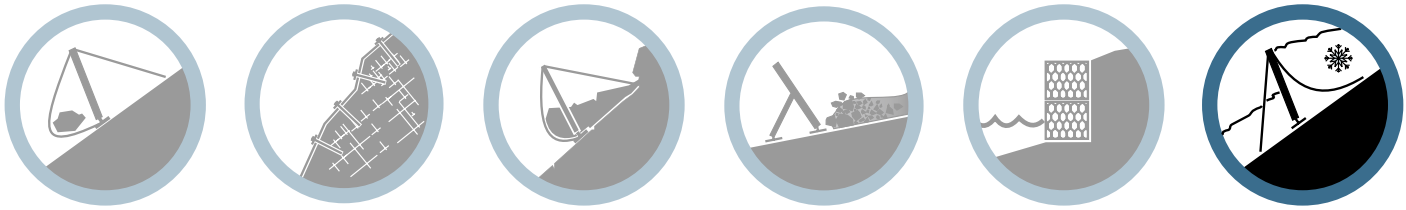
TRUMER
Schutzbauten

Avalanche Protection



Safety without Compromise

Photo: Adobe Stock | jancsi hadik

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Trumer Schutzbauten designs, produces and sells solutions for protection against natural hazards such as rockfall, unstable slopes, debris flows, landslides and avalanches.

Regarding avalanche protection, the following three areas of avalanche-prone slopes are identified during the assessment of risk (pictured above right):

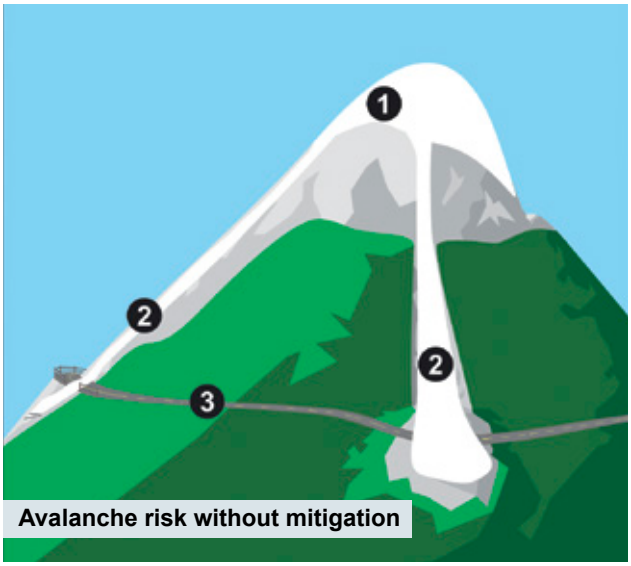
❶ **Initiation zone: area where the avalanche develops and releases**

❷ **Avalanche track: path of movement of the avalanche from the starting point to the area of deposition**

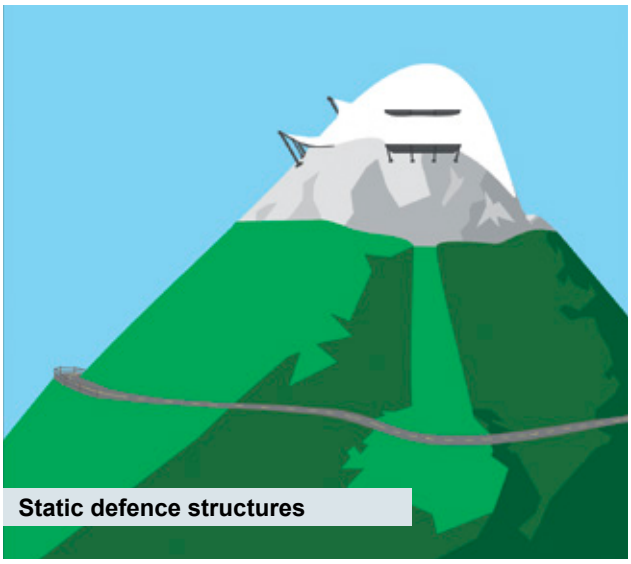
❸ **Elements at risk: e.g. infrastructure buildings, buildings, ski resorts**

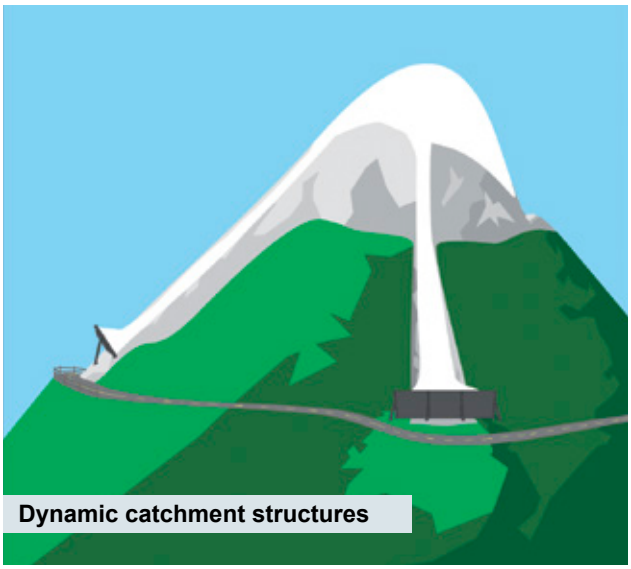
The use of avalanche protection systems has a long history, especially in Europe. Traditionally, snow nets, snow rakes and steel snow bridges are installed in the initiation zones to prevent avalanches from forming (picture center right).

In addition to these static defense structures, TRUMER uses snow catchment fences in recent years, such as the SNOWCATCHER, which effectively reduces the run-out length of an avalanche (picture bottom right). Such systems are often more cost effective for protecting linear infrastructure, buildings, tourist areas and infrastructure, where large initiation zones maybe too costly to appropriately mitigate.



Avalanche risk without mitigation


Static defence structures

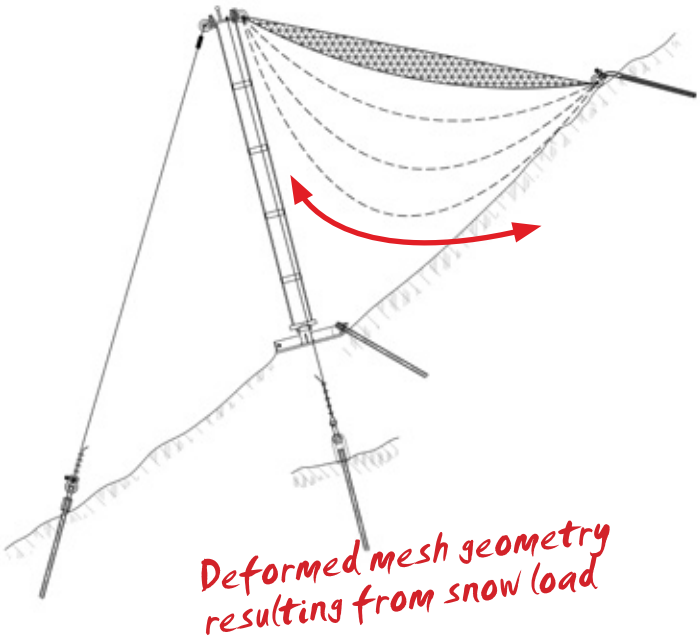

Dynamic catchment structures

Snow-nets

Snow nets prevent the development of avalanches by giving structural support to the snow mass in initiation zones having medium to large snow depths. This is in contrast to other approaches such as artificial release methods - e.g. by means of explosives – that initiate smaller avalanches before the hazard grows to an unmanageable size.

The advantage of stopping the development of an avalanche in its entirety, as in the case of snow nets, is that it is weather-independent and for the most part requires no action or decision making process once implemented. In scenic areas, snow nets are often chosen as an alternative to heavy steel or concrete structures, as they have less aesthetic impact.

Snow nets are dimensioned, constructed and produced according to the applicable standards and guidelines (e.g. ONR 24806, EN 1993, EN 1090). The assembly of avalanche systems is done mainly by hand with helicopter support for delivering net packages, ropes and small parts, since the access for heavy machinery is usually not possible.



In summary, TRUMER snow nets have the following advantages after professional planning and installation:

- ✓ **Nearly maintenance-free systems**
- ✓ **Weather-independent protection**
- ✓ **Possible reforestation of the avalanche track and deposition zone**
- ✓ **Elimination of the danger in initiation zone**
- ✓ **No costly construction of access roads required**
- ✓ **No exposure of human lives to avalanche-prone situations**
- ✓ **Low aesthetic impact on landscape**
- ✓ **Additional rockfall protection**

Snow-rakes

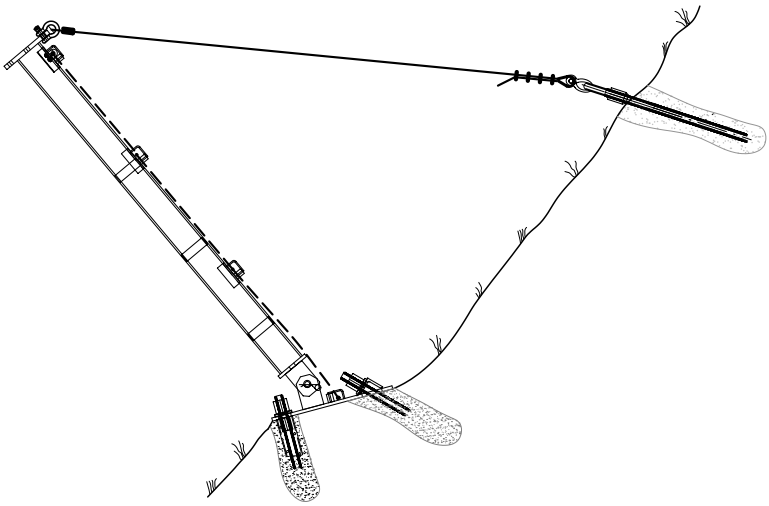
Flexible-net snow rakes are similar to snow nets as they are installed in potential initiation zones to prevent avalanches from developing.

However, snow rakes are a lightweight alternative in wooded areas and areas with low snow depths. Like other static defense structures, these systems also function independently of the weather and do not require action or a decision making process in an avalanche hazard situation.

Flexible-net snow rakes are dimensioned, constructed and produced by TRUMER Schutzbauten according to the applicable standards and guidelines (e.g. ONR 24806, EN 1993, EN 1090).

During assembly, the material is typically transported by hand to the installation site so that defore station is not required. Where access is favorable, installation can also be supported by heavy machinery.

Furthermore the areas with vegetation that were damaged by avalanches can be reforested.



Simple installation for low snow depths

After proper professional planning and installation, TRUMER snow rakes have the following advantages:

- **Little or no clearing measures required**
- **Nearly maintenance-free systems**
- **Weather-independent protection**
- **Possible reforestation of the avalanche track and deposition zone**
- **Elimination of the danger in initiation zone**
- **No costly construction of access roads**
- **No exposure of human lives to avalanche-prone situations**
- **Low aesthetic impact on landscape**
- **Additional rockfall protection**

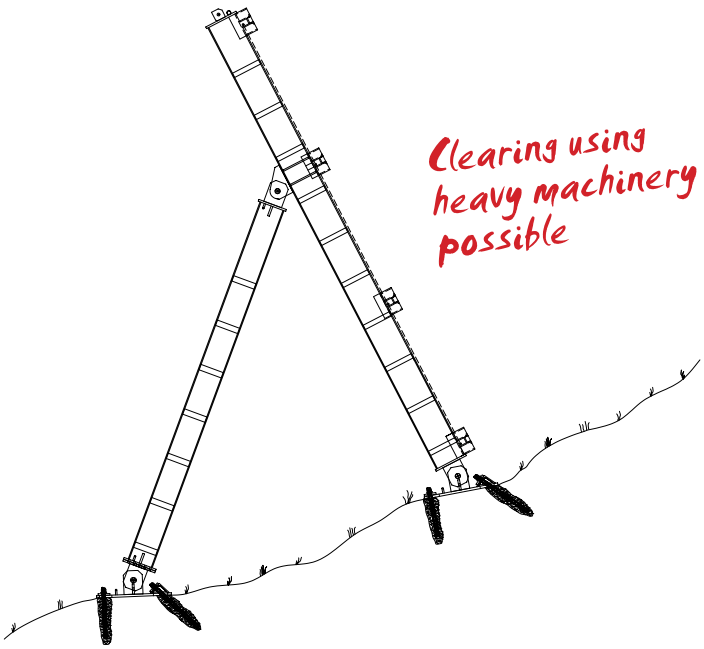
Snow Catchment-fences

Snow catchment fences such as the SNOW-CATCHER do not prevent the initiation of avalanches but instead interact with an avalanche in the run-out or deposition zones in order to slow the avalanche and bring it to a standstill. This shortens the destructive reach of avalanches.

These systems are more cost efficient in protecting isolated elements at risk within an avalanche path or even wide areas where the prevention of avalanche formation in the initiation zone would be too costly.

Since the systems are constructed closer to the objects being protected, they have no impact on scenically sensitive areas higher on the slopes. In addition, the installation and maintenance can be more efficiently implemented due to their proximity.

In general, catchment fences have a higher maintenance requirement than snow nets and snow rakes, since after a major event, the snow mass must be cleared and the system must be reset for further events.



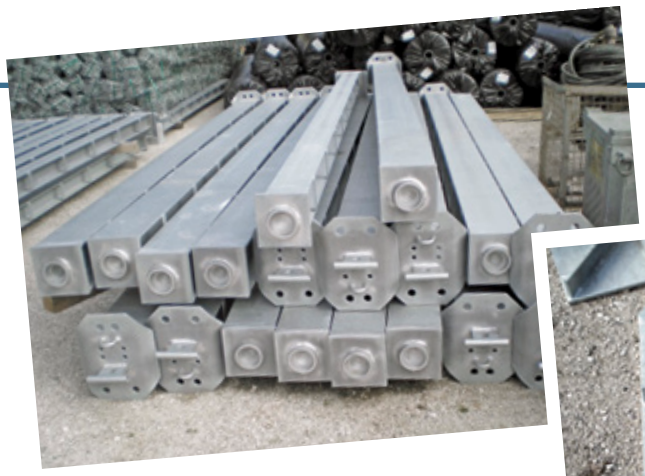
Compared to avalanche dams, catchment fences require less construction space. Thus, a larger area is available for the controlled interception and deposition of the avalanche.

In summary, TRUMER snow catchment fences have the following advantages after professional planning and installation:

- ✓ **Highly cost-effective protection**
- ✓ **Weather-independent protection**
- ✓ **No impact on the surrounding landscape**
- ✓ **No exposure of human lives to avalanche-prone situations**
- ✓ **Efficient installation and maintenance**
- ✓ **Additional rockfall and debris flow protection**

Transport and Installation

After aligning the posts and installing the suspension and retention ropes, Omega-Nets are pulled open like a curtain and connected together with shackles.



Posts and base plates of a snow net system with ball joint - coupling on the post foot and ball on base plate. Saddle plate with mounting tube on the post head for easy net installation.

Pre-flight preparation and compact packages allow quick installation and reduced flight times which together mean a more cost efficient installation.

Omega-Nets are delivered in packages that enable easy connection to the suspensi-on ropes by leading the ropes through the nets without the use of shackles.

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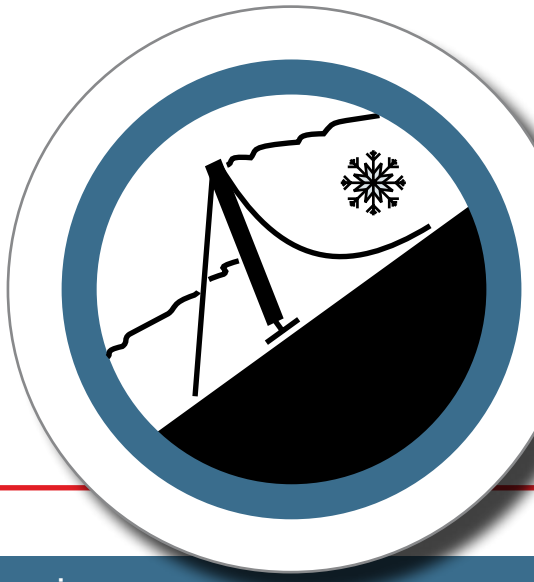

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