

# Bridging the Vulnerability Gap: Innovative Risk Assessment for Natural Hazards through User-Centric Solutions

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## Abstract

The Gebäudeversicherung Bern (GVB) suffers annual losses from natural hazards of around 60 million CHF, mainly from windstorm, hail, and flooding. A comprehensive risk analysis for 2023 and 2024 was conducted to address this, focusing on the risk: hazard x damage potential x vulnerability. While GVB has a solid understanding of hazards and damage potential, a knowledge gap remains in assessing vulnerability. This project aims to reduce this gap by developing a systematic approach to evaluate and mitigate vulnerability.

To address the knowledge gap, hazard overviews and vulnerability indicators were developed for hail, windstorms, and flooding. This was achieved through literature reviews, expert interviews, and existing vulnerability indicators. A physical vulnerability index was created based on these sources to quantify the vulnerability of buildings. Additionally, a catalog of behavioural guidelines was created for property owners based on their vulnerability index results. Risk was calculated using spatial data from hazard maps for hail, wind, and flooding. A clickable prototype was developed and tested through 20 customer interviews to evaluate its effectiveness. Feedback was integrated into an updated prototype, which was further tested for usability.

Sixteen key indicators were identified for assessing building vulnerability. These included:

1. Number of floors above ground
2. Number of underground floors
3. Residential use of the basement
4. Presence of raised ground floor
5. Entrance doors at ground level
6. Basement windows and doors
7. Value accumulation in the basement
8. Roof material
9. Solar installations
10. Roof overhangs
11. External shading systems
12. Number of motorized sunshades
13. Year of construction
14. Pool covers
15. Skylights and roof domes
16. Presence of backflow valve

These responses were categorised into vulnerability scores ranging from 1 (low vulnerability) to 5 (high vulnerability). The unweighted sum of these indicators produced a score that classified properties into three risk categories. Behavioural recommendations were then made based on the score. For example, if a building had plastic skylights, the recommendation was to install protective grilles and replace damaged parts. These measures provide both hail and fall-through protection, and GVB can offer financial support for these measures. The prototype received an average rating of 8/10 from users, although feedback indicated that some found it difficult to distinguish between hazard and risk, prompting a greater focus on risk in future iterations. Based on the positive feedback, the tool will be implemented on the GVB customer platform by the end of 2024.

The vulnerability indicators developed in this project provide a solid foundation for increasing homeowner awareness of natural hazards. The customer interviews were invaluable in improving the prototype's usability and gaining insights into user behaviour. Future plans include extending this methodology to other natural hazards such as landslides, debris flows, avalanches, and rockfalls to further improve risk mitigation.

## References

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