



## Reevaluation of the Design Loads for an Existing Avalanche Protection Gallery - A Probabilistic Approach

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### Abstract

When planning maintenance and repair actions, the owners of existing structures are often faced with the problem that the structure cannot be verified any more with the current design codes. The expected costs of retrofitting can be significant, which raises the question whether investments are proportionate or whether a lower reliability level can be accepted for a particular structure. The present paper shows how target reliabilities can be defined based on risk and efficiency considerations and how design values for loads and/or resistances can be derived from this design target. The focus is on avalanche loads on protection galleries, for which no standard probabilistic models exist. The derivation of probabilistic load distributions from scenarios and return periods estimated by experts is discussed. The methods are applied to a real structure in the Swiss Alps, illustrating the benefits of the risk-based, probabilistic approach.

**Keywords:** Existing structures, target reliability, cost-efficiency, design loads, natural hazards, avalanche protection gallery, updating

### 1 Introduction

For our aging infrastructure, the assessment of existing structures becomes increasingly relevant. Of particular interest is whether costly retrofitting is required when an existing structure cannot be verified based on the current design codes. Strengthening an existing structure is often much more expensive than achieving the same level of

safety for a new structure. To make best use of limited funds, decisions on retrofitting works should be based on efficiency considerations, explicitly taking account of:

- The cost of retrofitting and
- The consequences of structural failure

In Section 2 of this paper, it is shown how the reliability of a structure can be tailored based on risk and efficiency considerations and how the