

Reviewer #1

The authors present the development of a Canada-specific system for rapid earthquake damage and impact estimation, called the RED-E system. RED-E aims to provide critical information about structural, human, and economic impacts within minutes of a seismic event. This addresses significant gaps in situational awareness during the first 48-72 hours post-earthquake, a period essential for life-saving operations. The authors emphasize the importance of tailoring the system to Canadian conditions, leveraging a detailed Canadian building exposure model and Canada-specific fragility and vulnerability models, along with data from the Canadian National Seismic Network and the Canadian Earthquake Early Warning network to optimize its accuracy and usability.

The development of the RED-E system employed a user-centered design (UCD) framework, involving consultation with emergency managers, first responders, and critical infrastructure operators across Canada. Key findings from these consultations highlight the need for immediate, actionable insights on population impacts, infrastructure damage, and road disruptions. The manuscript describes the development and testing of wireframes for the system's outputs, which are designed in multiple formats (text, static PDFs, and GIS-based dynamic layers) to suit various operational scenarios, including low-bandwidth situations. The authors compare the RED-E system to established tools like USGS PAGER, demonstrating how it addresses unique Canadian needs while building on global best practices.

The topic is original, focusing on the development of a Canada-specific damage estimation and information delivery system that builds upon existing international models like PAGER and QLARM. Engagement of potential end-users during the development process helps bridge the gap between existing earthquake risk models and a localized, end-user-focused approach for delivering timely information. The RED-E system as described in this paper adds substantial value by incorporating features like debris modeling, bridge conditions, estimates of displaced population, and social vulnerability maps, aspects not always covered comprehensively in other existing systems.

The title of the manuscript is informative and adequately conveys the core aspects of the work presented in the paper. The abstract clearly outlines the objectives, methodology, and expected impact of the RED-E system. Overall, I found the paper to be well-written, and the text is generally clear and easy to follow. My recommendations from a reader's perspective are limited to the length and structuring.

In terms of structuring, perhaps Section 2 which is quite short could be folded into either Section 1 or Section 3? On the other hand, Section 3—which summarizes the results of the informational interviews—provides valuable insights into end-user needs and expectations, is lengthy (~10 pages) and might benefit from tighter organization and prioritization to improve readability and impact. The 13 questions presented in this section address overlapping themes, such as situational awareness, obstacles, and information needs. Perhaps these could be grouped or synthesized into broader categories, such as Challenges in Gaining Situational Awareness, Critical Information Needs for Emergency Response, Preferred Formats and Accessibility of RED-E Outputs, and Integration Challenges and Feedback (for example)? Readers interested in the complete survey responses could be directed to the first author's MS thesis. While this section comprehensively documents the

end-user feedback, it could benefit from explicitly connecting the findings to the UCD framework introduced earlier. For example, a brief summary at the end of the section could outline how the feedback informed the development of RED-E prototypes or influenced design priorities (i.e., expanding a bit more on the first sentence of Section 4).

Figure 10 and Figure 11 appear to be identical? Were they supposed to show the same information at different scales?

Overall, I think the manuscript is a significant contribution to disaster management literature and has the potential for high impact in emergency response practices. Minor revisions to streamline the text and prioritize the information conveyed to the readers will enhance the its quality.

Reviewer #2

Review of '*Introducing the Rapid Earthquake Damage Estimation (RED-E) System for Improved Life Safety Outcomes During Earthquake Early Response in Canada*' by Megumi Patchett, Tiegan E. Hobbs, and Lucinda J. Leonard. The manuscript needs a substantial revision in terms of the writing style and grammar (for example, by avoiding mixing of tenses when describing the completed work vs. discussing ongoing or future works). Most of the write-up is devoted to discussing the surveys or participant's feedback/comments instead of the product itself and its development or evolution and the text also appears to be borrowed as-is from first author's Master's thesis. The manuscript is also too long (31 pages of 35 total) and can easily be shortened by 25% without losing critical information. Despite the author's best attempt, it was unclear to this reviewer who the real target user(s) is of the proposed RED-E product. From authors' description and engagement, they can be first responders, emergency managers, and Critical Infrastructure (CI) operators at local, provincial, and national scales. For example, will the first responders (like firefighters, law enforcement officers, paramedics, emergency medical technicians, or someone who has legal authority to make visits on behalf of the jurisdiction) be the ones using author's product? If so, what specific content do they need, what decisions or actions will they take, and how their needs are being captured in the final product? The authors stated that the RED-E tool is intended to 'allow end-users to operate more decisively and swiftly during the early stage of the response period.' Note that the survey feedback also highlights several issues when targeting such a broad range of users. For example, the response to Q4 or Q6 suggested that the participants wanted very different information than what is being presented via RED-E product (for example, fewer participants were asking for the data that is presented in the sample product). Even though the authors remarked in the caption that their intention of this question was to know what additional information is desired, the framing of the original question and the responses from participants suggested otherwise. The framing of some survey questions is either too general or vague such that the responses from such a broad target audience is hard to comprehend, analyze, or respond to effectively towards developing a final product. Some of the responses and feedback are also concerning especially the ones about inaccuracy within the modeled impact results, the potential loss of trust, as well as the risks associated with developing a highly detailed forecast product that reaches directly to the general public in its current form. The authors reported on various feedback and concerns, but they did not explain how those were incorporated into the final product. Responses to Q13 and many other comments are also quite interesting as they appeared to undermine the business case of the proposed product. It is unclear how the key findings/feedback summarized in the Conclusion section led authors to develop a final product and which wireframe depicts the final product. Minor comments: Figure 9 shows the text format of the RED-E product. The authors perhaps should reconsider presenting the 'overall impacts' numbers with such a high degree of precision. Figures 10 and 11 seemed to be the same but the caption suggests otherwise, and figure 11 seemed to suggest presenting the map of debris and bridge conditions. The mapped data layers from Figures

12-15 are too busy, the legend text is too small, and there are too many layers presented within the same map making it not a very legible or usable product.