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Avalanche risk assessment for mountain roads - a comparison of case studies from Iceland and the Alps

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While the management of alpine natural hazards in settlements follows highly developed operational standardised procedures in many countries, there are very few approaches for a systematic survey and assessment of these natural hazard processes and the related risks and for a sustainable planning of measures for roads. This is even more surprising against the background of the ongoing increase of traffic in Europe and its economic importance.

This contribution compares the results of a regional scale assessment of the avalanche risk on mountain roads for case studies from Austria, Italy and Iceland. It provides the first assessment of the natural hazard situation for roads outside closed settlements in Iceland and discusses the applicability of regional scale risk based approaches developed in the Alps to the specific natural, economic and social situation. It also compares the role of risk in the assessment and management of natural hazards in these countries.

The assessment of the risk by natural hazard processes for roads follows approaches developed by Wilhelm (1997, 1998, 1999) and Borter (1999a, 1999b) in the Alps adapted to comply with the data availability of the regional scale. These approaches distinguish between the individual risk on the one hand and the collective risk for the society on the other hand for each process area as well as the cumulative risk for the investigated road section.

As the spatial and temporal distribution of avalanches is relatively well documented in some of the Alpine countries practical approaches have been developed for the assessment of this natural hazard process. These have been successfully applied e.g. to roads in inner Oetz and inner Stubai Valley, Tyrol, Austria by Huttenlau (2004) and Gufler (2007) and Sulden road, Ortles Alps, Southern Tyrol, Italy by Zischg et al. (2004). On the basis of these investigations the individual, collective and cumulative death risk for avalanches was determined for Siglufjarðarvegur between Siglufjörður and Straumnes in northern Iceland (Wastl et al. 2008).

The total length of the public road network in Iceland is ca. 13000 km, mostly low-volume roads outside built-up areas. Almost 10500 km of these roads are open all year. Substantial parts of the public road network e.g. in central northern Iceland, northwestern and eastern Iceland lie in alpine mountain areas and are affected by characteristic natural hazard processes. Though the resulting road maintenance costs are considerable there is no general overview of the natural hazard situation up to now.

The case study for Siglufjarðarvegur shows that a regional scale risk based approach is practical to determine, analyse and assess the natural hazard situation on mountain roads in Iceland and helps to assign priorities in following detailed investigations and the planning of measures. Thus road sections of a high risk level which should be given priority for possible protective measures can be identified and distinguished from areas of avalanche hazard where the collective avalanche death risk is low and acceptable according to international practice. The calculated risks can further be reduced by measures like temporary closing of parts of the road, which can bring the risk to an acceptable level almost everywhere in the investigated road section. This requires, however, a systematic monitoring of the development of the natural hazard situation along the road. The cumulative risk for the investigated section of Siglufjarðarvegur, for the case that no measures of avalanche prevention or control or temporary closing of the road are taken, agrees well with values determined for mountain roads in the Alps.

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