to maintain this on a 5-year basis. So, uhm, so the IBC I think it's every five years it's comes out with a new I think it's five years. And then there's all these other ancillary documents that are also tried to do it on the same on the same rotation. And so consequently everything gets updated together. So for instance, I teach a class in steel design. The steel specification is also on that similar rotation, right? So they've we're using the 2016 edition now. But the 2021 will probably come out closer to 2022. That is already in the review phase. They can make it publicly available for commentary to update the document, and so my guess is by I teach steel design in C term my

guess is by next C term I'll have a new steel specification. It's been updated to reflect the most recent version of IBC, ASCE 7. Not, it's not sure it's there's 2015 for sure. And then there's also a 2020 version as well. And so where the lag sometimes happens, is in the local state levels because they may be a little bit out of sequence as to which version of the IBC they're using. Because it takes time for the states to look at the updates to the IBC and then incorporate it. There's a political process that takes a little bit of time. So that's where the little phase lag might come in, but generally they're on that kind of schedule. Typically a five-year schedule.

Eileen

And then sort of going off of that, you mentioned differences across states. How uniformly would you say that the code is followed across the United States?

Prof. Leonard Albano

That's a huge improvement from where it was years ago. I mean, we're looking at a time. That you know through the until the emergence of the International Code Council, we basically had three major code writing organizations in the United States. We had what was called the we were in the Northeast and that had one group, the Boca code. There was another one in the South, the southern and then. The western part of the country had the uniform. And so knowing your local building code and its subtleties was actually a very significant competitive advantage because it was difficult to go across. Go from state to state and pick up the peculiarities of an individual state. Because there was a lack of a uniform. Platform, and so each and even you know we're at the point now where. Well, cities and communities just adopt the State Building code, but you actually had municipalities in the state could have their own code separate from the. From the state code. So it was just the sea of documents and some of it was just again because these are legal documents.

There is a certain amount of politics, perhaps you know you get certain provisions, maybe that favor certain types of industries or trades over others, because the state has a long history and its successful history with using those. Approaches. Other states may not have that background, and so they don't incorporate those provisions and so so that that's been a major accomplishment of the ICC. And then similarly when you look at Europe, the euro codes. With the European Union. Have gone a long way to unify what's done in Europe. Come in so consequently. The intent of the Eurocodes is actually for the widespread adoption throughout the European Union, and so on. So so it's interesting when you look at. Articles you know and they don't have to necessarily be Journal articles. They could be articles within the industry, publications you typically see work referring to euro code provisions or ICC. Or ASC is having problems, so it's very. Things have really cleaned up a lot if you will in terms of organizing it and having. Focus in terms of provisions.

Eileen

And so our project focuses on an earthquake risk in Romania. So you mentioned the codes used in Europe. How would you say those compared to? The codes used in the US.

Prof. Leonard Albano

It's interesting that what the stuff I've seen in the Eurocodes it seems to be. I mean, we all have the same philosophies in terms of looking at issues in terms of try to do things in a way that's probabilistic, recognizing that these are events that have low probability maybe, but high impact. And trying to capture the fact that we have uncertainty in predicting these low these loads, and then we also have uncertainty in terms of the material list. You know, speaking as a structural engineer in terms of the structural side with the capacity you know to respond. Although we do understand things quite well in terms of structural behavior, there's still uncertainty there, and so

both sets of codes try to capture that probabilistic approach. It seems to me, though, when I look at euro code, it's just my impression they have a lot more factors to try, and you know a product. The fact is, in order to try and make adjustments for various things, whereas in the, in the US We typically have factors associated with loads and a factor associated with resistance, it seems there. Design side involves products of more numbers in order to define the behavior or account for different subtleties. It probably brings us to the same place. You can't just say oh, this is that you know, line the two things up and see exactly how they align. It's different things quickly.

Eileen

Could you give an example of some of the factors that the US doesn't include that Europe does?

Prof. Leonard Albano

Yeah. Well, see as all put together. So for instance, when we look at, uh, resistance factor, we account for variations and materials we account for, say, variations in the fact that we idealize things when we would design it or do our analysis. There are tolerances involved associated with construction in terms of you know how close they're actually going to locate these elements to where we the way we prescribe them, and so those kind of all go together into one factor. That it's that's been accounted for and actually benchmark against some existing construction. And then you'd look at, say, Eurocode, and you'd have a string of factors dealing with a number of things that you know again. Again, it probably all comes together the same, it's just that it seems to be a bit more explicit.

Eileen

Gotcha and then you mentioned that it's low probability but high impact. Could you talk about some of those lasting impacts?

Prof. Leonard Albano

Well, you know in terms of the extreme, people can die, right, right? You're also looking at replacement and repair costs and huge. I mean the nonstructural damage due to earthquakes is just a huge price tag. You know on the structural side, we may have a building that gets through the earthquake with some damage that can be possibly that can be repaired. I mean that's not free, but there's some caught. You know the repair, but then you look at things like... Uh, what happens is, you know, with the Bay Area earthquake, you know gas lines broke and now you have now you have fire. Right now you have fires breaking out. You've got neighborhoods on fire. And so the consequences of an earthquake in that regard, particularly with. These other aspects can be very expensive to deal with, right? Because now you've got instead of buildings with cracks in them that are going to, maybe you can go through and prioritize which ones are. You know you need to remediate before you can re occupy M, which cracks are more unsightly, but there's still the building is still stable, versus a conflagration because a gas line broke or you know, a fire breaks out after an earthquake, but the water lines were ruptured so the sprinklers don't work. And so then, when you look at especially now right with the way our economy is, basically it involves a lot of computers and information technology. You know you look at. The amount of information that's stored in these buildings in terms of working environments. That's all nonstructural, material that can get totally destroyed by an earthquake. Those are the kinds of consequences that are that are very, very expensive, and it may be replaced depending on you know when was the latest backup made? Somethings might actually be priceless to replace. Just because of timing, right?

Eileen

Right and so, uhm. Romania specifically has a lot of different like historical buildings and such. Do you know anything about practices for retrofitting buildings? Specifically, there were some buildings in Romania that were damaged in an earthquake that's not quite recent anymore. It was 1977, but they're still seeing a lot of damage and vulnerability associated with kind of damage only sustained during that earthquake.

Prof. Leonard Albano

Yeah, that's always a challenge because I mean on the one hand, you can say, alright, we need to tie these elements together. Now we have extensive cracking, so maybe we can put in metal rods. We can kind of use dowels and tie things together so that they're they make a clear load path and that they're able to sustain load. Then the problem is that you start looking at the mix of new materials with old materials in. Do you get other effects happening because of a mismatch of materials? You know that, for instance, there are cases where patches to masonry walls were made with, you know, cement base material and these and it didn't have the right porosity. For the existing construction, and so there's moisture in the ground and the moisture gets into the into the structure and kind of wicks its way up. And what happened is when they repaired the foundations, it kind of blocked off the ability of the moisture that kind of come out the structure at the foundation level and it actually went up into the walls of this structure where there were these frescoes. And the paint starts bubbling because the moisture is trapped in the wall because the foundation used to let the moisture out. Because there was a certain porosity in this cement that was used. And so that becomes a whole area of study in terms of looking at material compatibility. So you know, I think understanding the structural part of it is probably the easiest in terms of saying we got to fix

this, we got to get the load out here. What can we do? But then looking at. How do you remediate that in a way, especially with a historic type structure? It doesn't cause any unintended consequences. Like you know, imagine seeing this. I don't know how old the fresco, you know hundreds of year-old fresco all of a sudden is disintegrating before your eyes because the dampness was coming up through the foundation, and historically it was always there, but it could escape because the foundation was poured. There was a porosity in the cement, but with a modern, so that maybe they put a polymer in it to give it more, because cements a brittle material to give it a bit more resilience so it can adjust to changes in settlement and things like that so it's less likely to crack.

Prof. Leonard Albano

And the problem is, the moisture just couldn't come out through the foundation. It ends up coming into the walls and then it comes out to the walls because that's the walls are porous. Right, so I think that part of it is what's really fascinating is looking at those and there are communities, I would say predominantly in Europe, Milan Polytechnic, for instance, that really looks at those types of studies, because that's really, that's the hard part.

Eileen

Uh, have you ever personally experienced an earthquake?

Prof. Leonard Albano

No no no. I mean, it's funny because we've had some rumbles and my wife has felt. Some. Oh, and uh and you'll see in the paper and then there was one. There wasn't too long, though. In fact, you know the covid world. One month is like a dog year, but I can't remember it wasn't that long ago,

but she said, oh, that was a, you know, she I was somewhere. And she was home. We were in the same, you know, it wasn't like I was off. I was in town; I just think I went downtown or something. Maybe the drugstore or something. And she said, did you feel the earthquake? And I go what? And she said, yeah, there was about such and such time as I felt the whole place kind of... I felt the rumble. And then shut up. You know, the Boston Globe the next day talked about that, you know whatever time that was there was a minor tremor was a tremor felt and the extent of it, but I've never felt one. Yeah, my son went to California, went to College in California. My youngest and he went to an earthquake. His roommate was a California native, and so I guess it was like it was maybe. Let's say it was like 3 or 4 in the morning. He feels it. And he comes like running out of his room, saying, Oh my God. Oh my gosh, there's an earthquake in the room. What do I do? When the roommate says, are there any pitches falling off the wall or falling over or something like that and he goes no, everything is fine, everything is still up. And he says, then go back to bed so they kind of have this built-in system to say OK if pictures are falling off the wall or glassware toppling or you know that. It is in this sense. Of yeah, intensity, right?

Eileen

And so do you know anything about The role that the government plays in preparedness?

Prof. Leonard Albano

Well, they contribute through things like national earthquake Hazard Reduction program. They fund those, they fund NSF. Ah, National Science Foundation, which does research on new building technologies or workshops to discuss findings. They fund Federal Emergency Management. FEMA be one huge thing. It's a fact that the government did in the 60s into the early 70s is they funded summer workshop series for faculty to learn about earthquakes, nuclear fallout, wind, and

I think fire. And so WPI hosted some of these workshops. I think they were organized through FEMA, and they were first shelter design like Fallout Shelter design or designed for earthquake. Because all this what the government recognized was all this research was evolving in universities. But it was in very, you know, back then you know there is small pockets of research. And so, how do you get this out so that the next generation of faculty can share it in and educate their students in engineering. And so this program was launched and come. There was a faculty member at WPI passed away was the former head of the Civil engineering Department, Cal Koonce. He ran some of these workshops and so sometimes when I first start when I there were a few times when I first started at WPI. I'd go to our conference, and they said where you're from and see that we've gotten. They'd ask about Carl and it's because they took these workshops with them in and they remember coming out to WPI. And, you know, during the summer it was like a two week or a three-week summer session. And so the government promoted this way of educating educators so that they could then incorporate it in their courses and update and new textbooks come out and ET cetera, to share this information. And so that was a huge. That was a huge initiative. Uhm, and so every you know and so consequently modern structural engineering education. In terms of has kind of descended from this from this model. You know, and it's and so it's not uncommon even in undergraduate text. I mean, there's a great textbook on wood structures that students you know as a sophomore level course I used to teach. Had great discussion on how buildings carry load and how do you calculate earthquake loads and how do you design for earthquake and a simple wood structure. I mean the point of it is, you know it becomes much more complicated with let's say steel or concrete, but just the notion of having a load path and those concepts. You know, and that's all to me. It's all an outgrowth of this program. That by making this, information accessible and thinking about how we're going to package this in a way so educators can bring it back to their

campus and incorporated in their courses or incorporated in whatever textbooks they're writing. And get it out there, and so I think that's part of the reason why we do have a good track record in terms of. In terms of seismic design, for the most part we do have a good track record.

Eileen

Do you know any programs comparable to that in Europe?

Prof. Leonard Albano

That I'm not aware of, I'm sure they're there. Uh, but but. The details of any specific program or not, yeah.

Eileen

And so then our project kind of looks to see if there's any disproportionality in vulnerability across different ethnicities and religions and socioeconomic status groups. Would you say that there's an observable difference in the US across groups like this?

Prof. Leonard Albano

It's interesting, I was asked the same question last year. There was a group doing something on fire codes. It was a similar type of question. I think the code system in the approval process works to avoid that as much as possible. I think the challenges are at the local level, in terms of like, think about the schools program. Going back into schools. Looking at old drawings. Opening up walls and or ripping opening ceilings to see how these things were built to see whether there was an adequate load path for seismic. You know the challenge is if you need to do things like that. The funding. And does it come from a state level or does it come from a local level the minute it comes

from a local level, you're going to have challenges. Right, that's just even the public schools model, right? We communities rely so much on local taxes to fund their schools and so on. But if things are done, you know, so I think the idea of doing things at a state level, the reliance on. State level building code requirements I think helps to level that playing field, but in the end though the end the it comes down to the property owners and whether or not they're making the renovations they're making are sufficient to require code review. You know, just because you can make a certain amount of modifications to your building, and as long as you don't change the occupancy to become something that's kind of more hazardous. And as long as those renovations are below a certain price tag, it doesn't open up a full code review, and so consequently, if there are elements of these structures that are not safe. It could, depending on the nature of a renovation it may go undetected. Because someone that the owner is only going to pay for. You know they own this. You know they own this strip mall and this building this business wants to expand into the next door space right? And so they hire a structural engineer to put in a new beam so they can open the wall without having a wall come down. Meanwhile, if you go away from that, you know 20 feet the other way in both directions you find out you have a problem, But that's not within the scope of the work. And so is never detected, right?

Eileen

Yeah.

Prof. Leonard Albano

In in the scale of that renovation is not sufficient to say all the entire building has to be brought up to current code. You know there's like a tipping point. So that that that's the kind of thing you know, so you look at like where? Foisie is now right that used to be Alumni Gym. And so, the

originally that was the plan was to amount to renovate alumni gym and make it Foisie, but there wasn't going to be any residents on top. And so, but the extent of the renovation was such that. It triggered now you got this. There was a masonry wall building. It was built 19 or something and so they had to actually look at structural systems to deal with seismic because you can't, you can't build like that today. It's not acceptable. Right, so you know they had to figure out a way to maintain the exterior of alumni gym, they wanted to keep it. And all the gargoyles and everything you know, and it's part of our history. But then you needed to provide a structural load path from a seismic point. So that's how I think the system works in the ideal. I think the challenge is though on the local level. The property owner level. Their budget, the extent of the renovations. I think that's probably, I think that's part of the challenge. I mean, I think the other problem too, though, is that collectively, you know you get a lot of tight densities of people in areas that if something bad did happen it's a huge impact. You know, and I think we're kind of seeing that even in the Covid event with certain communities in Massachusetts like Chelsea. Not that I'm predicting a major earthquake in Chelsea, but but you can just imagine that if you end up with a conflagration. There's a lot of people there that are going to be displaced and you know, living in Greater Boston area is expensive. And so, if Chelsea gives them an affordable dwellings so and they can better rather somewhat close to where they work. And they get displaced, uh, that poses a huge challenge. So that that's the part of it. Again, it gets to the nonstructural implications. I think that's really where the issue is.

Eileen

Yeah, we had done some research and found that a lot of the buildings in one region of Bucharest were classified as high risk, whereas some buildings in the adjacent neighborhood weren't classified at all, and so we kind of assumed that that didn't mean that there weren't any buildings

that weren't classified, just that nobody had gone in and done that type of classification. And when we asked an expert in Romania, he said that a lot of the regions are prioritized based on the industry that they provide or the benefit to economy. Have you seen anything like that?

Prof. Leonard Albano

No, I don't. I don't think so. I haven't come across anything like that. But you could see how it would happen.

Eileen

Yeah, that's for sure.

Prof. Leonard Albano

I mean, you see the same thing with economic policy where they create what they call enterprise zones, right? So if a developer goes in a particular neighborhood, they can maybe get some sort of federal grants or tax credits if they promote certain if certain development takes place in one of these quote unquote enterprise zones and the idea is to upgrade the community. You know, add value. And so there's a case being made that depending upon the motivations of the developer. The intent is to do one thing, but it may actually end up doing something else. That is, displacing the people that have lived there and growing up there and raised their family there because they can't afford them. They won't be able to afford the real estate, but for the passersby, it's a lot nicer thing to look at. Then maybe what's the current neighborhood looks like in terms of the challenges it faces, right? New shiny buildings. Sidewalk cafes and things like that. So I think that's true in all aspects of life, I think, right. That's the true... the sense of priority. Where, why don't we prioritize?

Andy

So would you say it's possible for like a historical or an old building, to remain out of code if no major renovations were done by it?

Prof. Leonard Albano

And then so now it's a question of risk management. Uh, you know, depending upon the situation, maybe you're dealing with limited occupancy hours. You know to try and minimize the likelihood that people are in there during a seismic event. There is an existing IBC international Code Council the ICC has produced an IBC for existing buildings. And so it has particular guidelines on those types of issues and in extreme cases, maybe you're looking at something that can just basically be like a museum where it's limited hours, or maybe it's a community, a local church that can be used for services on the weekend, but otherwise it's not used much, you know, because of the... try and manage the risk.

Eileen

So that's really all the questions that I had Abby, Andy, do you guys have anything else?

Abby

I think that's all that I had.

Prof. Leonard Albano

OK.

Eileen

And then so we are, you know, conducting interviews with other experts in the US and in Romania.

And so, do you have any recommendations for what other questions we could ask to get more information or a more comprehensive understanding?

Prof. Leonard Albano

I think a question related to when you asked me about and I talked about the program in the US to educate educators. Has there been some other similar programs in Europe? I mean, I think that would be interesting because then it works its way to, you know. You kind of think of where WPI was in 1960s, nineteen 70s, right? I mean we're small New England College back then, right? Most of our students came from the region. Uh, you know in the US news and World Report back then we used to like compete against Villanova as a regional University in terms of quality kind of thing. But you can still get that type of advanced technological information into curriculum. And schools across the country with an initiative like that in in and they package it in a way that actually you know. Uhm, you know I have some of the material in my office. You know, it's almost like a workbook. Where you can present the material as a lecture or whatever, and then there's assignments that you can give to students they had, like a case study building with drawings that you could open up the drawings and go over the drawing. You know, so the whole thing was put together in a way. That recognized the demands on faculty time to say if I'm going to develop a new course or I'm going to add this to my course, where am I going to find the time to do this and do it right?

Eileen

Right.

Prof. Leonard Albano

In that kind of program, it would be curious to see whether there was a similar one. Because then you've got it spreading to all. You know it doesn't have to be at the highest-level universities have it. You know, maybe some of the work might have been done at Caltech or MIT, but it spreads everywhere. You can make a similar case that maybe some of the high-level work was done at European institutions. You know, Swiss Institute of Technology. But it spreads everywhere because it or the way it's set up. I think that would be an interesting question.

Eileen

Yeah, definitely. And then I guess, finally, uhm, do you have any advice for us as interviewers for improving our process.

Prof. Leonard Albano

I think it's hard with zoom to make any judgments. I think it's hard. Uhm, in looking at it, uh, there seems to be a little bit of a lag. For instance, in From Abby's side, so it could be an Internet thing. And so consequently it's hard to make to make judgments like that. And I think part of it too, is just trying to feel. I mean, there's so many queues we can pick up on when we're meeting face to face, right that we struck our brain or we brain struggle with when we with through Zoom, right? And so if you were, if we're all sitting in my office, I can see how things are coming across and I can see how I can try and do things outwardly if it seems like you're nervous or you know. And same thing goes back to the interview. You look at their expression on your face and you realize, oh, maybe that question landed flat, or it wasn't quite the way I want you. You have opportunity to correct and you're doing that in a in a one-on-one environment. It's very subtle, but you can

adjust for it very quickly. In Zoom, it's kind of like whatever goes out is out. I mean, there's no getting it back. It's hard to correct.

Eileen

Right.

Prof. Leonard Albano

Because we lost that whole dimension of being face to face. So I think you've done very well. I mean, I think you know and I what I also appreciate is you kind of let it flow. You didn't give me the impression that you had 20 questions lined up and you're just going down the line now. You may have, but it didn't, and maybe you learned maybe you did, but you knew how to jump around, but you said, oh, he answered this question, so let me go to question 12, because this is a good time to ask 12 because what he said on Question 4 versus. Sometimes I get interviews where we end up revisiting things a lot because they're not really processing what I'm saying.

Eileen

Thanks a lot.

Leonard Albano

They're not realized. They're not, you know, and it's in fairness you're dealing with disciplines that may not be familiar with, right? So, I think he did very well in that regard to try and make it more like a conversation rather than say, here's my 20 questions that I need you to answer, and I'm just going to go right through him. Full steam ahead. You know, so I think you did well in that regard.

Eileen

Thank you, and thank you again for your time, I think we got a lot of really useful information out of this, and definitely some interesting things to be able to compare what you have given us to experts in the Balkan Peninsula and Romania specifically. So we really appreciate your time.

Prof. Leonard Albano

My pleasure, my pleasure, good luck with it and if there's anything comes up, I mean obviously I recognize your emails now.

Prof. Leonard Albano

If you have a question you want to shoot me an email on something, that's fine.

Eileen

Thank you so much and the rest of your day.

Prof. Leonard Albano

Thank you too. Take care bye bye.

## Appendix C: Prof. Naser Sharifi, Civil Engineering, Worcester Polytechnic Institute, Interview Transcript

Owen

All right, you are good to go.

Eli

Perfect. All right, just to start off to get to know you a little bit. Where are you currently working?

Prof. Naser Sharifi

I'm a postdoc in the Civil and Environmental Engineering Department at the University of Pittsburgh. So west of Pennsylvania, I live there.

Eli

Got it. And so you're studying Civil and Environmental Engineering? What specifically are you working on?

Prof. Naser Sharifi

Right now, I'm working on a couple of concrete related projects, the concrete pavements, and stuff like that. But as Dr. Sakulich said in his email, I have my background in earthquake engineering, because my master's degree was in earthquake engineering.

Eli

Got it. And how long have you been at Pitt University?

Prof. Naser Sharifi

At Pittsburgh? Two years?

Eli

Awesome. Okay. Um, so, in the event of an earthquake in a city, what kinds of infrastructure within that city could be heavily affected by earthquakes?

Prof. Naser Sharifi

Pretty much everything, everything in any structure basically. Well, we always think about buildings and structures that we live in. But in addition to that, like bridge, highways, basically, power plants, everything will be affected, depending on the design of that specific structure. And also, depending on the intensity of the earthquake, everything can be affected. And it's basically a function of the location. So here in the United States, mostly they're, California and states that are, you know, on West they are they, they experience intense and strong earthquakes, because it's really, it's really related to tectonic plates. So, for example, in the center of the country, we don't have this problem, but in the West, we get more earthquakes.

Eli

Yeah, I'm from the west coast. So.

Prof. Naser Sharifi

Okay.

Eli

I'm from Washington. So we're just waiting for the big one to hit at some point.

Prof. Naser Sharifi

Have you ever experienced one before?

Eli

I believe I was alive during an earthquake when I was really, really young, but I don't remember it.

Prof. Naser Sharifi

Okay.

Eli

I'm sure I've experienced smaller magnitude ones. Andy has, though.

Andy

And I'm from Japan. So I have experienced earthquake in fact. The day I was supposed to have my visa interview to come to the US, there was a magnitude 6.0 earthquake.

Prof. Naser Sharifi

Wow. Yeah. Yeah, actually, I'm complete. I'm aware that in Japan, they get a lot of earthquakes. So yeah, yeah. As I said, is that a function of the tectonic plates, location, how they move. Yeah.

Eli

Yeah. So with this infrastructure damage, you said it can be widespread across the city, and I'm sure it can have many different impacts. How can it affect the population of the city?

Prof. Naser Sharifi

So basically, the worst thing that could happen is that people lose their lives. I mean, if you want, I can share my screen with you.

Eli

Yeah

Prof. Naser Sharifi

I have a short PowerPoint, slide some details there. It might be beneficial to you.

Eli

Sure, yeah, you have the ability to share.

Prof. Naser Sharifi

Okay, so then this. So, here is the list of 10 deadliest earthquakes in 20th century. So for example, in China, you know, 270,000, 273,000 people died in like, less than one minute, you know, or in Japan, or I'm Iranian. So in Iran, we got an earthquake a few years ago, 50,000 people died. So you can see, basically, this is the worst, the worst thing that can happen. But in addition to that, so think about it, for example, we have a high school building, and it falls off, and then people cannot

have, they don't have access to that building. I mean, the students cannot go to school or, for example, we have a bridge that connects two cities together. And when it falls, you know, it really clearly takes a long time to go back to normal. The other things that you have, I'm sure that Andy knows about it in 2011, there was an earthquake in Fukushima, Fukushima, Fukushima. And so a nuclear power plant was damaged. And then basically, it was not functional for a while and then some and I think if I'm rep--, correct me if I'm wrong, some nuclear stuff just leaked out and it affects the environment. So basically, or for example we get tsunamis, so all the buildings and all this infrastructures that are close to the shore, they will be damaged. So basically earthquake would affect, unfortunately, they are strong, and we don't know when they happen. But when they happen that will damage everything.

Eli

Yeah

Prof. Naser Sharifi

Do you need more detail? More details, or?

Eli

Uh, so you've mentioned a lot of short term impacts that earthquakes can have like buildings collapsing, transportation, infrastructure, like buildings, or highways being damaged or power plants being damaged beyond repair. Are there some longer lasting impacts that earthquakes can have on a region?

Prof. Naser Sharifi

Yeah, I mean, basically, some of these, I mean, by short term and long term, I don't know, you're referring to like 20 years, or some of these may take a few decades to fix. When it comes to like, if it's a big power plant, or if it's like a long bridge, it takes a while to be fixed. And then the other thing is that it's really, it really varies in different countries. Some countries have better infrastructure, I mean, they are rich, so they have money. So maybe in a few years, they will fix it. But I have seen earthquakes that even after, for example, 30 years, people are still suffering because the buildings have been damaged, there was not enough money or funding or material or support from the government to fix it. So some of them really can take a while. And I actually, I have seen pictures that shows a building. I mean, a house, a structure after 30 years, and it's still not fixed. So these are like the long lasting effects of an earthquake.

Andy

So in addition to funding, do you think there were other factors or variables might be in play for how long it takes a, something to be repaired? After an earthquake?

Prof. Naser Sharifi

Basically, I would say the need for that is, is something important. So for example, if it's the bridge that people of the city really rely on that I think there's a higher chance that it will be repaired faster, rather than, I don't know, isolated building, somewhere in the corner of the small village. You know what I mean? So this is another parameter that I think affects it.

Eli

Sure. Um, so, uh you discuss some variables that can be in play for how badly things can get damaged, it depends on regions preparedness, and then the time it takes to repair can be dependent on the regions need for that specific infrastructure. I believe Dr. Sakulich told us or Professor Sakulich just told us that you're from Iran originally, right?

Prof. Naser Sharifi

Yes.

Eli

And Iran, from our understanding, is a really earthquake prone region, their fault lines across it. What kind of preparedness measures have they implemented in Iran to help prevent some of this damage or be ready to act when it happens?

Prof. Naser Sharifi

Yeah, actually, it's a very good question. Are you familiar with building codes?

Eli

We've done a little bit of research into building codes as part of our research, but not a lot of the technical details.

Prof. Naser Sharifi

Yeah, I mean, in general, you know, each country has some specific building codes, that, that is basically designed to address the requirements of that region. So for example, if you get a lot of

snow, the building should be able to carry the load or the snow, or if it's wind. So same thing about earthquakes. So there are a lot of building standards that are in place in different parts of the world. And specifically, in Iran, we have two specific building codes that conduct basically, a gives you the requirements of the building, depending on their location, if it's north, west, north, west or center. So underneath the engineers, and the private sector, who basically designed these buildings, and they build them, they have to follow these instructions are pretty much same thing about the I mean, any other country, for example, here in the US, they have IBC code, I mean, it might be beneficial to write it down IBC code or ASCE code or FEMA code. So these will tell you the requirements if it's there, for example, steel structure, concrete structure, if it's a bridge, so and then the problem is well, these specifications are well established. I mean, it's not the problem. But the problem comes from the fact that maybe people, I don't know, private sector, they really don't want to implement them correctly, or maybe they do not have enough money to do so. Here, we really know what's going on. I mean, we I mean, basically, earthquake engineers, they can analyze it. It's been done a few decades ago, all the requirements have been established very well. It's just a matter of doing, implementing that correctly. So, yep.

Prof. Naser Sharifi

And then, for your other question, well there are occasionally some workshops. I don't know, in high schools or in elementary schools that teach students, what should they do? When you know, when we have an earthquake? I'm sure it's the same thing everywhere. So yeah, things like this. And then, ideally, you know, the government is ready to help people that really suffered the earthquake. I don't know how well they do it. But ideally, they are prepared for that.

Eli

Yeah.

Andy

So I'm currently studying fire protection engineering, so I'm somewhat familiar with building codes. And what we've been taught is that usually in the private sector, contractors will attempt to do the bare minimum to reach the codes. Would you say that's the same for the earthquake seismic codes?

Prof. Naser Sharifi

Exactly. Yeah. It's just a matter of, you know, it's about benefits and money. So, I actually have a, I have a slide to show you. That shows, I think we will get to that question later on that, what should we do to protect the buildings? What are the requirements? So I show you and like, I try to explain why it is expensive. And some people hesitate to do that.

Eli

Sure, yeah. It's funny that you mentioned workshops, in schools for students, I remember, back in elementary school, we would do your earthquake drills, where we had to all hide under our desks and put our hand over our neck to protect ourselves. And that's something that we're looking to research in Romania, and in Bucharest, to try and understand whether that's something that their government does to help inform their populace as well, just to help understand and compare what different countries are doing.

Eli

You mentioned that contractors will often try and skirt building codes if they don't have the money or they don't want to. In Iran, do you think a significant, I don't know if a significant portion is the right words. But are these building codes effective? Are they often implemented? Or is it...?

Prof. Naser Sharifi

They are, They are, they are effective. But are they really, you know, today really do a good job to do it. And everyone does it. I doubt that, I don't think so. But I really do not have an exact number saying 80% or 50%. to it. But you know, there are a lot of you know, there are some agencies that really inspect and try to enforce the law. But we know that, you know, everywhere, there are some people that know how to work around it, and then not to do what they have to do. But I will say to some extent, the codes are effective, that's not the problem, but how people implement it. I don't think it's done perfectly.

Eli

Okay. On to questions about your experiences. Have you ever experienced an earthquake?

Prof. Naser Sharifi

Yeah, I experienced a very, it was not strong. I experienced an earthquake in 2011. Yeah. Yeah. 2011 when I was a master student, I was in the capital city, Tehran, and then there was an earthquake. And I just felt that that, you know, the building is shaking. But it was a minor one. So not, buildings were not damaged. No one was hurt. So it was a small one.

Eli

Okay. Um, you've mentioned that there are some workshop programs to help inform students in Iran, about what to do in the event of an earthquake. Are there other measures that you're aware of that the government takes to try and inform residents about earthquake risks and what to do in case one happens?

Prof. Naser Sharifi

Yeah, well, yeah, occasionally on TV, you see some, basically, they try to teach, you know, there are programs that are designed basically to show you what to do. And yeah, other than that, I would say the government is basically, they have some temporary shelters so that basically they send these shelters to the location of the earthquake right after the earthquake takes place. So for the few, the first few days people have a place to live in, before they really actually build, you know, the repaired structures. So these are the two things that I can add to what I said earlier.

Andy

So, could you describe a few of these shelters, for example, because I know, in Japan, the shelters usually take the form of local high schools or middle schools. And I was wondering how that would look, how those shelters were differ in Iran.

Prof. Naser Sharifi

I, I lost the word. I will email you later, because I can't remember right now.

Eli

Sure, that's fine.

Prof. Naser Sharifi

But basically, there are, for example, they are as big as one room. And then it's something that, it's not made of concrete or brick, it's just something that you transfer and assemble it quickly. And so yeah, I will send more details on this.

Eli

Okay. Um. One other question we had about preparedness in Iran. Do you think that the preparedness within different parts of the country or different parts within cities changes? Like are there areas where some buildings may be more at risk than others are areas where some people might know more than others?

Prof. Naser Sharifi

Well yeah, actually, it really is significantly different, for example, in the capital city, basically, well, we all know that in each country, there are some neighbors that are rich, or, for example, we have a small village that. But you know, so it's it really, for example, if it could go, when we have a big city and mega city or, Yep, so in these places, there are buildings that have basically they have been built based on their codes, but in small villages, or the parts that are not really, I mean, there was not enough money for them, I would say, no, they are, they are not those buildings have not built in a basic, based on the codes, and they are not in good condition. And then when an earthquake happens, if it's in, in a big city, or in a better location, I will say, it doesn't really cause that much of a problem. But if it's in a small village, unfortunately, it damaged all the buildings, and many people will be hurt. So the answer is yes, it really depends.

Eli

Umm, in countries surrounding Iran, my geography isn't great, so I don't know what those countries are. But do you know if they implement more preparedness measures, less preparedness measures? Because I'm guessing areas of similar that are in a similar area are probably at a similar risk to earthquakes, but it can depend possibly based on countries

Prof. Naser Sharifi

You know, to give a very accurate answer, you know, a person needs to read all the, basically building codes up to those countries, but in general, I think in a couple of countries, I think that they have good measures. I mean, they I mean, they have basically, well established infrastructures, but I will say that five other countries, they are not really they will be the same or unfortunately, they will not be as good as they should be. For example, Iraq or Afghanistan. I mean, I'm not sure if, and I said I really do not have correct, like very accurate answer, but this is what I think.

Eli

Yeah. Okay, that makes sense. Andy, are there questions here that are on our list that I've missed or follow up questions that you have?

Prof. Naser Sharifi

I think we were supposed to talk about and what can be done to, basically, to make sure that a building doesn't fall so I have it.

Eli

Absolutely. Yeah.

Prof. Naser Sharifi

So It really depends on the structure that we have, for example, if you have a concrete structure, and it's located in a place that, you know, strong earthquakes take place, if we wanted to, if we want to make sure that the building doesn't fall, fall off, because of the earthquake, we need to use more steel rebars, you know that, this, these are steel rebars, we should use better material, we should use thicker walls like stronger columns. So this is called the shear walls. And it's specifically for the concrete structures, when it comes to the steel structures, basically, you see these elements like this. So basically, we have columns, and we have beams. But if we wanted to, if we want the structure to withstand the earthquake, it should have these diagonal elements, which are called bracing. So this is specifically for the steel structures. And then there are some other techniques that can be used for both concrete and steel structures. These are called hydraulic dampers. So when a building starts to shake, basically, they dissipate the energy and try to minimize the movement of the building. And finally, this is, this is called base isolation. We have some rubber material, rubber materials down here, below the, this is foundation down here, and here is the main structure. So we separate the foundation and the main structure using these base isolators. So again, they prevent big displacements in the building, and then, they help, you know, and then going back to the what we were discussing, you can see that, you know, to do this, we really have to pay more money. I think it's clear that basically we need to buy more material, better material. And these are much more expensive than the conventional systems. So this is why some people or private sector really try to not to do it

Eli

Right, it's all about the money. So those are really interesting things. Those look like they have to happen during the construction, the original construction of the building, are there techniques that can be applied to help retrofit buildings?

Prof. Naser Sharifi

Exactly. This is actually a very interesting field of study, which is called retrofit of a structure. And then, basically, you know, many of the building codes have been developed in recent decades. So if you have a building that was built 100 years ago, most probably, they really didn't think about this. So what can be done is that the engineers go there and study the building, and see what the current status is, and then see what they can do to retrofit it. For example, they can add some elements to the building to make the columns and make the beams to, to be stronger. Or they can add dampers, as I showed you. Or for example, if it's a very important historical building, they can add base isolation to that. I'm sure if you Google it, you can find the buildings that have been retrofitted using the base isolation. Basically, they lift the top, they put the base isolations below the columns, and then put it back. So yes.

Eli

Are these techniques just as effective as building structures that are seismically sound, or did they just help compensate for some of the risks?

Prof. Naser Sharifi

You know, I think they help and, you know, if they are done correctly, they can guarantee that the earthquake doesn't damage that specific building.

Eli

Okay, that's good to know. I think that's something that is being done in some parts of Bucharest, which is where we're studying specifically, we're trying to understand whether the buildings, what regions of the city are more at risk than others and what the government is doing to try and help compensate for this risk. So we'll definitely research that and see if that's something that the Romanian government is doing within the city.

Eli

Andy, are there other questions that you'd like to add?

Andy

I don't believe so.

Eli

All right. I think that's what we have. Thank you so much for your time. This has been informative, and we have a lot of leads to go do some research on.

Prof. Naser Sharifi

Yeah, and please email me if you have any questions. Or if you want us to meet again, I will be happy.

Eli

Absolutely. Thank you so much.

Prof. Naser Sharifi

Have a good weekend, guys

Owen

Thank you very much!

## Appendix D: Dr. Emil Sever Georgescu, Senior Researcher, URBAN-INCERC Institute, Interview Transcript

Dr. Emil Sever Georgescu

Just a question for beginning the participants to this project, the fellows that I see, have you ever had the possibility to visit the Bucharest and Balkan area for this purpose or for other purpose?

Andy

So the original goal was to visit Bucharest for this study, however, because of the COVID-19 restrictions we're unable to visit Bucharest right now.

Eli

Yeah, we were planning originally on spending about seven weeks within the city visiting with different people exploring the area and learning more about the region, but unfortunately, we're not able to do any international travel right now.

Dr. Emil Sever Georgescu

Okay, I have sent last night some preliminary answers to your questionnaire. So, other questions more detailed or referring to other issues are okay. So how do you intend to go on today?

Andy

So we went through your answers earlier today and we have come up with a list of follow-up questions and we would like to ask you those during this interview if that's alright with you. So to

start with, we see that in your answer you're currently a senior scientific researcher in the INCER Bucharest branch. And could you elaborate more about what you do at this organization?

Dr. Emil Sever Georgescu

So, I am a senior researcher. At the beginning of my career, I asked for some five years practically until the earthquake of 77 and a little bit later, a researcher in structural engineering that means, reinforced concrete members to test and other issues related to reinforced concrete. After the earthquake of 1977, I was included in some survey and research projects for this time concerning the situation, the vulnerability of different building types. And since 1981, I was moved to the division of earthquake engineering, and step by step I shifted my concern to earthquake preparedness and to socio-economic impact of earthquakes mostly test [inaudible] this follow my fellowships in Japan. And after the changes of 1990 in Romania, I applied for a fellowship in Japan for 8 months, eight months in the Rush University of Technology. And there I research, some interdisciplinary research about the socio-economic impacts of earthquakes. Later on, I fulfilled my Ph.D. program in 1999 with the thesis about different strategies of seismic risk management. And I introduced in Romania after the earthquake of 1990 the first national program of earthquake preparedness devoted to share or to convey to people different possibilities of protecting during earthquakes. This issue was not published publicly addressed until that time because in the previous communist regime all these issues related to what the message are conveyed to the population were strictly politically controlled. And after 1990, we were free to, to send the message materials who printed or video or whatever, to the population, because in 1990, the earthquake happened in the middle of the day. And unexpectedly, the reaction was quite confused of the people. Of course, at that time, there were different political events that already disturbed the minds of people and this was some additional stress. However, this was a very good starting point,

because the earthquake preparedness of 20 million population is not an easy task. So, we devoted some materials in this video/period, there are some papers that were published. It's possible to send them to you he already has and in this respect was so beneficial, the <jaycar> project from 2000 to 2009, practically to 2010. And there I was involved with this division of knowledge transfer to population and with the help of Japanese experts and all these endeavors of our institute and our Minister of Public Works at the time were connected to the enforcement of the government ordinance 20 of 1994, concerning the strengthening of building seismic risk reduction of, also of buildings. This program started quite promisingly, but after a while, it gets stuck. And now there is a world bank project devoted to two strategies. One is for general renovation of buildings mostly related to energy performance. And the other is for nation, our strategy for seismic risk reduction, which is an ongoing program. Perhaps you already cited that. Some details in the Alanna Simpson blog. Elena is from the award, the back and on the world bank, the site, maybe there are some general information about this project with the strategy, and which she probably will be finished next year. And, of course, all the for the development will be in the next two years. Actually is my speaking and English good enough to understand?

Eli

Yeah, absolutely.

Andy

Yes.

Eli

Yeah. I had actually found a presentation that you gave near the end of last year in November, I believe. And in that presentation, you mentioned a few times the national seismic risk reduction strategy. And I did a little bit of research to try and find out more about that. But I struggled to find really specific details about what they're going to be suggesting. Are those new building code regulations? Are they new preparedness measures that the country should implement? Could you speak a little bit, I mean, do you know about what the specifics of that plan are?

Dr. Emil Sever Georgescu

The engineering codes or something, and the earthquake preparedness is different. This is covered generally by an ordinance about the emergency situation ordinance 21 by 2001 or 2004. And other measures of earthquake preparedness are included in subsequent disaster or disaster defense plans which are in the duty of the local authorities. That means county and each locality, but these are governed by the National Committee for emergency situation with the executive body the generally speculated emergency situation. So, in this respect things depend mostly on the local authorities that means, the flavor, the local flavor for the details, the specific details to make connection between the people living in a certain environment and the patterns of death environment which can be dominated or not, but the earthquake issue because the rigid the laws, the legal framework is general about any kind of disaster and the earthquake is a specific chapter in this and of course, from time to time when, when some earthquake happens somewhere, the people became much more aware about the earthquake, otherwise, flooding or storms are much more frequent than people are concerned about such possibilities of disaster. So, our problem is how to keep alive, all this interest about earthquakes. In a country where these events, the great events that we are facing happens from 30 something to 50 or to 80 years in history in between

depends on the hazard patterns, how harsh they are felt by the people and by, especially by the generation, we have now, full generation generations of younger people, which didn't have the opportunity to feel an earthquake, even a medium one, because Vrancea has this pattern of request, that the small earthquakes practically are not felt so you hear, but we hear about them from the TV and from the Institute of Seismology, but strong shaking very rarely an earthquake of six magnitude is felt by people, but when this will happen, next one, the big one, which in principle, may happen in any moment since '77 [and] on the people will be quite disarmed because they know only theoretical or they can see some movie or we make some small exercises to explain them by different TV or meetings or some kind of exercise using was more shaking something over carrier door. We don't have that simulator, like in Japan probably will be that time.

Andy

So, you mentioned that was the younger generation not having felt any major earthquakes. Would you describe there being a large discrepancy between awareness of earthquakes between the two generations?

Dr. Emil Sever Georgescu

Yes, because we, certainly there is some legal framework that in the schools to be two times a year an exercise or [evacuation?] that is not exactly for earthquake, its for fire in general for no matter which kind of event may impose this. We recommend that and we prepare some brochures for each grade for what kinds of groups there are available somewhere on our website and they are in Romanian, but there is a paper about this and I have some PPT which describes in English, the content and so on. And our idea was that with the opportunity to have this potential exercises two times a year to be given some knowledge and to make the practical exercise of course, hold and

when the under the desk to keep alive for the youngest kids if possible in kindergarten too. This minimum protection possibility and this is the minimum we believe that it was practiced in many schools, but we are not sure that how many they were because the people even the stuff in the school, they are bombarded with a lot of things to do. And the staff of emergency situation which must accompany them in this exercise is twice a year are also busy in Bucharest, maybe they were in many schools in some other earthquake-prone area depends on the willingness and the capacity of local authorities to make more propaganda about this and in some remote village, I don't know. So, our concern was how to provide a minimum level of preparedness and to help and in many cases, how to make them to believe and to understand the specific for our experts in Romania because the people living in the highest buildings in Bucharest will feel differently their way because Vrancea is moving differently high rise buildings because it's a long period, long wave the motion is different from raw motion way when the end is moving differently [high-rise buildings] while in some other western part of the country, there are shallow crustal earthquakes which are like in the rest of the world affecting stiff and the low rise buildings and the people will feel differently the earthquake. So, the problem is how to convince the people about the minimum earthquake preparedness possibilities and how to distance themselves about some fake news or different very tricky approaches like this a triangle apply for Douglas fir, which is a very dangerous tool for keeping the attention from some reasonable behavior to some very imaginary possibility to the contrary to the safety of people and from time to time even some seismologist presented the probability [of an earthquake] very, very remote and some people were generally the people who want to receive will peaceful messages. So, between two message one which is warning others [that the earthquake will] come there will come no matter we don't say when this will come, and the other we say oh there's we will not come ah How long will it be until maybe after 10 years, we

do other 10 years. Let us be happy 10 years and we shall see. But earthquake preparedness is not as the only today, if you have like I have that we can make some smaller feature on the one the world if there will be a big one and I will sleep underneath is possible that this will fall down and injure me. This is some easy tasks to put some better connection out there to Tableau to make the people maybe don't know all the furniture, the slender furniture, some bookshelves in the room to be put in some other place or to be fixed to some device to go [over]. So this is taking time and this needs some assistance to be to make people do that. And this is approved a few aspects of the program.

Andy Li

So you mentioned that aspects of this program. are what you would consider to be the minimum level of preparedness. So if you could go beyond that minimum what others measures or programs would you possibly propose to increase earthquake preparedness.

Dr. Emil Sever Georgescu

So, our basic concern was to convince people of our generation to enroll in all these official programs offer earthquake risk reduction, that means the strengthening of buildings, which are listed on the red dot level, or land other which will be assessed as vulnerable to earthquake to avoid a huge number of casualties in case of the next earthquake to come. And these programs lack the means wherever the rate of strengthening during the last years, was quite low, and this is the region of This World Bank project with us concerning a new approach, a new strategic approach in doing all these things, including Africa.

Eli

So, I'd like to shift gears just a little bit. You've mentioned a few times now and this has come up in our research a lot. The 1977 earthquake in Romania, that's, I believe, the most recent major earthquake within the region, right? Did you experience this earthquake?

Dr. Emil Sever Georgescu

Yes, yes

Eli

Could you tell us a little bit maybe about where you were and what your experiences were during that earthquake?

Dr. Emil Sever Georgescu

Yes, I told it on many occasions. So to some measure, this could be boring for some other people, because, in general, older people tend to repeat and repeat things from their youth. At the time, I was a young engineer with five years experience. And in that event, evening, I also in the bigger palace hole in Bucharest, fall with some 5000 places. It's a big blue [cooper/hotel], just in the center of Bucharest palace walls. And I was with a girlfriend for me at the time. And at a given moment, we felt some noise and the rumbling and low-frequency vibration. And then somebody shut, this is the heating center which exploded. But after that, the motion started. And so at that time, I think I made my first attempt [in] earthquake preparedness, and that is because I showed to the people don't worry this building is sturdy, and get under the, between the line of chairs and be protected. And why I did that, because as any younger engineer of the time, I was very confident in what our professor told us. And the professor of reinforced concrete, informed us how the bigger

dome for this whole was designed. Initially, it was only the shell, because the concrete, steel concrete shell of the shirts were very fashionable in this time. But after some discussion with the leadership of the country of this time, because that this bigger dome was intended to help to accommodate the bigger Congress, Congress of the Communist Party and the leader of their time, before Ceaușescu, asked them about how is the structure and so on. And finally, he told me something like these [inaudible] engineers, I appreciate very much the shell and the concrete and all the things you're presented by because I am originating from a railway worker, I believe very much in steel. So, I want to put some visible steel somewhere to be sure that during my Congress parties, I will be sure about this bigger span route. And of course, the project was already done every single prepare, they put some process but not of steel, of aluminum and because, there was no more place under this, under this dome, this were a little bit less inclined to get the room there and there the roofing which is roofing with acoustic isolation for not making reverberation, but also put somewhere there. So, in my mind of young engineer, I think, I trust it very much all this information and indeed nothing happened with the structure after this will finish. So, it was dark only the safety, the green safety light, we went outside and I have seen the what's happened with those which have some running instinct. So, some people which were in the margins of the whole run were running out, but out were the steps and there was a place with some other steps going down and other rising steps, because there are some place for the wardrobe and then some other places, other steps aren't in there the exit and all the glassing of the exits were something like two centimeters glass thickness, because it was simply something like a special safety record. And all these people in the darkness they bumped in, glass and they were war with some funky shapes because they had some bleeding in them [he is talking about bloody noses from walking into glass here]. So, and going outside I wish I could have seen all the buildings around standing and I was

very proud because like a young engineer, I was very confident about earthquake engineering that I learned during my engineering studies. And only later on after I conducted my girlfriend to go home. So we separated and I wanted to go home and in the center of Bucharest, somebody arrived in some bus station with a baby, a man in pajamas with a naked baby and very confused into the line to, waiting for, for the bus. And we were looking to do this any idea about the disaster in that moment, even I was at some details of the disaster. But I wanted to go home and somebody [said] “ah poor man, this must be from [something] building. [Something] building is just over the street to Intercontinental Hotel, peoples are partially for optimism. I was very angry to say that something collapsed. And because I was so curious, I left the bus and I crossed the street and the building was collapsed. And the people was very strangely behaving because they were with some capital candles and when they were looking in the debris for relatives speaking very very lonely when you're there you are there you are there any pain or some other people it was just me as a university just in the very center of Bucharest and some other people were waiting for the for the bus is a rough day and back to the to the crushed building. Each one with interest before became very very strangely for me with my mind for today. And of course any bus was coming because some buildings were over destroyed at the time. And then I went home by bus and I have seen that indeed all the high rise buildings were okay. So no no crushed the new high rise buildings only what do you do build them to collapse and in my home everything was okay except that in the living room some two pieces of furniture which were a slender, very fashionable and slender overtone, the chinaware was destroyed to the to the disappointment of my mother, of course, I repaired the furniture later on. The China, but there are plenty more to buy others and then I went to my [something] engineer which is nearby my home. And we started to look about the the slow motion recording. And in that moment started practically my earthquake engineering research, right

because until that moment, it was reinforced concrete structural engineering. And actually, earthquakes were just in books, and in books about other countries and something about our earthquake from 1940 from books, few books, very few books, until that time where people already wanted to be quiet about this problem always but only in the university there was some courses, and one of the engineers knew about this other people were very happy with themselves. And the buildings of 1940 were very, very, hard to say, lot of prestige for them. Some people believe that new buildings built by this regime, are not at all resisting, especially for instance precast building large buildings, the opinion about these buildings was very worse. And in fact, the things happened previously, the large panel buildings and other business where the research in my institute was done became pretty well why the earthquake, the buildings, which were not designed to any earthquake, but where they will vary modern type for that period had a lot of problems and they represent the book for this 350 buildings which are not yet strengthened. This is briefly not very "Give me the story of 1977".

Eli

Yeah, thank you. So you talked about some of the reactions of people in the streets afterwards and what people were doing. Do you remember what kinds of assistance were given to people who were maybe displaced? Who didn't have a place to live because of a collapse building or any assistance that the government gave out?

Dr. Emil Sever Georgescu

Right, Yeah, yeah. You will find in the library of university precisely there are some reports for covary and off departmental format, I can send you later the references, but if you search about Romanian earthquakes, there are at least three big reports and they're in 1985 there was a joint US-

Romania seminar is and there are two big books, it was about the earthquake and the energy This was from the US side was somewhere [Arony from Cucra]. And there are a lot of things about this. At that time the state had everything including a large residential program to build the buildings for the urbanization of all cities, mostly related to the industrial, our industrialization, industrialization and making more and more factories to go on to be dependent, important so on. So at this moment existed, a lot of apartments are almost ready and they were given to the people, which were evacuated, or those which were saved from the debris or to those where their buildings were not considered safe. That's not to say, and say there was a little bit a bit more propaganda about this in the newspaper of the time, and this is reflected in many other publications of this time and the press release, it was some kind of opening to the Foreign Press, at the moment that the government provided free of charge this apartment including all of us, who needed the furniture, and all other daily cleaning and things in this respect, and, and some money and some other assistance for the people from the insurance, there was a compulsory insurance at the time, and the money from the, from the insurance to be used for like for installment for buying other apartments, different situations. But at this time, of course, this was a kind of strong point of the regime to show that we have, we take care of the working class of the people, and so on the or after the flooding of 1970. It was a big flooding in the 1970s people were finding it happened the same. Of course, in the same time, there was a huge international airport to be different assistance and aid including from US, we received very important assistance from US aid in slow motion data and in some computing, big computers in [something] failure the two come together with some other this assistance that was from \$20 million from Carter, the President Carter, something like this.

Eli

I think you mentioned a little while ago, that after the 1977 earthquake, you became more focused in structural engineering with regards to earthquakes. Did the 77 quake change any other aspects of your life?

Dr. Emil Sever Georgescu

Oh, so, my view was improved, because in '79, two years later, I was in Japan for a short term fellowship of one month and then I felt the taste of earthquake engineering because all the framework, there are some opening at the time in our part of scientific knowledge and earthquake engineering. This was a little bit in contradiction with what happened in some other aspects of the order of their life. So, in economic life, sometime after the earthquake, Ceaușescu decided to pay all the external debt to mend for this, all the imports were cut and all the exports were increased. So, the internal market suffered very much and somehow it is going on after the end of the regime. This is, some things are much longer to explain. And in our case, there was some much more freedom in the contact with foreign academia. In this year and the next year, there were plenty of scientists from all over the world, including so many from the US and all young engineers like me, we were appointed like the guys for this prestigious visitors to see the places where the buildings exist, and then they were through plane or they were revealed or things like this. So by this direct contact to you, you receive something I've received some publication of today, you need to go to yourself why some people did things were a little bit relaxed and don't feel like and for many who were the contract with the foreigners was strictly controlled. And in this period, we were left quite free, we saw was being shown the speaker, what did you download, we use talk with we were just put to show the country is free and eager for contact and so on. Then things changed a little bit later. And in between there was this program that you will find in that paper of 40 years ago about

what's happened to the strengthening of buildings is after the meeting for July 4 1977. And there are the roots of the lack of safety of this generation of buildings which needed strengthening and received only some cosmetic repair. So if you didn't find only internet, they're using my name all these papers, I will send some after a few days because no why am I at all? So I may send different papers where you will find different to puzzle people to reconstruct the big table of 1977 if this is useful for your survey understand you better understand the situation of the time.

Eli

Absolutely, yeah I think that data would be really interesting. One of the things we're trying to do is compare the response and the feelings in the country around the 1977 earthquake may have changed since the end of the communist regime and with the new government....

Dr. Emil Sever Georgescu

There are some papers which attempted to look about this. Some of them were too much directed towards the program of the destroying of the traditional village. Some of them are too much about Bucharest, the problem of the directing or shifting the resources and the demolishing of a lot of all the public of Bucharest to build a new city center. Even myself I'm the author of such papers. In fact the attitude of the regime and the Ceaușescu was very changeable and unpredictable in that period and even myself like which was leaving at that time didn't understand exactly at that time and even some aspects even now why and how his mind changed to make that decisions. People like this which have some other kind of brain do think like this in all the history of mankind and we like non-eternal people don't understand all these things but they are from piece to piece some big part of the story can be reconstructed and probably there's much more about this period like about Alexander the Great.

Eli

I'm gonna ask you to conjecture or guess a little...

Dr. Emil Sever Georgescu

I have some additional things I remember. I see that your names are Italian or Spanish, are you US students or are you came from Europe? Andy Li maybe I don't know maybe.

Andy

So I actually grew up in Japan so its interesting when you say you had a fellowship in Japan.

Dr. Emil Sever Georgescu

Oh okay, I also studied in China for times we had cooperation with them. Okay so you're from Japan. Eileen?

Eileen

I'm from the US, no I'm from Pennsylvania

Dr. Emil Sever Georgescu

Ah, but from Italian descent somehow?

Eileen

Yes, my great grandfather, from my moms side is actually Irish but my dad's side came from Italy.

Dr. Emil Sever Georgescu

Ah yes, nice combination. And Eli?

Eli

Yeah, so my last name is Benevedes, my dad's side is Portuguese, but I'm from the United States. But I'm from Washington State, which is on the west coast which is on the pacific cone of fire so back at home we're just waiting for the big earthquake to hit, people have been talking about it for a while

Dr. Emil Sever Georgescu

There was a movie about such a possibility some time ago?

Eli

Yes

Dr. Emil Sever Georgescu

Interesting combination anyways and took a lot of courage to enter into this field even on the east coast where this is maybe not so but generally probably because you've been more affected.

Eli

Absolutely, yeah. So I'm just looking through the questions here to see if there's something we haven't covered yet. So the main focus of our research is to understand if specific ethnic or religious minority groups might be more at risk when the next big earthquake hits in Romania, we found through an article published recently through a map that I believe you helped create that

maps the red dot buildings within Bucharest so we can see where concentrations of these buildings are, am I correct that this is something you helped work on?

Dr. Emil Sever Georgescu

No, no I don't [AUDIO CUTS OUT FOR AROUND 10-20s] kind of map

Eli

I've just posted a link in chat

Dr. Emil Sever Georgescu

There are such maps trying to put the buildings according to the [inaudible] or some other patterns with statistical data and so on but I don't know if such a map is related to ethnicity or religion because I don't know if there's data for people in NGIS parameters.

Eli

Right, yeah, we've looked at this map a bit and tried to compare this against data we've looked at and some of the names we've looked at of some of these neighborhoods within Bucharest and one thing we've noticed, just one example that we found I believe, the highest concentration of red dot buildings is within the "Old Town Neighborhood" which makes sense to us since the Old Town neighborhood probably has older buildings, however in some of the neighborhoods adjacent to it there don't seem to be any buildings classified under any seismic risk categories. Do you know if there's been a rhyme or reason, any specific way the government has decided which buildings to do research into to determine if they're at seismic risk or not?

Dr. Emil Sever Georgescu

So there is nothing with the government with the history of Bucharest. So when you come into Bucharest like a tourist, you will find on the internet that there is a historical center, some pubs, and nice places to enjoy. This is the natural historical center with low-rise, mid-rise buildings and which are still a little bit refurbished a few years ago mostly concerning the infrastructure, the sewage, but the buildings were, only a few of them, were strengthened. Even for [inaudible] is not such a big issue. The problem was that for these buildings, this area, it was invaded in some years mostly after 1990 by some illegal tenders and when the process of property restitution started the owners of these buildings were not easy to find and such buildings remained in between with no legal owners but nobody to care who lives inside really. And step by step they were cleaned and property owners [inaudible]. And some spaces were rented for very popular for foreigners. And these buildings, most of them, do not fit the code and they receive the classification, the labeling, but the big problem of Bucharest, is not this one. In 1977, let's say in 1940 the first signal was the big Carleton building which collapsed, killing 600 people or something, I have a paper about it in Springer. In 1977, 25 other buildings from the same generation collapsed, killing at least 1600 people, and other buildings from the same generation between 1930 and 1940, high rise reinforced concrete without any earthquake design exist and they are on the list of red dot that means first class, now on the list of second class and other kind of classification not yet put in accordance with latest codes. So these high rise buildings are along the main avenues of Bucharest, and if the map, much better done it should show you such buildings not only in the old city center which are low rise buildings which are along the main avenues [said some names of avenues I couldn't understand] and what happens after 1948. In 1945, 1944, Romania shipped in the [inaudible] to Germany to US, UK and [inaudible]. In 1945, communist regime was enforced, in 1947, assembled

30 that King Michael was worth to [inaudible]. In 1948, June 11, all the economy and properties, big properties, were seized by the government, nationalized. The owners of these apartments, some of them more happy, they were left with one apartment, given this was taken. These apartments were given to different person of new political elite in the center. The people were really happy at this time. Nobody put the problem of the moral at this issue because many of the owners of these apartments were not so far up there put into the political jail and most of them or many of them died there. The people of this knew [inaudible] used this buildings step by step after a while they moved to some low rise buildings near the green area of Bucharest in the quarter of [inaudible] and the apartments which existed in the center passed to the another kind of [inaudible] it was a kind of reward given to artists because they needed to be near the theatre to play or some other writers or people from the college. Again any of these persons didn't put the problem of the moral because they received from the state such apartment. Okay this is the fate. The people tend to forget nasty issue of their family of their country, it's a way of surviving or coping with the first disaster, there was a lot disaster, political disaster. In each harmony [unsure] there were problems but everyone attempted to pass through the six in a better way. For the working class, they started to build new apartments very few in the center because there was no space. But the government in the city all of the time used some urban settlement which existed around Bucharest there were some parts of Bucharest which are practically communes that means a big village, just link included the Bucharest but they were like in a big group/village. Not all the city or a town. And some of them of this space were clean and they built high rise buildings that initially [inaudible] that means five story later on better. In some places there were not even there were some [inaudible] so it was easy to build. Some satellites quarter around Bucharest. And this was for the people working in the factories which happen to be just nearby in that area. So this is the reason

why you will not find red dots because in that area the buildings are built after '50 or '60. Of course, among this types of structures we discovered, we found we learned in 1977 that some of them in Bucharest or in this satellite [unsure] because some of them were in Bucharest by raising some buildings and some others were in these villages. We discovered that some of these buildings are vulnerable because the level of design at this time was not enough for what we learned is the power of Vrancea earthquake of 1977 and in some other cases there are very vulnerable because they are so story or things like this which already were recorded in the other earthquake in the Europe or US or Japan. [inaudible] So if we're finished of making a whole Bucharest and whole Romania risk assessment, we'll find more red dot or blue dot or something, different grade, not the first class or the second class or the third class some other class, in some other places, not so often in the central area where the buildings built between 1930 and 1940 are definitely vulnerable because we've seen this twice in 1940 only the signals and some other signals were forgotten and in 1977 clearly the signal and the let the solution by political decision.

Eli

That makes a lot of sense. We've struggled to find information about why and how different buildings were chosen to be classified so that's a lot of good background information.

Dr. Emil Sever Georgescu

Classification, the grading of, to be included in this list is made by specialists any connection with the connection, the government only paid them and they applied the code. The code was changed a bit in 1996 and there are two categories, the pure red dot is after 1960 and the categories U1, U2, U3 are before 1977.

Eli

Okay I think that almost wraps up all the questions we have for you, this interview has been fantastic.

Dr. Emil Sever Georgescu

I think after you remember, after you make some reviewing of what I said hopefully you understand my poor English, you may write to me, I will try to answer you some detail trying to understand. You are a little, you are in a better situation than those of the history department which tried to understand what happened to Alexander the Great in that year because the sources are better in some aspects but they are not so good even in our phase. I lived in that period, many things I didn't know. When I recovered some of the data, put it together data from abroad with data from Romania, we [inaudible] but I didn't care about them or they were not at my hand and I tried to put together the puzzle but some pieces didn't fit and this is maybe the interesting aspect of looking in such a historical approach or a challenge to dig more and to try and understand it all.

Eli

Yeah, it's really great being able to talk to someone who's actually experienced the '77 earthquake that we've done so much research into at this point

Dr. Emil Sever Georgescu

Because you are of Portuguese descent, I appreciate very much Portuguese friends that I have a lot that earthquake of 60s, 70's, 65, if the steel and they still find so many to be for help or for present-day approaches.

Eli

Yeah, we're really interested in hearing earthquake experiences from people in Bucharest, do you have any friends, family, colleagues that have experienced either an earthquake in a region or the earthquake in 77 that you think might be willing to be interviewed?

Dr. Emil Sever Georgescu

I have some colleagues that are a bit younger than me that maybe they, engineers or students or things like this, I may try to ask them something similar.

Eli

Absolutely, yeah.

Dr. Emil Sever Georgescu

Okay, yeah, I will try to ask them or ask of them some of them to try to maybe you might think like easiness for this case it might be better to look through to see how many I can still find. For a brief questionnaire to be easier for them so don't be related to the precise moment of the interview manner it's easier to express memories.

Eli

Absolutely yeah we can put together a list of questions similar to the ones we asked you

Dr. Emil Sever Georgescu

I will try to see which of my younger colleagues. There are still older than me but I don't know how eager they are to write in English. Of course the people who are older than me had an

interesting experience in that they are engineers and they carry about them all the professional aspects very very big problem for them they are out some of the designs they helped them build, why they cracked, why this happened like this. Most of them, they are not but some of them not even, I don't know how eager they are to express in English because this can be a problem for some of them.

Eli

And you mentioned some of them might not be comfortable writing in English, it would be very difficult for us to do a face-to-face interview in Romanian since none of us speak the language but if they would be more comfortable writing in Romanian.

Dr. Emil Sever Georgescu

So, old generation was Francophone, they spoke French. I was in between starting with Russian because in the general school I was obliged to learn Russian and then in the period of new government between Ceausescu we learned French and English was something like cake, starting with the Beatles and Rolling Stones by ourselves. Really English only later, later on.

Eli

Yeah that makes sense. So if any colleagues would feel more comfortable writing to us in another language we have tools available to translate their answers so don't feel like writing in English would be a limitation.

Dr. Emil Sever Georgescu

Yeah I think you may find some Romanian students in your institute to translate if I found something in Romanian. There are a lot of students and even professors in the US maybe you would find, but more so for our generation its about expressing in English but maybe they could be afraid of elegant grammar.

Eli

Alright, I think that's all the questions we have to ask, thank you so much for your time. Have a nice day Dr. Georgescu.

## Appendix E: Matei Sumbasacu, Co-Founder, Re:Rise, Interview Transcript

<Call began with connectivity issues, transcript begins once all parties are fully connected>

Matei Sumbasacu

Okay, sorry, so I moved, so I should have a better, adequate connection. It's so embarrassing because Romania has, like, is known for good internet connections and I can't really connect right now. Uhm, <cuts out>, so, can you hear me right <cuts>.

Owen

Eli I think if you're using your headphone you might be muted.

Eli

Yes I was muted. I could hear you clearly for a bit, it was still dropping out a little bit but, lets try this for a little bit and see if it works.

Matei Sumbasacu

Okay, lets try it like this. So, I am working as a, I am one of the founders of Re:Rise, one of the first NGOs in Romania dealing with seismic risk reduction. I do have other jobs as well because we are all volunteering at Re:Rise, it is a 100% volunteering organization. I am also a civil engineer, and I work as a budget manager in civil engineering. I am also a consultant for the world bank for the new seismic risk reduction strategy for Romania, and for the new seismic risk reduction strategy for Bucharest. So that's what I do right now, uh, trying to talk to as many people

as possible about earthquakes and earthquakes in Romania, basically translate in people talking, human language what earthquakes mean.

Eli

Absolutely, yeah. Uhm, we've had the opportunity to interview with different experts, some civil engineers in Albania, some civil engineers in Croatia, but you're the first Civil Engineer we've been able to contact in Bucharest. How long have you been working with Re:Rise?

Matei Sumbasacu

Ever since its inception, since I am one of the founders. It has been 4 years now since we have basically started existing.

Eli

Got it. Could you tell me a little more about what Re:Rise does? You said that you do public outreach to try and translate into human terms some of what earthquake vulnerability looks like. What specifically do you guys do?

Matei Sumbasacu

So, we have, as well like to say, we are one of the NGOs with the broadest and narrowest scope, because we, it's the narrowest because we only work for seismic risk reduction and nothing else, it's the broadest because we do anything to reduce seismic risk. What we do and we do it quite well is we communicate to the public, so first of all we, as I was saying, we are trying to encourage public engagement and to translate, you know, seismic engineering or seismic risk into human language. But also, we are also working with, for example, institutions and authorities in Romania

in order to try to inspire some changes, be them legal changes or actually procedural or system changes in order for us to die less in the next earthquake. So, specifically we now have about 4 projects which we are running. The first one which is not necessarily a project per say but is an ongoing activity is informing the public. We have loads of infographics on our Facebook page and on our website. Unfortunately they are not in English, but they're infographics translating what an earthquake means, why are we so special in Romania with the earthquakes because there is a history to it and there is an explanation as to why we became so seismically vulnerable. We are also alongside another partner in the NGO we basically adopted, lets say, a community in downtown Bucharest and we are trying to help them to empower them to better face the next earthquake. And to tell them what they can do till the state does something. One of the main things that we are dealing with is trying to shift the paradigm of, and it is a very deep rooted paradigm in Romania with the state being expected to do everything. And everyone is expecting some sort of a, uhm, saving action from the state. We are trying to explain to people that their safety in case of an earthquake depends first and foremost on themselves, then on the state. We are also, as I was saying, we are also speaking with institutions and trying to digitally transform the way intervention is done in Romania, post earthquake we are talking about response right now, there are loads of ways that we are proposing in order to save time after the earthquake will happen, save time, I mean, to enable the saviors to reach the potential victims in less time. What else, what else, what are we doing. We are getting ready to launch a public information campaign on visually representing what an earthquake would mean for Bucharest. We have this problem, "problem" <air quotes with hands>, we did not have, in Romania at large, we did not have an earthquake, a large one I mean, for the past at least 30 years, I would go till the 1977 earthquake so that is 44 years, and people you know are not reminded by an earthquake itself, when they are not reminded

of the possibility of an earthquake to happen, they tend to forget because Romanians have tons of other problems that are on their heads. So we are trying to be a constant reminder of the possibility, we are trying to explain and illustrate the potential impact of an earthquake, and on the other hand we are working with the authorities to digitally transform the intervention, and secondly to basically streamline and enable people to get, bridge the gap between the authorities and the potential beneficiaries in what regards seismic strengthening of buildings in Bucharest, we have a huge problem with this as well. So we're trying to basically put everyone on the same table, and make them speak and talk between themselves.

Eli

Yeah, that's a lot of stuff, and we're interested in all of that. A lot of the things that you brought up there are different parts that we are thinking about with our project. We're trying to understand what parts of Bucharest might be vulnerable, who is responsible for helping fix some of those problems, and what the community can do to help protect themselves. One thing you mentioned, you said you kind of adopted a community within Bucharest. Could you tell me a little bit more about that?

Matei Sumbasacu

Sure. So, we have this project, it's called "anti-seismic district" where we partnered up with an NGO that had already adopted that community in downtown Bucharest. We went to downtown Bucharest because it is an area that is filled with old buildings and vulnerable buildings. We are talking about interwar buildings, like 1920s, 30s, 40s. Buildings that went through several very large earthquakes and that have never been strengthened. So we got, I can send you the map of the community, so we basically adopted an area of, I don't know, let's say 4-5 blocks, and we have

been organizing meetings with the community, on site meetings, so we're talking, we started this project in 2019 when we could organize on site meetings. And basically what we did was several times, I think we had like 12 or 14 meetings, we were going and posting posters on the lobbies of the condominiums, and announcing that we would be present 2 days per week, Fridays and Saturdays, so if someone could not reach us on Friday they could reach the meeting on Saturday. And talking about earthquakes, talking about Romania's seismic context, how did we get here, and explaining to people, and this was one of the highlights and the most effective points for the audience, what they can do in terms of strengthening their building. Basically simplifying the process for them because the legal process is very entangled and people get intimidated and action is not really encouraged by the way the process is presented at least. So what we did was we took the law, we really really studied it, and we broke it down to more simple steps for the community. Apart from this, we were telling them about the, lets call it preparedness backpack, so that's the emergency kit that everyone needs to have in case of an earthquake. We were trying to get across the message that after the earthquake, we all will need to be independent for 72 hours. We were framing this necessity of basically putting together your own backpack, your own emergency kit, we were framing it in a way that basically meant that this is the most civic thing that you can do in terms of earthquake protection. Why am I saying this? Because this safety kit, this emergency kit, this emergency backpack or call it what you want, basically means that I, myself, the person that has that backpack will not become a problem, I'll call it a, yeah. Will not become a problem to the emergency system after the earthquake. If you don't have a blanket, if you don't have water, or if you whatever, or if you have a small cut, and you don't have bandaids to put on, you could be tempted to call in the authorities, which is the worst thing you can do in an earthquake, especially in a country like Romania where the resources are scarce and the authorities should

focus on saving the ones whose lives are really endangered. We were telling the people in this community that they need an emergency kit because their neighbor's survival might depend on them having an emergency kit. The emergency kit is not something that you do for yourself, it's something you do for your peers essentially, it's a civilized gesture of allowing the authorities to focus on those that need the help the most. Those were the most important points that we were communicating with the audiences, the community. Why are we here in the seismic context, the emergency kit, and what can you do <inaudible> to strengthen your house.

Eli

That makes a lot of sense, yeah. Uhm, it's interesting, we've talked to a lot of different people about preparedness measures that happen in a city or that happen at a personal level, and we haven't heard of an earthquake preparedness kit even though in the US I know that my family has an emergency kit at home to just be prepared in case of a natural disaster or an event like that. One thing that you brought up in some of your emails and you've mentioned a few times is Bucharest's history of vulnerability. Could you tell us a little bit more about that, what specific parts of Bucharest are vulnerable and why?

Matei Sumbasacu

Sure. First of all, when you are talking about risk, and I think you already know this, the risk calculation. Risk equals hazard times vulnerability times exposure, you might say. So in terms of hazards, there is not much that we can do. So Bucharest does not have a microzonation, a seismic microzonation so that you know where the local <inaudible> effects will transform the earthquake, the ground motion into something more serious lets say. So we don't have this microzonation.

Basically we consider the earthquake hazard for Bucharest is the same everywhere. That's the first point. But, we have vulnerable areas, right? And, I wouldn't go into like you know drawing areas on Bucharest map to say this area is more dangerous than the other, I would say that there are a lot of old buildings, I would say that the center area, because Bucharest is a city that basically evolved organically, so we have the city center which is <inaudible> part of the city, and as you move towards the outskirts the city gets younger and younger so to speak, the buildings get younger and younger. So of course the main problem and the main topic when we are discussing seismic risk is downtown Bucharest. But, there are a lot of hidden vulnerable areas lets say. Areas, neighborhoods, entire neighborhoods, about which nobody discussed openly with the public, for example where we can say, or we can talk about communist, socialist, condominiums, <inaudible>, which have been built before the earthquake in 1977. I can tell you a bit about this and why this happened, I think it's quite interesting, for me at least. I'm really an earthquake geek, so I can talk a lot about this. <connection dropped for a chunk of time> for a long time. Earthquakes have been here before Romanians were here, before whatever, Romans or Dacians were here, so earthquakes have been here for millions of years. So the question is when you have a population that has been dealing with earthquakes over and over again, right, why, how come that we got here? How come that no one like did anything in all of our history to prepare our buildings and our infrastructure and our communities for earthquakes? And there are several questions, er several answers to this question. These are, this is why Romania's seismic situation and Bucharest's seismic situation is so special. First of all, you are, I understand you are basically engineers to be, right? Or already engineers? Super.

Eli

Yes.

Matei Sumbasacu

So, okay. So you do know about, you know, amplification and about resonance in the seismic, in seismic motions in earthquakes, you do know all of this perfect?

Eli

We know this generally, not a lot of the specifics, but we have a general understanding of some of these concept

Matei Sumbasacu

So basically when you have any time of vibration, we have the, what do you call it, the period of vibration, the period of anything. So in very simple terms, this is a building, my hand is a building, if I pull with a very huge hand bite <unsure> and let it vibrate, <cuts out> basically resonates with that <cuts> exactly as it returns towards the big hand, right? This is very important in earthquakes in general, and is very important, even more important for Romania's context. Because our earthquakes come from very very deep below. 90 something percent of the earthquakes around the world are what they call crustal earthquakes, or surface earthquakes. These are earthquakes originating from lets say 20-30-40 kilometers tops from underneath the top of the surface. In Romania, our earthquakes happen somewhere between 70 and 150 kilometers deep. This creates a phenomenon of long period amplification, because the very short period vibrations are basically damped by the soil and by all the ground and the rock and whatever, so they don't really reach the space, not in their most powerful stances <unsure> anyhow. But the long period vibrations do reach the surface. And the long period vibrations mean basically that they resonate with taller buildings, because those are more flexible and more wavy lets say, you know? Okay. So this is the

explanation why Romanians never really adapted to earthquakes. Because the first earthquake that we consider to be a tragedy, this is to say the earthquake that really affected the population, took place in 1940. Because we did not have tall buildings till the 1920s let's say, 1910s 1920s. So even though, even though earthquakes happens and they happen on a regular basis, what generally happens for, in earthquakes in the case of the earthquakes before let's say the 20th century in Romania, only taller structures would be affected. And those taller structures generally would be either churches, or like very rich guys homes, houses. And you know the general public would look at what happened with the earthquakes and effects and would say oh, okay, so a church that makes sense because all those priests you know corrupted priests, so God punished them. And for the rich guys as well, you know? Oh, that rich guy's house fell down, because someone is watching over us. So no one really, no one really spent some time to see that happened, well they couldn't have in the 18th century they couldn't have a conversation on long period <cuts>. But then 1940 came, and in 1940 there was this collapse, very very famous Romanian collapse. So in 1940 only 1 building fell, it was called the Carlton building. That Carlton building was basically what I like to present it to the general public, let's say as the place for rich hipsters to live in, in that period of time. So there was like, there were like very, you know, high profile individuals, very very <inaudible> full of money because it was the top structure in Bucharest, the tallest residential structure in Bucharest. It had a cinema at the ground story, it was a residential structure but it had a cinema on the ground floor, several bars in the basement, it was really really the place to be and it was really the center of Bucharest so it was kilometer 0, ground 0. What happened in 1940 a lot of buildings in Bucharest were damaged, but that was the only collapse. And it was very very impactful, also because of the, you know, the profiles of the individuals living there, because they were high profile individuals. Also because of the building, it was in the dead center of Bucharest,

and it was the tallest residential structure in basically the engineers, and everyone who took part in its construction really took pride in that building, and it fell and it created a huge tragedy, and it created a ripple effect throughout society. And engineers really spent some time to see why that happened and how they could avoid it. But they didn't spend too much time, because we also had other things going in Romania, so basically we were getting ready to join the World War II, and Germany was getting ready to set up some bases in Romania, because we started WWII being allied with Germany and finished being their enemies. So Germany actually postponed construction of the military bases because of the earthquake, they were like a bit shocked, I wouldn't call it a funny story but an interesting fact that the only survivor in the Carlton building was actually a German soldier. He was contained <unsure> at the top of the building, it was a garrison basically, and when the building fell, he basically fell with the building but he fell on top of everyone else, and he just you know dusted off. Well, not walked away, but he was alright. He was also German soldier knight (?) <laughs>. So this is with the contemplating. It created a huge ripple effect and everyone was really alarmed. Engineers published like papers of how can we seismically protect our buildings, we need to seismically protect our buildings, but then we joined the world war, and after the war the communists came, so we didn't really have time for at least repairing the buildings that had been damaged by the earthquake. So people quickly forgot, both the authorities and the general public. 37 years later came 1977, which was the earthquake tragedy till now, to date. The next earthquake will be much more tragic, but this is something else. But till now, till present day, the earthquake that on the 4th of March 1977 was the worst that would happen. Why was it so bad? First of all, we had about 400 buildings in Bucharest that had been damaged in 1940 and had been left unrepaired for 37 years. Everyone ignored them. It's interesting to note that in 1977, in Bucharest we had 33 buildings that collapsed. Out of them, 30 of them had

been damaged in 1940 and had been left unrepaired. <inaudible> buildings collapsed in 1977. The tragedy was really really really large this time. Not only in Bucharest but throughout the country we had entire cities that fell. But more importantly, a lot, and when I say a lot I'm talking about around 30,000 buildings only in Bucharest, deemed to need, to be in need of repairs. 30,000 buildings. <cuts out>. So a lot of buildings needed repairs. But, as you probably don't know, or maybe you know but I don't think you place enough importance on this aspect, because, of course, I didn't even know at those times, they still have, their marks are still present in Romanian society. Basically in '77 we were in a dictatorship. And the Ceaușescu regime was very very hardcore, and what they did, they first of all they saw that they can't afford repairing all the buildings, the economic impact was just too high. There's a world bank report on the estimated impact of the earthquake, and it speaks about \$2b USD in 1977 terms. This would be equivalent to something like \$9b for today, in today's money, which is immense, right? Its immense for Romania right now, but for Romania back then it's even much much worse. So the regime, what they did to fix. They started a very well coordinated effort of getting donations and whatever aids they could get on an international level. And they initially tried to repair the buildings. After 4 months of trying to repair the buildings, Ceaușescu, the dictator, he noticed that we were basically running out of resources, and the progress was not there. So he gathered all the site supervisors, the engineers coordinating the strengthening works, or the repair and strengthening works, and he gathered them in a huge room here in Bucharest. Actually I can show you the room because it's quite interesting. This is why I didn't know, I wanted to. So, you see that dome, that dome over there? That's the hall where they met. It's a huge hall. It's a huge concert hall. Basically Ceaușescu gatherers them all and he basically said that anyone that will intervene on a building where the defects are not visible, in other parts where the defects are not visible, they will have to deal with the prosecutors

and the police. The <inaudible> actually, which is the way we call the police back then. So basically he said only do cosmetic repairs, that was his message, only repair where some defect is visible, and only cosmetic repairs. Only like, for example, resin injections, or just render some plaster over it and get it done. So people don't see the traces of the earthquake. But of course people are not stupid, people have gone through the earthquake, they saw that they could basically see their neighbors apartment after the earthquake because of the cracking. And then this guy said okay, you are ready to repair your place with not much worse <hard to understand>. So basically people started asking questions, they are panicked and started asking questions. Hey, I think my building is not so safe. I mean, what have you been doing here? Is this work that you <inaudible> will it keep me safe for the next earthquake? And this is the moment that a huge, a huge effort, a huge coordinated effort of basically state sponsored fake news started. So Ceaușescu and his regime, and they and all the <something> to do it. They had the political police, they had the news, there was only 1 TV channel and basically several newspapers that were controlled by the state. All of the information, all the access to the information basically in their hands. Moreover, they had the secret police, you couldn't know, this is why it's called secret, right? You couldn't know who was in the police and who was not in the police. But there were civilians, and there were a lot, we're talking about hundreds of thousands of agents. And whenever, and these are reported officially reported things from documents at the Ministry of Internal Affairs back then, saying that whenever they identified people spreading "false alarms" and people being "faulty alarms" they would positively influence those persons in order to, you know, get these doubts out of their heads, lets say. The positively influencing has nothing to do with anything positive. So, they were basically, first of all, they were, in their workplaces, because this is how the state controlled people, through the managers at their workplace. So the manager would call you at your factory, or

whatever you would work, pull you in a room and would go “Matei Sumbasacu, I saw that you are alarmed and you are panicking everyone else. This is not something that you want.” And you would go say “yeah but I am really terrified of another earthquake.” “No you don’t have to be terrified of another earthquake. I will have to remove you from the city and send you to whatever, Moldavia or whatever, far away town somewhere in order to calm your nerves.” This is how this positive influencing was going on. If you couldn’t be convinced by your manager, you would be taken by the police, and we have a very famous case, a very famous case of an engineer that refused to be a witness, a silent witness to this. He was one of the engineers that had been called in the hall that I have just shown you. And he was managing two strengthening, two whatever red dot city sites in Bucharest. He, first of all, he tried to pay from his own salary to do more works than it was, than the government allowed. This was refused. Basically he sent out a letter to radio free Europe. This was the only way, the only channel that provided non-state news, but it aired from somewhere in Europe. Basically if you were caught listening to this radio you would be put in jail, no questions asked. This guy, he went and sent a letter to radio free Europe, basically explaining that Ceaușescu is a criminal and he lied to everyone in Romania. The buildings, these buildings, these thousands of buildings have not been strengthened, not been repaired, they basically have been made to look as new but actually they were heavily heavily damaged. This guy at the end of the day, he paid with his life. He was found, he was arrested, and he was beaten to death by his colleagues, his cell mates lets say, who were of course unofficial interrogators for the political police. So basically <inaudible> some criminals, they were, <inaudible> with you, they needed to extract information from you. Because this engineer, <couldn’t understand name> was his name. He refused to give them the information as to how he managed to send the letter to radio free Europe, they basically beat him to death. They were beating him nonstop, and in about 1.5 months

he died. This is what was going on. The system was super super powerful. They conducted this information campaign, fake news campaign, for tens of years. We're talking '77 and it lasted up until the point the communist regime fell, and I would say even <inaudible>. Basically calming the population when they had nothing to be calm, no reason to be calm. This is a very very difficult inheritance that we need to deal with right now. I am going and telling the people that your buildings is not that safe, the earthquake will come, it is a false impression that the earthquake, earthquakes stopped in Romania or whatever. We are trying to tell these people, we're hitting some blockages because these guys have been disinforming, have been officially disinforming, disinforming Romanians about earthquakes with no basis, right? So basically we are here, we got to this point, due to two reasons. First of all, the nature of causes. The long period amplification that did not allow us to understand that earthquakes in Romania also affect other people apart from priests and rich people, right? And, so this is the nature of the thing. And of course I would say societal or political thing that we have been lied to, we've been lied to in what regards our vulnerability, and we've been told for tens of years we've been told the situation is much better than it actually is. Actually, even now, in Bucharest, we already have like 350 something, 360 very very vulnerable buildings, highly vulnerable buildings, seismic risk class one. No one is talking about the other 1600 of them about which, which have been checked in the 90s, so the communist regime was no longer there. They have been checked by engineers and have been found to be extremely extremely vulnerable. They were prioritized for retrofitting back then. They have been registered in what we called urgency categories. You would have urgency 1, urgency 2, or urgency 3. Urgency 1 would imply that retrofitting should be done in 2 years, urgency 2 would imply retrofitted in 5 years, and urgency 3 in 10 years. So around 2000 buildings back then were in Bucharest, only in Bucharest, but also countrywide a lot more, but in Bucharest 2000 buildings

have been classified as urgency, but they should have been retrofitted in a maximum of 10 years. Nothing happened of course because Romania did not have any money, and what they did in order to solve the problem once again, in 1997 they changed the classification to seismic risk classes from urgency categories, and they basically did not equivalent anything that they did before. So in one night, right, Romania had 0 vulnerable buildings, because the rating system changed. We're really really good at concealing our vulnerability, and now, we have these 370 buildings, and for example when they're going to the EU to ask for money to repair our buildings, the EU says okay how many buildings do you have, and we're like 300 and something, and they're like yeah but, European program for 300 buildings? If we would have been honest with ourselves, with our public, with everyone, we would go there with 3000 buildings, or 2000 that we already know of, maybe we would have a better chance of getting some money to fix the problem. Basically as we say in Romania, we have a saying in Romania, that you are stealing your own hat. That is what we have been doing for a lot of years, we have been stealing our own hat, we have been basically auto faulting <unsure> us. Because we didn't <cut out> and this is, I am talking about the authorities of course but also about the public, the public did not want to say, not even now. We are trying to tell the truth to people, and a lot of people don't want to accept it.

Eli

That makes a lot of sense, yeah. Uhm, so our project has been going on for I think 11 or 12 weeks now, where we have been researching and studying and interviewing people. And in the first 7 weeks we did a lot of research into red dot building classifications and the old urgency, the U classifications. So it's interesting to hear, we hadn't made that connection as to why the U classes and red dot building classes were different. We knew that the new risk classifications were newer and introduced with new legislation, but we never really connected the dots that the old U

classifications just kind of went away overnight once the new long got introduced, so that's really interesting.

Matei Sumbasacu

Yeah. I felt that on my own. Because I used to live in an urgency building. My father bought an apartment for me and my brother when we were in college. He bought an apartment in Bucharest, making a very very difficult credit, applying for a credit to a bank, and also spending as a down payment spending the inheritance from my grandfather. My grandfather who has been, his father was an enemy of the communist regime, because I am part Greek. Any foreigner was an enemy of the state. Not only was he a foreigner but he had a lot of money, so the state took everything away from us, and never gave back almost anything, apart from like \$20k dollars, which my grandfather managed to win back from the state after like 15 years of trial. Those 20k were put in as down payment for this apartment, which was an urgency 2. Back at the time, so my father is a mechanical engineer, I was a college student, my brother was an engineering student, both in civil engineering. And we did not know what urgency 2 means. And we bought the apartment without knowing that it basically is highly vulnerable apartment. So I've been there, I really, I really, that was one of the triggers for me to start saying this loud. Then when I discovered it, I was like how come no one thought of equivalating? The Romania state spent in the 90s a lot of money in order to do those reports on urgency buildings, and then in 97, 96 97 they all went away. No one really considered this in no other... I only managed to, so there are two ways how they did this. And when I say they I mean the state. The first one is they issued the ministerial order, the minister issued the order, the minister of public works or whatever. Saying okay, we are now moving towards seismic risk classes, no more urgency categories. So all the mayors that previously classified buildings with technical experts and stuff, that previously classified buildings as urgency whatever, they need to

come back to us, the ministry, to tell us which of these buildings are red dot, which of these buildings will fall into seismic risk class one. That's good, but there are two caveats. First of all, this order had been issued, has been issued on the 3rd of October 1997, the deadline for reclassifying buildings, for all of the minorities <unsure> was the 30th of October, so they had 27 days to basically reclassify something around 4000 buildings, 5000 buildings at large. That's one. And once that deadline passed, no one, it was not an ongoing process. Once that deadline passed, all the mayors who couldn't respect the deadline were like okay, we're in default right now, but we can't do anything. There's no other deadline, that's it, so that was it. This is the first thing how they did it. And the second thing which is even more perverted if you want, is the way that they presented seismic risk classes. That's a very interesting thing. Basically when you analyze a building for earthquake resistance, one of the key points that you analyze is basically you simulate, the design earthquake on the earthquake on both axes, and you see what stresses it induces in the elements of the building. And you see basically how, when you analyze, how much of those stresses can the building take. And you have a percentage, basically its called a seismic coefficient in Romania. You can say this building can take 25% of the designed earthquake or 30% or 35% or whatever, right, after you analyze it. Now, the urgency categories had very clear thresholds for this. U1 was maximum 15% of the earthquake, U2 was between 15 and 25 percent, and U3 was between 25 and 35 percent. All well. When they passed to seismic risk classes, there was no guidance, no guidance whatsoever. They passed to seismic risk classes in 1997, and until 2008, 11 years, these seismic risk classes had not been defined in terms of a seismic coefficient, had not been defined mathematically, from an engineering point of view. So all expert judgement lets say. I feel this building is around seismic risk class 1 or 2. So they couldn't, it was impossible for them at the time to create a mathematical relationship between the old urgency categories and the new

seismic risk classes, because the seismic risk classes were not completely norm, right? And then in 2008, everyone forgot. But what's very interesting is that seismic risk class 1, from the point of view of a seismic coefficient, means all buildings that can take 35% or less of a designed earthquake. This is the whole segment of the urgency categories, which were 0 15, 15 25, 25 35. But it took them 11 years to do this. Moreover, the designed earthquake that were <inaudible> so I'm talking about some percentages of earthquake, very very simplistically speaking, the designed earthquake, <cuts> so in the meantime, the designed earthquake grew with about 50%. So if a building could take 35% of the designed earthquake in 1990, in 1990 whatever, it can't take more than 20% of the earthquake today. So this is double, double argument for automatically classifying all those buildings into seismic risk class one. Why they haven't done, why didn't they do it? Because they didn't have the money to repair them. This is it. And it was an informal, I also know the informal answer of a guy who was very very high profile in terms of seismic risk reduction, whatever, or earthquakes in Romania, and this guy said that he was the advisor of the mayor back then, mayor of Bucharest. And also the advisor of the minister for public works. And I got to ask him at an event, at a public event, I got to ask him, I was in the audience, I got to ask him, I was like okay, what about the urgency versus seismic risk classes? What the fuck happened then, right? Pardon my French. He was like well, I was with the mayor back then, and he asked me Mr. Mormuraru <unsure on name> what are we gonna do with all these thousands of buildings we know are vulnerable? And I ask him in my term, I ask him, well do you have the money? And the mayor said no! And I was like, well okay, what to do? And then some other guy who was in the panel, interrupted the conversation and said, I don't think Mr. Mormuraru <unsure on name> is the one who can answer that question, but I was like he already did. This is the answer. So basically they knew they didn't have the money, and they consciously decided to ignore the buildings, and

to leave them out, and to basically request another round of analysis to those buildings. Which is of course a thing that we are dealing with still to the date. To the date, we can't convince people living in urgency categories that basically urgency categories are red dots waiting to happen.

Eli

So, I just want to make sure I understood all of what you just said correctly, cause there was a lot there. Essentially, all of the old urgency classes, categories, fall within, or should based on the new definitions, should fall within seismic risk class 1, which is the red dot buildings? That would be an extra 2 to 4 thousand buildings within Bucharest that would fall within that classification?

Matei Sumbasacu

In Bucharest we have almost 1600 buildings in urgency categories. So the real number of red dots would be around 2000, yeah.

Eli

And the main reason, from what you've seen and research you've done, is a lack of money--

Matei Sumbasacu

A lack of resources.

Eli

A lack of resources, and therefore a conscious effort to not classify these buildings?

Matei Sumbasacu

Yeah. To not equate them based on, as per the new rating system, as per the new classification system, yes.

Eli

That's really interesting. We hadn't, that wasn't something that we had looked at again between urgency categories and risk categories, but that seems like--

Matei Sumbasacu

I have a table that basically, yeah. I have a table that basically equates the seismic coefficient to, basically, illustrates what I just said with the 35% 25% of an earthquake. I can send it out to you. But yes, this is, and these are the buildings that we know about. Again, there are a lot of buildings that no one looked at, so these are the buildings that engineers looked at and deemed them unsafe. We have the socialist buildings that I was talking about earlier, those built before 1977, which are again disasters waiting to happen. Because till 1977 Romanians did not have any recording, any accelerogram for earthquakes here. In 1977 it was the first time that we managed to record the earthquake in Romania. Funny story but really illustrative. We had 3 seismic stations in 1977, but we only got one recording, because one of the stations did not work and one of the stations was unplugged. This is really true. So, yeah, but we had that recording. Actually, I have it on my <pulls back shirt sleeve 58:30> wait. I have it on my hand. That's the recording on all the three axes. So basically we had this recording, and they did a Fourier transform on it, because we were engineers, we all know what Fourier did, to us, and they did the Fourier transform on it and they found these long period effects. It's only after 1977 or more specifically after 1978

because it took some time to adapt all the norms and code and legislations. Only after 1978 did we start building buildings with this in mind, so the taller the building, the worse it will be for it during the earthquake. Till then, it was exactly the opposite. Why was it? Well, why did that happen? Because we calibrated our codes to an earthquake that wasn't a Romanian one, because we had no recording, right? So we calibrated them, its actually funny. We basically copied the Russian code, which basically had copied US code which was calibrated on an El Centro Californian earthquake, which is a surface earthquake as well all know, and it produces short period effects so to speak. So, and the communist regime liked that a lot, cause that meant the taller the building, the less protected for earthquakes should it be. And they built really tall condominiums, and they did not want to waste any money on like earthquake protection. So when the engineers came and said oh, the tall, we're gonna build the better, okay, we're going to be like 12, 14 stories, and we're not going to protect them at all. This is basically was overlapping with Romania's highest or largest effort of building anything ever. So a lot like millions of homes had been built in that period. Millions of apartments I mean, I'm talking about tens of thousands of condominiums. And they, no one talked about them, because also in 1977 only one of them fell, so it wasn't such a huge, remember 1940, you know, in 1940 where you had 1 building that fell. Same with these buildings. So in 1977 only one of these new condominiums fell. Of course the regime quickly did what they did, what they needed to do to calm the population and tell them it was an accident, the buildings that they built are very good or whatever, and people still believe this to date. But actually that's Romania's, if you want, that's Bucharest's and Romania's largest problem in terms of seismic risk. We have a lot of people concentrated in these buildings. It's not like the buildings in downtown Bucharest here which are like... Actually here I also have a sample of a building that is actually, this whole area here has been built in the 50s and the 60s so its a very good study material. Wait.

I don't know if you'll be able to see anything but I'm going to try to show it to you no matter what. It's also very sunny so I don't think you can see into the sun. But I'm just going to show you what a tall building in that period, in that time meant. By the way, this church behind me <1:02:10> it hadn't been built here, it was moved on rollers from a site over there, you can see the background, where it used to be the central committee for the communist regime. A guy named, Romanian engineer, who pioneered this technique, mounted some rails and moved, translated this building from there to here.

Eli

Is that the palace of parliament behind the church?

Matei Sumbasacu

No, no that's not the palace of parliament, that's where the government used to be. So not the parliament. Can you see this really tall building behind me? Yeah, that's the perfect example of <cuts out> lower but not really low. The tall one I think has 17 stories, and the lower ones have 10 stories, so that's not really really low. And the very unprotected buildings built in the, these are actually buildings in the 50s and the 60s, exactly how I explained. So by considering that they will not be affected by earthquakes, not at all. They would be <inaudible>.

Eli

It's funny, the church that you pointed out back there, we did a presentation earlier in that term that included that church, and we learned about how it moved on those rails. It's cool to actually see it.

Matei Sumbasacu

Yeah. It's a really nice church, and it's also really nice because it's only brick work.

Eli

So I have a little bit of an odd question but it will lead to some follow ups. Are you familiar with some of the work done by Doctor Iuliana Armaş at the University of Bucharest about earthquake vulnerability and preparedness?

Matei Sumbasacu

Yeah. Yeah.

Eli

Okay. We've read a few of her reports at this point and we're, one of the main components of our project is taking one of the analysis techniques that she used to do vulnerability analysis across different regions of the city, and instead of splitting it up into regions of the city, we're stratifying census data across different religions and ethnicities within the city. So one of the main components of her analysis is building vulnerability and that's what we've been talking a lot about. Some of the other components were socioeconomic vulnerability and social vulnerability, and there were different factors that she considered in there. Do you know about how some of these factors can impact earthquake vulnerability?

Matei Sumbasacu

Uhm, so, yeah. Vulnerability first of all has multiple, multiple lets say dimensions, right? As you were saying, it's physical first of all, it's social, and you're talking about communities and

preparedness, and it's also like institutional where you have the systems and the procedures to help you mitigate the crisis and recover from its effects. So I know about Miss Armaş's work, I'm not a huge fan of her work and her study. I think her, the study is much too refined for the level of data that we have. In engineering we have a saying, it's a saying that's kind of falsely attributed to Einstein, make everything as simple as you can but not simpler, right? So if you don't have the detailed data, you don't consider a detailed analysis. So I'm not sure, of course there are factors that affect seismic vulnerability, of course a community <unsure> apart from the very obvious physical vulnerability of the buildings. And you have the institutions, we can talk about the institutions and how Romania's institutions think they would respond to an earthquake, that's one side. But we also have factors such as the layout of the city, for example in this area the city center, streets are quite narrow, there are a lot of troubled <unsure> buildings. Actually we have Re:Rise, I think I can get you, grant you access to the work in progress that we have. It's already close to being finalized. We're, what we are doing is basically putting, so geocoding the vulnerable buildings in Bucharest that we know of, this is the seismic risk class 1 and the urgency categories, we are geocoding them and putting them on a map, and then we are simulating them being collapsed. Basically we are tracing the areas around them where you would find rubble around them, right? So we have sort of a standard for this. Basically Romania civil protection law says that a building, the collapsed area of a building is, starts from its perimeter and goes towards the outside of the building with a  $h/3$ , with the height over 3. So this is what we are doing, we're <cuts out> the list of vulnerable buildings, we are estimating their height, based on the number of floors, and then we're tracing around them an area, a perimeter which is basically offset with  $h/3$  from their perimeter. Why do we do this? First of all, we want people to see what a collapsed Bucharest would look like from the point of view of blocked roads and blocked accesses. We are tracing

hotspots throughout the city. This is something that also Ms. Armaş did, I don't know if in her work or in a work with another guy from the national institute of physics, they basically tried to do some sort of an accessibility map, a post-earthquake accessibility map of Bucharest, and showing hotspots in Bucharest. But, my question is, what is the value of such a map if you don't take into account urgency categories first of all. But what is the value of such a map if you don't take into account the socialist buildings that I have just shown. That building that I have just showed you isn't in, it's on no list, it doesn't appear on any list. But I can almost stake my engineering degree that it will fall at the next big earthquake, right? So what's the value of those maps if they don't show us the true level of vulnerability? We are basically playing with some very limited data and we are really really exploring them in depth, instead of enlarging our scope and gathering more data, and simplifying our analysis, because we are not there yet. It's not, it would be, it's like I would like to stop global warming, and only we create a mitigation, climate change mitigation plan for one factory or whatever, right? So you have a lot of elements that put together they give you Bucharest vulnerability. There is no point of turning these 300 buildings that we already know, everyone is speaking of, there is no point of turning them on all their sides and analyzing all of their inner aspects, and basically ignoring in such an analysis the other 1600 buildings that are urgency categories, at least, right? So especially when you are talking about an accessibility map, a post-earthquake accessibility map, you can't be so naive as to say that we only have those 300 problem buildings, it's a very optimistic scenario. And that's very, very very bad because again, in 1977, which was a real tragedy, we only had like 30 some, 33 buildings that collapsed. In the next earthquake, in Romania, the next powerful earthquake, I don't see how Bucharest will get away with less than 200 buildings, just to start with. 200 collapsed buildings. So, it will be a challenge.

Eileen

So I had a quick question for you. I think that you have a really unique perspective being so close to the community in Bucharest, and I guess my question is have you noticed in your work with your organization and also just in your civil engineering career, that there are differences in vulnerability and preparedness across different groups in the city? Specifically religious or ethnic groups.

Matei Sumbasacu

Well, first of all, religious is putting the, Bucharest and Romania at large is not really diverse. We are like over 90% we are Christian orthodox. It is very difficult to notice such differences because basically everyone religiously speaking, everyone is the same. Or, okay, I wouldn't say that I'm the same with other Romanians religiously speaking, but we are all the same, lets say, faith. Now, no. I wouldn't say that when you are talking about the poverty levels, yeah. We can, there is a lot to talk about. We have very very poor areas in Bucharest where people can't afford, not that they can't afford to strengthen their house, they can't afford to think about their houses vulnerability. We have people that don't have anything, they don't have any heating, the can't, they don't have any running water, in Bucharest, in a European capital. So those people, its basically you can't expect from them to worry about something as they say may or may not come, right? An earthquake. Because till that earthquake they need to eat, they need to sleep, they need to wash, and they can't right now. Apart from this, the center part of Bucharest is quite a, it's interesting really. Because the central part of Bucharest is quite rich, its quite, the people in the central parts are not necessarily poor, but they are very vulnerable, their communities are very vulnerable to earthquakes as well, because buildings are so old and they did nothing about it. I wouldn't say that,

I don't have, so, I don't think there is any data to disaggregate the level of vulnerability on social segments lets say, or be them religious or income or whatever. I don't think there's any data. In our work, I'd say that there is a clear correlation with the level of income, because people that have more wealth, they care about it more, first of all, and they have the time and the mental availability to think about it, and to think about their vulnerability. But apart from that I don't, I can't say I know of differences in, for sure there are differences, but I don't have enough data to say that those or the other people are more prepared or less prepared depending on their confession or other social traits.

Eli

That makes a lot of sense, thank you for that. I know in our project we said that we're basing a part of it on Armaş analysis, but we're going to be careful to limit the kind of claims we make, we might make suggestions that one group may be more vulnerable than another based on these factors but we'll be sure to include some of what you've told us about the limitation of the data and the limitation of data available around buildings and how that's probably playing a much larger role than some of these other things that we may be looking at. Uhm. We've talked about a lot, I'm trying to find other questions that haven't come up yet. I mean do you have other follow up questions?

Matei Sumbasacu

I told you that I talk a lot about earthquakes.

Eli

<laughs> its awesome, this has been fantastic.

Eileen

I guess one question I did have, could you talk a little more about the preparation methods that the government employs to keep Bucharest, preparedness measures that are in place in Bucharest.

Matei Sumbasacu

So there's a very highly ineffective strengthening program for multi story residential buildings, highly ineffective. That's the problem that I have, I was telling you about it, we're trying to simplify it and tone it down in simpler terms. You really can't strengthen your building with the help of the state. So there's this program, and then in terms of education, in terms of lets say what should I do in case the earthquake comes or whatever, there is not much. So what we've been doing without community, lets say, with our adopted community is really a first for Romania, and when I'm saying a first, it's not only a first for NGOs in Romania, it's a first for anyone. For institutions, for anyone. I need to stand up because I'm numb. My cellular <cuts> right? Did you lose me, did I lose you?

Eli

No, I think we're still connected.

Matei Sumbasacu

Ah, super super super. Other questions?

Eli

Eileen, if you don't have other follow up questions, I can go into our two last questions.

Eileen

Yeah, that was really all I had, we touched on quite a bit. It was super helpful, thank you.

<last two questions were asking for assistance on projects methods, not included here.>

## Appendix F: Alina Kasprovschi, Executive Director, Bucharest Community Foundation, Interview Transcript

Owen

It is recording so we're good to go.

Abby

Fantastic. Okay, now that that's out of the way, we want to give you a little bit of background, a project where because I know Professor Vernescu probably told you a little bit about it, but you definitely like, haven't been told a bunch. So we're researchers from WPI in Worcester, MA, and we're trying to investigate earthquakes in Bucharest, and how different groups might be prepared differently for those earthquakes. And just kind of the differences and preparedness measures across the city. Could you maybe start by just telling us some of the work that you've been doing, like with the Bucharest Community Foundation. And like any projects that you're working on right now?

Alina Kasprovschi

I assume, but maybe I shouldn't assume that you know what the Community Foundation is, in general, because we in Romania work quite similarly to the way you work in the US with community foundations. The only exception, and it is an important exception is that we don't work very much with very rich people. We work more with corporate donations and individual donations, regular donations, and we have flow through funds, meaning that at all times, we need to fundraise and offer money in the community for the projects that we consider relevant. And one of these projects is Bucharest prepared, which is a program that gathers together the community of organizations that work in earthquake preparedness, on the one hand, meaning awareness

campaigns, information simulations about what to do in case of an earthquake. And also, they prepare networks of support for when the earthquake actually happens, meaning training of search dogs, first aid classes, radio amateurs, if you know what these are in case, the communications are down, and we will need to use that kind of technology which was used in the 1950s. But it will come in handy when there will be no mobile telephony. In the hours after the earthquake. We started this program. Following an article in a magazine hearing Romania is an article which depicted the situation of what would happen in case of an earthquake, similar to the one in 1977, you might have researched it already. And it was a moment in which everybody, at least everybody in our team, not definitely not everybody in our community realized that. We haven't discussed much about the earthquake. And we know we know quite little we know it abstractly. Many of us were not born or were very young when the last big earthquake struck. And there is no system with the authorities that prepares the people in case of an earthquake. Moreover, Bucharest is in the situation that it is the riskiest capital in Europe in terms of earthquakes, and it's not risky, because we have the biggest earthquakes, but it is risky in in the sense that we have a lot of vulnerable buildings, we have depending on whom you ask, we have between 300 and 3,000 buildings which might fall in case of an earthquake or would be very damaged. And also, we do not have any means of preparing ourselves for the earthquake, meaning, we have very few people who know how to give the first date, when he started the program. There were only three search dogs in Bucharest, imagine, what would you do with only three dogs? And actually, people just prefer to not think about it. And we have this saying, God help us, you know, let's hope God will help us when it comes. We cannot rely on God helping us alone. So we needed to do something. So we started raising funding and offering money to the projects that are doing this kind of work. By the time we started, these projects were like hobby projects for different people. For instance, the

organization, working with radio amateurs, is managed by a lawyer who just has this as a hobby. And many of the projects that we support have never been supported before finance Usually, the state doesn't support them, or other companies don't support them. And basically, it was the first time when somebody started speaking about how do we prepare for the earthquake in a more strategic manner. We've been doing this work for two years, now we've had to run the grantmaking. And we are now preparing for the third round, every time we offered 100,000 euros in the community for projects, preparing Bucharest people for an earthquake.

Alina Kasprovschi

We are working with corporate donors, we have quite little support from the authorities, we have a protocol with the Department of Emergency Situations, but it's just actually a contract saying that we will help each other, full stop. So we do not actually receive very much support from them. And what I would say is that when we are looking at this huge area, which is a huge city, 2 million people, 3000 buildings, which might fall, a lot of other kinds of dangers. Of course, we did not attempt to save everything and to solve all the problems that might arise before or during an earthquake. But what we said is that we want to reduce preventable losses. For instance, it's a very famous case here in Romania, in the 1977 earthquake, we had a famous actor who died because he didn't know what to do in case of an earthquake, and he ran down the stairs, the stairs collapsed, he died on the stairs, and in his home, the glasses were still intact on the table after the earthquake, so if he knew what to do, if he knew that he should stay at home and wait until after the earthquake, him might not have died. And it's that kind of things that we want to do. We are not raising funds to consolidate the buildings, one building costs millions to consolidate, multiply this with hundreds or 1000s of buildings, and you get the the amount which is definitely not sustainable from private sources. So what we want to do is we want to prevent, to prevent preventable losses, be the

death or other kinds of losses, and we want to make sure that after an earthquake, which is inevitable, we will build the city better starting from the citizens resilience upwards.

Abby

Well, it sounds like you're doing incredible work in the city. That sounds phenomenal.

Alina Kasprovschi

We have a grantee saying that our work is very, very limited. But unfortunately, it's the biggest work that is being done in the city about the earthquake. So somehow it's the good news and the bad news. We are the most important entities doing this work, but it's still very, very limited. Compared to the needs.

Abby Kasprovschi

Yeah, you'd mentioned it a little bit. What's the government doing to prepare people in the city?

Alina Kasprovschi

Not much, close to nothing. We have. So we have the Department of Emergency Situations, which is running everything from floods to COVID pandemic, just a second...

Alina Kasprovschi

We are working from home, and I have my, my house is the dispatch for contracts and careers bringing things to the foundation. So this Department of Emergency Situations handles everything emergency related by preparedness and intervention after, after the earthquake, or any other emergency situation. They are part of the Ministry of Internal Affairs, so they're kind of similar to

the police, which make them quite formal, quite rigid organization. And also in times of peace, they didn't have enough resources to cover this area. But now in terms of pandemic, definitely... Sorry, just a second. My son is covering the dispatch. Some now they're basically not covering it at all. They have in terms of manpower, they have half a person taking care of the relationship with civil society, a person who is working part time for that. So it's not by far sufficient to cover everything that needs to be done. Two years ago, three years ago, and two years ago, then 2018, 2019, we had a simulation of an earthquake. The simulation was very much focused on the intervention, but not only involving the civil society, the civil population. So basically, we were announced that this department is doing an intervention, it's with armed forces from all over the EU, and they are taking care of everything. So we just...

Alina Kasprovschi

they will take care of everything. The same thing happens with a town hall. Here in Bucharest, we have a general Town Hall, and we have six districts, each with their own district Town Hall. Most of this administrative local administrations do not do anything about it. Just to give you an idea, last autumn, we had local elections, and three of the local of the district mayors were changed. And the general mayor was also changed. So we started meeting with these people to present the situation and we went into one district. So we have six districts, and this particular district held 1/3 of all the buildings with problems. So two times more than the average. And we were discussing with the mayor and with the person taking care of the emergency situations. I told them about this number. And they were shocked. They had never heard about this before. So that's the level of awareness and implementation of the local authorities if you want. There is in the general Town Hall, there is an administration taking care of consolidation of buildings. During the past 30 years, I think it's less than 100 buildings were consolidated. If you're looking at the number

of 3000, which are in danger, you can imagine that we don't have this time to wait for for the public administration to do something about it.

Owen

I actually have a quick follow up question. First. Do you guys know what number sector it was that was considered to have that had I think we said 1/3 of all the consolidated buildings?

Alina Kasprovschi

Sector 2.

Owen

Sector 2. Okay. And then I guess another question. Oh, sorry, go ahead.

Alina Kasprovschi

Do you know the map if you're looking at the maps of there is one map which centralizes all the buildings with different kinds of risks? And yeah, okay, if you know it. No, no need for me to send it to you.

Owen

And then I guess I did just have another quick question. So you mentioned that seems like sector two didn't necessarily know as much about other, is there a specific sector that maybe seems like they're doing the most about it? Or is it just kind of widespread, no one's doing anything?

Alina Kasprovschi

I think that most of the people consider it that this problem is such a huge problem that the best thing to do about it is stop thinking about it, because otherwise it gives you nightmares. So let's pretend it's not here. And we are not discussing about it. That's the end of the story. It's it's widespread, it's everywhere. I mean, we were meeting with three of these sectors, so half of the district town halls we've been visiting, and none of them is doing anything about it. So and actually sector two is in one of the best situations that they have this local department within the town hall, they have this local department of emergency situations, most of the districts don't have such an entity.

Abby

To the government preparedness, I'm sure that you're very aware of the red dot program.

Alina Kasprovschi

Yeah.

Abby

Could you maybe talk about how effective that program is in assessing earthquake preparedness?

Alina Kasprovschi

Well. It is effective in the fact that most I would say 99% of the buildings which are marked with a red or with another kind of risk. You know, the red dot means they have the highest risk of falling or being severely damaged, but we have second degree risk, third degree risk and we have those emergency levels. You U1, U2, U3, meaning that they should have been U3, which was the less,

least urgent should have been repaired within maximum 10 years. And it's been, for most of the cases, been more than 20 years in which nothing has been done. There are some, some places in which these red dots have been given falsely illegally in the hope that there will be some consolidation offered by the state. The, there are, if you want urban legends, about people bribing those making the expertise so that their building is, is marked with the red dot, and that in the hope that of getting government to support, which didn't happen. But I will say this is rather the exception than the norm. So I would say that most of the buildings which have the red dot, are in a very dangerous state. But in the same time, most of the buildings in Bucharest, I think it's more than 100,000 buildings. Most of them have never been expertise [assessed]. So we don't know. Now there is among the people working in constructions, there is also a worry about the buildings built in the 90s and the 2000s. Because the codes and regulations of buildings have not been respected during the time. So we expect that many of the buildings which are considered to be new, are not actually as safe as people want to believe also looking at another district Town Hall I was meeting with, with a counselor of the mayor telling him, in district six. Now if you know that well. District six has a lot of buildings of blocks of flats built in the 60s 70s. And I told him, you know, you have a seismic seismic risk here in Sector six as well, and shall no we don't have that many buildings in the city center. We have strong buildings, there's no worry about them. And I was the one to tell him that actually 1977 one of those buildings, which had just been built two or three years before had collapsed one of those big buildings, I think it was 17 floors or something like this. And he had no idea about this. And there is also a problem about the red dots and buildings being or not expertise. There are twin buildings, two very similar blocks of flats built on the same technical plans in the same time with the same materials completely identical. One has been expertise and other hasn't one has a red dot, and the people living in this next one, say our building

is fine, it doesn't have a red. No it has never been expertise, it cannot be fine. I mean, it's exactly the same building, it simply cannot be fine. Or we have buildings which have been marked as safe, safe, but they are between two buildings with red dots. I mean, it just cannot be completely safe, for sure. But as I was, I was speaking with people living in these blocks of flats, and many of them are very old people who've been living in those apartments for 15 years or more. In order for them not to go completely crazy, they have to just deny the fact that their building is not safe. They just don't think about it. It's a psychological mechanism. And it works very well, because otherwise they would have gone crazy by now.

Abby

Is there anything that those citizens should be doing? Other than not thinking about it, that they could prepare themselves?

Alina Kasprovski

Yeah, for sure. They should start thinking about it. I don't know for sure what can be done in the buildings marked with the red dots. When your building collapses, and you're reliving seven storey building, and it collapses on you, I'm afraid there isn't much to be done. It helps, of course, hope you don't know how the building collapses. I mean, all these are just scenarios and you definitely don't know for sure, you can just hope that it doesn't collapse completely as we've had collapses in the 70s. It was called the sandwich collapse in which the lateral walls just collapse inside. So everything was completely squished. Nobody could survive in this. So there's nothing to be done actually other than move out of it. But in case there is a partial collapse, and people are still in those buildings that they need. Of course, they have an emergency kit so that they can survive for 72 hours. And that might make the difference between life and death. They also need to make sure

that they know what to do in case of an earthquake. And that means also rehearsing it because you probably know, we think with the prefrontal cortex, but when an emergency happens, then this prefrontal cortex is shut down and you think with your reptile brain, if you want, and in case you haven't rehearsed something many, many times before, as it happens, for instance, in Japan, you don't have this habit. So you even though you think you know what to do. Your your reptile brain will say something else, like jump out of the window or go down the stairs, or let me tell you it's completely an anecdote. It's not the doesn't have scientific effect. I think. Two, three, something. No, I think it was more years ago, four years ago, something like this. We have a news platform, which is called "Biziday" [Romanian EEWs]. I don't know if you heard about the "Biziday" case. On the news platform, they created an earthquake alert. And somehow it happened that somebody hacks their earthquake alert, and they sent an alert out to everybody who had the platform saying a nine earthquake is coming and you know, you have in Bucharest now we have 25 to 35 seconds to react. So we had 25 to 35 seconds to react to a nine earthquake, which is devastating. I mean, we've never had the nine there's quick and I hope we'll never we never will have because probably there will be no more Bucharest. And I remember I was I was driving, I was coming from a different place. I was like 60 kilometers away from Bucharest. I was with a colleague of mine, and we stopped the car to the sidewalk. And we started making calls to our family. My son was four or five years old, and we were living at the time in at the sixth floor. And I called my husband and I said, there's a huge earthquake coming. Where are you? Where's our son and everything. And he was climbing up the stairs, and I told him don't take the stairs, the stairs will fall. And he kept on saying I have I have to go to my son. I cannot not climb the stairs. And I was like, these stairs are going to fall. He just didn't care. He wanted to get to his son. And then of course, we kept on talking. But where's the earthquake? I mean, there's been two minutes what happened? And then

it was a huge scandal. The news alert room stops this earthquake announcements. There were a lot of panic attacks, people calling the emergency and so on. But you know, people who have been trained intellectually what to do they knew they should not take the stairs. No, my son is upstairs, I will take the stairs. I don't care if I die there. I need to do that. So definitely we need to rehearse and to do these kinds of training of, what now? It's an earthquake, what do you do? And this is something that has never been done in my life. My life is 42 years old. So you can imagine nobody younger than me has ever done such kind of a simulation. We started financially supporting these kinds of information and simulations in schools and high schools. But it's so far it's a drop in an ocean. Other than that, what should people do? To get back to your 10 minutes ago question. Maybe we don't live in in a red dot building. But we go by a lot of red dot buildings, because there's a lot of them in the city center, it's in the places where we go out when we eat. When we go for a walk a lot of tourist places like the old city center, what we can do is that we can avoid those buildings, we shouldn't go inside, we shouldn't go near them because if it collapses, it will collapse on the sidewalk as well. And there's nothing to do in those very few seconds. Other than that, what people can do and what we've started doing is that we should get more angry. And we should ask our administration to do something about it. The problem is that these are private buildings so the government cannot repair them on government money. So it's a bit of a challenge of okay. And we know we have this problem, what do we do? And what do we do fast? the consolidation of a building lasts from one to four years, depending on the complexity. So anyway, it's huge time, huge amounts of money that needs to be invested in this. And also, there is this question about historical buildings, but not, you know, like the Louvre or something. Regular historical buildings. They are historical, because they're old. If you consolidate them, it costs a huge amount of money. The question is, do we really want to keep all these historical buildings? Because they will fall

anyway, in case of an earthquake? Or do we want to put them down and build from scratch and build something which will last better? And that's a tough question, depending on whether you ask an architect or you ask an engineer. And it's not something I can answer to.

Owen

So I actually do have a quick question about one thing I know, we interviewed a lot of people from Albania. And they recently had an earthquake in 2019. We interviewed people who were there during the earthquake. And one thing that they often said was that everybody just ran out onto the street, as soon as the earthquake happened, because they thought I'm not in the building. That's where it's safe, not thinking, well, the building collapses into the street. So it's definitely something we've seen before from a lot of people just finish with bricks that even if you know what to do, it doesn't exactly take over in the moment. But so I have a question kind of going back a little bit. When you know, and I'm not sure how much you've been assigned know about this. But when you're kind of purchasing property, if you're looking to move into a part of an apartment that is labeled with a red dot, is there any type of like information that you get on the red dot buildings, or is it you know, or are you required to be told that you're moving into a red dot building or anything like that?

Alina Kasprovschi

There is a list of red dot buildings on the town hall website. It's hidden somewhere, but you can find it if you want. But mainly people speak about red dots. As I said, it's not just about the red dot buildings, because you actually see the red dots. Most of them when they're there, there have been some red dots taken out of some buildings, but most of the buildings have the red dots. So when you go in and you see, you know, what you're purchasing, I think the problem is about the other

buildings which do not have a red dot. Now the legally you cannot rent to rent or sell to, to accompany a red dot building, or a red dot apartment or whatever. So at least, the government wants to make sure that employees working somewhere will not be in a in an imminent risk of dying because they have to go to work. Otherwise, you can buy and sell random buildings. And what has been happening in the past five years at least, is that a lot of people have purchased red dot apartments because they are cheap. And actually, they are in beautiful historical buildings right in the city center. And they have purchased them and they are offering them for short term rentals like Airbnb and many of the sort. That's a huge problem. We have started to address this. Actually, in the beginning of last year with Airbnb now Airbnb has much bigger problems than the seismic risk in Bucharest. But it is a problem because most of these apartments are not, well, they are legally rented. But semi legally if you want. I mean Airbnb knows that they are rented sometimes they are not declared to the financial administration in Romania and taxes are not being paid. But the biggest problem is that nobody knows how many people, if there are tourists, how many people are in such a building at any moment in time. And if you if you have a regular building, which is inhabited by regular people, same people throughout the year, you know exactly how many people are there. So you know how many you need to rescue. How many are outside? How many you find that then how many still are somehow trapped inside. But when you have tourists, you have no idea whatsoever. Whether they're two, they're 50. And you don't know anything about it. That's a huge concern. Because of Covid there are not so many tourists in Bucharest and anywhere in the world, but probably it will come again. So yeah.

Abby

To circle back just a little bit. You mentioned the high cost of repairing new buildings. Is there any connection between socioeconomic status and your ability to prepare for an earthquake?

Alina Kasprovschi

There isn't a reason because as I said, most of these buildings are right in the city center. So they're not exactly poor people living in there. Sometimes they were people who rented these apartments during the communist times they rented it from the state. So actually, how it happens is as follows most of these buildings are old buildings built before the 40s before the Second World War, which means that every time they belonged to somebody, an individual person, when the communists came, they nationalized most of these buildings, because they're beautiful houses, beautiful blocks of flats, very modern for the time. They nationalized it, and they rented the apartments, cramming a lot of people together to whoever. If you're looking at the people who received these apartments in the city center, you can expect that they will people connected somehow to the Communist Party. As a simple worker, you didn't receive an apartment right in the city center. But these people are now quite old, like they're in their 80s or even older. So they have become somehow vulnerable people. This makes them not very much able to invest and actually willing to invest in their apartments knowing that they will die within the next year or so. So anyway, they're dying. So that's one thing I would say no, they're not financially vulnerable. But anyhow, the cost is huge. I mean, imagine an a block of flats of I don't know, 100 apartments costs 100 million, probably doesn't cost 100 million, but it costs 20 million, they just cannot afford these payments. How it happens right now is that the town hall can afford to consolidate some of these buildings on its own budget and they they will get back the money from the owners in 20 years, I think installments without? How do you call it not without the profit without margin. So in what what you receive from the state to give back in 20 years, exactly the same amount. The problem with with this, first of all, is that it's huge actually doubles the cost of the apartment. And in case you want to sell it, you will not get your money back. That is one thing. The second thing is that, since it's all these

consolidations are most of them are run by the state. The state decides what is the vendor that will repair the building. The owners have no saying that, what is the vendor? What is the type of consolidation being done? What is the budget? What is the timing and everything. So actually, you just give your apartment to the state. And they will call you when it's done. But you don't know whether it's six months or five years or something like that. So it's a complete lack of control. And actually a complete lack of trust from the people to hand in their apartments to the state not knowing what will the consequences.

Owen

So I know we just talked about the how like the communist government basically gave apartments in the city center to workers are there any other ways that the communist past of Romania kind of influences its earthquake vulnerability today?

Alina Kasprovschi

A lot of ways in which they influenced our lives completely since they ruled the country for 45 years. One of the things in one of the ways in which the influence was the way the 1977 earthquake was being managed altogether. So while the repairing and the reconstruction after the earthquake was done, quite quickly, because the army was also involved, and a lot of political prisoners were involved in repairing a lot of the buildings, which of course, as in any dictatorship, it makes things easier. And but, of course, with the costs when the cost integrated, what happened is that in order not to scare people away, the communists lied about a lot of the things when it comes to repairing the buildings. One of the lies, which you may have heard about is that some of the buildings were not actually repaired or not thoroughly repaired. Some of the apartments, for instance, were just painted over the cracks in the walls. And the people were lied that the painting was safe make

painting. I mean, how can you prevent a building from falling just with the paint, but people believed it and they believed it for so many years, that now they just can't believe that their building is not safe. Also, because during the communist times, there was a lot of stealing from the state property. All these works of consolidation, included a lot of stealing of materials, of manpower, and everything. So if you needed to add, I don't know, one ton of concrete, they are actually only added 500 kilos of concrete, and the rest was being stolen and sold somewhere else on the black market and stuff like that. So a lot of the buildings that we believe have been consolidated, after the 1977 earthquake actually have never been consolidated at all. So the situation is believed to be better than it actually is.

Owen

And so I know, we talked about like information campaigns being very important to kind of getting the public ready, would you be able to speak to I know we talked a little bit about them, but I know is your organization from you know, working on entities. I know for the most part, it seems like you guys do a lot of the kind of behind the scenes money work, funding other organizations, but would be able to speak to any of the information campaigns that are going on now?

Alina Kasprovschi

Well, we haven't done much communication campaign ourselves. This is a debate we've been having and... We are the entity which puts people together and brings resources so that things get done. The problem with this positioning, and it's not just marketing problem. It's a trust problem. And it's actually a positioning problem, is that nobody else does this information campaign if if it's not for us, then it's nobody. I mentioned, the Department of Emergency Situations, they have a website, which is called in English, "Be Ready" [fiipregatit.ro], you might know it. It looks like it

was built in the 90s. It wasn't. It was built a couple of years ago, and all their campaigns because they've been doing awareness campaigns on earthquake, there is this campaign saying, I'm not shaking at the earthquake. And it's very, it's a very ugly campaign. So people... they've heard it, there is such a I mean, they recall it, but they don't recall exactly its contents, because it was so ugly. It's like it's been done by the Ministry of the Interior. So by exactly a person in the ministry, not an agency commissioned by the Ministry or something like this. But somehow they are still the expert and the voice in terms of information campaign. Now we are supporting, we are financially supporting some initiatives in terms of getting involved in initiatives of communication, if you want to have at least two grantees which are planning or have already launched some campaigns. The problem here is also the fact. And I think it's a it's a cultural problem that we still need to work on. People want ownership about this. So more organizations compete about ownership. And the result of this is that each one of them owns a little bit of communication. And nobody knows exactly who is communicating and why are these people communicating. So the results are very, very, very limited. For instance, now we are supporting an app, which can be used before the earthquake to prepare for the earthquake. And immediately when the earthquake strikes, it automatically changes and turns into what to do when the earthquake happens. And in the same time, there is another organization grantee that we are supporting, who knows about this, but they've also started developing their own website. And it's not something which we can in a centralized manner decide, you do this, and you do that because we are not in this in this position. So what happens is that there are more voices speaking, but the impact is quite limited. We've also had our own advertising campaign in the beginning of the year, which you may or may not have seen. It was a campaign in which we wanted to, on the one hand, raise awareness on the earthquake, that it's coming, even if it's a pandemic, the earthquake can come at any moment. And we also

wanted to raise funds from individual donors. It was an SMS campaign. It didn't work. We know now we know the reasons why it didn't work, but it didn't work at all.

Abby

Lack of trust in the government, and that's why these smaller voices need to be heard?

Alina Kasprovschi

There's definitely a lack of trust in the government. We've been having corrupt government for 30 years now, I know most of the countries have this situation, but since I live here, we feel here is the worst that could happen. Starting 2016 we've had really the worst government and we had a lot of corruption scandals, which resulted in in the leader of the ruling party being sent to jail for corruption. Finally, this resulted in, in a civic movements, which was unprecedented in Romania since the revolution in 1989. But it's also unprecedented in the region. This happened 2017, 2018, when hundreds of thousands of people went out in the streets, it was really winter, very cold winter blizzards. But we were in the streets in hundreds of thousands of people every day, especially during the weekends, but it was day by day by day for hundreds days. And this resulted in, in being put into very, two very different camps. We were the protesters and the government. So the protesters hated the government and the government hated the protesters, and we couldn't get face to face to discuss any issues. This government has, has toppled ever since we've had the new government for one year, or at least a new ruling party for one year now. And but since the distrust in government as an entity as a general entity is still there. So apparently, what I know it's the same situation everywhere where you have two sides, which can get eye to eye, but we have unfortunately, this is in Romania as well. So no matter we choose the ruling party, the other part says that they are thieves, they're doing nothing, they are incompetence, they have no idea of what

they're doing. So there is this general idea that we are on our own. And this helped create a lot of the civic movement, which we've seen in the past two years in Romania. But it also created this very small, fragmented initiatives, which do not flow into a bigger stream and they flow as as a bigger strategy and as a bigger country. If not just personal initiative.

Abby

Yeah, that sounds really interesting. I think those are all of my interview kind of questions. Unless Owen or Andy has something they want to throw in there. We do have a couple of different questions, our teams trying to distribute a survey to residents of Bucharest. And we're just really, if you had any advice for us on organizations that we could reach out to that would maybe be willing to help us distribute the survey, we're trying to get it mostly to members of either smaller religions, or maybe minority groups, or really just anyone who would be willing to take it. So if you have any ideas, or anyone who we could reach out to, who would maybe help us?

Alina Kasprovschi

We could try to help you distributed depending on how many answers so you hope, of course, as many as possible, but what is your target?

Abby

Um, I would say as many as possible. We've optimistically hoped for like 100 total answers. We have been trying to distribute it and have I think, like three responses, so any amount that we could get would be.

Alina Kasprovschi

And your questions are in which area?

Abby

They're pretty basic questions that they're about earthquake preparedness, and, like the personal measures that people have been able to take to be prepared for an earthquake.

Alina Kasprovschi

Um, you can send it to me, and I can try to distribute it. I'm thinking now whether there isn't already I know, maybe you need to do your own research work. But I'm trying to think whether there isn't already some information regarding this. And I'm thinking now, we had an over the phone research this February, about how prepared people are in case of an earthquake, we've taken answers only from Bucharest and we've had around 200 and something answers, I think, which is considered it was done with within a research agency and it's considered to be relevant for the population of Bucharest, especially the segmentation of population, what it's been doing, if you want, I can send it to you. I have created this research for communication purposes, because what he wanted to show is that people are not prepared in case of an earthquake and this is where we come in. But it's, it's a real research. I mean, we haven't faked it to match our information, what is very interesting and it also has something to do with our national culture is that people say, "Ah, I'm very prepared, I know exactly what they need to do." But when you ask them, and that was very interesting question for us, for individual preparation for earthquake, and they nobody said, it's mine, it's the individual preparation. So it's my responsibility. Now, they said it should be the police, the town hall, everybody else, but not me, I. And that's, that's the culture of former communist countries in which we expect things to come from the state at all times the state to do

something for us, we should just wait and, and see what comes from there or, at at best complain about what we don't receive what we shouldn't move to do this. So if you want, I can send it to you. I'm thinking if I have it in Romanian or English, I'll try to locate it. And if you feel that you need more, I can try to, to send it out. The thing is, now Easter is coming next week. It's we have orthodox Easter here. And since people are very, very tired, and we've been working so hard, everybody's so looking forward to leave. So everybody's now just interested in finishing whatever they're doing and getting the hell out of the city. So I can't promise that you will get many answers in the next two weeks.

Abby

Okay, if it sounds like access to that phone research that you guys did would be super incredibly valuable to our project.

Alina Kasprovschi

Okay, I'll send it to you.

Abby

Awesome. Thank you so much. I think, Owen, Andy, do you have anything else?

Owen

Besides, you know, that the last kind of contact question, I think, yeah, I can, I can ask that though. So one thing that so we were supposed to be in Bucharest, doing this project for a couple months, we, we basically we do like a two week, two month term where we learn about the project and get it all ready. And then we were supposed to be in Bucharest actually doing this project, conducting

interviews in person. But of course, with COVID, kind of changes everything. So there's no international travel. So of course, we're not able to be there. But what that means for our project is that we have to basically use like snowball sampling to try and get as many interviews as possible to speak to as many individuals. So are there any contexts that you think you might know of that you might be wanting to just provide the team with some in some contact information that we might be able to reach out to, to see if they'd be also willing to interview with us?

Alina Kasprovschi

I can ask in our, in our community of grantees. I know a professor Vernescu asked me about Edmund, but he's working with a town hall now in his impossibly busy to, so I don't think he'll be able to catch him. Not that he's the most important person in the world. But he's definitely the most busy person in the world these days. I can ask my, my community of grantees meaning people working in, as I said, education, information, dog training, radio amateurs, and so on so forth. If you think that that's relevant, I can ask them with the same disclaimer that they might be on, on the way out to the Easter holiday as well.

Owen

Absolutely. That's understandable. Yeah. Like we said, anything would be appreciated, of course. I think we're pretty much all set.

Abby

Yeah, I think that that is all of our things. Oh, one last question. Can we use your name when we are finished? Are you okay, thank you. So we have to ask for explicit consent for that.

Alina Kasprovschi

And it will be recorded. So yes.

Abby

Perfect. So I think that's all we have. We're gonna let you go now. Thank you so much for interviewing with us. This was super valuable to our project.

Alina Kasprovschi

You're welcome. I'm sorry you couldn't come to Bucharest but yeah, who knows? Maybe one day?

Owen

Yeah, one day.

Alina Kasprovschi

Hopefully one day we'll be able to travel.

Owen

Yes, fingers crossed.

Alina Kasprovschi

I'll check for the report. My only concern is that if it's in Romanian, can you google translate it or something like this? Because I'm, I'm almost sure that nobody from my team will be able to do this in the next coming days.

Owen

Yeah, absolutely. We can take care of that without a problem. Absolutely.

Alina Kasprovschi

Okay. Okay. I'll send it in. Then I'll send the word out. When is the last day in which you can take interviews? I know you have your presentation on the 11th or something.

Owen

I want to say it's the 11th. Yes. So I would just likely guess the first few days of May is likely one of the last opportunities we'll have before we need to have our results officialized. So I would say yeah, probably the second or third of May would likely be possibly even fourth or fifth. I'm sure we could squeeze some stuff in.

Alina Kasprovschi

So actually, next week, we have. So the national holiday here starts on the 13th. And it and the first working day is the fifth. So they should do something between Monday to Thursday, next week.

Owen

If that's possible, then yeah, that would be fantastic. If they're able to.

Alina Kasprovschi

Okay, I'll ask them. Then we have a plan.

Owen

Absolutely. Yeah. Thank you so much.

Abby

Thank you.

Alina Kasprovschi

Welcome. I hope you enjoyed working on disasters, which are far away from your country like you.

Owen

Definitely feel a little safer. That's for sure. Yeah.

Andy

I come from Japan. So I don't know about you guys...

Alina Kasprovschi

Yeah, I know. But you're much better prepared. So you can sustain earthquakes much better than I was. Yeah. When, when we're talking to people what is happening in Japan in terms of earthquake preparedness? People say yeah, but Japanese people are, are not like us. They're different species. We don't work the same? No, they're exactly the same species in case of an earthquake, they exactly act exactly the same. Yeah, culturally, we couldn't be further away from the rigor and the order of the Japanese culture. We are like herding the cats.

Andy

Yeah, but I think something that is shared is part of the culture where you think about like, Oh, it's not gonna happen. Don't think about it. It's kind of present as well. But people still, it's still in the back of the head. So they still have like, kits and stuff available. But when like, you will try to talk to people about it. They'll still do the whole don't talk about it mentality.

Alina Kasprovschi

Yeah, but you have that many earthquakes. They can't keep it very further away in the backend. So for us, it's 44 years now. So. Yeah. Okay. Then I'll, I'll send you the research and I'll let you know, for the day, if there is somebody who's, who can take the time within the next four days to talk to you.

Owen

Great. Thank you so much, very much.

Alina Kasprovschi

Welcome. Bye. Have a good weekend.

Owen

You as well.

## Appendix G: Georgiana Ilie, Senior Editor, Decât o Revistă, Interview Transcript

Georgiana Ilie

I think it's better I, I tape everything, all the, all the interviews. I just ask people and I tape everything that, that they agreed to.

Eileen

Yeah, it's definitely easier that way, for sure. So I guess to start off, firstly we read your article, "Earthquake in the vulnerable city", and we really enjoyed it, we actually took some really valuable quotes from that and used them in one of our presentations, a while back. We did not expect to actually get an, you know, set up the interview with you so we're really grateful for that opportunity. But I guess you could start by just having you tell us a little bit about yourself, what you do and how you got the topic of earthquakes in your writing.

Georgiana Ilie

Sure. Well, first of all, thank you for reading the, the article I mean it's been five years already, and I'm surprised people still find it useful and it gives me hope that what I do has an impact in the world, which is something as a journalist to struggle with everyday. I've been a journalist for more than 20 years now, but I worked both in, in NGOs at some point, especially media NGOs and as a freelance journalist, and for the past 12 years- we just turned 12 last week- for the past 12 years I've been working and actually we said, we created the magazine with my friends. It's called DoR, or rather than the magazine is like it was a joke title and we thought we would only without one issue but 12 years, 12 years later we have a five story newsroom and, you know, things have evolved. And we write, we do long form journalism it's something you are definitely used to

because you probably read New York Times, New Yorker, Atlantic and all those magazines is, it wasn't common here and it's still not common but this is what we do. We try to look at complicated stories and explain them to the reader using relatable personal stories. In most cases, this is what we do. And we used to be a magazine and now we're digital first. So our content, content is now written or built rather first for for the online experience and we also put out the magazine which is a quarterly, so every three months we put out a magazine that looks, and I don't have one here but I'll bring one, that looks basically like a book, not like magazine anymore. And since 2010 I became interested in emergency services. First I wrote about firefighters. I think I wrote about firefighters for a very long time. It's such an uncovered field here. People write news about firefighters, and this fire happened this many, you know, engines were sent and this and that, but we don't know much, we didn't know much about how firefighters live and what it means to do this profession and I started covering that, which took me to a lot of other areas that are connected to first responders. And in 2015, I think, Kathryn Schulz wrote the story in the New Yorker called "The Really Big One", where she wrote about what will happen in the American Northwestern area when the Cascadia fault will create a new earthquake because apparently it's active every 300 years and all you know about it and since there were no record of the previous ones, it was only this was, this became known, I think, in the 60s and she wrote this amazing story that's so easy to read and immerses you in this world of, you know what happens when an earthquake of this magnitude hits, who is affected, and there was, of course, this is something on the, on the back of our minds here a lot because we live in an earthquake bound area. And it's the only capital in Europe that is affected by a medium depth earthquakes. You have earthquakes in Greece in Italy, or Croatia recently, in Turkey, obviously, but they're only, they're always surface earthquakes and they, they affect small areas, they're very violent but they affect small areas. We have a different kind of earthquake with

different kind of implications, and nobody knows much about it. And Bucharest was hit by a terrible earthquake in 77. I wasn't born then, but the stories and especially when I moved to Bucharest in 2000, I met a lot of people who are still affected but what happened to them or their families in 1977 and how they survive and how terrible it was but nobody- I mean, I'm not, \*sighs\* this will, this is considered, it's not people- the media writes about earthquakes but writes about very specific things like, "Oh look, we have so many buildings that will fall," and that's about it. Or they go to Japan and they say, "Look how beautiful all their system is," and this is not is not relatable, you look at Japan like it's a different planet basically because Romania is, yeah we're in the EU, but we're not an overdeveloped country so you can't really relate to the stories they tell about how prepared the Japanese people are. And there was a line in Kathryn Schulz's story that hit me very hard. She, she talked like, it was really just one phase where she talked about how many years it would take for the utilities to be back on in the area affected by the Cascadia fault earthquake and I realized that we have no idea how- I mean we know about the earthquake, we know that there will be an earthquake, and that probably a lot of old buildings will fall and people will die- but we have no idea when we will go back to normal life. There was nothing about that. Even, even when I started asking this question, the, the gas district, the gas distribution district, whatever, they were like, "Oh, but that's not gonna happen, we will not have an earthquake," and I said, "Mhh, that is not a good answer because you obviously don't have any plan for that since you don't seem to think there's no earthquake coming." And that was my focus. Well, some of the things I already knew. I knew how the emergency services work. I knew who was in charge of what, in terms of, in case of such a cataclysm, but there were so many other things I had no idea of, and I was terrible at sciences, unfortunately, and I had no idea how an earthquake was actually produced and how it propagates and how it works and I started from there. And it took me about,

I started working on it on January 1 2017 and I submitted my last draft, I think, on May 20. So that's four and a half months, while doing other stuff too because in an independent magazine you also do project management and, you know, we don't write news but we do a lot of administrative stuff too, and I, again I was lucky to have all that back, it probably would have taken me at least three more months to, to understand how firefighters work and how the, you know, all the emergency services work together but because I knew that it only took me four and a half months to document the story. And during that time, I just, because it was also was uh, it wasn't, I didn't look for this but it was a happy coincidence, "happy". It was the year we would mark 40 years from the last big earthquake, from the one in 77. And that meant, there were many initiatives that were addressing this. There were studies, there were anthropologists and sociologists studying this and how people relate to, to risk in their buildings and there was a lot of new material that helped me to understand and and focus the story. So yeah, that was it.

Eileen

Yeah, that's awesome. That's, That's a lot of great information. I think it's funny that you said that you had more on the social side, as opposed to some of the sciences, I think that I speak for all three of us, were budding engineers so, usually the, the science side is what comes easily. This project is giving us a pretty unique opportunity to explore the, the social sides of it. So you talked a bit about the gas distribution, and some of the infrastructure that would be impacted by an earthquake. Could you talk a little bit more about that? Like what areas of infrastructure are most vulnerable in Bucharest?

Georgiana Ilie

It's definitely the gas distribution system. We, we have- I don't remember the data but it's been a while and again I'm not good with numbers but there in the story. We have a huge exposed gas distribution system. Like if you look around you will see yellow pipes everywhere around the city and these are the pipes that carry the gas. They're not underground as you probably have them in the United States. They're all exposed and the risk with having so many vulnerable old buildings, basically, is that they will crash and they will break the pipes and then there will be thousands and thousands of fires. This is what happened at the Kobe earthquake in I want to say '93 in Japan. It was, again it was a surface earthquake, but although the worst thing that happened was, there was, there was, I think, 300 fires- gas fires- that started in the first minute after the earthquake happened, and that killed a lot of people, not the earthquake itself. This is one of the major, major problems and yes, now they are installing this, electro balls are called, that the moment there's a tremor they would turn off gas in buildings but they're still a work-in-progress. That would help, because then you wouldn't have, maybe you would have just the huge pipes that they could break but then they wouldn't be inside buildings and they won't kill people just because they, they are close to where they live. So you have that. First, and most. I, I personally don't think that access to water and food will be a problem because we have millions of- this is a very consumeristic city, you have supermarkets literally at every corner. I don't think that will ever be a problem. But we have terrible roads. Terrible in the sense that they're covered in parked cars. Like wherever you go in the city people can park their cars, anywhere, and that means you don't- I mean I've been to the States. I know, for example, in Washington in DC you have lanes that are dedicated for emergency services, and you're never allowed to park there you never allowed to drive them on those lines just to make sure that in case of an emergency, you will have the emergency services able to go to the place.

We don't have that here. And that's a, that's one of the problems. I don't think I covered that enough in the, in the article but also, like, I wanted to stop at 50,000 characters, because it used to be 75,000 but I cutting down to 50, because I wanted people to read it, not just you know, like freak out and not read it because it was too long. And that that's a major problem and there is no investment or plan to change this to make dedicated lanes, to have the infrastructure that would allow you to intervene, where you are needed because you will be needed everywhere, especially in the, in the city center which is pretty huge. Bucharest is a very large city. It's supposedly 2 million people, but so many people live here without legal papers so it's estimated it's 4 million and that's a lot, it's really really huge. And so you have that. You have the road infrastructure and you have the gas distribution. There's also, we have a huge lake and a damn on the west side of the, of the city. The dam is pretty old. There were some French in engineers who ran a study about what would happen if the dam breaks during the earthquake, and it would literally flood half, the lower city, the southern part of the city and it would be terrible it would take hours and hours and hours for the water to run through that part of the city and probably kill a lot of people. We don't know for sure, we don't know how vulnerable it is because this is not one of the things that they, they would come, they would actually invest in or analyze and see what the risks are. And there's the hospitals, which now during the pandemic, you can imagine it's even worse. The hospital's- some of them have backup electrical systems, they have generators, but it happened, as I was writing the story, it happened that the electricity was off in one of the hospitals and none of the two backup generators started. So I would say they're not very reliable. There's also the, the blood donation center is in a building that has a red dot. That is a risk one. And well that's it. After I, I published the article, there was a study done on the earthquake, earthquake resilience of public hospitals in Bucharest, and there were many things that were, that they were, that were pointed out

there. First of all, some of the buildings are vulnerable buildings, they are very old, they haven't been reinforced in a long time and they don't have, they don't have emergency escapes, because you know it's possible. They don't have a fire permit to function.

And they don't have drugs reserves, they don't have a backup of drugs that would be necessary in case you have many people with physical injuries- like mechanical injuries- because they say there's no money, but actually there's no habit of doing that. Hospitals here because they've been underfunded and not in a good shape, survive. They don't plan ahead, they just survive and they use any money they can get to, you know, solve a problem here, solve another problem there, replace a broken window, or buy some new equipment but there's no planning, they just <gestures with hands>. So that would be, uh. One of the, one of the people I interviewed back then, he painted this picture that I thought was terrifying that a lot of people will die at the door of the emergency rooms, because everyone will go to the same hospitals. We have 22 General hospitals in Bucharest and all of them have ER. So, basically, you could cover a lot of people, but people will go to the bigger ones- which are three- obviously because they know them, they know "they must have a room for me there because it's such a big hospital", and people will just not have access to medical care because everyone will go to the same place. It will be just impossible for the doctors, and again, I don't even want to think about this if it happens now, because now, everything is terrible. We just were, just over the peak of people in intensive care in the COVID hospitals. We just dropped a little bit after under 1500 people in intensive care every day so, there's not much room left for another emergency right now.

Eileen

Right, yeah. Yeah, that's interesting, the conversation about COVID. I hadn't even really thought about that, what would happen if there is an earthquake right now. We were supposed to be in, in

Bucharest for seven weeks but with international travel restrictions and such. We've been doing this project remotely.

Georgiana Ilie

I'm sorry you don't have the, it would have been, it would have added a lot of value to the experience to just be able to see the, the city. Yeah, I'm sorry, this is I, I've never been, you know, soil bound for so long. I can't believe I haven't been in a plane in a year and a half.

Eileen

Yeah, it's definitely been interesting, I mean in the grand scheme of things it's not the worst.

Georgiana Ilie

Oh yeah, I don't want to complain.

Eileen

We're safe and, you know, making the best of what we have. So you touched a little bit in your paper about, about some of the things that the government is doing to help prevent earthquakes, but also a lot of things that they're not doing, and, and one of the things that we've been looking at is kind of where the responsibility for preparedness falls. Obviously there's, there's, you know government, government instituted preparedness measures but then there's also a lot of, you know, personal preparedness that you have to take into account as well. Could you talk a little bit about that and where the discrepancies between, you know, what people think should be government control and what people need to be doing for themselves.

Georgiana Ilie

I can send you, they're in Romanian but they're pretty easy to follow, there was a study about two years ago, run by the, I think the the emergency masters program, the emergency response master's program at the University of Bucharest, where they asked people in Bucharest, about this, about how they feel about who should help them during the earthquake. And what are their expectations about what the authorities are supposed to do. And the, the numbers were wow. People thought that they should get help from the government in three hours after the earthquake, even if they did not have any kind of injuries, and so on. I mean, that's kind of the baseline, this idea that you should be self sustainable, unless you're of course hurt and that's a different story altogether they should be self sustainable or, you know, self reliant for at least for 72 hours, as you probably hear that a lot in the States, it's not something people know or I don't think, I don't think they even heard about that. There's no public campaign about that and I blame the government for that. Sure. Now they will say while the pandemic and whatever but this has been, this is not new. We know about the earthquake for at least 200 years. So there's no, there's some really sad misguided public campaigns. There was one called "Too quick to quake" in English. They had a campaign in English in Bucharest <Stated dramatically, gestures questioningly> wha- I, I don't know. They have another one called. "I'm not shaking during the earthquake." \*Pause\* That was in Romanian. And they have these animations that are pretty sad. And I asked the people in charge of this, "How do you develop this?" Now, I didn't say these suck, I said "So how do you develop these ideas?" and they were very happy with their, their outcome. Sure, they're not people who are specialized in communication, but in Romania you have so many- as everywhere- we have so many ad agencies who would do this work for free just for the award possibilities they can get. And I told them that "You know there are so many communicators who can develop these amazing campaigns that will

not cost you anything, then they can actually measure if they change attitudes and behaviors," but it was just not... The problem, I think, is that this is a, an army service, the emergency service in, in Romania they are militarized so there's not a lot of independence, say, in the way we can communicate or they can say things.

Eileen

So those were, those were government funded.

Georgiana Ilie

Yes, yes, campaigns. Yeah. And also there's this absurd thing where you celebrate <gives air quotes when says celebrate for sarcasm> where you mark National Safety day on the first Tuesday the 13th of the year, because you know, it's a supposedly the, how do you say this, "bad luck day" so let's turn the bad luck upside down- I, I don't know what they're thinking, really, I don't know. And they're doing this and they're very proud and I actually take pity on them because they don't know what they're doing. But the thing is, these are always top down. You will, you'll see this on TV these ads these parts, they would be on TV but you don't have this kind of education part of the regular, you know, in schools or in the workplaces. You don't have this kind of ideas, given to people or helping people make better decisions. These are just something that some people are become interested in and they find out what they're supposed to do, but they're like, very, very few. The only thing that I saw working. And again it was an NGO, an underfunded NGO, that was actually trying to do this in a better way. In downtown because there is a district called district 40 that's basically every building there will fall. It's really the, the most vulnerable place in Bucharest. It's downtown and not only that, theaters, cinemas, we know, exhibition places, a lot of cultural venues are there in this area and buildings where people live. And they started just knocking on

people's doors and inviting them to this, like square meetings where they would, there would be these two guys. One of them is a seismic engineer. He's one of the guys in my story, Matei Sumbasacu. And the other one is an art, artsy hipster guy who loves Bucharest, I don't know. But very convincing both of them. They would show- and people would come, I think most of them would come because they thought this would help them get funding to get their buildings refurbished but either way they came there and they listened to them talk about the earthquake kit, the backpack you're supposed to have, and, you know what you're supposed to, how you're supposed to react when it happens, how to create a family plan, but this was like a little drop in the sea. And these are just two people, it can't be on their shoulders to solve the whole problem, because yes we talk about Bucharest, and let's say people here have higher income, I don't know if you saw the news, the Bucharest area makes more money, has a bigger GDP than some other countries in Europe, some other smaller countries in Europe.

09:55:11 So this is a very large country. Most of it is very poor but you have a very large and rich Center, which is where Bucharest is. So you have people with access to resources, knowledge, it's not like- if you want to find out these things you can find out. But the earthquake, it's not going to be just in Bucharest , it is going to be on all outside the Carpathian Mountains all up to Krishna in the Republic of Moldova, which is the country next door. And there's no, I mean, if it's this difficult to, to educate people to inform them to give them options in downtown Bucharest, you can imagine that it is absolutely impossible and nobody is doing it outside this area. So, to me, this is, this is not people's fault. Sure, each of us can take responsibility and do this, but I think it's, it's a problem of, it's a government problem. It is because they don't, they never make this a priority. They never think about this long term, they just want to hit and run with some campaigns for which they probably have some European funding and they spend it and they, you know, they check.

<makes check mark with hand> They like, they would say things like, “But 2 million people so these animated ads’. Okay, that's great that you know that but what did that change? They, they don't even have the concept that you're supposed to measure how people's behavior change when you do behavior change communication, which is a science in itself, it's like there are books about it, there are specialists all over the world. To me s, uh, every year on March 4, which is when we mark the 77 earthquake, this is what I do. I tell people, are there are four things or 3 things you need to do: Make a plan for your family, learn where to hide when it happens and I took this, the “drop, take cover, and hold on”, phrase from the American Red Cross promotes this because it's so easy to remember. And have some stuff you can eat for a couple of days. It's, I mean it's not much. I mean it's nothing that- I do it- but as a, as a message it's not much and authorities should be able to just keep sending it out there. Have three things in mind, you don't have to- cause everything they put out is so complicated. There's this page, this web page called [could not discern] which means “be ready” or “be prepared” .ro, where you can find guidelines about what to do during, you know, floods, earthquakes, whatever. And they say “We put everything out there.” But that's, again, they just do not listen, that's not enough, you know, your job is not just to put information there, it's to make it, you know, find people, not the other way around.

Eileen

Yeah, that's an interesting point. The other day I was actually looking for, another interviewee that we spoke with had mentioned some of the, the animated campaigns and I was looking for them and literally could not find them at all

Georgiana Ilie

Oh, I will send them to you, I will send them to you, they're on YouTube.

Eileen

I think that's you know that that's a good point that they have to find people, not the other way around, because I know I was looking for a while to find anything so I'm sure that people who are, you know, are not even thinking about it struggle to get to them.

Georgiana Ilie

And for me, there are these YouTubers that I follow on YouTube. And especially in the area budgeting and productivity because that's something again, there's no education about that here so I look at what, especially Americans do about this because information is really well structured, and it's English so you know I can do that and French. And there is this a YouTuber called Jordan Page, she's a Mormon Mother of eight, and she talks a lot about productivity- I think you need to be very organized in order to raise 8 children. And she and her husband were doing this, they live in Salt Lake City, I think, and she and her husband were doing this q and a's about how they prepare for, you know, bad moments or stuff like this. And they were talking with such ease about this idea that you should always have food for seven to 72 hours for all your family and your pets and water and if you, after you reach that goal you should strive to go for a month or two, and then three and then keep adding as much as you can afford to buy and, you know, probably hide somewhere or have it stored somewhere.

And because they were saying, this is what the government is asking you to do. And this is what we think you should do and it told me it seems such a normal reference for them. And I realized that it probably, this is something that people hear about a lot in school, from their churches, from their local administration, from the city hall or whatever, right, and we don't have that at all. There's

no- nobody even talks about it. It's, it's a shame because, again, when it happens a lot of people will be affected, at least for a couple of days there will probably be no water and no electricity, and people, then the, the level of panic and despair will be heightened by the fact that people have no backup, because this is what, and I think I wrote about this a lot in the story, that if you make your decisions now for your family for yourself to be so much easier to do the right thing when it happens because if you make the decisions as it happens in you will most probably make the wrong decisions because you will be frightened, you will be you know. And there's no, there's no school about this, this kind of thinking, unfortunately. And to me that's a huge disappointment, because this whole country lives online, especially now during the pandemic but even before. We have amazing internet access, we are very proud about it, but we don't use these tools to reach people and give them this kind of things that can actually save their lives. And I keep thinking, you have so many people with chronic disease, as well as in every country now you have diabetes, you have so many people with heart problems or blood tension problems, whatever it's called blood pressure, which are very important, it's very important that you have medicine for the, you know, you always have medicine otherwise your health will be so affected. That's one basic people should always know, that you should have a backup meds, drugs, whatever you need in case this happens because it's not going to be "Oh, the earthquake happened and now everything is open and we can just go and go back to our-" We don't know how it will be. And there's this other thing which sounds a bit nostalgic, but it's not. During communism the economy was centralized. Not just- everything was centralized. So it was even if they made a lot of really bad non sym-, non empathic decisions, they were able to enforce very easily all those decisions. Like, for example, there is this note in some reports from the city services that Ceausescu was afraid that people would starve and then they will throw him out. Because you know, starvation kind of makes you angry. So what, you know,

he, I mean he was crazy but he was not stupid and he ordered food brought from the rest of the country, to make sure that they get all the super- they were not called supermarkets back then but the food stores open, and they brought so much food like Bucharest has never seen before just to make sure that people have access to food, and if they have access to food they will not be angry about all the other things that were not right. And again, this is something he could do- they could do as a, as a regime as a government- because everything was centralized. Now I don't worry about access to food, that's not something we, it's not really a problem, but everything else: having the necessary resources in order to look for people in, in debris, just picking up the debris and taking it outside the city or somewhere just to clean the street. You don't have that kind of centralized power that allows you to put together trucks, drivers, people able to pick up, it will take forever if you don't have a plan. If you have a plan, and these are some of the things that have been happening since the, the article was published. The NGOs work together and now the NGOs in the story they work together now, and with the World Bank, the World Bank finances them, so they can help the authorities to implement some of these plans now, so that when it happens, it's easier. And one of the things I think it's in the, in the story too is this national registry of equipment, trucks and bulldozers and stuff that will be necessary after the earthquake. Companies just signed that they would release the equipment and the necessary drivers to help the state when it happens, you don't have to do it after you can you can do it now and then you just call them and they will be they will bring the equipment, the necessary equipment, but that's something that came from the social, from the civil sector it's that an idea that came from somebody who was outside the system. It never crossed their mind to do that. Yeah, right. So sorry, I talk a lot about this, I'm sorry.

Eileen

No, it's awesome! We love all the information we can get... You touched a little bit on some of the remnants from sort of Romania's communist past is there other ways that you've seen sort of.

Georgiana Ilie

<sound from YouTube video> I found, sorry I found the video. Just a moment. The first, there's a bunch of them but I'll send you the first one. <sent link in chat> Yeah, sorry. Okay.

Eileen

Was there other, you know, ways that you've seen remnants of the Communist history of Romania impact preparedness, or vulnerability to earthquakes.

Georgiana Ilie

Well, there is this, Romania has one of the lowest social trust indexes in the world. It's only about 7 or 8% of the population believes that the other people are trustworthy, which is terrifying when you think of it. Like Sweden has 70%, Romania has 7%. Um, this was from 2014, so it's not that I mean, I'm pretty sure things haven't changed that much. And this is a, this, this is the heritage of communism, because what they did, it wasn't just a political regime and it wasn't just an economic way of looking at things. They kept people afraid of each other a lot. Everyone could be an informer, everyone could tell on you and your life would be ruined. And sure we only had 50 years of communism. And there's only already been 31 years of freedom or democracy, and you think that, you know, things would die out, people will, you know, rebuild trust, but it's not that easy. This, this is one of the things that once destroyed is very hard to put back into the society. And sure there are many good initiatives and there are many people who are not like that because

otherwise, I mean, this whole country we just wouldn't exist if nobody trusted each other. But there's, that's one thing that makes things more difficult. You don't trust the others. You don't trust why they, you know, they tell you to prepare or you don't-. you just assume that everyone is after you or everyone does not have your best interest at heart. It is very hard for people to believe that when other people give them advice or try to help them prepare for something as abstract as an earthquake or any kind of disaster, it's hard for people not to think that they have a hidden agenda and that they're manipulating them. And that really does not, I mean, there's really no way you can move past a trauma like this, trauma, disaster like this by yourself. Even now with the pandemic- and I'm sure you've probably, you're probably feeling like this too- there's a lot of disconnection and people, you know, they don't get to see each other anymore and some of them resist the vaccination and whatever. It's the same everywhere. And there is, there is this psychologist, psychotherapist, who has this amazing idea and we've been trying to put it out there in her name that- I'm sure she's not the only one but she, she explains it very clearly- that there's no way out of this than together, other than together. The more you, the more energy you spend defending yourself from the others, the more you will not be okay because then instead of growing all you'll do is just protect yourself and stay away from other people and that's, that's something that I think really affects our ability to be prepared for- and I saw during the pandemic too. The measures they took in March, February, March, April last year were extremely, I don't know how to say this, they were extremely restrictive. We were not, we were in lockdown for two months, and you would not allowed to get out of the house without a paper- and we're still under partial lockdown at night-but for two months was extremely oppressive, and there was no message of, "We need, we all need to work together to make- to move past this", there was nothing, just "you have to do this." They fined so many people they found in the streets, but huge fines 500 Euros, which is huge for

Romania, it's really debilitating for some people. Then the Constitutional Court said that these are not constitutional and they said that they're not allowed to make people pay for them. But it really aided people's trust in the good intentions of the government. Because, if the government infantilizes you and treats you like you'd have no you're not understanding person and you wouldn't understand why restrictions are necessary, why would you participate in this society?

Why would you trust the others? Why would you trust the government? And then they were very shocked when people went out. The lockdown was lifted on May 16 and just as summer came, and everyone was at the beach and everyone was, you know, not respecting the, the rules.

Well, obviously. It's not, I mean, psychologists we're not surprised at all. This is how people reacted, only the authorities were surprised. And I remember they never talked about responsibility- personal responsibility or things like this up until I think five days before the lockdown was lifted. They, there was this, the head of the emergency situations department he said in an interview, "We, we did our best as the government- as a government, we protected you now it's your turn to be responsible, and you know, apply these safety measures in your daily life."

That's, that's like three months too late. There was no preoccupation for how these things land in people's minds and this is, I mean, 2020, 2021, this shouldn't be such a novelty idea for people in government, they should be aware that people, you work, when you work with people you can just tell them what to do, that's not, it's not gonna work. And it didn't. We had a huge infection rate during the summer and even worse now during the winter, it's just slightly getting better. With a vaccination now.

Eileen

So we kind of were, well we read about it but we also, you know, Professor Vernescu informed us of how impactful your, your article was on the anniversary of the Vrancea Earthquake. Could you

talk about some of the reactions that, that people had to that paper and sort of how successful it was, I guess.

Georgiana Ilie

Well, there were a few things that happened. First of all, first of them is the one I mentioned that all the NGOs, that they didn't know each other they met and they started working with- they were invited by the World Bank, and they now they meet- well during the pandemic they haven't but up until last summer they met every two or three months and they put together the resources and they started planning to do things together and they also brought to the Department of Emergency Situations to the table so they could work with them. And that happened because they didn't know about each other doing these things, they just didn't. It's a small world But still, they were not in contact with each other. At the same time, the, the Community Foundation of Bucharest, decided that- they read the story, we knew, I mean I knew people there but I was kind of shocked at the reaction- they decided that they cannot honestly fulfill their mission to help the community of Bucharest if they don't make earthquake resilience a priority for their foundation because they realized that all the other things they we're building- you know, funding local initiatives and everything- would just disappear in the city, or disappear during the earthquake. And they created this fund called the Prepared Bucharest fund I think, Bucharest prepared and they got, they convinced, at first three companies and now I think there's six of them that put together money and twice a year they give out, I think they started with 100,000 euros and now there are, I think it's a bit higher. They give this money to grassroots NGOs like the ones that train search and rescue dogs and the ones that set up, radio, radio receiving systems because that supposedly, that's the only one that will work after the earthquake the radio system, training teachers to in CPR. This, this program that I mentioned before with the, in downtown Bucharest where you try to get

neighbors to know each other and have, you know, know what, what to do in case of an earthquake. I think they, I don't remember the number, I think they funded so far about 12, 15 projects in the past two years, which is pretty amazing. And they're all NGOs that wouldn't get funding from no one else really. Nobody else cares about this, nobody would give them money to train rescue dogs. I mean, and this happened and then the, the World Bank, when we published the English version, the World Bank was very happy with the article. I don't know, they thought it explains very well what happens. And now they use it as a sort of an example to how you can write about science, which is very funny to me, because you know science. And they invited me to speak at understanding risk conference in 2018 in Mexico City, which was focused on communicating risk. And it was considered a good practice story that can help other communicators. They asked me to have a keynote there and a workshop where I talked to other communicators about how to make risk, you know, palatable I guess for regular people. For me it was sort of a back tracing process because I didn't set up my way- I didn't set out to do "let me explain earthquakes to you," I just wanted to write a good story, honestly, and I was passionate about the subject. So I did some back tracing, about what worked, and I think I helped a little bit. Um, so yeah, this happened I don't remember anything else. Yeah, now I'm invited to talk at everything that's about earthquakes. They even invited me at the French Institute to moderate a very very scientific discussion between two French researchers which is hilarious because they don't speak French. And, yeah, so I, I'm the girl with the earthquake they call me which is also very funny. But for me, I mean, I'm a journalist, I write a story, I put it out there I do my best to promote it, and whenever it is relevant I go back to it and I, I give it to people. It was surprising for me to see that people reacted so well to it, that they were, that they were inspired to take action I think that's the thing that I'm most grateful about, because otherwise it would be still probably be like a exciting story about something people don't

think about, you know, in “oh look, it makes such a dry subject interesting,” but that would still be kind of, you know, pointless. If it’s just for the pleasure of reading. So I’m very happy that they were, they were inspired to take action, that they, they found partners, that they, they created things together and I have nothing to do with it anymore. I just enjoy it from afar, and I’m glad that they’re working on making this a bit safer because there’s not so many people thinking about that.

Eileen

So I think this is probably one of my last questions but we are kind of interested in seeing if there’s differences in preparedness and vulnerability across the city. And so, in your research and, and what you put into writing the article. Did you find that there’s any difference across certain groups within the city, whether that’s based on, you know, ethnicity, religion, status in any way.

Georgiana Ilie

Hmm, I don’t think I think awareness wise. I look at this from a different perspective, I look at this and who is able to be resilient? Because I think a lot of people are able to create an earthquake kit, and, you know, live in safe buildings, it’s a lot of people are. Romanians in Bucharest make a lot of money but also there are so many people who live on minimum wage, and in in precarious conditions and who would never be able to afford to have a stash of food and water set aside, that they can just easily not eat because you know. And to me that they are the most vulnerable people. I’m finishing now a story on precarious living in Bucharest, and this is a large population that lives in in those old decrepit buildings some of them are squatters, some of them just as tenants of the city hall. And these people are extremely vulnerable to what will, whatever will happen when the earthquake comes. The building will fall and even if the building doesn’t fall, these are the people who live off of odd jobs, and they don’t have a steady income or they have a minimum wage, and

that's not a lot. And I think this is the greatest risk, that there will be so many people who are already left behind by the society and they're not given- there's no social program, there's no social housing there's literally nothing for them and they will their situation will be even worse after the earthquake. There will be some of them will probably be homeless, jobless and hurt, and they will not have any means of survival. Other than that, I think, people who work abroad and came back, or studied abroad and came back are more aware about personal responsibility. But even so there is- even with people who are educated and have the means to do something- there is a terrifying approach. I don't know how do you explain, they're so scared of the idea of the earthquake that they would rather not think about it. Because this is all we know, that during the 77 earthquake so many people died. There's not much room in the- except I mean, I think that's why I wrote the story first of all, that and the other thing. There's no room in the public discourse about what you can do for yourself and what's in your power. And that's still, I mean, there's so much more to do here. I understand the fear. I'm scared of the earthquake too, I'm not, but also this idea that I have my, my emergency kit and I have a plan with my family and I have a, a night lamp, have one like the ones you do when you track, trek. And, and then the radio and whistle, these things, just give me comfort and I wish people would be aware that every little thing you do can just give you a little more comfort. You cannot control what happens during the earthquake, you don't know where you will be, you know how the building you're in will, will behave, even if it's a seismically safe building. You don't know that, you can control that, but there are other things that you can do that will make your life a little bit easier afterwards. And I wish people would have that mindset, but not many do. Still people move into these terrible vulnerable buildings that have a coat of paint that make them look, you know, because they're downtown and it's nice and they, they look so different from communist buildings like my own. You know they have large rooms with large

windows and so beautiful to live downtown. Sometimes, I have no arguments anymore with them. But I've also seen a lot of people, I know about, at least five people who sold their apartments who were in this kind of bad buildings after the article came out. And I know at least one person who moved to a different city. A sociologist who said publicly on Facebook that he moved to Cluj, which is in northern Romania and it's not an earthquake area. After he, he read my article. Okay. I wasn't aiming for that, but. Sure. Yeah. The. I've been learning, I'm doing a master's in anthropology now. And one of our teachers, professors, sorry, talked about what he called an opinion climate. This idea that people might want to do things, or say things but they will not because they think it's disapproved by the rest of the, by their community, by the people who listens to them and this is a factor that sociologists take into account when they ask questions for example because they don't want people to answer with what they think people want them to answer but they're truthful answer. And I keep thinking about how that influences a lot of the things we talk about. That it's not like it's not appropriate to talk about money, so we don't talk about money and you don't know how much money other people make. It's not appropriate to talk about earthquakes because this will bring bad luck so we never talked about earthquakes and what we do. And maybe in time that change and it will be, you know, just acceptable to have a normal conversation about "So what's your earthquake kit like and where did you buy your radio. And you know what is your, what is your meeting point after the earthquake." If I, if I would open that conversation now with people I just met and don't know how crazy I am about this, they would freak out, they would think I'm a very very weird person.

Eileen

That's very interesting. Yeah. I'm, um, I think that's that's pretty much all the questions that I had. Owen, Abby, you guys have anything to add?

Abby

I don't think so I think that was everything.

Eileen

Yeah, we touched on quite a few really important topics, and we really appreciate your time, really.

Yeah. So, I guess that, that's all. Again, thank you so much.

Abby

Oh, there is one last thing with you, would you be comfortable if we use your name. If we reference you in our paper?

Georgiana Ilie

Sure, yeah sure. I mean, I stand by whatever I said. Thank you for being so interested in this. For me it's, I mean, like I could talk this forever, as you can, as you can tell, so I'm very happy you gave me the opportunity to reminisce about this and to, it's good from time to time to draw a line to "Oh look, look what, what happened." It's good for the soul and the ego.

Owen

Yeah, and I think another thing is that our project, so they do it, they do a project every year. They usually change from year to year but they try to base them on similar things I think one thing and this will really help us is to actually inform next year's project on some things that could really be done and could work because our year's the first year that they've done the earthquake project in Bucharest so we were kind of just kind of thrown into it and said, "All right, figure out something

to do", and now I think we have a really good direction to kind of help a student group next year work on it so thank you so much for that.

Georgiana Ilie

It's been my pleasure and good luck to you all, and I hope you're very happy with the outcome.

## Appendix H: Gent Gjuta Interview Transcript

Abby

Thank you so much. So can we start by just talking about what work you're doing right now professors give us a little bit of insight but didn't go super in depth.

Gent Gjuta

Yeah, sure. So I'm a civil engineer. I've been working for the past year and something I guess, with reconstruction of civil buildings in Tirana and Durres mostly. So the big earthquake that happened on 26th of November, in 2019, damaged quite a lot of buildings, houses and educational compounds, mostly in Tirana, in Durres, in "Fushë-Arrëz"? Tirana and Durres are two of the biggest cities in Albania. So we'll say that the greatest damage is that the earthquake aftermath was in two of the biggest cities in Albania. So a lot of work was to be done. So this is basically what I'm doing right now I'm working in construction of educational buildings and houses like apartment complexes and buildings.

Abby

That's super interesting that totally relates to our project, when I guess you would probably have some really good insight into this. What kinds of infrastructure Have you seen be most heavily impacted by earthquakes?

Gent Gjuta

As for infrastructure, the effects of the earthquake were mostly in the buildings, you know, in old maybe 30 to 40 year old buildings that were constructed, right after the fall of communism just at the fall of communism in the year 1990. And some of the buildings that were constructed maybe

after 2000, but in a very informal, let's see, informal campaign, if you if you maybe have read some of some of the Albanian history, let's say 30 years after, after communism. In these three decades, there was a time where a lot of buildings were being constructed. And since there was an expansion of this type of construction, and maybe the laws were not that adequate, and the quality of the buildings were not was not that good. So some of the buildings that were damaged by the earthquake, were some of these buildings. And as per infrastructure. There haven't been any, say major problems with infrastructure, because of the earthquake. But since let's say, a lot of homes have been damaged, and then the new homes that are going to be rebuilt are going to they are going to be rebuilt somewhere else, not where they were used to be. So it's like, a side effect of the earthquake, because new infrastructure has to be constructed because of that.

Abby

Yeah, because everyone's moving away.

Gent Gjuta

Yeah

Abby

So you would mentioned like the buildings that were built really quickly after communism fell, is there anything that we can be doing to prepare those buildings? Better to withstand earthquakes?

Gent Gjuta

Well, the first thing that should be done is to assess, to assess the state of those buildings, you know how strong they are? You know, by the way, what are you guys majoring in? What's your...

because I just want to know a little bit more on your education so that you know, I know what I'm talking about.

Abby

Yeah, for sure. I'm an industrial engineering student. But we've been studying Romania and Albania and earthquakes and all like, all of this has been our IQP project. Eli and Andy, do you want to give your background?

Andy Li

Yeah, so I'm a mechanical engineering, fire protection engineering major.

Gent Gjuta

Okay.

Eli

And I am computer science and robotics engineering. So not super related, but I've been learning a lot of structural engineering and mechanics.

Gent Gjuta

The thing is that, yeah, the thing is that earthquakes and civil engineering in general, it's like A 3000 year old, the subject, so, you know, maybe more most of the things that I'm going to talk about, you already know because everybody knows, but I just wanted to, to, in a way have a good sense of know what you're majoring in because, for example, in building and earthquakes, for all buildings that were built right after the fall of communism, you suddenly you'd need to assess the

state of the building its columns, its beams, and foundations, like three of the basic elements of construction. And after getting this assessment, maybe you could say, propose solutions to let's say, help out in the longevity of that building, in a structural manner.

Abby

Yeah. So you can then retrofit these buildings to be earthquake safe, right, that countryside?

Gent Gjuta

Yeah, you know, there are many types of retrofitting mechanisms, or maybe construction methods that you use to old buildings so that they are better able to withstand earthquakes. Of course, not like the major, some of the biggest earthquakes. But if you could divide up Albania into two or three seismic zones, seismic zones, then maybe you would be able to better determine which measures must be taken for, let's say, buildings that were built in Tirana during 1990. And buildings that were built indoors. We must have read also about the type of earthquakes that are being faced, the type of seismic zones, because there's a crack in the continental plate, right close to us and Italy. That's why we tend to have huge earthquakes, mostly in the Durres area. Having this knowledge would, I think, would help anyone better determine what types of steps people who live in those buildings should take to know to fix up as much as possible their existing homes and buildings.

Abby

And, in that kind of vein, what role would you say that the government plays in keeping everyone prepared for earthquakes?

Gent Gjuta

To be honest, the government was not prepared, in a sense, even with letting people know about the consequences, and how to, you know, how to react to these types of situations. So I would say the role of the government is, of course, important because it has access to pretty much all the population, not just parts of the population. It's the voice of the government that is a voice that tends to be trusted. Because sometimes, you know, I think Andy was, was majoring in fire protection or something related to that? Yeah. When you tell people how to prepare when there's a fire or when you instruct people how to prepare when there's a, like a difficult situation, and people tend to be reluctant to believe you because they would think that Yeah, I know what to do and everything, but the voice of the government is more commanding and more compelling also for the population. So of course, the role of the government is indeed very important in this. I think our government was not prepared to face, you know, the earthquake aftermath. But there was a lot of, let's say, human interactions, a lot of people went voluntarily to help, as I would think would happen in any other country. But after the earthquake, the government took, let's say, a serious note. And, you know, started activating these branches of government that maybe people think don't work or don't serve for anything, but just like the fire protection units, the emergency units that were not, didn't look like they were doing a job or something serious.

Andy Li

Can you give a few examples of what some of these units of the department have done since the earthquake? Like how they have changed or improved preparedness if they have.

Gent Gjuta

So basically, Albania has a national emergency unit that pretty much commands the emergency situations in Albania, including earthquakes, including floods, including extreme fire situations and everything. And this national unit has their own respective branches in each city, let's say, and I'm just doing it like a short introduction of, of the, of that government institution. If you're, you must have read that before the 26 November earthquake, there was a big earthquake before that, which happened in September of the same year in Albania, I can't remember the exact date. But if, if, if the November earthquake in 2019, was 6.4, of the Richter scale, there was another one, which was 6.1, or maybe like 5.9. But it was a very, very big earthquake. Fortunately, there were no casualties in the first one, only the second one. So after the first one, which was a, it is included in the big earthquake, league, let's say, this institution became more active with the instructions to people how to react in case of an earthquake, for example, one of the most common suggestions that they were giving was that during the earthquake, for example, if right now was an earthquake was happening was happening, you shouldn't tend to go to stairs and get out of the building right away, because, you know, something might fall on you. Or things like this, you know, you should stabilize, focus and concentrate on the situation, think of, let's say escape ways, don't use the elevator, and right after the first wave of the earthquake stops, then you should get your essentials, you know, your phone, your coat or whatever, depending where you are, and where the earthquake is happening. And find the safe way where you have, like, clear eyesight, from big things or big buildings that might topple and get upon you. So, this branch of the government was immediately activated after the first earthquake in September 2019. But mostly with the, with, like, telling people what to do, something that they should have done, in my opinion, was that they should have inspected or like, somehow created a platform where they could get civil engineers, architects, you

know, other fields of other people with experience that can evaluate the state of existing buildings. If they had done that, maybe a lot of people would be alive today. And, and even the role of that agency would, would be fulfilled, if they had made some steps that in my opinion, word to be very important.

Andy Li

So in that sense, how, how are buildings assessed now compared to before the earthquake?

Gent Gjuta

Yeah, as I said, you know, there are three elements who are the, the most important components of a building, and I'm talking mostly about buildings, because in a sense, people live in them. And you know, it's more sensible to evaluate a building rather than, let's say, an industrial compound. But basically, the terms of evaluating each one is, is similar and maybe even the same. There are three main major components of a construction, let's say a construction site building, a bridge or whatever. It's the foundations, the columns and the beams because this is the basic way of trends. Making loads from, you know, from people who are living or transmitting them through through beams through columns, and eventually through the foundations to the are evaluating these three structures on their condition is the first thing you would you would do in order to, to understand whether this this structure is is strong would be strong if an earthquake happened. Another thing which we use here in Albania is that there is a standard for the construction standard that we are applying, which is the European standard for construction, according to earthquakes. And in short terms, it's called Eurocode 8. It's a it's one of the bunch of sets of construction codes, which are only used in the European Union, actually, I think, the United States uses another set of codes, I think they're called as ASTMI or something like this, I can't remember the exact abbreviation of

the set of codes. But let's say design and construction codes for buildings and bridges and other civil structures. Through this code, we tend to evaluate the capacity of structural elements that can support the, let's say, the effects of a typical earthquake. So based on the Richter scale, which is I think, the global scale of measuring the impacts of earthquakes. And using this Eurocode, we can say that this building, for example, a three storey building can withhold the power of 5.0, Richter scale earthquake. And another building can withhold the power of, let's say, seven, I can't imagine a 7.0 earthquake, but you know, using that code, you could tell which structures can... the capacity, let's say, of each structure. Another thing are walls, but they don't account as a major factor in the structural capacity of a building because most of the buildings that are at least here in Albania, they have a system with beams and columns, which is a common system. So whilst they don't tend to keep the load of the building, or the structural component.

Abby

So with that system, if a building is found to be still standing, but not capable of withstanding an earthquake, what happens currently in Albania?

Gent Gjuta

Yeah, so this is basically the reconstruction program that I told you I've been working on for the past year. After the second and the biggest earthquake, a lot of agencies and national agencies and other international agencies were engaged into determining which buildings were safe to live in, and which buildings were not safe to live in. So let's say they took a neighborhood 100 buildings and 50 of them are not safe to live in, they can't withstand another earthquake 50 other ones they can withstand. So with the 51, there were half of them that cannot withstand the government took charge of destroying all the buildings, metal that couldn't withstand another earthquake and

rebuilding them. The first option was at the same place, and another option was in another place. And the reason for these two options was that after this evaluation, that led up to 50 of them being destroyed. The reason why they were damaged during the earthquake was because of the foundations because the place where the building was raised, where they didn't have enough foundations to support the seismic amplitude or the effects of the earthquake. So even if another building would be built there, it would suffer the same damages for the same earthquake. So that's why they will plan to build it in another place. So like all these, let's say evaluation processes happened in five or six major cities in Albania that were affected by the earthquake in Tirana, in Durres, in "Fushë-Krujë"?, [inaudible], and some other places as well. And, you know, they came up with the total number of, of houses, like personal houses of educational buildings of complex apartments. Others structural units that were damaged by the earthquake and could not withstand another earthquake that in other words, they had to be demolished and then rebuild again, in the same evaluation, other buildings were assessed that, you know, they could withstand the power of another earthquake, but they need some minor rehabilitation or reconstruction phases and processes to it, to turn them into a normal state. So basically, it was an evaluation process that would separate buildings in five types of demolition. The first type was very minor demolition, maybe cracks in the mortar or something like this. The second type was minor cracks in the walls of the house or of the structural unit, but with no effect to the load bearing compound of the unit. As I said, the beams, columns and foundations. The third, the third type of damage was bigger, big demolition. Big cracks on the walls, also cracks on beams and cracks on columns, maybe or something like this. But the building itself didn't need to be demolished, you know, you could repair columns, you will because they are methods of repairing columns, repairing damage, without the need to destroy the whole compound. And the fourth one was major, major damages

to the unit, the possibility of it being destroyed or not, will be assessed in a second evaluation, because each element will be taken in particular. And the first one was total damages, and the building would have to be destroyed because it was not. It couldn't withstand any other, you know, load.

Abby

And so just kind of clarify there a little bit. When buildings are categorized into that fifth final category. Is it the city that demolishes them? Or is it like the homeowner whose responsibility is that?

Gent Gjuta

Well, it depends on the type of structure because, according... there's the law. The Albanian law or constitution, let's say has a central government and municipalities. And, let's say a high school is owned by the municipality. So the municipality needs to destroy and demolish the damaged High School let's say. But if it was, if it were a museum, the museum is part of the Ministry of Culture let's say and, and the Ministry of Culture is part of the central government. So that type of structure falls under the jurisdiction, let's say, of the central government and not the municipality. So basically, this is the type of division that would be employed to these damaged structures, whether which part of the government would follow up on it on the destruction and demolition and also on the reconstruction of the building. But since this was an extraordinary, extraordinary situation for a normal state, you know, in the earthquake, a lot of damage. Our government declared a state of emergency just after the earthquake and in a sense, most likely say 90% of all damage, all the buildings that were evaluated as damaged and had to be demolished, were taken in charge by the central government through an agency, which is called the Albanian Development Fund.

It's a special agency working only with construction, infrastructure and civil buildings. And they have facilitated the process of... you know, proceeding with the reconstruction of all educational buildings, complex apartments, and other social social units. Meanwhile, the small, you know, the private homes of people who were destroyed in Tirana, Durres, etc. You know, like, one story, home or two story home, they were managed by this municipality by the local government.

Abby

Okay, that makes sense. Also, certainly back a little bit, if you were like a homeowner, and you own one of those lower level buildings that needs to be retrofitted. Is there any system in place to tell you how to retrofit your building? Or is it more of a like, Hey, you need to fix this kind of

Gent Gjuta

there isn't. I think people are not, at least for you know, being a hearing, there'll be people who were not, didn't know a lot on the retrofitting options. So there was a lack of information, you know, there, there are so many new materials in the market that you could use to, to fix the damage, the damage being which does the first to someone who probably hasn't, you know, worked in construction would seem impossible, because, you know, they see the rebars coming out, and the concrete all cracked up and stuff. And, you know, they would think immediately this is this is not, this will not work anymore. But you know, the, the elements that make the beam work, they are they are there, they just need to be reattached to each other, you know, the rebar and everything. So using the particular cement, you could just fix it up real quick and with no big cost. So, in regard to this, people are not, we're not really informed on the techniques. But part of this information process was done by, by the groups that were raised to evaluate these buildings. And in the five types of demolished states of the other buildings due to the earthquake that I mentioned before.

Some of them but not in an organized way, some of them would mention that, you know, this element could be retrofitted with this, you know, with this particular material. But as I said, it was not... they were not focused to write it in each evaluation letter, but someone who knew about it wrote it, someone who didn't know about it didn't write it. Basically, that was it.

Abby

Yeah, that totally makes sense. We have definitely read a little bit about mixing new construction materials and old construction materials, did that ever cause problems?

Gent Gjuta

No, I don't. I don't know that causing any problems as long as you use them in accordance with what you know, what would the design engineer have, you know, as has mentioned, in the end, most of the materials are reusable, most of the materials, not most of them. But, you know, if you find a way to reuse them in an efficient way, then you know, why not apply it to a damaged building?

Abby

For sure, okay, now, unless Andy has any questions. Can we switch gears a little bit and ask Have you ever experienced a major earthquake? Yeah. That's kind of something you would say, um, mind if we asked you about what that experience was like?

Gent Gjuta

I don't. So the first earthquake that was it was in September, I think it was at noon time. It was during the day I can't remember the exact time and I was at my grandmother's house, two story

building. It was a bit strong, let's say the the, the effects of the earthquake. Some of my family members were a bit scared, for sure. And they they just, you know instinctively went out of the house. I personally, I wasn't scared of the first earthquake because I maybe because of what I do, you know, I might have been around, you know, or maybe I've studied it in more detail the earthquakes. And maybe in a way, I have visualized the way how the building should move during an earthquake, because we you know, we model everything we model buildings and certain structural units in, in computer, so we kind of have a better understanding of how the unit will, will move during an earthquake. But the secondary earthquake was a, you know, at 4am 3:50am, or something like this. So, not just me, but everyone was was panicked, and I was a bit scared. So, I was sleeping, as probably most of the people were at that time. And, you know, everything started shaking right away. So I just got up and I didn't know what what was happening. And, and this is all in, like, in seconds, it's not like, you have a lot of time to think and everything. But you know, I needed a few seconds to understand that it was actually an earthquake. You could also hear people screaming, and you know, but it was, like an experience to be remembered, actually, there's, there's, there's fun in it, to recall when you're when you talk with friends, and with you guys, but, you know, when when you know what happened, then it's not fun anymore. But people have to be cold blooded in these types of situation, because the wrong move would, you know, would end up at your own expense or at someone else's expense. As I said, in the beginning, these agencies that were you know, trying to help people learn how to react to these type of situations, when when a strong earthquake, or maybe when any emergency situation occurs, and you are in that situation. Everybody has to try to teach himself or herself to be very cold blooded to think, you know, to think on your feet, I think it's the exact expression. You know, to just analyze the situation if you are next to a like a high, a tall, tall. I can't get the word though. You put your clothes in the thing

you put your clothes in the, at your home or at your apartment. What do you call the things that you put your washing machine? No, no, no, yeah, you fold them and you put them I can't get the English word now.

Eli

A dresser? Your...

Gent Gjuta

Closet closet. Sorry. Yeah, something like this. So, you know, you just kind of, you know, analyze the situation, analyze the place you are, if it's an earthquake, you know, if you have something tall next to you that might fall upon you, you know, just kind of reorganize yourself. And, you know, if you're with kids, if you're grown up, and you have kids that you have to be more responsible. And another thing that, you know, everybody should keep in mind is that, you know, you always have to say positive words during that emergency situation. Because, you know, everybody panics, it is for sure everybody panics, even someone who, who might be saying, no things are going to be okay, don't worry about don't worry about it. He's also or she's also panicking, too. But no, you have to stay positive to keep a positive mind think on your feet, analyze the situation. And then after the you have control of the emergency situation, then you can decide what to do. Maybe go under a table for the moment. And no, stay in between at the door. Because it's safe to stay at the door because the beam of the of the door is is very strong, and doesn't let the wall on your shop. That's like another safe option. But you know, in any case, try to try to analyze the situation and know where you are.

Abby

So in those experiences, what was it like in the couple hours directly following especially I know one of them was at four o'clock in the morning, so I'm sure it was it wasn't like Let's go back to bed.

Gent Gjuta

Okay, so I'm gonna answer this as how it was for other people because honestly, I after the earthquake, I fell asleep, I woke up, I woke up at seven and went for work. But I can tell you about the couple of hours people experienced after earthquake. But not only that, you know, the three days to maybe a week after the earthquake. I live in Tirana, which is a capital of Albania, it will say it's a big city, you know, big buildings. After the earthquake, like those couple of hours, people were all of them were outside the buildings, they were all gathered and the main road, which is just like, you know, down our apartment, our building, and they wouldn't go in, they didn't go in until throughout the whole day, they stayed in their cars, they had their kids in their cars. Of course, some of the people who... some types of works were canceled that day, the next day, mine wasn't canceled, because, you know, we were, I'd say, in a way engaged in the past earthquake activities, you know, digging up, and you know, trying to save some people because the the activities happen for another couple of days, I think not trying to save people who were who are in destroyed buildings, but they were still alive and something like this. So basically, there was a lot of fear and panic and insecurity throughout people in Tirana doors, and other cities that were affected by the earthquake. People were not didn't think their buildings were safe. They didn't know anything about their buildings, but they didn't think they were safe. So they were sleeping in their cars, most of people, a lot of people left Tirana and they went for North or South of Albania to their families,

because, you know, they they felt they were safer, or they took their kids there and came back here because of work. There was a lot of panic in the streets, because after a major earthquake, they're all there's always after aftershocks, they're called aftershocks, there's another wave of the earthquake, which is always which is always less strong than than the bigger quake. But it still shakes you up. So in that panic, you know, another earthquake another way would you know what would terrify people even more so you would see streets crowded with cars trying to leave Tirana and on people who were in a rush going somewhere. And it was total chaos. The day after the earthquake was total chaos.

Andy Li

What do you think some people didn't trust the safety of their buildings?

Gent Gjuta

Well, since a lot of complex buildings got destroyed in the aftermath of the earthquake. And you know, you're in panic. So you you tend to disbelief something that you had believed in before, before you thought that the home you're living in is strong is not a problem for an earthquake. But then you see on the TV that say, an apartment building that is maybe five kilometers or three miles away from you was destroyed, and you know, people maybe died or were damaged there. So you tend to feel that something like that can happen to you, too. So basically, it was that. Another factor that will push people to think in that way to think that their buildings were not cheap, was another factor is that what I mentioned before that in these three decades after the fall of the communism, there was a lot of construction going on. And in this current construction phase, not a lot of quality was being seen or being evaluated in these new construction. So in a way people know that these new buildings that were built within the last 20 years they're not entirely safe. Or... it's an opinion,

it's an opinion that complex buildings, residential buildings or have not been built in, in a safe way. So that added up to the panic and the fear of people in those times. And maybe that's why that's those are two of the main reasons I think people stayed outside of their homes for maybe three days, or even a week after the earthquake.

Abby

Also, do you remember what the media coverage was like right after the earthquake?

Gent Gjuta

The media was mostly focused into regions of Albania where the earthquake hit the most which one of them is [inaudible] are, where a lot of buildings were damaged but the most lives were lost were in that region. I think another region was in Durres. A neighborhood in Durres. So these two regions were the most exposed to the earthquake. And the media was mostly covering those two parts. Again to my opinion, stressing out... it was like a countdown, 20 people died, 21 people died. And you had this for three days in a row. This continuous focus on the damage report was not good for people. It kept them on their toes, it kept them panicked, it kept them fearful of what was going to happen. I didn't like it. It was... most of the media channels were using the same technique because it attracts attention. But it wasn't calming people down.

Abby

For sure. It is a super easy way to get views but not always super productive. Also, after that earthquake, I know we talked a little bit already about the response and the categorizing of all the buildings, but were there any other changes to daily life after that?

Gent Gjuta

The earthquake happened in November and in March we were in quarantine so... I'm only going to talk about the four months from November to March. There was a lot of people who cared about what was happening here. If you read a little bit about Albania you would probably have read that the Albanian people, the nation, is not just the country of Albania, but also the country of Kosovo which is an adjacent country. It is a very long historical and political issue but the two countries, Albania and Kosovo, Albanians lived in both of them so a lot of people from Kosovo came to help us. Kosovo sent their army, emergency units to help with saving the lives of people in damaged buildings. We received a lot of help from Turkey, from France, from Italy, from the United States, a lot of other countries who were able to help, lets say. In the midst of this solidarity, also the people here in Albania were more, let's say, close to the subject, for example, Sarandë? Is another city in Albania, but 500 km from Tirana, the place where the earthquake happened. So the people there probably didn't even feel the earthquake. But in the midst of this situation they were more interested in knowing how the people in Tirana were doing, what could we do to help? There was a general volunteering going around. Collecting food, water, shelters, when possible for people who lost their homes. And in this sense, they realized Albanians for that period of time was involved a lot of this... maybe talking about it with your friends and family. Maybe volunteering in some of the parks or they had raised the help centers, or contributed in other ways. So I think they realized [inaudible] impacted by the earthquake.

Abby

Yeah that was a really positive perspective on it. I think that was my final earthquake question. I don't know if Andy or Eli has any questions for you. We really just want to say thank you so much for sitting down and talking with us. This has been super valuable for us...

## Appendix I: Mirian Bllachi, Cultural Heritage without Borders, Interview Transcript

Andy

Alright. So to start off, what is your current field of work and what do you do at the cultural heritage without borders?

Mirian Bllachi

Yes. I'm currently a program manager, at cultural heritage without borders, which is an NGO, and which works in the fields of uh, uh, preservation and promotion of cultural heritage as a platform for human social economic environmental cultural development. So, our main field of work is of course monuments and arts and culture. But it's from a perspective of the Development Corporation, and we work, you know, with the region, Albania, with the Balkans, but also in other areas of the world. My day to day, well, tasks are coordinating managing implementing writing the application for fundings, meeting people, stakeholders, partners, beneficiaries so it's a very variety.

Andy

What are some examples of the work you had to do before it after the earthquake in Albania, in 2019?

Mirian Bllachi

Oh, well, if I may say that that event did not really mark, you know, substantial changes in. Well the data works, we were doing, I was doing, but it also. It marked, on the other hand, our portfolio of projects because as a result of that event and as a result of the damages that it's caused on on

some monuments you know in Albania we were able then to as a, as a emergency rescue response we were able to intervene in some of those moments and then mount up a bigger project of interventions that, you know, we are implementing now and it's a big program of three years, which is funded by the way by the US, USA via um, um a specific grant which is called the ambassadors fund for preservation of cultural heritage. So in that way yes there was a change but I would say, if I can compare the pandemic any actually ready to change things we were doing and how we were doing compared to the earthquake if that makes sense. I don't know if it's clear enough.

Andy

Yeah, that was clear. And how would you say, social and economic factors influence or earthquake vulnerability and Albania.

Mirian Bllachi

Well that's, yeah. That's a tough question. A priori I would say that we have been no matter our social, economic, you know, cultural backgrounds. I think we were all, we experienced the same thing which was you know this fear during the moments of the earthquake, but also the sense of insecurity and you know, not having any kind of point of reference, you know, in the, in the period that immediately followed the earthquake and the and the aftershocks. So, that's was something that united you know united us in that sense of insecurity. But when it comes to the, you know how one deals with, uh, I mean, on a longer term basis with the earthquake, I think the evidence is that you know if you have access funds capital, the chances for for for, you know, to make the necessary adjustments to that situation, are you know, much higher compared to people that are coming from a background, you know, that is more characterized by needs and by not economic related vulnerabilities. I cannot even dare to imagine, know what it means for people to lose their

homes and you know, and not to have a steady job as a result of that, of the earthquakes. So, I think, yeah, definitely that gap, you know, makes us experience the longer term effects of the earthquake in very different ways.

Andy

Yeah. And do you believe the vulnerability is equally distributed, for all ethnic and religious groups in Albania?

Mirian Bllachi

Uhm, that's a, that's a tough one.

Andy

Yeah, I'm sorry, sorry, for starting with the tough ones

Mirian Bllachi

Because it makes you think, and, you know, just trying to territorialize a bit what happened in the sense that you might have specific areas of Albania, where you have a certain heterogeneity, of social backgrounds or religious or ethnic backgrounds. And one of those areas that were severely struck by the earthquake was the area of ladge (*not correct*) where you have mostly Catholic population, but I'm not sure about what I'm saying it's just a feeling, yeah?. And then, the, the souther where you go from there, then the more heterogeneous it gets. But not that I know, not that I, you know, a priori there shouldn't be any, you know, big difference. But I just wonder if these areas where there is homogeneous, Catholic population or Muslim or whatever. If there is something that Yeah, But I would like, I can't say anything right now about that.

Andy

Right.

Eileen

You mentioned that, I'm sorry, that that varies based on the means that an individual might have.

Would you say that there's a difference in the socio economic status across religious and ethnic groups in Albania?

Mirian Bllachi

No, no, I think, from that point of view. We had a, we have, it's a balanced mix of profiles within the ethnic groups and across the ethnic groups, I would say too so um, I don't think that that played a role, but just to give you some context, more context. You should relate this kind of question also to the, to the communist experience of Albania. Which, you know, it was for 35, 40 years at most and its legacy continues still today. But if they manage to do something, you know, very interesting was that they flattened down completely you know differences based on you know ethnic and religious backgrounds. In, in poor words, we were all in the same position when, you know, communism collapsed. So poor and you know, and not having access to, you know, even to basic resources. And that's, I think that plays a role, still nowadays where you don't have, you know, a very distinctive situation between specific religious or ethnic groups in Albania I would say. Perhaps a Roma minority is a bit disadvantaged from this point of view. But if I can relate it to the earthquake experience, well I'm not sure there was data analysis done specifically on that angle actually. But it's an interesting question, definitely.

Eileen

Yeah, we've definitely found there's not much information taking it from that angle, in, in research. Do you know, if I'm sorry I don't know if you know much about, Romania, do you know how the experience in Albania, would relate to the experience in Romania?

Mirian Bllachi

But when you say Romania, and the experience in Romania you mean earthquake related experiences or, you know, put into other systems or, I don't know, economics.

Eileen

I was sort of interested in your answer about communism and I know that Romania also ended their communist era in the late 1900s so I was wondering if you knew anything that could compare those two.

Mirian Bllachi

Well, it's very hard to say, I think. Although these experiences then convert. I mean, at some points, such as you know, denial of, you know, basic freedoms and stuff like that, or deprivation of, you know, some type of division from you know basic needs and basic goods. I think every situation is very specific to the country and to the, you know, to the internal issues and, you know, the strictly speaking, history of the country. So I wouldn't yeah, I mean, be able to draw so many comparisons right now between Romania and Albania, when it comes to the communism experience and its long term impacts. There is something that I think brings us together. And that is the fact that the institutional systems, you know, the governmental bodies. Uh, well, the whole environment of, you know, of the state, you know state making state building and state functioning

was severely, you know, voted into into test after the communism fell and I think there is this buzzwords that you can hear often for Romania and Albania which is transition period. And I think that, well, in Romania and Albania, there are problems when it comes to how successful this transition has been in terms of you know developing the country, in terms of providing equal opportunities for people to continue to develop or to, you know, to know whether to subsist, basically. And what is strictly related again then to catastrophes and to disasters, it's like you know the preparedness and awareness of you know of the populations differently. That's a public authority to handle these situations. You know foresee them to you know organize in such difficult circumstances, such as you know what a disaster like the earthquake. So I think that's something that you can know, can be interesting to to investigate in, and to draw comparisons.

Andy

Definitely and. Would you be able to speak to how this transition period may have affected earthquake preparedness, or preparedness measures in Albania?

Mirian Bllachi

Yes, uh, well, I think, during communism time, there was something that was you know also related to the, well, the ideology of the Communist, let's say, leaders, which was to make sure that the country was relying on its own forces. I mean in every possible field of activity, which meant that you wouldn't, I mean as a communist Albanian at the time, you wouldn't buy things from outside you do, you wouldn't engage your relation building with, you know, countries elsewhere in the world. And as a result of that type of isolation, then, you know you would put the focus on developing your own capacities in science, in economy, you know agriculture, knowing that that needed to happen in, you know, in a very, you know, you know, in one economy, that was scars

and that was poor, so it's a bit of a contradiction on how you can develop the right technology and you know the right knowledge in several fields without having necessarily the contact and the and the exchanges with the outside world. So what's the result of that was that at the end of the 80s you did have institutions that were monitoring, or you know, managing, or doing several studies you know on a regular basis. When it comes to seismic activities, and stuff like that, but then what happened is that already at the time those institutions were very poor working, uhm working on very tight budgets and people doing you know all sorts of works with, you know, with obsolete machines and techniques and you know equipment. So, already there, then you had a huge gap, you know, when, when it comes to what was really needed and what was really, you know, the possibility to, you know, to do want to accomplish. Then, when the regime collapsed, one of the first things, you know, to be put into question mark was precisely the scientific institutions, this you know this bodies, holding a special kind of expertise, like, you know, specialized Institute in seismic activity and stuff like that. So those were the first ones to be shrunked in the first stage. And then the second stage that was, you know, melted, if I may say, several, several institutions were combined together and their stuff was undersized, because of the lack of the budget. Again this economy of scarcity you know this poor economy, you know, came back to haunt us when it comes to, you know, continuing the work or not with these specialized institutions. And that made that, that you know, over the 90s those institutions shrunked. And then, from the beginning of the years 2000 you know they were just there, you know, initiative in, but there was no reality behind those institutions, because they were not able to you know to to do studies, or to, you know, monitor the situation, or to, or to even you know propose protocols and stuff like that so to deal with catastrophes especially, and especially referring to the earthquake intro to seismic activities you know in Albania, knowing that this is a region actually that is you know seismic region. And

then in 2019 there was this first wave of earthquakes in September, and you know, there were damages already in September, and then there were task force, task force groups actually that were organized by the government but you know without clarity, without clear task, without the real capacity actually to implement those difficult task of, you know, assessing damages and proposing measures. And then two months later, you know, this big earthquake which I mean really shows, to everyone including to the, to the government authorities themselves that they, you know, we were totally unprepared. Totally unprepared and zero preparedness when it comes to you know, handling the situation. And I can take a very specific example of this. They come from the field of activities. I mean, monuments and culture you know, you know restoration of historical assets. Well, there were no forms for assessing damages and every institutions that were involved with assessment of damages was going according their own you know, you know, forms and, According their own formats of assessing damages, which, you know, in a, in a normal circumstances, it should have been a unified approach or, you know, a more harmonized way of doing that. So, um, yeah, I think, to me that says you know that this is a country that is not prepared to, I mean prepared to go for such eventualities. And another probably representory example is, trying to find the word in English. There is a department of civic emergencies which recently, I think it was sitting in the Ministry of Internal Affairs, or Ministry of Defense. I'm not sure I need to check this information, but it was relying on, you know, on, you know, four or five people, you know, to function. And that's a department that is supposed actually to, you know, to cover the entire, the entire nation and its a cross, cross field and cross sector, you know, department that needs to make sure that all institutions from museums to schools or hospitals and stuff like that are prepared or have you know have at least some protocols in place to deal with situations like earthquake, so the department was really really thin in terms of you know capacities, now things have changed because it took a

bigger earthquake to, to, you know, to move things and now the department I think is becoming a bit more guarded with people's and with expertise. And recently, my information is that we have also. I'm not sure if it's approval rate but there is a new law on civic emergency which is a much better law in terms of integrating all these cross sectoral components, such as culture for instance and, yeah, preparedness in, in, in the field of cultural and historical assets too, you know.

Andy

Yeah. So, are you able to give a few examples of what measures the government has employed since the 2019 earthquake in terms of earthquake preparedness.

Mirian Bllachi

This is something that I would need to check and compare. There was, I mean if this brings an element of answer to your question. One of the problem is how the as well know how the government is communicated, communicating, well, activities in this field or measures that taken, in this field and there is to say that all the communication around those aspects when it comes to large public is done on Facebook and social media, and stuff like that so. And it's very difficult to find, you know, technical documents or, you know, documents and resources of legal character, if I may say, to really see what is in place and what is the new kind of you you know approach after the earthquake. I think this requires a bit of time and preparation that I do not have at the moment, unfortunately.

Andy

That's alright. I'm also wondering like, are there any preparedness-- there's programs like for example in Romania, they have earthquake drills in schools and they have like awareness campaigns on TV. Does Albania have something similar to that?

Mirian Bllachi

Not Not that I've heard of, but again, I'm not you know specialized in this field I'm sure there are pilots. And, you know, smaller programs. But, yeah. The wider public or there is widely known, but I cannot remember anything at the moment.

Andy

So we'll be moving on to a different section of our interview unless Eileen has another question to add.

Eileen

No, I think I covered all the questions I had for this section.

Andy

So, next we will be asking about your personal experiences with earthquakes. So have you experienced a major earthquake like the 2019 earthquake in Albania?

Mirian Bllachi

No, it was the first type of that magnitude. I hadn't experienced earthquakes before in other seismic areas, but that particularly was, you know, the marking experience.

Andy

So have you experienced it like a major earthquake in the past?

Mirian Bllachi

I have, I mean I have the memory of another big earthquake, which was in Istanbul. I cannot remember exactly when it was 2003 or 2004 but. And I don't remember how big it was, but it was something that frightened me at the time. And the reason was that the place where I was staying, I mean, was mostly hosted by, you know, Turkish family in an exchange. And the room when I was staying actually in the mirror and there was this kind of small other (?) is covered with a mirror, and then it was full of, you know, small bottles of perfume which was you know glass bottles, and all you know packed up with each other. And those made another terrible sound, you know, for me it was midnight and when we were discussing then the why those bottles and (?) were there. That was one of the ways for people to acknowledge when an earthquake would start and even if there was something you know that was powerful then they would have at least you know a few seconds to you know to two more seconds to react to shelter themselves. That's something that I didn't know and didn't heard of back then. While in the 2019 in Tirana. That was a very different experience also because of the fact that my personal situation had changed when I was in December 2003 or four. I was, you know, a teenager and you know, no family obligations and stuff like that and you know, I was not in my home, that's something that didn't check up psychologically places well while 2019 was different, you know, family, let's say I have a family with my wife and two to three very young kids, very small kids, so I was afraid for them as well you know so that's, you know, this is why I mean I felt it much more. I mean, on several levels, not just the shaking but also, you know, the fear, the security for for myself. And you know part

of my family members so this is why it was such a powerful marking experience. I hope it doesn't repeat again.

Andy

And so, what would you say was the social atmosphere in Albania, following the earthquake?

Mirian Bllachi

Yeah, that was another part of the experience which was newer thing to all of us. The aftermath of the earthquake is you find yourselves yourself very quickly know, from what, was 3am in the morning so we were sleeping. So you quickly find yourself, you know with your job and stop having my kids, and I'm carrying them in the, in the staircases, we went down with there's a small patio at the foot of my building, and we were all there. So, immediately you had this crowd of people that were standing there, you know not understanding exactly what was going on. And that's a first I think element of bonding, you know, when you know you are suffered the same thing is some of the the same thing as some of the same trauma, and you don't yet realize it. I think yeah there is this very human tendency of you know going to, to someone else and you know trying discussing and you know, try getting a sense of a new situation. And then immediately what's called after that (?) is that you know we were all on our phones, you know, calling people making sure everyone you know else in Tirana or nearby was sure and that's, that's something that provoked, you know, a breakdown in communication system so for some for some at some point, you know, not able to communicate, again so that's good. That adds to the already complex atmosphere that was creating. Then there was this very interesting things thing that relates to how the catastrophes are communicated, because then the media and I'm talking about media about TV media, at least in Albania, so what they did that was that immediately started to cover the, started

to cover the, you know, the events, and immediately fishing for, you know, terrific images you know people, you know, getting drawn out of the other how do you call it, you know the fallen, you know parts of the buildings, you know sometimes that sometimes you know near near the situation, and that was you know visible on tv live you know so everyone could could look at that, you know, adults, kids you know everyone, so that I think that's exacerbated a lot of the situation and you know that put us you know even more stressful situation, you might say, you know, why didn't you turn it the TV off you know but then again on social media, you know everywhere you know, that was, that was dominating. That's a type of news. So, when you have that and when you combine the two also to the, to the continuous aftershock you know because it continues for weeks and weeks and weeks, you know, that, that made it really really scared I think it was as scary, you know, managing the next

two or three days after the work, earthquake was as scary as you know those 40 or 50 seconds that we that we endured. Then there was, at least in Tirana, I don't know for for other cities how it was managed, then you had this, well people tended to leave the city already so which which blocked the main roads and the main highways, so immediately people who are stuck in. In, you know, in their cars, you know, in the streets, which is not something that one should really do right you know, it should be avoided. And then, and then and then there was also a lot of speculation, you know, media, portraying when giving space to the people who were saying we know when the next earthquake will happen exactly, and a few conspiracy and fear. What I did in my personal situation, so we took the car, we drove three hours away from from Tirana and we went to Kosovo where we have a part of our family. And that was a way for me to find some inner peace and you know to make sure that, you know, that we wouldn't be affected in any other way by any of the aftershocks. Another interesting part was that you know that was immediately solidarity among

people, there were people that were providing food, you know, material (...) that were under more stress, so that was something that, you know, we weren't used to and we don't see in normal times. So that was the, the nice part of the, let's say of the story.

Eileen

You mentioned that there was difficulty getting out of the city, immediately following due to overuse of the highways and such. Did you notice any other overuse or damage to infrastructure that inhibited people's abilities to go about their, their normal daily lives?

Mirian Bllachi

I'm not sure I correctly understood the question, but I think the most damaged parts were well flats. I mean, building blocks, especially 40 (?) bad constructions. Then we're damages also to public equipment like schools and, and sometimes hospitals. But in terms of infrastructure like roads or bridges or you know anything that helps people commute and transport I think that was okay. So I don't know if that was the sense of your question.

Eileen

Yeah, yeah, that's pretty much what I was asking.

Mirian Bllachi

There was even this this very funny way of dealing with all that was to, you know, buy a ticket and completely leave Albania, there was a peak in the number of passengers in the International Airport in Tirana. That very same day, and the day that followed. So some people took the planes

you know very completely you know left grounds. So it's the prefer to be in the air. So that's interesting I can talk about now with back then.

Andy

So how has experiencing, like a major earthquake change how you perceive earthquakes?

Mirian Bllachi

Well, that helps a lot. Having the experience of a major earthquake helps a lot. In terms of you know knowing what to do, and not to do when the next one comes. At least, that's, you know, having, I mean in terms of preparedness there is I think an impact. And now, of course, there are also these adjustments to the systems from the fact that now there are things that are beginning to be taught at school. So, so, from a very early age, you have a certain reflex or certain awareness of things that you shouldn't do. In terms of, well, regulation and you know construction regulations and policies I think that that has impacted the thinking and you know, there are much more, there's a bigger focus now on making sure that the building code is you know is updated regularly, that is implemented also in the right way because sometimes as in Romania, for the reasons that I explained earlier. The fact that the biggest problems are in implementing laws and regulations and codes, rather than the quality of the regulation itself. So, I think that's also something now abilities are more you know aware and you know the feel of the the more the responsibility of making sure that everything is implemented in the right way. Well, in terms of communication also I think it's also helped spark this discussion about making sure that there is a baseline at least for for emergency for dealing with this kind of emergencies and this kind of disasters, as I said, the new low and the new organization of the Department of the civic emergency is directly related to that so I think that's a huge step forward.

Andy

So, how do you think feeling a major earthquake has helped people, individuals feel more prepared for a future earthquake like since they know what an earthquake is like now.

Mirian Bllachi

In theory, I think, yeah, that's should be the case. Or if I think if I take our case in my family or my close family and friends. I think yes that people are more, much more aware now and you know, would be discussing sending things over, you know, you know, over the phone and stuff like that, you know, documents you know suggestions stuff. So there was definitely a reflection moment after that followed, and you know, that's, I think, will be very useful. Then, I, my understanding is that you are never fully protected and never fully prepared to such eventuality. All you can do is you know make sure that you have a certain, you know, feeling about what needs to be done but then I think it's a, it really depends on the personality and the nature of someone, you know, if you're calm or If, on the other hand if you're more like a person that tends to be hasty or panic you know in this situation so, but definitely having a background information, a baseline, always, always helps.

Andy

Alright and I believe that's all the questions I have from my end. Eileen, do you have any questions?

Eileen

Yes, I actually do. I believe it was Professor Kinicki that that recommended that we reach out to you, and he had mentioned that it towards the end of our IQP term that your shift with the organization that had to, I mean your organization shifted gears a little bit to kind of help with some responses to the earthquake, and specifically in terms of historic in culturally relevant buildings and such. Could you talk a little bit about that?

Mirian Bllachi

Sure, yes, in the aftermath of the earthquake. So that is December 2019. We immediately started to go on the field and to assess damages, you know by yourself with teams of architects, because that's the core. I mean, expertise we have we, architects, but we are a bunch of architects, urban planners, historian and economics, that are working in this field, very long time that we were able to assess some of those damages and understand very quickly that the situation around us was, you know, not only bad because of the damaged of earthquake but it was bad because no one had a clear idea of what to do, and that includes us, that includes our partners institutions, but it was a very Celtic (?) moment in the aftermath of the earthquake. And then, when, you know, the things became more clear in the sense that institutions, working in the field of, you know, culture and cultural heritage, when they got a sense of where were the biggest priorities they reached out to us and said, as people could help in any way with. Especially this old fortified walls of Duress were one of the towers actually this part of the old walls that had totally collapsed, you know, part of these old walls. They had totally collapsed and that had rolled down on the streets and you know that there is to know, keep continue falling. And we, what we want to do at that moment was to, to understand if there was any room for us, given our budget and our you know strategic orientations to do something about that. And as a result of that our first action was to ask to our

donor, or, which is the country of Sweden, if we could divert the funding we had, you know, left in our program to start an emergency consolidation. Emergency intervention actually repairs in Duress. That was hopefully, you know, accepted. And we started immediately immediately, and I'm putting the focus on this because I think it's very important for people for communities for everyone, you know, that is involved in such a catastrophe to, to understand very quickly that you can do something about this. This is not a fatality you know it happened, but you need to get back on your feet and then fight and. And I think that's the message we try to to send to to ourselves first but also to our partners to the institution and especially to the community of the city of Duress, which was severely affected. Then, that led to a bigger, let's say, process of teaming up with, with various other donors that joined the, the effort, including as I mentioned, the United States via this ambassadors fund for cultural preservation and, which ended up being you know a project that involved four different donors. And, well, founding the emergency consolidation phase, which is the first phase. The second phase which was, you know, really assessing the situation, getting to understand what roads, you know, the catastrophe. And the damages to the monuments, because it wasn't well, it rarely is only the earthquake, you know, there were other things that happened before the earthquake, but the earthquake was you know just the last you know push to make those moments fall. And the third one, the third phase was, still is, we just started it actually it's the full restoration measures. And, well, we call this structural restoration and structural rehabilitation, you know, processes. So these three phases are, are being done or, you know, were implemented for four different sites. So, one of those is the castle (?) in Duress that I mentioned, the other one is, well, the clock tower in Presa (?) it's a small castle in Central Albania. The tower of the castle in Krujë, which is quite an iconic monument. The (inaudible) also in Krujë, which is you know it is just building that is also a very famous for its paintings, wall paintings. That was, well, we are a

big organization, I mean a small organization, who, you know, which is doing big things and just to give you a scale, you know we are working on four of the 53 other monuments, you know, 53 monuments of culture that were severely damaged by the earthquake. The other monuments being, you know, restored or having entered the study phases now, and that that work is being done by the UN ops, UN operations, say services you know, the big international body which is doing that. Well these efforts, especially in the field of cultural heritage and the preservation of monuments are being spearheaded by the European Union, in a sense that there was a donors conference in February 2020 where funding was pledged, federal funding was pledged to the recovery process in Albania. And we were very happy to, you know, to receive as part of those you know generous of donations from countries and from international actors, financing actors, you know, something that 50 million euros that that would go to that will go to, you know, repairing damaged monuments, which is quite a big injection of money in this field for a country like Albania. Of course there is much more than more to say and we can go very specific about some of the things, but I think you know having a, you know, a general idea about what is going on. I think it's more helpful at this stage, perhaps.

Eileen

Yes, definitely. I did have another question. You mentioned, buildings, a building a wall paintings on it and it kind of sparked my memory that in some of the attempts to, to kind of retrofit historic buildings, some of the art and culture has been damaged by the, the actual attempts to fix some of the problems. Do you, can you talk a little bit about sort of the precautions that you have to take that are different for working with historically and culturally relevant buildings as opposed to just other structures I guess?

Mirian Bllachi

Yes. That's a very good question. And I think the answer to this question is speaks to, you know, dealing with this type of, you know, very rare events and catastrophes but also speaks to normal, the normal way of dealing with the restoration and you know, cultural preservation in this field and that is that you should really have a very light touch, you know, approach of interventions because what is damaged, in a way, and especially so important for the wall paintings, you know, you can never come back and fully, you know, restoring or fully reconstruct because it would be, you know, it would go against the standards and the principles of restoration and conservation. So, what we tried to do or once you know once we're doing this circumstances is to know, preserve as much as possible, of what remains, and you know, based on what remains then you can get an understanding or feeling or fantasize on what has you know disappeared unfortunately, but I think it's never never never you know, trying to reconstruct, all the or you know to to recreate something that you know is gone. It wouldn't be, you know, the right way of doing things. And it's even more so when you deal with the mural paintings, you know, historical, let's say the historical building.

Andy

Alright. I believe, thank you again. And I think that's all the questions we have, unless Abby or Eileen do you have any final questions? Alright, so thank you again so much for agreeing to interview with us and it's been very valuable hearing about your work with the cultural heritage without borders, as well as, like what you guys have done and what has been done in Albania before and after the 2019 or earthquake.

Mirian Bllachi

Thank you, likewise it's interesting, you know, to see what other type of activities, students for WPI are working on. And it's if it's possible, you know, when you do the study or if you have the results in all the interviews, it will be interesting. And if you can to share those with us since we are working so I mean, with some of the issues and will be good to, to have, you know, a bit more information on, you know, this type of studies results and you know how other people in other areas, actually are trying to deal with it or how do they live with it so it will be very interesting for us.

Andy

Yes, definitely. We can set your final report. We can also invite you to our final presentation as well.

Mirian Bllachi

Please do, I will be very happy to follow your, your work and to support you, and just let me know. I mean, in what way I can support and I'm very happy to do so.

Eileen

Thank you so much.

Mirian Bllachi

You're welcome. Good luck for the rest of the interviews and you know, with the rest of the investigation. And yeah, I hope to, to hear from you soon. And, nice, nice things of course from you. Thank you very much.

Andy

Thank you.

Mirian Blachi

Thank you, bye.

## Appendix J: Prof. Marija Mustać, Geophysics and Seismology, University of Zagreb, Interview Transcript

Owen

Alright, looks like we are good to go. So just to start off, we just kind of want to know a little bit about you. So basically where are you currently working and studying what you're studying at the moment.

Prof. Marija Mustać

So I'm currently working at the seismological survey, which is part of the Department of geophysics at the University of Science, sorry Faculty of Science University of Zagreb. And I've been working here for the past three years. I have also finished my bachelor's and master's degree at the Department of geophysics in the field of seismology, and physics of the earth's interior. And after that, I went to pursue a PhD at the Australian National University in Canberra. And after finishing my PhD, I came back to Croatia and started to work here.

Owen

Okay, that's great. So yeah, obviously, earthquakes are a major focus of our project. So one of the things we're interested in is kind of what types of infrastructure end up being heavily affected or affected the most by earthquakes?

Prof. Marija Mustać

Well, it's mostly been some historical building so well, I think it's all masonry buildings that have been affected the most, and the buildings built after implementing seismic codes. So roughly after the 60's have been much less influenced by the earthquake.

Owen

So I also and I'm gonna skip down a few questions. So Eileen might get a little messed up, but so I know that a similar kind of in that entire the Balkan region, they all kind of have a communist past where they recently or not, so recently came out of it. And I know, like you said, buildings built in the 60s, possibly right in the middle of that kind of Communist regime of a lot of countries. Does that have any impact on you know, how does the communist history of a country or a Croatia simply affect the actual infrastructure in that city or countries?

Prof. Marija Mustać

Well, I don't think it really depends on the political system. It just depends on the occurrence of earthquakes. So, because major earthquakes in this area at the end of the 19th century. So seismology basically started here after the 1880, great Zagreb earthquake. And especially the beginning of the 20th century, when the Croatian geophysicist, [NAME] discovered the [INAUDIBLE]. So the boundary between their crust and the mantle, which was discovered that this building, and our department is basically based on the heritage from the discovery. And when it comes to buildings themselves, well basically you know, people sort of built with the materials and the knowledge they had. But the main change happened after the SCOPIA earthquake. So this happened in the former Yugoslav Republic of Macedonia in 1963. And the city was really heavily damaged, and there were a lot of casualties as well. And that made a huge impact on the former Yugoslavia. And it's sort of pushed for a change in building codes. And after that, once the buildings codes changed in the entire former Yugoslavia, and basically, they're much more resistant to earthquakes.

Owen

You are you are, you know, if are buildings that were built before ever required to be retrofitted so that they they meet certain codes or is it generally they're kind of grandfathered in if they don't meet the codes when they were already built? They don't necessarily need to I'm not sure what the answer to that would be?

Prof. Marija Mustać

Well, I'm not a civil engineers, so I'm not entirely sure about that. Well, I think it's mostly funding dependent. So I think the buildings are we're not required to have any retrofitting, but some for some more important buildings some studies were done if there was enough funding and or interest from the research community. But well, as far as I know, there was no requirement to retrofit older buildings.

Owen

Yes, so kind of on the same topic of not necessary retrofitting, but just kind of preparedness measures. Are there any current measures that are taken in Zagreb or just in Croatia in general, that basically prepare a city for earthquakes?

Prof. Marija Mustać

Oh, well, especially in Zagreb, there were some measures. So for example, a flyer has been made with the city, sort of an office for sorry, I don't know the exact English word for it, but for emergency responses, together with the seismological survey, so they made the flyer on how to prepare before and what to do during and after the earthquake for the citizens. And the flyer was

basically handed out to everybody in there, through the post. So just in their post boxes. And besides that, every bus and tram station had a map of the city with the marked evacuation areas. So for each part of the city, there was a designated evacuation area for the citizens to go after a hazardous event. So I think the citizens could have been prepared for such an event. And a lot of them knew sort of, at least roughly how to behave after an earthquake. And when it comes to the entire country, it also mostly depends on people's experience. So in the southern part in [inaudible], earthquakes are a lot more frequent. And people remember their crisis happened before and occasionally feel some smaller earthquakes. And they are much more aware of the danger of this.

Owen

So are there any, would you say these measures are, you know, mostly effective to the point that they need to be? Or are they sufficient enough to to get the job done to prepare for citizens? Or are there more measures that need to be implemented now?

Prof. Marija Mustać

Well, from my experience, by interacting with the people, I think they just did not take the measure seriously enough, I would say. So I think they just didn't perceive an earthquake as real danger. And they sort of ignored it as something that just popped up in the mail. And they could have been more aware, I think it's kind of hard to say. While also, I feel that there should be more education on natural hazards in the schools, and that would be a great way to educate everybody sort of the hazards they can expect. So after these earthquakes after the Zagreb, March 2020 earthquake, and especially after the December 2020, Petrinja earthquake, and schools in the affected areas had evacuation drills in case of a new earthquake. But this does not happen throughout the whole country. So it is just happening now in areas that were already affected by an earthquake.

Eli

So just to clarify, those earthquake drills weren't happening before these major earthquakes in Croatia?

Prof. Marija Mustać

Not in schools, no, but there were some earthquake drills organized by the Civil Protection part of the government that serve as a display for the citizens, I think once a year or something like that, but they are not much covered by the media. So I don't know how aware the citizens for these measures that were taken.

Owen

Yeah, it's unfortunate that to kind of get an understanding of how real earthquakes are, it seems to happen after there is an earthquake, especially I know, Croatia had a couple pretty big ones last year. But one thing that is kind of interesting is a lot of the earthquakes we've been researching, you know, we're in the 70s or 80s, even before, but Croatia has just recently had major earthquakes in and especially I think one thing we're kind of interested in is the response during the time of the COVID pandemic and how, how COVID kind of affected the ability to respond. Different medicine, different measures didn't show any measures that work really well or measures that possibly need to be improved upon how did the pandemic kind of affect the response.

Prof. Marija Mustać

I think at first on the day of the earthquake, it's probably had a positive effect. Because the earthquake, Zagreb earthquake on March 22, it occurred when lockdown was imposed in Croatia.

So there are basically no people on the streets and there was only one casualty, I think there could have been much more casualties or injured people if there's no lockdown in the country at that point in time. But on the other hand, the lockdown sort of forced people to stay in the house all the time. And there was much less traffic and much less seismic noise in general. So if you look it up, you can see how seismic noise reduced during the COVID lockdown in the entire world. So people were much more susceptible to feeling aftershocks. And I think that caused a sense of fear and unrest in the citizens sort of in the aftermath of the big earthquake, because as the aftershocks were occurring, people were being afraid even of the smaller earthquakes.

Owen

So you talked about some other people's reactions to the big earthquake and the smaller ones. Were you in Croatia at the time of an earthquake?

Prof. Marija Mustać

I was in Croatia, but since you're working remotely, I wasn't in the affected areas at the time, I was a bit further away.

Owen

Okay, that makes sense, I guess. Good that you didn't have to do it necessarily. But so how, obviously being in the technology community, how did your peers seem to respond to toward you or your peers respond to, you know, the feeling of finally a pretty decently sized earthquake? happening? Where I know I believe, I think that the last one was the 80s. I want to say before that I can't exactly remember the date. But what was that kind of like, finally, you

know, experiencing an earthquake after I'm not sure if you'd experienced them earlier in life, but after a major, or excuse me having that being your basically field of study for a while?

Prof. Marija Mustać

Oh, well, feeling was really mixed. Especially for me personally, I was really in touch with the general public through our Facebook group. And I was mostly Well, we all were sort of concerned for the fellow citizens, because people didn't have enough knowledge on earthquakes. And there was really a sense of fear, especially on the first day, there was a rumor that the larger earthquake is going to occur and tourists, panic was spreading through the citizens. So at first time, there was mostly the feeling was concerned for our citizens, and especially with all the damages that occurred is interesting from a scientific point of view. And really, we have gathered a lot of data. And now we have a lot to work on. So I guess it's mixed feelings, really. And when it comes to other earthquakes, I sort of have a unique perspective here, because I did my PhD abroad, and especially from Australia, that doesn't have major earthquakes in the country itself. I find it really convenient to do research, when earthquakes happen somewhere else. It's much more easier that way.

Owen

That is, yeah, we're in the United States, and we're on the east coast. So we're not an earthquake prone region at all. So it's kind of I think, we can all agree, it's kind of interesting researching this, because, you know, you see, like, a lot of people are super, you know, there used to earthquakes, it's kind of a daily thing, or a weekly thing, there's smaller quakes or they're big ones, or they're prepared for them that you're about them. Whereas, you know, I've never experienced one of my life. I've really never thought about it until this project, just not a big deal. But um, so it's really interesting to hear.

Prof. Marija Mustać

For my senior colleagues for the professor's here, they have never personally felt an earthquake and it's like, whatever, you know, I'm not sure that it can prepare you for the actual event. It just sort of react instinctively, more or less. And so all your knowledge comes after that first shock of feeling the ground shaking.

Owen

I know. In your email, you said that working on the geological survey In the survey, you were able to interact a lot of citizens through social media platforms. Could you just describe what some of those interactions were like? Now, you mentioned a lot of people were, of course, scared. But what were kind of the general sense of the public after the earthquake,

Prof. Marija Mustać

I feel it's kind of difficult to summarize everything. First people were a bit, they're criticizing our work, because since the earthquake happened here in Zagreb, actually are building didn't have electricity in the first hours. We have power generators for our servers. So the data kept coming. But since it was the time of the COVID, lockdown, it was not possible to work remotely. Although we were like, we were working remotely. But that just wasn't feasible because of the power outages, which happened just as a precautionary measure our basically, power supplies automatically shut down if the ground acceleration exceeds a certain level. So that was a precautionary measure. So people had to physically drive here from their home so they can provide information to the public. And this wasn't this couldn't be done in a timely manner for the general public. So the first reaction was criticizing our work. And especially when we've heard that rumors

of larger earthquake first spreading through the city, we're just trying to use the social platforms to inform the public on the scientific basis of everything, to inform them, that they can expect aftershocks, but that they will be smaller than then the main event. And that's the probability of a larger earthquake happening is very, very low. And later on, while people are fairly, really eager to get as much information from us as they could, and also, they were informing us real time of all the aftershocks that they felt. So it was basically similar to Did you feel it. JCS part of the of their work, or even like the European Mediterranean psychological center is an application where users can report feeling an earthquake, within a combat due to not our technological parties and that developed, we have only 10 people working in the seismological survey. And at the time, there are only four people and at the university doing research on seismology. So we're not really technologically developed to give information, for example, through an application on smartphone or something like that. So we opened the Facebook group as a way to communicate with the public is to be sort of open and approachable to them. And we used it. Well, the initial idea was to get information on the effects of the earthquake from the citizens. But as the citizens were full of questions. We're also using it to provide information to the public and to give notices on aftershocks that are occurring.

Eli

So, I'm sorry, I have a question real quick. Um, you mentioned that power supplies were shut off due to high ground acceleration. Was that just for the group that you work with or was that a city wide precaution?

Prof. Marija Mustać

It was part of the city that are closest to the epicenter. So basically, for whichever power stations that measured grant acceleration above a certain level shut down. So there were power outages throughout the city. In the entire city.

Eli

That's interesting. Yeah, yeah, I haven't heard of that before. Um, are there other similar measures that are taken at a citywide level event of an earthquake or is power being shut down really the main one?

Prof. Marija Mustać

Well, for Zagreb, there was really a plan on how to behave after an earthquake. So the city council had an office with a special room, basically a bunker for emergency situations where they gather all the relevant institutions or all the relevant experts, they need for a certain topic. So for example, one of the people from the seismological survey was in that room and giving information to the city council and to the government on seismicity that was occurring. So we're in constant collaboration with both the city civic Council and the government of the third country.

Owen

So we, none of us are super versed in terms of seismology, when it comes to the actual effects, but kind of similar to those questions. So what exactly is the main issue with the power grid during an earthquake? You know, is it just that you do? Like, what's the purpose of shutting it down? What does that help with in the moment,

Prof. Marija Mustać

It helps to prevent fire occurrences. So for example, and I think 1903 San Francisco earthquake there earthquake itself damaged the city a lot, but it mostly suffered from the fires that happened afterwards. And that was very common after every earthquake, and especially with in historical times where people had open fires in their homes, that there was just spread throughout the city. So as people don't have open fires in their homes anymore, like electric supplies can give a spark and cause a fire, which is a big hazard after an earthquake. So it is customary in some countries, at least it is in Croatia, as it was in the whole, former Yugoslavia to basically shut down the power if in case of an earthquake, well, Japan has a much more sophisticated system, where they even stop the trains running, etc. Yeah. And that's you and for early warnings. So after an earthquake happens, but before the seismic waves reach the affected areas, they will affect, they are able to shut down the tram wise. Pull down the power supplies and do other measures. I'm not sure what exactly, they do. In Croatia, unfortunately. Unfortunately, that is not possible. Because our faults, so our earthquake sources are basically beneath our city. And there is no time to implement an earthquake early warning system. But we have some measures, for example, as the one for the power power grids to shut that down.

Owen

That's really interesting. Yeah, it does. So we were talking before about how you were able to interact with citizens, kind of like in the immediate after effects of the earthquake, especially with the aftershocks. Now, having been a few months out a while after the first big earthquake in March. And now again, after the one in December, have you seen kind of the response to earthquakes

evolve over time or as a not as much communication with the citizens now that we're, you know, three months after the earth or four months after the earthquake, excuse me.

Prof. Marija Mustać

After the Zagreb earthquake, it was really tense, because typically found in a really densely populated area. And it continued for, I guess, about six months, when most of the aftershocks were happening. After that the interaction reduced a lot. After Petrinja their current situation was different. I'm not sure why exactly, but I think because it was a stronger earthquake, and it caused more probably more damage with the citizens themselves. So they were more focused on repairing their phones, and basically, they had bigger problems than to interact with seismologists and also we had a lot more work. And we were not able to spend that much time on social networks and to communicate with the public. Unfortunately, we don't have a designated person for public communication, it was just our voluntary work to help out the citizens.

Owen

Right with a group of I think you said, 10 people, I'm sure there's a lot of work that needs to be passed around. So like I mentioned earlier, our project is very much focused on kind of the socio economic or cultural different cultural groups and how they're there, they could be disproportionately or differently affected by earthquakes or redness. You know, are you aware of any influences or links between socio economic groups or cultural groups and varying earthquake preparedness measures, whether that be in Croatia or anywhere else that, you know,

Prof. Marija Mustać

I'm not aware that there should be any differences, I think it mostly depends on the education that people get, and on the preparedness of the country to react for these situations, so on the education of the government, when it comes to natural hazards. So I would say it is mostly a country that is mostly uniform within a country. Differences do exist, but they're mostly related to people's experiences. So in areas where earthquakes are more common, people are aware of the danger. I don't know if I think about it, maybe some national minorities, on average, are less educated. So I would expect that they don't receive Well, they don't get as much information as the other citizens. But again, I don't know. Well, based on their lifestyle, are they affected by the earthquake as much as the rest? I would rather not speculate on that. I. I'm not sure that within a country did you have many differences?

Owen

Yeah, that's definitely completely understandable. The insight, nonetheless, is still helpful. So we've already talked a lot about how the government is, how the government helps out when it comes to earthquakes. So I guess just kind of overall, what would you say the main role of the government is when it comes to earthquakes? What is their main job?

Prof. Marija Mustać

Basically, the most important thing is the immediate response. So I think firefighters were the main contributors, contributors here, because they were helping people and collapse buildings, sort of to find people that are in danger, and to help them out. And also to protect everybody from partially collapsed buildings. So in case there was a collapse chimney, so it doesn't fall down on the street, etc. Also what I think is a problem here is that hospitals are often located in old buildings, which

are maybe not all built according to at least not according to the most recent seismic codes. So there was a case during the Zagreb earthquake, a hospital that had newborn babies that were prematurely born, had to be evacuated, because of the danger of some damages to the building itself. So I think that's, that's basically the biggest problem, that some of the crucial infrastructure like hospitals are not prepared for such a situation. When it comes to the government, yeah, so their main purpose is the immediate response so to secure that no further damage occurs in the city and endangers the citizens and to help out the victims that are occurring, but also I believe to calm down the situation and to reduce the panic that happens after such an event. I think like after the Petrinja earthquake, there was so much damage that it was difficult even for all the government institutions to handle it and there was actually a lot of effort from the citizens themselves, like people from all around the country came to help out the people that lost their homes, and that had to be displaced. There were donations for human material aid, and to give people some accommodation, at least in the first days after the earthquake.

Owen

Yeah, that's very interesting. I had a question about the hospitals, but I'm blanking on it now. I guess so you did mention that there was a lot of damage on the city. Was there? Was there any, like noticeable patterns of like, where the damage actually was? Was it on the inside of the city? You know, kind of centered in a in the center of the city? Or was it a lot on the outskirts? Was it just mainly the tall buildings? Is it really the only the old buildings where were most of the damage located?

Prof. Marija Mustać

Mostly in the old historical parts of the city, because the the buildings were all the amount built according to today's codes. And of course, in the very epicentral area where the ground shaking was most intense. And there were some also geological effects. So for example, in certain places, after the Petrinja earthquake, there are occurrences of liquification, where the ground is saturated with water, and then it sort of became starts behaving as a quicksand. But that didn't affect the infrastructure that much. But there were some I'm sorry, I'm not sure of the English term, because I'm not a geologist. But basically, pitfalls were occurring in certain places, just as a geological effects of cavities in the ground that were present before the earthquake. But then the top of the cavity just collapsed. Because of the shaking. So basically, big holes appeared in some places.

Owen

Terrifying, I think, is a good way to put it. In here, I'm looking for questions. You know, I believe that's mostly what I have. I don't know if UI or even Eileen, if you guys have anything to add or any other questions.

Eli

One other question that I'm curious about. We've asked some residents in Albania, what media coverage was like their what they saw on the news in the aftermath of the earthquake? How do you remember what the media coverage was like after the earthquake in March?

Eli

When it's not really, there was just so much work to do that I didn't have the time to follow the media reports. I know there were on site. So during the Petrinja earthquake, there was an event before the biggest earthquake. So the media was already there. And when the biggest earthquake happens, they were interviewing somebody, and you can actually see the wreck happening on the cameras they had at the site. And the media mostly focuses on the most dramatic things. So perhaps it might induce more fear in the citizens. But besides that, we're very interested to hear the experts' opinion. And seismologists, geologists, civil engineers all started to appear in the media in the Primetime shows during that period, so they're also like trying to interview the experts in the fields. Which is good, I believe.

Owen

Yeah, really interesting. So I guess the Last question we would have. So I know we talked about it. Sorry, Eileen, go ahead. I'll let you go. Before I go.

Eileen

I did have one. One question. You had said that some of the crucial infrastructure was not prepared for the situation, is there any chance you could elaborate on that?

Prof. Marija Mustać

Well, a lot of the buildings are situated and up, sorry, a lot of hospitals are situated in historical buildings, which are not built based on today's seismic codes. And also, they are located in city centers, which are mostly affected during an earthquake. So it wasn't the case with these two events, but in case of a bigger event, you could have a situation where even if everything around

the hospitals collapsed, injured people couldn't reach the hospitals and couldn't get the help that they need. And I think that is a big problem, I believe in the entire surrounding area. So not only that, but also the neighboring countries.

Eileen

Yeah. Are there other parts of infrastructure that you think are vulnerable in the same way that hospitals are?

Prof. Marija Mustać

Well, I guess some fire stations and police stations are also located in city centers that are mostly affected. Besides that, sorry, I'll just check my notes because I prepared something. Oh, yes. And now, the Zagreb earthquake, it's happened in the capital. So a lot of university buildings and a lot of schools, so not only Zagreb, but also for the other earthquake in Petrinja. It affected a lot of schools that were in city centers, so in these historical buildings, which was a problem because children could not attend schools afterwards. And there were measurements to repair them as soon as possible. But it was not possible. Like it was not feasible for all the schools to some other, for example, like children from some schools that were most heavily damaged, were transferred to other schools and measures such as these happened.

Owen

Yeah, that's interesting. I never thought about the idea of, even if the hospital is in the sort of damage, if the buildings around are damaged, the access to it might be difficult. That's not something I've never even thought about. What's really interesting. So I think, I guess our My last question would basically just be that, so of course, we're doing all of this project, this project,

highly remote. And we would have been, you know, in Romania or seeing people within Croatia, it's kind of difficult to access these contacts too briefly So are there any people that you may be able to provide us with some contact information with that we might be able to access or we may be able to contact? Who wouldn't? Who might have some good information for us about our topic based on the questions we've been asking that you think might be helpful.

Prof. Marija Mustać

I'm first, personally not involved and collaborations with the city council or government. So I'm not sure I can't think of anybody right now. Perhaps you can contact the civil engineers correlating enormous work after both of these events, because they were in the field from the very first day accessing the state of the buildings to check if they are like if the buildings can be used anymore. So to check their state. I'm just looking at some contacts. Maybe you can ask them, they'll probably have a lot of information, but they're quite busy. So okay, I can give you a couple of emails. So basically, it's an organization of civil engineers that we're doing that protecting the buildings after after both earthquakes Sorry,

## Appendix K: Prof. Robert Hersh, Interdisciplinary, Worcester Polytechnic Institute, Interview Notes

Zoom recording did not function properly, therefore notes from the interview are included. Responses from Robert Hersh are italicized.

1. Were you in Albania when the earthquake happened?

*Yes*

2. What were your experiences during the earthquake?

*I remember coming back, it was just my wife, who met a future sponsor for the Albanian project center in a restaurant. At around 3:40 (in the morning) we felt an incredible sharp movement. Everything seems to be moving. We were on the top floor of an old building. You know, one thought, you can't get under the bed (no clearance), you think in the fractions of a second how poorly the buildings were constructed. The old school of thought you would stand under a doorway (lots of wooden "meat" there so to speak). That wouldn't work, the walls in Albania are ceramic blocks. 30-45 seconds there was shaking, then it stopped. Thought I would see lots of damage, but to my surprise and delight there wasn't any damage in our neighborhood. The next second, what do you do? You're an advisor, so we called all of the students. First concern is what happened to the students. Sent out a note to our general slack channel, asked "is everybody alright? What's going on?" wondering if the message would send or not (didn't know about damage with respect to network connection). I think it was a mixed bag, most of the students slept through but most of the students were awake (?) and saw what other people were doing in the building. They lived in a 9 story building. A lot of people, because there had been an earlier earthquake in September of that year, a lot of people decided to get out of the building and headed to the street. In some ways, that might not be the best idea because you don't know if other buildings (lots of apartment*

*buildings) would be safe, whether you would be exposing yourself to more problems. Most people weren't making that kind of risk calculation. Most students went out into the streets, then I think they, it was clear the building was standing, I think after a few hours, it was November it was cold, they went back in. That was the first 2, first 3 hours of it. You would hear alarms, you would hear car alarms going off, there would be other alarms. I remember 6:30 in the morning I walked up to see how the students were. You could see there was superficial damage to buildings, I didn't see any collapsed buildings, this is in Tirana. There was, that was the experience I had. I think we had a couple of days before the Thanksgiving holiday. A lot of people were scared because there were aftershocks, and everybody managed to get a powerful and accurate application on their phone which told them about the aftershock (many of which you couldn't feel). You would feel some of them would freak people out. That was the experience in the 24 hours after the earthquake from my point of view. There are other things I could tell you about with respect to anger and frustration from the Albanian population.*

3. What was the social atmosphere around (earthquake location) following the earthquake?

*Longer story between population and the government. Government is seen to be extremely corrupt, seen to be a narco state. A lot of money from selling drugs in Europe cementing the power of the socialist party. Elections are bought, bribes are part and parcel of any project, and unlike in the US or many other countries, if say for example the Democrats won the recent election, that doesn't mean that people from the civil service are thrown out of their job. Civil service still remains in Albania, when a new party comes in, for reasons of patronage and bribes, they get rid of the equivalent of FEMA, they get rid of it all and put in their own people. Less continuity between administrations, and a lot of people put into those tasks are not well qualified, they are put there for a reason not about qualification but because they donated money or brought in votes for the*

*party. There were people who believed they would be doing useful things, the PM was the mayor of Tirana before, over the course of 6 or 7 years lots of people considered him to be a “Pharaoh”, not to worry about the well being of most people. How did this play out? In 1991 (?) when the communist regime fell, it controlled where people could travel and live. They wanted to keep a backbone of collective agriculture to feed the country, and they didn't have the infrastructure in place to house people in the city. After the regime fell, people said “I'm leaving, it's hard living, the work is difficult, not effective schools or welfare”. 600k (?) left the country out of a 3M total population. Now the population is around 1M. People from all over the country moved to Tirana. No planning, apartments were built without permission, without licensing, it's not as if you have building codes that mean anything. You had places that were built on places where the soil couldn't really support that size of building. You can't blame the government for that, there was a nature of post-communist dynamic following that. There was during the Rama (?) administration, there was a lot of speculation in the property market and a lot of building, and building in places where they shouldn't be built on (swampy areas that don't drain well). Some of the damage in Tirana were to newer buildings that were housing people with larger incomes. There was anger at maybe a week or 4 or 5 days later that the system was so corrupt. There was no proper set of applications for buildings, no real inspections. There was a sense that there was damage in Tirana (not as much as Durres on the coast). Growing anger that the system was in place, if you could build a machine that would make people vulnerable to an earthquake this is what it was. No site inspection, no permitting, contractors who might be cowboys, not an effective damage assessment after the earthquake. How is it that the system is in place, how did it make us vulnerable? I think people knew since there wasn't transparency. What really got people upset is in the previous earthquake in September 2019 in the area around Durres. Part of it was Roman. It was seaside, it's a big port.*

*A lot of drug money was washed and made into hotels. Phalanx of hotels that go for miles facing the Adriatic Sea. Close to the epicenter of the earthquake. In September there was an earthquake, and there was a damage assessment, some houses were condemned. I think, not sure what the sign was, but there was a sense that these buildings or hotels should be condemned. Municipal government of duress nor the central government provide opportunities to find other accommodation. No money available to find new accommodation. The stories that came out, I heard various things about people paying off inspectors to let them stay (not sure about the validity). Hundreds of houses condemned. 7 weeks later some of those houses collapsed, people died in them. So when this story came out, people were livid, because Albania there are 2.8M people, there was a sense of it being, each victim is somehow someone known to you. There was a closeness about that. Mixed with anger there was a deep shame that in the hours after the earthquake, when people were trying to dig out survivors, Albania emergency response didn't have anything that could do the job. Not adequate expertise, materials, equipment. The first people that could do the job were people from the neighboring country of Kosovo. Mainly Albanian, part of Yugoslavia, fought a war against the Serbs. Very impoverished, not much in the way of resources. Our poor cousins in Kosovo were the ones leading the emergency response. Also people from Greece, and the Italians came. Many countries trying to do this, but Albania didn't have the wherewithal to do it. A lot of shame and anger. Came in waves. First thing was the sense of Albania couldn't get together the response to save people in the aftermath. Those people died even though their houses were condemned. Why couldn't we help people move out? Even at the local level, when people know each other because of the municipality, not having a national election or anything, people weren't looked after? It grew to a large portion around Tirana where the damage wasn't as extensive, but it was significant. Raised questions around national response planning,*

*made people feel that the corruption was party of daily life there has this effect. Was a reckoning of sorts for these people.*

4. Was there media coverage of disaster relief?

*I don't speak Albanian very well. My sense was from talking with people and watching English language press that it was very negative. Why has this happened? Why can't we put together an effective response? Who's to blame? Would be a great question for people who are Albanian. There's more Cafe's per capita in Tirana than other countries in the world. There wasn't a sense I had, there were pictures of damaged buildings and foreign emergency response teams. And angry people denouncing what had happened. Didn't see any positive coverage, don't think there was that feeling of the time.*

5. To what extent did the earthquake change any aspects of your life?

*It's not so much that respect, but it's, you know, when you're an advisor and you have 24 students you're responsible for, you do wonder how fortunate it was that none of the students were injured, that the building we put them in was well built. The person who built it, the landlord, someone I knew for the last 7 years. I think he did things well, they showed me the blueprints, I assume they followed, the structural engineer was impressed by the strength of the building. You just feel like, well, how do you try to offer students an experience that is a powerful experience in a way that it is very different? In a place where codes or (?) aren't enforced. Is it worth the risk? That's what I felt. The aftershocks I wasn't so concerned about, but I was concerned with the students' mental health. It's hard when you're 21. Different when you're an old guy like me, you've lived through other things. You're very concerned about how the students are responding, they're picking up on a lot of the fears of the local population. When you feel a little shake, everyone would sit and say nothing (in a restaurant). How do young people manage that? Away from their families,*

*don't speak the language. That's what I felt, what does it mean to take people to places, part of the global program, that's what I thought. Didn't really change my risk tolerance. If you're an advisor, you have to have a pretty high risk tolerance. You have to have certain people understand what these risks are. In Albania we talked about meeting points, what to do and where to go if a natural disaster happens. Didn't talk as much about earthquake preparedness that we could have.*

6. Do you have friends or family that have experienced an earthquake? Would you be willing to provide contact information so that we could reach out to them about a possible interview?

*Structural engineer, also been involved in bidding for contracts. He's 28, something like this. Works for an engineering company that does road building and infrastructure work, mostly road building. His company had been bidding for work on rebuilding parts of Duress. In Tirana at the time. He also looked at our buildings, he did the assessment of our building. He knows WPI well, he's somebody I've known for 5 or 6 years. Spent his Junior year in Wisconsin*

Extra: First major earthquake you had been in. Feeling aftershocks, does that change how you expect it to come? Does it seem like it's going to be another major earthquake?

*The science suggests that the aftershocks are less likely to be another big one. Result of tectonic plates sorting themselves out. This is a natural occurrence from a seismic event, so you don't feel it bears such a risk if you're going to have another big one. There is a sense that if people who don't necessarily trust what scientists are saying, or they feel that their building in some ways has been damaged in ways they can't quite see, even a small aftershock could be problematic. I know people who were sleeping in cars with babies, people who didn't want to go back in or go back to their villages. Many students went to different places for Thanksgiving,*

*managed to find some structural engineers to evaluate where they were staying, most surficial (superficial?) damage.*

Extra: What have they done a few years later?

*Haven't been back since because of COVID. I think they, there has been, a couple other things. So one of the difficulties was there wasn't an effective emergency response plan to help people in Duress get food. This distributed food to places where there was no electricity, people were out of their house, it was a private sector, the people who I had dinner with the night of that earthquake. People I had dinner with worked with agro-tourism. Organized with farmers to create a feeding plan, but this was all private sector. I think what's happened, I have friends that were architects working with Cultural Heritage Without Borders. They went to Duress along with other people, can't remember the name of the org, "national risk management group" or something, they in Duress were doing surveys of all of the buildings, so they, I think there has been a lot more work now looking at the ramifications of the earthquake, trying to assess structural damage of the earthquake. I haven't followed it with respect to what changes have been made in the policy world. I know they have been trying to get, for rebuilding Duress, they've been trying to get EU/US funds. But they need buildings, I think the rebuilding will be going slow because it's a poor country, the money they collect through taxes.*

Extra: Compare and contrast between the countries the difference between Albania and NZ?

*(?) has done so much about rethinking its codes, about public outreach regarding if an earthquake/tsunami happens. In the forefront of people's minds, so much more prevalent in NZ than in Albania. Elected officials in the bureaucracy that are more responsible that have public*

*interests at hearts and fiduciary responsibility. You look at NZ's COVID-19 response. People in the power of government are trusted. There's a strong risk in how people understand risk. To what extent people see the extent to which risks are imposed on me, vs risks that are outside any, that are natural earthquake risk. These feelings change based on how much the government is trusted. IN the case of Albania natural risk is amplified, in NZ they're dampened by public information campaigns, building codes, retrofitting, and a clear idea of what to do. These are things that Albania doesn't have, like emergency response plans, adequate resources to maintain and upgrade plans, oftentimes you plan for past events but the current earthquake has a different set of demands. That's for me, it's hard to disentangle the natural risk from the apparatus around response. In Albania because there was little belief in government, .... That was my sense. Two different societies, two different political systems.*

## Appendix L: Rachel Kinicki Interview Notes

**Lead Interviewer:** Andy

**Secondary Interviewer:** Eileen

**Notetaker:** Eli

Writing in italics are the responses of this interviewee.

1. Can you tell us about your experiences during the earthquake in Albania?

*Sound asleep, staying in a 4th floor walkup apartment in a 5 story apartment building.*

*When you came up the stairs were kind of interior, but open to the outside. Small one-bedroom apartment. Sound asleep, an earthquake hit at 4 in the morning. Woke up, “what’s happening? What’s going on?” feelings. Realizing it’s an earthquake, watching the light fixture (domed fixture on a single string/cord/whatever) swinging like crazy. What am I supposed to do in an earthquake? Get underneath heavy furniture, but trying to get out of bed might be a bad idea (violent shaking). Could hear people above reacting to the earthquake, they were sort of pounding on the floor, could hear them headed down the stairs. Seemed like it lasted forever, in reality it was about 40 seconds. Will the ceiling collapse? Am I going to die? I couldn’t get out of bed, the room was shaking so much. Ended up staying in bed, it stopped shaking, thinking “now what?” Went back to sleep afterwards. Could hear commotion in the streets. Many people out in the streets. Many people seemed unsettled by what had happened. Because it was so early in the morning, I touched base with the students who were a 3-4 block walk from them to make sure they were all okay.*

2. What were your experiences in the hours after the earthquake?

*Hit on a Tuesday morning of a Thanksgiving week. Had arranged for a private driver for Wednesday (don't remember exactly) to get a tour of Southern Albania. Spoke both English and Albanian, could help interpret what was going on in the news. Center of the earthquake was about 30-40km, that town had suffered major damage. Leader of the country's son's fiancée and family died in the earthquake. Albanians have this "moral code" called code of Besa, should treat a visitor like god and would take care of them. All hotels opened their doors to people or Durrës to let people stay there for free. Nobody should be here, but everybody had left the city because they were terrified. Everyone was being taken care of by the Albanians. War with Kosovo, Albanians had taken care of people in that region, and they offered the same during the earthquake. Sense of community, wondered if you would ever see that in America. Found it very enlightening and welcoming. Kept wondering what Americans would do in that situation. Would we be so good about taking care of our fellow Americans?*

3. What were some physical changes around (earthquake location) after the earthquake?

*Cracks along the plaster in their apartment were repaired while we were gone. Buildings are built differently, not a lot of weight on the side/exterior walls, so they're better able to handle earthquake damage. Trying to do the buildings to be more earthquake-proof. Took us to a religious place, not a mosque or Christian place. It was closed because of the damage, but could see cracks in walls through the windows. Duress is known for its amphitheater and roman ruins which also took a hit from the earthquake.*

4. What was the social atmosphere around (earthquake location) following the earthquake?

*Had gotten stories from another guy who had taken the whole group on a hike. Talked about a situation during WWII where an Italian soldier being hidden by a family, instead of turning them over to German troops, son of the owner of the house said "I'm the Italian soldier" instead of giving up the soldier that they had taken in. Back to the code of Besa, "treat a visitor like you would treat God"*

5. What were the emotional reactions of those around you?

*I don't speak the language, but you could tell people were very nervous. Much more time spent outside even though it was cold. Staying near the center of Tirana, I could see small groups of people talking on the streets/sidewalks discussing the earthquake. Were playing clips from the earthquake and interviews from officials from the government talking about the earthquake, basically everywhere. People congregating and talking outside (instead of inside), probably talking about their experience with the earthquake.*

6. What types of assistance did you witness in the aftermath of the earthquake?

*Don't know, didn't affect me.*

7. Was there media coverage of disaster relief?

*Covered both disaster relief and what had happened. Rescuing survivors, damaged buildings. Had an earthquake a couple of months earlier. A lot of anger because a lot of damaged buildings after the first earthquake were not pulled down, and collapsed killing people in the next earthquake. A lot of angst that those buildings had not been pulled down.*

8. To what extent did the earthquake change any aspects of your life?

*Well, we were supposed to be in Romania right now! Wouldn't want to stay in a building with a red dot on it. Maybe you make sure your affairs are in order before you travel to somewhere earthquake prone. You have to live your life, they are such random events that you have to hope you're not in the wrong place at the wrong time. Probably would take more precautions before you left. Not like a storm where you can prepare, it's more about the shock factor when it does occur.*

9. Do you have friends or family that have experienced an earthquake?

*Nobody that has experienced a major one. Daughter may have experienced small ones in California.*

*Sent an email to family back in the states, who had no idea that an earthquake had happened.*

*Made it clear that people don't pay attention to all international news*

Extra: Would you be willing to provide contact information so that we could reach out to them about a possible interview?

*Albania's economy is depressed compared to the US economy. Helped the driver get income to help pay him during the off-season. Went through a travel agency and they arranged the private drive. Didn't notice any shortage of buses since they weren't using them. A lot of people were roaming the streets, hotels were fuller than they normally were. One of two people in the hotel originally, then every room (including theirs) was full. Took everyone a couple of days to*

*recover and go somewhere else. Hotels are small in Albania, hotels will have 20 rooms, not 200 like a Marriott.*

Extra: Was your response different from the locals?

*To experience such a strong earthquake was pretty shocking. Couldn't speak as to how other Albanians would have reacted. Had been in a really small earthquake in California in a hotel. Quick earthquake, very small. The one in Albania seemed to go on forever, and was much much stronger. Can't speak to how Albanians had been, but they had been through the one in March. Were angry because the government hadn't done what they could to prevent damage from the second one, w/re to buildings damaged the first time around.*

Extra: Other assistance in the aftermath of the earthquake?

*Taking in people and helping where they could. Trying to dig through the ruins to find and rescue people. Other countries (Croatia and Kosovo) were taking in Albanian citizens that had taken them in during previous wars. People were just really nice to other people and tolerant to the chaos.*

## Appendix M: Prof. Bogdan Vernescu, Office of the Provost, Worcester Polytechnic Institute, Interview Transcript

Owen

Perfect, we are all set. Thank you so much, Abby, you are good to go.

Abby

Okay! So, I guess our first big question is could you tell us about your experience with the 1977 earthquake? Uh, like where were you, and

Prof. Bogdan Vernescu

Yeah, so, I can't remember when, so it was in the evening, I was a senior in high school, and I was studying for a geography class or history class the next day. I was reading from the book I was in my bedroom, all of a sudden the bed started to shake which was kind of -- we used to have small earthquakes, so I knew what an earthquake feels like. So, oops, there was an earthquake right now.

Here. Right now, there was an earthquake. Isn't that funny?

Abby

Oh. Wait, really? That's crazy

Prof. Bogdan Vernescu

The house shook

Abby

I saw your camera shake, that was nuts

Prof. Bogdan Vernescu

Speaking of earthquakes. It's a sign. We should check the, what's it called, the earthquake center. Anyway. So, my mother immediately said "go under the door" and so we were in an apartment building, so the doors were the place that you wanted to be, or the tables or something. It looked like something that would never end, because I was used to earthquakes that were short in time and not spectacular. And at some -- so the light went off, there was this horrible noise, and I thought "that's it". When the noise, uh, uh, stopped, my mother said "are you okay?" and I said "I'm not sure, my knees are shaking" I'm not sure if it's an earthquake or if its me. My dad of course was going to the apartment to see if there were any cracks or if any civil engineer would check the building, and then everybody in the building started knocking on the door, because he was has PhD in civil engineer in the building so everyone wanted to consult him, should we stay or should we leave? The traditional earthquakes in the US are (inaudible), but in Romania they (inaudible). And therefore we all stayed. My father was very confident that the building was, although it was an old building, it was very well built. And so we were, the people in the building were the only people who didn't go out into the street. The rest of the neighborhood went outside on the street. We could see them from the window. Little did we know that actually the building that was next to ours collapsed. And that's why there was that horrible noise. It was a 7-8 story building that collapsed. We were just separated by, it was wall to wall. In the back, not in the front where the street was where you could really see it. That was the horrible noise that we heard. And we only figured out the following morning. It was disbelief. What happened in Romania after 1944, after the end of the second world war, the soviet troops came in and Romania flipped from being a kingdom to being a communist country, mostly because the soviet troops were in Romania and the (?) was coming from Moscow to transform Romania to communism. All the intellectual people

who had studied with a college degree or leaders of the parties and leaders, you know, of the economy were all taken to labor camps or to prison. And, and, the, uh, mantra was we, uhm, we, uh, protect the workers. It's the workers that get us to the rest of the classes. If you were a capitalist, you were an enemy of the people. My grandparents went to labor camp. And, uh, uh, the idea was that the economies in these countries have to be self-sustaining, and they should not be dependent on the rest of the world that might not view the political views. You should not import from the US. And, so, uh, or not even play golf because golf was seen as an American sport. So golf was forbidden in Romania for the time of the communist. So, so, you, I'm just giving you a bit of background of some things that you might not understand, the context of, but uh. And then the idea was since the working class was the leading class of the society, and since we did not want to depend, or they didn't want to depend on other countries, the industrial, starting to build an industrial base so the country is self sustaining. So everything from food to cars to airplanes had to be produced inside, not imported, right? And so, lots of factories started appearing everywhere, and so there was a big move from the countryside because Romania was at that time an agricultural type of country, to the cities. And therefore all these really ugly apartment buildings appeared, were just concrete, very small, with practically no closets, I mean people were storing things on the balconies because they didn't have space inside. And there was this, all this ugly communist architecture that appeared, and everybody who was living in those places thought that, you know, these are not really well built, built really fast, not built with necessarily good materials. These would be the first that would collapse when an earthquake would come. And so, I was in the older building that was built at the beginning of the 1900s, and everybody thought that these were the buildings that were actually the ones that would be more, more safe. Uh, and it turned out that a lot of the older buildings collapsed because, by the way, all those buildings had been in the 1944

large earthquake, and survived, and so the second time they didn't survive. And so, one of my aunts was in one of these communist apartment buildings was really panicking, called us, and said ‘we're coming to sleep in your building because its safe’ and so, the next morning, we realized that actually the old buildings had collapsed, not new buildings, and actually it should have been the other way around. (inaudible). But it was a big tragedy, 1400 people passed away, you know they searches with dogs like its done during the, at the earthquakes. There were some people that were saved. And, uh, we were at a point where everybody knew someone who passed away. And so after, after 1990, sorry, after 77, there was this committee commission with my uncle to look around and see what buildings need to be reinforced, and, uh, and, uh, somewhere but not all of them, because of lack of money, basically. Funds. And so, uhm, there was some public buildings that have, were reinforced, some hotels, but not a lot of the other buildings. So after 1990, uh, there was another effort, so, you know, the communist regime was over, going into the free market economy, uh, and there was another affect to assess the infrastructure assess what needs to be done. And so, the apartment buildings we were, my parents lived in, which had been reinforced, not a lot but a little bit, there was some changes made in that building because there was (?) at the ground floor and they wanted to take out some walls, the structure of the building had been jeopardized. So when my uncle came and said “here the wall needs to go back here, this thing here needs to be fixed”. So that was done. But because of that, there were a hundred or more, actually, uh, apartment buildings that were deemed as needing more repair. More reinforcement. And, so, the government decided to put on the walls of these buildings a big round circle, you know about that? It decrease the value of all of the apartments that were in those buildings. And, uhm, some people actually exaggerated the need because they were wanted to have their building new, made as new, right? And uhm, so, but, nothing happened, that particular apartment has not been reinforced ever since.

Every year or every two years someone comes in from the city and says “this year we will do this” and then nothing happens. I kept the apartment for a while, then I decided to sell it, and still nothing happened. Yeah. So that’s the story with, uhm, with that. There were lots of strategies at that point in time. One of my good friends was, because, he was being (?) for math, we have this entrance exam for the university, he was at his (inaudible) place, and uhm, his, the building where he lived collapsed, and his parents and grandmother passed away. He was all of a sudden orphan in a few minutes. Uhm, and so, uhm, that was a sad story. Uhm. But there were people who survived. There was this apartment building downtown where there was this old lady, uh, that my mother knew, that, uh, she was, she had a big appliance (inaudible) and the building collapsed with her big plants [I think he had said she was watering her plants on her terrace] and she, of course everything was dark because the electricity was off, and the, uh, she started walking, and she found herself on the street. Because the thing collapsed, she was outside, it collapsed, she kept on walking and she was on the street. Because it was just the, uh, rubble, mound of rubble. And so, uh, some people survived. Even in collapsed buildings. There was uh, person who responded in, there was a guy in the basement of the building and he was found a week later. So there are all sorts of stories. But the point is that nothing much has been done with these buildings. And, uh, that’s why all these uh, civil society and NGOs are interested, I mean the uh, (inaudible) for instance, they wrote a, uh, article that actually generated some (inaudible) change. So by the way, I know the editor in chief of the publication, if you want to, and actually met also the author of the article, uh, but I don’t know if she remembers me or not, because I was at one of the meetings. I can put you in touch with her. And then, uhm, my, my, my uncle’s thesis at the university was how to reinforce, how to build uh, concrete, he was an expert in concrete buildings. (inaudible) concrete buildings that are resistant to earthquakes. And then there was no legislation about that, and uhm, the legislation was

introduced afterwards was based on some of his works. That's why he was on all these committees and commissions to assess these damages. Also. So, questions? What are your questions?

Abby

Okay, yeah, that was a lot. I want to kind of go back a little bit. We were talking about, right after the earthquake you said that they came and gave your apartment building a red dot--

Prof. Bogdan Vernescu

That was many years later. That was after 1990.

Abby

Yeah, yeah. Do you think that a lot of those buildings that have been given those red dots haven't been rebuilt? I know you said yours hasn't had anything happen to it. Is that a common thing do you think?

Prof. Bogdan Vernescu

Yeah, yep. That is common. Very few of them. Very few.

Owen

In terms of the amount of buildings that have been given red dots, everything that we read has suggested that, yes, some buildings have been identified, but most buildings in Bucharest have not yet been classified in any way shape or form, whether or not they are ready for another earthquake.

Do you find that is the case now in Bucharest now, do a lot of buildings still, are they not sure what the case is going to be with them in the next earthquake?

Prof. Bogdan Vernescu

That's correct. Yeah. There is, there has been very little work. For, you know, a number of reasons, but the result is that things haven't been done.

Abby

Did anything, so, after the big '77 earthquake, did anything change in the way that, like, society felt, in, uh, Bucharest at that time? Like, obviously there was a lot of repairs and stuff, but did you notice any major changes in the way that people were building buildings or the way people were approaching their own safety?

Prof. Bogdan Vernescu

So, there is some legislation, and I don't know if you guys can figure out when that was passed. That, uh, is, is requiring new buildings to have some standard of safety for earthquakes. Uh, but, so, going forward the new buildings that are being built are being built with safety for earthquakes. I don't know what the standards are exactly. Are they comparable to what standards are in California for instance? Uh, I mean, even in the US if you look at the different states, the standards are different. Massachusetts and California do not compare. That's my grandfathers (inaudible) (ringing in the background). And uh, uhm, uh, so, so, the new buildings are okay, the major problem is with what happens with the old buildings. The problem is that some people think that that is a, no, if I live in a newly built building it is okay, except that the earthquake doesn't always catch you at home always. It can catch you at work, it can catch you on the street, it can catch you anywhere. I think what people don't realize is the fact that these buildings that are (inaudible) major earthquakes, are not being consolidated, or not being repaired, is a problem for everybody, not only for the people who live in those buildings.

Abby

Yeah, so do people see it more as a problem of “oh they live in that building, that’s their problem, not my problem?”

Prof. Bogdan Vernescu

Right.

Abby

That definitely makes sense. Do you think experiencing that earthquake has changed how you think about earthquake preparedness, you personally?

Prof. Bogdan Vernescu

Yeah, of course. It's a traumatic experience. And, and you, whenever something like this, like today, for instance, I'm really curious I need to go and check, uh, uh, when this happens, you know I do remember my friends pass away with the buildings next door where I have friends. And so, yes, of course, it's a traumatic experience that (inaudible). On, on, on the other hand of course, it's something that you can't help, right? If the earthquake happens, it happens. It is something that you can't really prevent. Uhm, so, I do know to worry about things like earthquakes.

Owen

I have a quick question. You mentioned that, you mentioned obviously that the red dot buildings, not many had been classified, but do most Bucharest residents know what that red dot means? It is a very common thing that everybody knows about? Or is it more just like, you see it, and you're curious and you look it up?

Prof. Bogdan Vernescu

No, everybody knows, Everybody knows it. For example, my apartment is for a young couple with a one year old kid. They wanted to move in, I mean, right? Were not that concerned for themselves or for their (inaudible). So, uh, they, they, some, uh, risk avoidance that is also happening, which is, “ah, for the next ten years it probably won’t happen so it’s fine” which is, you can never know this. So.

Abby

So, in situations like that, where people are moving into buildings they know is unsafe, are there any well known ways that people can try to protect the buildings, like easily? Like is there anything that someone who is moving into a red dot building that they can do to protect themselves that you had been made aware of as a resident? Uhm.

Prof. Bogdan Vernescu

If the building collapses and you are there you can’t do much.

Abby

Okay, yeah.

Prof. Bogdan Vernescu

So the problems are with the city hall who are supposed to do these things. And they are not. And we had several mayors in Bucharest and they all, you know, in the campaign they said “yes we would do it” and then they didn’t. And so the next person comes and says in the campaign they say oh we will fix all the problems. And they did some, but not that many. So there is still a long list. And that would be interesting for you guys to find out.

Abby

How do you think that residents of Bucharest feel the government is doing regarding earthquake preparedness? You seem to have a pretty grim view on how they are doing. Do you think people share that?

Prof. Bogdan Vernescu

Yeah, that's why the politicians in the campaigns talk about it, because the population cares about that. But then they don't really deliver.

Abby

It's a lot of empty promises.

Prof. Bogdan Vernescu

Yeah. That's true not only for Romania.

Abby

Yes, yeah, it's a common thread.

Owen

That's for sure. I see, I have a quick question. Abby has asked about, kind of like is there anything the government had told you to do about red dot buildings. I don't have the article up so I can't remember exactly what but I believe there was a massive earthquake preparedness drill in the past couple of years, past few years. Was there anything like that, you know (inaudible) of the 77 earthquake or afterwards, or any mass preparedness campaigns or anything you remember?

Prof. Bogdan Vernescu

By the way, I left in 1990, so, I'm not sure what happened in between. Yeah.

Abby

Also, kind of going off of that, you had said that you knew to go to the door because it was the safest way to go. How did you know where to go during that earthquake?

Prof. Bogdan Vernescu

Because both of my parents were civil engineers (laughs)

Abby

That's fair.

Abby

Uhm, I think that's all of my earthquake questions. Owen, do you have anything else you want to ask?

Owen

No, not particularly.

Prof. Bogdan Vernescu

Okay, so you have homework, if I can give you homework.

Abby

Yes.

Prof. Bogdan Vernescu

Give me a list of things you want to have access to and I'll figure it out for you, okay?

Abby

Absolutely, its sounds like you have a lot of really good contacts over there that.

Prof. Bogdan Vernescu

Yeah, I still have a lot of, you can imagine that a lot of my friends from childhood they are old and are politicians or attorneys or doctors or engineers or they are all somewhere. You know. Uh, members of the European parliament, also the connections. We can get connections for you guys.

Owen

That would be a great help, yeah.

Prof. Bogdan Vernescu

Okay, yeah. Good. Anything else?

Abby

I think that we're all set, uhm. We'll definitely be reaching out for those contacts, and we just want to thank you for sitting down and talking with us, trying to contextualize all this stuff we have been reading about with earthquakes. It's cool to talk to someone who actually has lived through one.

Prof. Bogdan Vernescu

So see you on Monday for the cultural event (recording ends).

## Appendix N: Interview Confidentiality Statement

You are being asked to participate in an interview about your experiences during an earthquake. Before you agree, however, you must be fully informed about the purpose of the interview, the procedures to be followed, and any benefits, risks or discomfort that you may experience as a result of your participation.

During this interview, we will ask you about your personal experiences regarding earthquakes. We will ask you to tell us about where you were, how you felt, and what happened after you experienced the earthquake.

The interviewer will be taking notes during the interview based on responses. If consent is given, audio and video will also be recorded. This will be used to accurately recount provided information for future purposes.

This interview pertains to earthquakes, and while questions were crafted with the interviewee in mind, we recognize that some of the topics discussed may be sensitive. At this point in time, we ask that you consider your well-being before agreeing to proceed with this interview.

There is no benefit to participants in this interview.

Records of your participation in this interview will be held confidential so far as permitted by law. However, the study investigators, the sponsor or its designee and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of the data will not identify you without explicit consent.

No possibility of injury is anticipated in participating in this interview. However, you do not give up any of your legal rights by signing this statement.

For more information about this research or about the rights of interview participants, please contact:

Ruth McKeogh, 508 831-6699, [irb@wpi.edu](mailto:irb@wpi.edu), IRB Manager

Gabriel Johnson, 508-831-4989, [gjohnson@wpi.edu](mailto:gjohnson@wpi.edu), Human Protection Administrator

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IQP research team, N/A, [gr-balkan-D21@wpi.edu](mailto:gr-balkan-D21@wpi.edu), Group with all IQP team members

## Appendix O: Common Interview Questions

O.1 What gender do you identify with?

O.2 How old are you?

O.3 Where are you from?

O.4 Where are you currently living?

O.5 What ethnicity do you identify with the most closely?

O.6 What religion do you identify with the most closely, if any?

O.7 Have you ever personally experienced an earthquake?

O.8 If more than one, how many, and where?

O.9 How has this experience shaped your perception regarding earthquakes?

## Appendix P: Earthquake Survivor Interview Questions

### Earthquake experiences

P.1 What were your experiences during the earthquake?

P.2 What were your experiences in the hours after the earthquake?

P.3 What were some physical changes around (earthquake location) after the earthquake?

P.4 What was the social atmosphere around (earthquake location) following the earthquake?

P.5 What were the emotional reactions of those around you?

P.6 What types of assistance did you witness in the aftermath of the earthquake?

P.7 Was there media coverage of disaster relief?

P.8 What were the reactions of those around you to the earthquake?

P.9 To what extent did the earthquake change any aspects of your life?

P.10 To what extent does experiencing an earthquake change how you perceive earthquakes?

P.11 Do you have friends or family that have experienced an earthquake?

P.12 Would you be willing to provide contact information so that we could reach out to them about a possible interview?

### Earthquake Awareness

P.13 Could you tell us what you know about the history of earthquakes in your country?

P.14 Do you know what organizations are responsible for earthquake preparedness?

P.15 Do you know what earthquake preparedness measures these organizations are taking in your country?

P.16 To what extent were the preparedness measures implemented effectively?

P.17 (For those from Romania) What do you know about red dot buildings in Bucharest?

P.18 How common are red dot buildings near where you live?

P.19 Has anything been done about these buildings?

P.20 How would you feel about living in a condemned building like a red dot building?

P.21 Do you have a disaster plan if an earthquake happens??

P.22 What are some measures you have personally taken to prepare for an earthquake?

P.23 What are some measures you have seen others take to prepare for an earthquake?

## Appendix Q: Expert Interview Questions

Note: These questions will differ between the experts we interview. Before conducting an interview with an expert, the team researched to understand the nature of the interviewee's expertise to help customize the list of questions to be the most relevant.

Q.1 Where are you currently working/studying?

Q.2 What is your current occupation and status at \_\_\_\_\_?

Q.3 What is your current field of study?

Q.4 How long have you worked/studied \_\_\_\_\_?

### Infrastructure questions for seismologists and structural engineers

Q.5 What types of infrastructure are heavily affected by earthquakes?

Q.6 How does this affect the general public?

Q.7 What are some lasting effects of earthquakes?

Q.8 What components of infrastructure are vulnerable specifically in your city/country?

Q.9 What are some common preparedness measures taken in your city?

Q.10 To what extent would you say these measures are effective? Why?

Q.11 To what extent would you say these measures are sufficient?

Q.12 How do the preparedness measures in your country compare to neighboring countries?

### Social questions (will be asked to sociologists)

Q.13 What are some influences or links between socioeconomic or cultural groups and earthquake risk on socioeconomic or cultural groups?

Q.14 To what extent are there differences in vulnerability between socioeconomic groups?

Q.15 How about ethnic groups?

Q.16 Religious?

Q.17 Can you explain the causes of these differences?

Q.18 Follow up questions should ask about the specific research they've done, as its very relevant to our project

Q.19 What role does the government play in earthquake preparedness in (country)?

Q.20 In what ways does the communist past of (country) influence the current earthquake risk and preparedness

## Appendix R: Survey Confidentiality Statement

You are being asked to participate in a survey about your knowledge and experience with earthquakes. Before you agree, however, you must be fully informed about the purpose of the survey, the procedures to be followed, and any benefits, risks or discomfort that you may experience as a result of your participation.

During this survey, we will ask questions about demographics, any personal experience you have with earthquakes, and what you know about earthquake preparedness in Bucharest. All questions are optional, but please answer as many as you are comfortable with.

There is no benefit to participants in this survey.

Records of your participation in this survey will be held confidential so far as permitted by law. However, the study investigators, the sponsor or its designee and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data, but it will not identify you by name. Any publication or presentation of the data will not identify you without explicit consent.

No possibility of injury is anticipated in participating in this survey. However, you do not give up any of your legal rights by signing this statement.

For more information about this research or about the rights of survey participants, please contact:

Ruth McKeogh, 508 831-6699, [irb@wpi.edu](mailto:irb@wpi.edu), IRB Manager

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Owen Lally, 860-338-5039, [olally@wpi.edu](mailto:olally@wpi.edu), Interview Coordinator

IQP research team, N/A, [gr-balkan-D21@wpi.edu](mailto:gr-balkan-D21@wpi.edu), Group with all IQP team members

## Appendix S: Bucharest Resident Survey

### General Demographics

S.1 What gender do you identify with?

- a. Male
- b. Female
- c. Other (Please specify)
- d. Prefer not to answer

S.2 What is your age?

- a. 21 and under
- b. 22 to 34
- c. 35 to 44
- d. 45 to 54
- e. 55 to 64
- f. 65 and above
- g. Prefer not to answer

S.3 What ethnicity do you identify with the most closely?

- a. Romanian
- b. Romani
- c. Hungarian
- d. Ukrainian
- e. Russian
- f. German
- g. Turkish
- h. Muslim
- i. Armenian
- j. Other (Please specify)

S.4 What religion(s) do you identify with the most closely?

- a. Eastern Orthodox
- b. Protestant
- c. Roman Catholic
- d. Islam
- e. None
- f. Other (Please specify)

S.5 What is the approximate distance in kilometers from your place of residency to your place of worship?

*Numeric Textbox*

S.6 What is your annual household income?

- a. 15,000 lei or less
- b. Between 15,000 and 25,000 lei
- c. Between 25,000 and 50,000 lei
- d. Between 50,000 and 100,000 lei
- e. Between 100,000 and 150,000 lei
- f. Between 150,000 and 200,000 lei
- g. Greater than 200,000 lei
- h. Prefer not to answer

S.7 Please select the neighborhood where you live.

*Answers not listed for brevity. This question will be presented as a drop-down box, so that the team does not have to manually code responses.*

S.8 What type of housing do you live in?

- a. Apartment (not government funded)
- b. Single home (not government funded)
- c. Government-funded housing
- d. Condominium
- e. Other (Specify)

S.9 What is your primary method of transport?

- a. Car
- b. Metro
- c. Bus, trolley bus, or tram
- d. Walking
- e. Ride share service (Uber/Lyft/Bolt)
- f. Other (Please specify)

S.10 How often do you utilize public transportation (train, bus/trolleybus, metro)?

- a. Daily
- b. Multiple times a week
- c. Once a week

- d. Once a month
- e. Once every few months
- f. Rarely/Never

S.11 How long is the commute to your local grocery store via your primary method of transport?

- a. 0-9 minutes
- b. 10-19 minutes
- c. 20-29 minutes
- d. 30-45 minutes
- e. 45-60 minutes
- f. Greater than 60 minutes

S.12 How long is the commute to your place of worship via your primary method of transport?

- a. 0-9 minutes
- b. 10-19 minutes
- c. 20-29 minutes
- d. 30-45 minutes
- e. 45-60 minutes
- f. Greater than 60 minutes
- g. Not applicable

## Earthquake Risk

S.13 How many earthquakes have you experienced?

*Numeric textbox*

S.14 Please indicate how much you agree with this statement, with respect to each row below: "I believe a major earthquake would significantly impact this part of my life." If you are not sure or it is not applicable, please leave the row blank. (*these questions are in a Likert scale*)

- a. Housing
- b. Transportation
- c. Employment
- d. Education
- e. Access to utilities (water, electricity, heating)
- f. Access to healthcare

S.15 Have you ever seen these red dots on buildings in Bucharest?



(<http://internationalreporting.media.illinois.edu/romania/entry/signs-of-trouble.orig>)

- a. Yes
- b. No

S.16 Is there a red dot on your building?

- a. Yes
- b. No
- c. Unsure

S.17 What do you believe these red dots indicate?

*Textbox*

S.18 In your neighborhood, approximately how many buildings do you think have this red dot?

- a. 0
- b. 1-2
- c. 5-10
- d. 10-20
- e. Greater than 20

S.19 Please indicate whether you agree or disagree with the following statements. If the question does not apply to you, please leave the row blank. (*these questions are in a Likert scale*)

- a. I have been negatively impacted by an earthquake in the past.
- b. My place of residence is prepared in the event of an earthquake.

- c. My primary form of transportation would be negatively impacted by a major earthquake.
- d. I am aware of what to do to stay safe in the event of an earthquake.
- e. The Romanian Government has taken measures to protect me from risks caused by earthquakes.
- f. My place of residence is more prepared for an earthquake than my neighbors.
- g. Homes in my neighborhood are at a higher risk of damage caused by an earthquake compared to homes in other areas of Bucharest.
- h. The majority of people living in my neighborhood practice the same religion as I do.
- i. The majority of people living in my neighborhood are of the same ethnicity as me.

## Appendix T: Expert Interview Coding Themes

- Religious and Ethnic correlations
  - Positive Correlation
  - Negative Correlation
  - No Correlation
  - Unknown
- Socioeconomic Correlations
  - Positive Correlation
  - Negative Correlation
  - No Correlation
  - Unknown
- Social Impacts of Earthquakes
- Building and Infrastructural Impacts of Earthquakes
  - Buildings
  - Transportation
  - Water Systems
  - Gas/Electrical Systems
  - Emergency Centers (Hospitals, police and fire stations)
  - Other
- Preparedness Measures
  - Government
    - Existing Codes
    - Assessment
    - Maintenance/Retrofitting
    - Public Educational Campaigns
    - Early Warning Systems
    - Utility Shut Off
    - Other
  - Limitations to Government Preparedness Measures
    - Existing Codes
    - Assessment
    - Maintenance/Retrofitting
    - Public Educational Campaigns
    - Early Warning Systems
    - Utility Shut Off
    - Other
  - Role of NGOs
  - Limitations of NGOs
  - Personal Responsibilities
- Historical implications
  - Government
  - Past Earthquakes
    - Generational Divides
    - Lasting Damages
- Other Important Quotes

## Appendix U: Earthquake Survivor Interview Coding Themes

- In the Moment Reactions
  - Emotional response
    - Positive
    - Negative
    - Neutral
  - Physical response
- Post-Earthquake Observations
  - Government Responses
  - Physical Damages
  - Social Atmosphere
- Powerful Quotes

## Appendix V: References Frequencies of Coding Themes from Expert Interviews

Interview/Code	Religious and Ethnic Correlations					Socioeconomic Correlations					
		Positive	Negative	None	Unknown		Positive	Negative	None	Unknown	
Ilie		0	0	0	0	0	4	0	4	0	0
Matei		3	0	0	0	3	6	4	0	0	2
Kasprovschi		0	0	0	0	0	1	0	0	1	0
<b>Albania</b>		<b>8</b>	<b>0</b>	<b>1</b>	<b>4</b>	<b>3</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>0</b>
Gent		0	0	0	0	0	0	0	0	0	0
Bllachi		8	0	1	4	3	4	1	2	1	0
<b>Croatia</b>											
Mustac		3	1	0	2	0	2	0	0	2	0
<b>United States</b>		<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>17</b>	<b>5</b>	<b>11</b>	<b>1</b>	<b>0</b>
Sakulich		3	0	3	0	0	12	1	11	0	0
Albano		0	0	0	0	0	5	4	0	1	0
Sharifi		0	0	0	0	0	0	0	0	0	0
<b>Overall Total</b>		<b>17</b>	<b>1</b>	<b>4</b>	<b>6</b>	<b>6</b>	<b>34</b>	<b>10</b>	<b>17</b>	<b>5</b>	<b>2</b>

Frequencies with which experts referenced religious and ethnic correlations and socioeconomic correlations across all 4 countries.

Interview/Code	Social Impacts of Earthquakes	Building and Infrastructural Impacts			Water Systems	Gas/Electrical Systems	Emergency Centers	Other
			Buildings	Transportation				
Ilie	5	20	5	3	1	5	4	2
Matei	0	18	18	0	0	0	0	0
Kasprovschi	0	8	8	0	0	0	0	0
<b>Albania</b>	<b>6</b>	<b>9</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>2</b>
Gent	5	4	4	0	0	0	0	0
Bllachi	1	5	2	0	0	1	0	2
<b>Croatia</b>								
Mustac	2	11	4	0	0	1	4	2
<b>United States</b>	<b>8</b>	<b>43</b>	<b>14</b>	<b>9</b>	<b>7</b>	<b>7</b>	<b>0</b>	<b>6</b>
Sakulich	0	16	3	4	6	1	0	2
Albano	4	12	5	2	1	2	0	2
Sharifi	4	15	6	3	0	4	0	2
<b>Overall Total</b>	<b>22</b>	<b>117</b>	<b>63</b>	<b>12</b>	<b>8</b>	<b>14</b>	<b>8</b>	<b>12</b>

Frequencies with which experts referenced social impacts and building and infrastructural impacts of earthquakes across all 4 countries.

Interview/Code	Preparedness Measures	Gov.	Existing Codes	Assessment	Maintenance/ Retrofitting	Public Education	Early Warning Systems	Utility Shut Off	Other
Ilie	33	8	0	0	0	4	0	1	3
Matei	15	4	2	2	0	0	0	0	0
Kasprovscihi	23	8	0	1	3	2	1	0	1
<b>Albania</b>	<b>58</b>	<b>30</b>	<b>4</b>	<b>10</b>	<b>3</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>6</b>
Gent	32	20	2	8	3	4	0	0	3
Bilachi	26	10	2	2	0	3	0	0	3
<b>Croatia</b>									
Mustac	24	12	1	0	1	3	1	2	4
<b>United States</b>	<b>70</b>	<b>37</b>	<b>19</b>	<b>2</b>	<b>6</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>4</b>
Sakulich	13	4	1	0	3	0	0	0	0
Albano	20	10	5	0	1	2	0	0	2
Sharifi	37	23	13	2	2	4	0	0	2
<b>Overall Total</b>	<b>246</b>	<b>113</b>	<b>28</b>	<b>17</b>	<b>16</b>	<b>27</b>	<b>2</b>	<b>3</b>	<b>20</b>

*Frequencies with which experts referenced government preparedness measures subcategory of preparedness measures across all 4 countries.*

Interview/Code	Preparedness Measures	Limitations to Gov. Measures	Existing Codes	Assessment	Maintenance/ Retrofitting	Public Education	Early Warning Systems	Utility Shut Off	Other	Role of NGOs	Limitations of NGOs	Personal Responsibility
<b>Romania</b>	<b>94</b>	<b>58</b>	<b>1</b>	<b>11</b>	<b>15</b>	<b>19</b>	<b>1</b>	<b>1</b>	<b>10</b>	<b>43</b>	<b>22</b>	<b>22</b>
Georgescu	23	7	0	3	2	2	0	0	0	0	0	2
Ilie	33	25	0	1	1	14	0	1	8	17	5	13
Matei	15	11	1	3	6	1	0	0	0	14	4	7
Kasprovscihi	23	15	0	4	6	2	1	0	2	12	13	0
<b>Albania</b>	<b>58</b>	<b>24</b>	<b>4</b>	<b>7</b>	<b>4</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>4</b>
Gent	32	11	1	2	3	3	0	0	2	0	0	1
Bilachi	26	13	3	5	1	0	1	0	3	0	0	3
<b>Croatia</b>												
Mustac	24	11	2	0	2	6	1	0	0	0	0	1
<b>United States</b>	<b>70</b>	<b>33</b>	<b>18</b>	<b>2</b>	<b>12</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>
Sakulich	13	9	2	0	6	0	0	0	1	0	0	0
Albano	20	10	8	0	2	0	0	0	0	0	0	0
Sharifi	37	14	8	2	4	0	0	0	0	0	0	0
<b>Overall Total</b>	<b>246</b>	<b>126</b>	<b>25</b>	<b>20</b>	<b>33</b>	<b>28</b>	<b>3</b>	<b>1</b>	<b>16</b>	<b>43</b>	<b>22</b>	<b>27</b>

*Frequencies with which experts referenced the limitations to government preparedness measures, role of NGOs, limitations to NGOs, and personal responsibility subcategories of preparedness measures across all 4 countries.*

Interview/Code	Historical Implications	Government	Past Earthquakes	Generational Divide	Lasting Damages
<b>Romania</b>	<b>73</b>	<b>52</b>	<b>21</b>	<b>6</b>	<b>15</b>
Georgescu	12	8	4	3	1
Ilie	10	10	0	0	0
Matei	31	17	14	1	13
Kasprovschi	20	17	3	2	1
<b>Albania</b>	<b>16</b>	<b>14</b>	<b>2</b>	<b>1</b>	<b>1</b>
Gent	5	5	0	0	0
Bllachi	11	9	2	1	1
<b>Croatia</b>					
Mustac	6	0	6	6	0
<b>United States</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Sakulich	0	0	0	0	0
Albano	0	0	0	0	0
Sharifi	0	0	0	0	0
<b>Overall Total</b>	<b>95</b>	<b>66</b>	<b>29</b>	<b>13</b>	<b>16</b>

*Frequencies with which experts referenced historical implications across all 4 countries.*

## Appendix W: References Frequencies of Coding Themes from Earthquake Survivor Interviews

Interview/Code	In the Moment Reactions	Emotional Response	Positive	Negative	Neutral	Physical Response
<b>Albania</b>	<b>49</b>	<b>34</b>	<b>4</b>	<b>20</b>	<b>10</b>	<b>15</b>
Kinicki	9	8	1	5	2	1
Gent	16	14	3	7	4	2
Hersh	12	7	0	4	3	5
Bllachi	12	5	0	4	1	7
<b>Romania</b>	<b>14</b>	<b>7</b>	<b>2</b>	<b>5</b>	<b>0</b>	<b>7</b>
Vernescu	7	3	0	3	0	4
Georgescu	7	4	2	2	0	3
<b>Overall Total</b>	<b>63</b>	<b>41</b>	<b>6</b>	<b>25</b>	<b>10</b>	<b>22</b>

Frequencies with which earthquake survivors referenced their “in the moment” reactions.

Interview/Code	Post-Earthquake Observations	Gov. Responses	Physical Damages	Social Atmosphere
<b>Albania</b>	<b>58</b>	<b>12</b>	<b>11</b>	<b>35</b>
Kinicki	10	2	2	6
Gent	22	2	4	16
Hersh	13	3	4	6
Bllachi	13	5	1	7
<b>Romania</b>	<b>33</b>	<b>13</b>	<b>10</b>	<b>10</b>
Vernescu	32	12	10	10
Georgescu	1	1	0	0
<b>Overall Total</b>	<b>91</b>	<b>25</b>	<b>21</b>	<b>45</b>

Frequencies with which earthquake survivors referenced their post-earthquake observations.