



Landslides along Highways: GIS-based Inventory and Planning Issues

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Highways rank as critical transportation infrastructures that are at risk of landslides in many areas worldwide (e.g., Hungr et al., 1999; Bhandary et al., 2013). Safe and affordable operations of traffic routes constitute the two main criteria for transportation planning in landslide-prone terrain. A right balancing of these often conflicting priorities requires profound knowledge of landslide locations across highway networks and the costs caused by landslides in the past (e.g., Saha et al., 2005). Much of the direct costs affecting transportation departments relate to capital investments for landslide repair or mitigation and operational expenditures in connection with maintenance works. A systematic collection and inventory of such data sets combined with an acquisition of hazard information on vulnerable road sections is still rarely the case in engineering practice. This is despite significant cost impacts and budgetary burdens, especially in peripheral mountain areas where financial resources are naturally limited (e.g., Klose et al., 2014).

The present contribution introduces a regional inventory of landslides along highways in the Harz Mountains, NW Germany. As subset of a landslide database for the entire country, this focused GIS-based inventory has been compiled in close collaboration with the Lower Saxony Department of Transportation. The inventory includes data sets gathered by archive studies and relies on high-quality information sources such as maintenance protocols, geotechnical reports, and documents from tendering, controlling, and accounting. A mapping tool in ArcGIS format is used to specify and visualize road sections affected by landslides. This spatial information on hazard exposure is complemented by narrative risk profiles for landslide sites showing a long history of damage events. By summarizing the occurrence dates of landslides, the associated damages, and the types and costs of repair or prevention, such risk profiles are useful to assess landslide impacts and the effectiveness of measures for their mitigation.

The landslide inventory is part of an ongoing study concerned with the problems of damage financing at low-volume roads in mountain areas with shrinking populations and fiscal deficits. Using the example of the Harz Mountains, a key research question refers to a comparison of the costs necessary to spend for safe road operations with the benefits from providing traffic connections to landslide-prone rural communities. This study combines the damage and loss data stored in the inventory with different data sets on traffic density, local population, and road financing. The research results contribute to the development of planning strategies for cost-efficient maintenance of highway infrastructures exposed to landslide hazards.

References

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