



## **Relations between artificial snow and skiing accidents in the European Alps**

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Artificial snow is approximately 50 times harder and 4 times denser than natural snow. This is caused by the compact, spherical structure of the “snow crystals”, that lack the dendritic structure of snow flakes. Thus the porosity of artificial snow is very low. This has implications on snowmelt and infiltration. Since artificial snow has temperatures close to the 0°C point, it can melt easily during the daytime and refreeze quickly towards the late afternoon. The hard subsurface of artificial snow and its slippery surface increases the probability and nature of accidents. Therefore the late afternoon coincides with most accidents. Other causes include the increased frequentation of ski runs, increased speed and loss of control over the icy artificial snow surfaces. This is not only dangerous for experienced skiers but also children and young people. Accident witnesses describe artificial snow surfaces being “hard as cement”. It is judged that the accident probability of artificial snow is between 20-40% higher than for natural snow. With a lack of natural snow and dominant artificial snow production as was the case for the winter of 2006/2007, the severity of accidents due to artificial snow increases and there are less typical “light” skiing accidents. Many accidents are related to falls outside the runs or onto protruding rocks. Accident risk also increases due to the higher density of skiers over smaller and more limited runs with artificial snow.

There are three major risk zones related to artificial snow accidents, particularly in the early or late season when there is a general absence of natural snow. One concerns snow-free patches within the runs, that can cause severe injuries when not recognized quickly enough. The other concerns the boundary between the artificial snow covered runs and the surrounding snow-free region. The third risk zone concerns local differences between artificial snow and natural snow on heterogeneous runs that can

cause severe accidents due to the differences between the slippery artificial areas and the “breaking” effects of looser accumulated natural snow below. This poses another potential factor for severe accidents, including concussion, fractures, and ligament injuries. The risk of injury differs according to skiers, snow boarders, snow bladers or carvers. Skiers are more susceptible to injuries of the lower extremities such as the knees and thighs. Snowboarders and bladders are more likely to injure the upper extremities and in addition skull and spinal injuries. Typical injuries include very complicated fractures and may even result in artificial limbs.

Artificial snow in the mountains may soon become inevitable but accidents too. Increased accident probabilities are likely to result in higher insurance costs in the future.