

Interactive comment on “Brief communication: Roads and landslides in Nepal: How development affects risk” by Brian G. McAdoo et al.

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Anonymous Referee #1

I have responded to these comments in an earlier version, but respond again here as it was decided that the paper should be expanded from a Brief Communication to a full paper. Below are the updated comments.

Reviewer #1 (RC1) makes some very good comments and points out some extremely helpful papers that we were not aware of. RC2 suggests that the paper should be expanded past a Brief Communication- while I certainly agree, we feel that the timeliness of this paper with the coincidence of the special issue and the rapid expansion of roads with the Belt and Road Initiative (BRI) make it quite topical right now, and should get out

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sooner rather than later with a more thorough treatment (which is indeed underway).

We have agreed to expand it to a full research paper.

RC1 points out that there have been links between roads and landslides have been addressed in the past- while this is indeed true, this paper seeks to point out the heightened need to pay attention to this well-documented phenomenon as the development increases a notch following the end of the civil war and the pressing forward of the BRI. As far as I am aware, this is the first study to compare landslides generated by an earthquake to landslides generated by monsoon rains through a lens of development.

RC1 points out a recent paper by Roback et al. (2018) that mapped coseismic landslides in this region. There are at least 4 different landslide catalogues that I am aware of, and we chose to use the one generated by our Nepali colleagues (Gynawali and Adhikari, 2017) that we have been partnering with since before the earthquake. We find it important to not only include our local colleagues in the paper writing process, but also use the data they collected as a way of building the necessary local capacity. Without entrusting our colleagues to do this critical work and see their work represented in the literature, and having only the work from large, well-funded researchers from overseas recognised, local scientists are actively disincentivised from doing their own research. While I would hope we could trust a published reference, we have described the methodology for identifying failures in the text.

On lines 57-59, RC1 asks about the correlation between landslide location and soil type, and specifically mentions the possibility of bedrock failures. We expanded this in the text, noting that the vast majority of slides that we groundtruthed in the field involved only the regolith, we were not able to assess all slides, and our sampling would have been biased as we were traveling along roads. It is exceedingly difficult to identify bedrock failures from satellite data alone. Furthermore, while RC1 is correct that this is a strong correlation, being critical of that fact does not rule out causation. As there will be more landslides (shallow) where there are soils in steep terrain, the soil is weaker

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than bedrock (which because of climate hasn't developed soils...), therefore is more likely to fail under the same stressors. This is an observation based on the data as shown in Fig. 2. The distinction of soil type and land use is significant, since nearly all economic activity in this region is agriculture-based, therefore that is where most of the risk is located. Because the sample size of the earthquake (EQ) landslides is large compared to the pre-EQ slides, there are quite a few EQ slides in unpopulated areas, and those might skew the results. As those are not pertinent to the question of development and risk, we cut them out based on the fact that development occurs where there are resources available to support it.

RC1 states that there may be a problem if the landslide areas don't match the size of the hillslope where they have been randomly placed. I think that they are referring to the possibility that a landslide could be large enough to exceed the size of the hillslope it occurs on (but I am not entirely clear about that). Most slides are quite small as compared to the scale of the topography of the region- we have sought to clarify this by adding an inset to Figure 2 that shows the histogram of the slide areas. We also noted that we did 10 Monte Carlo simulations for each class of slides (EQ vs. monsoon triggered- thanks for catching that).

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