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New design guidelines for buildings in hazardous avalanche areas.

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Avalanche hazard is a complex problem for all mountain countries and it involves several aspects of human life (i.e. transportation, civil constructions, tourism and environment) causing very high social costs. To mitigate avalanche risk in built-up areas, Authorities can exploit only two instruments: urban planning (hazard maps) and defence structures.
In the present work, the mitigation of avalanche risk by proper structural design of civil constructions is considered. Thanks to a good design, the structural parts of a building can absorb the avalanche impact with a consequent reduction of vulnerability.
Considering the traditional architecture of Aosta Valley, we suggest design approaches and requirements for buildings to resist powder and dense snow avalanches.
These guidelines apply to masonry bearing walls and consider in detail the different architectural configurations. Thus, all the possible resisting mechanisms are considered depending upon the slenderness of the wall and the geometry. To make the design procedure easy-to-apply, abacuses are plotted for the common cases and herein presented. We suggest both the use of reinforced and unreinforced masonry walls. The former solution might be useful in existing and historical buildings while the latter can be applied to blank walls.
Concrete partitions are fundamental in such cases when the geometry of wall openings may not be sustained with a proper structural scheme. In addition, the main building framework has to resist to high magnitude transversal forces induced by the impact. The joints have to support high bending forces and, therefore, have to be properly designed. Sketches on the possible reinforcement configurations are given.
The use of timber in houses is the most traditional expression of Alpine architecture. Hardwood and glued laminated timber are suggested for buildings in avalanche hazard areas. Thus, the design of such structural components has to take into account the different loading schemes and the various resisting devices. In particular, the use of metal screws is suggested, even if nail connection are enough for secondary elements. Timber density and humidity play an important role in the definition of the capacity of the whole roof. Design abacuses are presented for the most common cases.