

Basal stresses in snow avalanches: implications on snow shed design

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In alpine countries, transportation routes in steep mountain terrain are frequently protected by snow sheds which deflect snow avalanches across the road or railway line, allowing important transportation routes to remain open in dangerous avalanche situations. Snow shed roofs must withstand the static and dynamic forces exerted by the avalanche impact and flow deviation. In Switzerland, the existing Swiss Guideline for Snow Shed Design (Edition 1994) predicts snow avalanche loading using simple hydrodynamic models. Advances in the mechanics of granular systems, numerical modelling and recent experimental observations of avalanches call into question the use of hydrodynamic models to accurately predict snow shed loadings. In this contribution, we present basal shear and normal forces measured in chute flows of snow on a 34 m long and 2.5 m wide snow chute. The Swiss guideline formula to predict the decrease in loading after a slope deviation does not agree with the measurements: Near the deviation, the calculation formulas underestimate the applied forces; far from the deviation, they overestimate the forces. We also found that the effective coefficient of friction μ on the chute surface varies between dry snow avalanches, wet snow avalanches and slush flows, and is, in general, higher than the value suggested by the Swiss guidelines for snow shed design.