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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Mapping Accessibility for Earthquake Hazard Response in the Historic Urban Center of Bucharest" *by* Cristina Merciu et al.

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Detailed responses to both Referees, and to S. Boengiu (SC)

First of all, we thank the Anonymous Referees and S. Boengiu for their careful analysis of our paper, and for the constructive suggestions on eliminating confusions, increasing the visibility of the results, and improving our proposed article.

Our detailed responses to them following:

#REFEREE 1

1. Referee comments:

Compared to the previous version, the references improved. However, technical correction to Crowley, H., Colombi, M., Pinho, R., Meroni, F., and Cassera, A.: Application of a prioritisation scheme for seismic intervention in school buildings in Italy, in: 14th World Conf. Earthq. Eng., Beijing, China. Although the WCEE papers are archived in the web, there is a better referenceable paper by the authors in Earthquake Spectra (Damian N. Grant, Julian J. Bommer, Rui Pinho, G. Michele Calvi, Agostino Goretti, and Fabrizio Meroni (2007) A Prioritization Scheme for Seismic Intervention in School Buildings in Italy. Earthquake Spectra: May 2007, Vol. 23, No. 2, pp. 291-314.)

1. Authors' response:

It's right, we agree your recommendation seeing that the article published in Earthquake Spectra is better as reference, and the content is the same.

By consequence, we replaced, in the main text, at the line 53, Crowley et al., 2008, with Grant et al., 2007.

At the same time at the REFERENCES we made the same change, replacing:

Crowley, H., Colombi, M., Pinho, R., Meroni, F., and Cassera, A.: Application of a prioritisation scheme for seismic intervention in school buildings in Italy, in: 14th World Conf. Earthq. Eng., Beijing, China. ftp://ftp.ecn.purdue.edu/spujol/Andres/files/09-01-0097.PDF, Oct. 12-17, 2008,

with

Grant, D.N., Bommer, J.J., Pinho, R., Michele Calvi, G., Goretti, A., and Meroni, F. (2007) A Prioritization Scheme for Seismic Intervention in School Buildings in Italy. Earthq. Spectra, 23, 291-314, 2007. https://doi.org/10.1193/1.2722784

2. Referee comments:

The Frank Fiedrich article I suggested within the same collaboration is for example http://ieeexplore.ieee.org/abstract/document/4117644/?reload=true or

https://www.informs-sim.org/wsc06papers/059.pdf which included simulation of post-earthquake fire for Magheru Boulevard in Bucharest.

2. Authors' Response: Thank you for this recommendation! Indeed the paper of Frank Fiedrich completes our references giving, at the same time, the possibility to add new ideas connected with our topic.

Following to this, the authors added new phrases inside of the main document:

a) At the line 60, we add the following phrase: As Fiedrich (2007) suggests are fundamental the response actions to a disaster during the first three days after that, when the main goal is to fire fighting (if it is the case), to rescue the trapped victims, and to apply the urgency treatment of injured persons.

b) At the line 289, we introduce a new phrase: There are some studies on fire fighting simulation outside of historical center of Bucharest, in the Magheru Blvd (for example), which releave the importance given to this related phenomenon with an earthquake event (Fiedrich, 2007).

At the REFERENCES, we added:

Fiedrich, F.: An HLA-Based Multiagent System for Optimized Resource Allocation After Strong Earthquakes, Simulation Conference, 3-6 Dec.,WSC 06, Proc. Winter, Monterrey, CA, USA, 2006, added to IEEE Xplore: 05 March 2007, DOI: 10.1109/WSC.2006.323120

3. Referee comments:

More recent writings adressing urban infrastructure such as roads by the author are Urban Disaster Resilience and Security. Addressing Risks in Societies. Editors Alexander Fekete Frank Fiedrich (Springer).

3. Authors' response: Your suggestion apdated our literature on the topic, as we have found in this publication new confirmations of the importance of the accessibility in the

case of an earthquake event. By consequences we make some interventions in our paper:

At the line 236, we have added: a) In the recent years, the scientific approaches on risk reduction of natural events, as earthquakes use resilience, as an important concept, which could offer new theoretical and practical tools for a better civil protection (Fekete and Fiedrich, 2018). Using this concept, the scientists pave the way for revigoration the expectations, by joint actions with decision-makers and people (Anhorn, 2018). These ideas ask, maybe, other complementary issues connected with a higher accessibility to the affected areas.

We added to REFERENCES:

Anhorn, J.: Nepal and the "Urban Resilience Utopia", in Editors: Fekete A., Fiedrich F (eds), 2018, Urban Disaster Resilience and Security, pp. 13-26. The Urban Book Series, Springer, 2018. https://doi.org/10.1007/978-3-319-68606-6.

Fekete, A. and Fiedrich, F.: Introduction to "Urban Disaster Resilience and Security – Adressing Risks in Societies", in Editors: Fekete A., Fiedrich F (eds), 2018, Urban Disaster Resilience and Security, pp.1-12. The Urban Book Series, Springer, 2018. https://doi.org/10.1007/978-3-319-68606-6.

At the line 32, we have added: b) In a disaster situation, one of the most important elements is the public-private emergency cooperation, which can act in all the disaster phases. Developing a model to harmonise the joint cooperation, Wiens et al. (2018) identify some efficient ways to improve the logistics operations during the crisis management.

We added to REFERENCES:

Wiens, M., Schatter, F., Zobel C.W. and Schultmann, F. in Editors: Fekete A., Fiedrich F (eds), 2018, Urban Disaster Resilience and Security, pp.145-168. The Urban Book Series, Springer, 2018. https://doi.org/10.1007/978-3-319-68606-6.

4. Referee comments: Connected with the previous suggestion, the Referee 1 recommend another “recent writings”: ..... Einführung in den Bevölkerungsschutz. Autoren: Fiedrich, Frank, Kud- lacek, Dominic (Springer)”.

4. Authors’ response:

This interesting book is not yeat printed! Having only some general information it was difficult for authors to use some ideas. Any case, in the following our approaches we will use it.

REFEREE 2

1. Referee comments:

“Nevertheless, approaches of post-disaster accessibility analysis are not discussed”

1. Authors’ response:

At lines 33 (a), 54 (b), 66 (c), and 83 (d) we have added the followings:

a) In any disaster situation, one of the most important factors across all the disaster phases is public-private emergency cooperation for post-disaster accessibility and efficient intervention. By developing a model to harmonise this strong cooperation, Wiens et al. (2018) identify efficient ways to improve the logistics of these operations during crisis management.

b) Post-disaster recovery needs to transfer the most debated academic concepts (as disaster resilience, for example) into appropriate politics and transform it into real tools for an adequate planning. The governments have an important task to prepare the population and all stakeholders for future similar events (Comerio, 2014).

c) As Fiedrich (2007) suggests, the disaster responses made during the first three days are fundamental. After that, the main goals are invariably rescuing trapped victims, and treatment of the injured, though ongoing fire control may also be required in some cases.

d) A similar study, based on different hazard scenarios and a deep analysis on social vulnerability in Bucharest, identifies the importance of fire stations, hospitals and parks in post-disaster situations (ArmaÈŹ et al., 2016).

2. Referee comments:

“What remains somewhat unclear is the consideration of travel modes. The described network also includes walking and cycling routes (see Line 190) that are unsuitable for emergency purposes in many cases. Please clarify this aspect.”

2. Authors’ response: We have clarified the text in line 197 to show that, while walking and cycling networks have been considered in other studies, given their nature they have not figured in our research.

“The calculation of accessibility was initially based on the geometric structure of the public transport network (busses, trams and underground services), but not on the walking and cycling networks, which, although they have been included in other studies, are less amenable to emergency service access in this context (Graeme & Aylward, 1999; Parker & Campbell, 1998; Naphtali, 2006; Svensson, 2010; Weiping & Chi, 2011; Sotoudehnia & Comber, 2011; ESPON TRACC Interim Report, 2013; ESPON GROSSE, 2013; Blandford et al., 2012; Coffee et al., 2012; Yiannakoulias et al., 2013; Vojnovic et al., 2014).

3. Referee comments:

Still, the methods section is not coherent (especially Lines 187–217). A lot of tools and steps of analysis are mentioned (without detailed description or their background) without including their results in the following sections for e.g. different density estimations (only Kernel density was used later for visualisation purposes), assessment and estimation of potential damages, and exacerbation of impacts by gas stations. Please focus on the methods used to produce the results shown in the paper and provide details for step g) “determining, by simulation, the immediately inaccessible or poorly

accessible areas" or assign the named tools in a structured manner.

3. Authors' response: We have provided further details on the GIS technologies in the Methods section and provided further information on the techniques and the analysis in the Results and Discussion sections. Our paper focuses exclusively on the magnitude of the accessibility challenges resulting from the potential collapse of buildings in various risk categories, rather than dealing more generally with the evaluation and estimation of damage.

In our opinion detail for step g) is provided by Fig.10 and the text related to it in which we elaborate the hypothesis that, should an earthquake having the same intensity of the March 4, 1977 event occur, there is the potential for all the buildings in the Risk 1 category to collapse. Furthermore, it only requires building collapses sufficient to create one blocked street segment to achieve a decline in accessibility for civil protection. Fig.10 therefore indicates the areas and street segments that could be considered as potentially inaccessible or poorly accessible. Our intent here is to postulate and discuss an intuitive simulation (without applying formal simulation techniques), in order to demonstrate the importance of accessibility in this context.

At the same time, we have removed the following text from line 217 (it was a remanent phrase, from other very early version):

Accessibility was also calculated to take into account the presence of specific service locations which could exacerbate the impact of potential disasters, such as gas stations and electric transformers (Rezaie & Panahi, 2015).

4. Referee comments:

The used method is limited because it is based on two assumptions: (1) Every building with the given classification (Risk I) collapses during the notional event and (2) every collapsed building leads to a road congestion and therefore to a functional loss of the street segment (although it should be represented by a function of building character-

istics like age, number of storeys, material, and the surrounding space).

4. Authors' response:

Our (in our opinion, defensible) position here is that the buildings classified in the Risk 1 category are more likely to collapse and thereby to cause accessibility challenges in the historical center of Bucharest in the case of a very strong earthquake. Axiomatically any building which flanks a street has the potential to collapse and impede accessibility. Certainly, it is possible that all the buildings in Category 1 may not collapse while some buildings outside this category may do so. This does not alter the fact that the greatest likelihood of building collapse, and therefore of street section blockage, will be where the concentrations of Risk 1 buildings are greatest.

5. Referee comments:

I recommend excluding Figure 3 because the visualisation is very hard to read and not necessary when there is Figure 5.

5. Authors' response:

We agree! Figure 3 has been removed (line 265).

6. Referee comments:

A big improvement would be the homogenization of Figure 4 and Figure 5 regarding the scale (Figure 4 seems to be clinched and a scale bar with 1320 m is very uncommon) and the extent of the maps to make them comparable. Please also reconsider the design of Figure 5; the map has too many classes, there is no intuitive colouring, and density measures are missing in the legend.

6. Authors' response:

We agree! The figures are now at the same scale and the number of classes in the Figure 5 has been reduced (lines 273 and 283)

7. Referee comments:

Figures 6 and 7 have been improved, but they should also focus on the historical centre/study area. In the presented visualisations, the historical centre shows a rather homogeneous accessibility and the details described in the text (Lines 285–296) are missing in the figures. Homogenisation with extent and scale of Figures 8 and 9 is highly recommended to make differences between pre- and post-event situations visible.

7. Authors' response:

We agree! Both maps have been replaced by others which are now at the same scale and clearly focus on the study area (lines 304 and 312).

8. Referee comments: A separation of results and discussion may improve accessibility. There is a significant change of perspective at Line 312.

8. Authors' response:

We agree with the referee's argument. Indeed, the original version of our paper incuded these two sections. We have therefore reverted to our initial structure as per the referee's recommendation, albeit with a slight modification in that we commence the discussion at line 315.

S. BOENGIU – SHORT COMMENTS

1. S. Boengiu comments:

The avoiding of the comment to the Fig.2b, respectively: "the photograph shows efforts to identify victims and property"

1. Authors' response:

We have removed "the photograph shows efforts to identify victims and property", and the explanation of the Fig.2b is:

"The collapse of the Continental block in Bucharest's historical centre in 1977 blocked the access streets, so clearance was delayed by more than 12 hours" (line 128)

2. S. Boengiu comments:

The streets canevas on the Fig.10 is not clear. Please, make clearer, for a better orientation of the readers2

2. Authors' response:

We have improved the Fig.10 (line 411), making the street network more visible.

3. S. Boengiu comments:

For uniformity of English, please replace in the entire manuscript all centre(s) with center(s), or inversely. See the followings lines: 120, 165, 166, 168 (inside the table), 204, 340, 352 and 412

3. Authors' response:

The spelling of "center" has been changed to "centre" as requested in the specified locations.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2018-41/nhess-2018-41-AC3-supplement.pdf

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2018-41, 2018.