COMMUNITY COMMENT #1

General comment: This manuscript is very interesting and on an important topic of earthquake vulnerability assessment in one of the most vulnerable regions of the Indian Himalayas. The topic has high significance and the approaches used are good. Though well written there are some typos in the paper that need to be corrected. However, it may help the authors to improve the manuscript by considering my following comments and suggestions:

Response: Thank you for the very useful comments and suggestions, which have helped us to improve the contents of the manuscript. We have responded point by point to all the comments and suggestions raised by the Commentator#1 as follows:

Comment #1: The authors have provided useful information about the past destructive earthquakes in the region in a tabular form. Despite such a long history of destructive earthquakes, the authors claim that people don't follow the building codes and plans which is hard to believe.

Response: Thanks for the appreciation. Yes, it is a fact that despite the building codes being in place, but the same are not followed in letter and spirit by the people due to the poor implementation of the regulations and inadequate monitoring mechanisms (Yousuf et al., 2020). However, this is a scenario in most cities of the developing countries (Petal et al., 2008). The residential buildings in the Srinagar city are mostly built by local semi-skilled masons, who don't have the adequate technical expertise in building earthquake resistance infrastructure and therefore these structures lack the basic earthquake risk reduction features including seismic resistance features as are otherwise prescribed in the building codes. Furthermore, economy plays a major role in constructing safe infrastructure and there are socio-economic inequalities within the city, with the citizens in the lower-middle-income groups residing in the densely populated old downtown wards which have grown organically without any urban planning or adherence to building codes. Whereas the upper-middle class and wealthy people reside in the uptown wards of the city where, building codes and other infrastructure development regulations are usually enforced as per the master plan prescriptions. The same has been briefly mentioned in the revised manuscript from line number 74 to 78.

Yousuf, M., Bukhari, S. K., Bhat, G. R., and Ali, A.: Understanding and managing earthquake hazard visa viz disaster mitigation strategies in Kashmir valley, NW

Himalaya, Progress in Disaster Science, 5, 100064, https://doi.org/10.1016/j.pdisas.2020.100064, 2020.

Petal, M., Green, R., Kelman, I., and Shaw, R. (2008). Community-based construction for disaster risk reduction. In *Hazards and the built environment* (pp. 209-235). Routledge.

Comment#2: The authors should provide information about urban/city planning of the region and why these are ineffective (in the Study area section) and State briefly how findings from this research might help to build better earthquake-safe master plan for the city (in the Conclusion section).

Response: Thank you for your suggestions. Srinagar is an old and historic city, and most of the areas have grown organically without following any physical plan or building codes for the construction of its built infrastructure (Yousuf et al., 2020). Post-1947, Srinagar grew very fast mostly in a haphazard manner with no proper urban planning. The first Master Plan of the city was developed in 1971 followed by Master Plan-2021 and 2035. However, all the three plans didn't have effective implementation in the city as per the Master Plan prescriptions because of the problems in the planning and implementation setup including the inadequate legal framework and institutional structures. The chronology of the city master planning and why it has not been very effective is provided in the revised manuscript under study area section from line number 163 to 167.

Definitely, this study can assist city planners in choosing safe, low-density areas, and even guide to propose new infrastructural development envisaged under the master plan, as well as identify densely populated areas that are particularly vulnerable to earthquakes where no further infrastructural development should be permitted other than the development of open and green spaces. The same has been incorporated in the revised manuscript from line number 584 to 588.

Comment #3: The authors have used two methods; AHP for assigning weights and MCA-based TOPSIS for ranking wards based on the best alternatives. The integration of the outcome from these two methods is not very clear and needs to be elaborated further in the methods section.

Response: Thank you for suggestion, we have added information about the advantage of the integrative use of the two approaches in the revised manuscript from line number 390 to 399 and the same is reproduced as follows:

The integrative use of these two models reduces the uncertainty in the input data and improves accuracy and validity. Furthermore, decision-making based on the integrated use of the AHP and TOPSIS leads to more robust and effective outcomes for addressing complex problems (Nyimbili et al., 2018). Many studies have recommended the integrated use of TOPSIS with AHP for determining criteria and conducting analyses regarding complex decision-making problems (Behzadian et al., 2012). Additionally, the integrated use of AHP and TOPSIS helps to resolve the weighting problem by incorporating expert opinions and preferences, thereby increasing the consistency of outputs for arriving at consensus in decision-making in earthquake disaster vulnerability analyses (Nyimbili et al., 2018).

Nyimbili, P. H., Erden, T., and Karaman, H.: Integration of GIS, AHP and TOPSIS for earthquake hazard analysis, Natural hazards, 92(3), 1523-1546. https://doi.org/10.1007/s11069-018-3262-7, (2018)

Behzadian, M., Otaghsara, S. K., Yazdani, M., Ignatius, J.: A state-of the-art survey of TOPSIS applications, Expert Systems with Application, 39(17):13051–13069 https://doi.org/10.1016/j.eswa.2012.05.056, 2012.

Comment #4: The authors have, at a few places in the paper, briefly talked about the virtues of the traditional wooden earthquake-resistant construction practices in the city but have not really provided any details about these traditional buildings and how these are considered earthquake resistant. It would add value to the manuscript if a section is added in the paper on these traditional and now abandoned construction types

Response: Thank you for the suggestion. We have now included the details of the traditional construction practices and why these are considered resistant to earthquakes in the revised manuscript under introduction section between the lines number 65 to 72 and the same is reproduced as follows:

The traditional building types such as "Taqq" and "Dhajji-Dewari" are earthquake-resistant. In the Taqq type buildings, wooden runners are placed at each floor level that tie the walls with the floor together whereas the Dhajji-Dewari buidlings consist of a braced timber frame with masonry infill that is placed diagonally in the walls. The timber braced frames offer stable confinement to the infill masonry as long as it rests together (Hicyilmaz et al., 2012). When compared to more contemporary building types, the Dhajji-Dewari constructions are more earthquake-resistant because energy is dissipated between mortar joints, the frame, and the infill rather than through non-linear deformations.

Hicyilmaz, K. M. O., Wilcock, T., Izatt, C., Da Silva, J., and Langenbach, R.: Seismic performance of dhajji dewari. In 15th World Conference on Earthquake Engineering, Lisbon (pp. 24-28). 2012.

Comment #5: The authors have not included socio-economic vulnerability in this paper and intend to do that as separate research; however, it would be helpful to the readers if the authors can provide a brief general overview of the SE vulnerability in this paper.

Response: Thank you for the suggestion. We have now added a general overview of the SE vulnerability of the Srinagar city in the revised manuscript under section Earthquake vulnerability analysis at lines 566 to 578.

The socio-economic conditions of an area play an imporant role in determining the vulnerability of an area to earthquake hazard. The Srinagar city has witnessed population explosion with the population having increased from 0.25 million in 1961 to 1.5 million in 2011. The city also has a high percentage of female and child population (59%) and a high population density of 4000 per sq.km. Migration from rural areas and population growth are the primary drivers of this enhanced population expansion (Nengroo et al., 2018). The city has been under pressure to expand its built-up area in order to cater to the population boom, which has also led to excessive resource depletion, widening wealth and poverty gaps, and detrimental environmental and socioeconomic concerns (Mitsovaa et al., 2010; Kamat and Mahasur, 1997). With the mounting demand for new housing, the quality and condition of houses have received negligible attention. These concerns of accelerated population progression, along with high urbanisation have increased the Socio-economic vulnerability of the built environment in the Srinagar city to earthquakes.

Nengroo, Z. A., Bhat, M. S., and Kuchay, N. A.: Measuring urban sprawl of Srinagar city, Jammu and Kashmir, India, Journal of Urban Management, 6(2), 45-55. https://doi.org/10.1016/j.jum.2017.08.001, 2017.

Mitsova, D., Shuster, W., and Wang, X.: A cellular automata model of land cover change to integrate urban growth with open space conservation, Landscape and urban planning, 99(2), 141-153. https://doi.org/10.1016/j.landurbplan.2010.10.001 2011.

Kamat, S. R., and Mahasur, A. A.: Air pollution: slow poisoning Chennai, The Hindu Survey of Environment, 1997.