

s n o w   n e t s

**MACCAFERRI**

# Snow nets

The inhabitants of mountainous areas have always been affected by the **risk of avalanches**. The need to live alongside this threat has led to attempts to mitigate the risk by constructing intricate systems of artificial structures.

The deforestation, sometimes indiscriminate, of some areas and the development of tourist infrastructures has resulted, on the one hand, in the reduction of natural barriers to the triggering of snow instability phenomena and, on the other, to an increase in the need to guarantee the safety due to a different use of the territory - not to mention the need to protect residential areas and roads and railway lines.

Snow barriers enable a considerable reduction of this risk.

**The mesh snow nets are designed in order to stabilise the layer of snow at the potential avalanche detachment zone, thereby preventing triggering of the avalanche.**

The layer of snow exerts a pressure which must be absorbed by the nets and transmitted to the ground by means of a system of posts and anchors. The flexibility of the system results in a reduction of the pressure exerted by the snow on the structure in a parallel direction to the slope. The stress depends on the slope angle, the thickness of the layer of snow, the environmental conditions and the exposure of the slope itself.

The **snow barrier structures** act on the slipping and sliding mechanisms of the layer of snow in a downhill direction, creating a "stagnation zone" on the upslope side characterised by compression forces which absorb a part of the dangerous shear forces in the weak layers and limit the propagation of the shear fractures. In this way there is a reduction in the shear forces and a consequent increase in the stability of the layer of snow.

The snow barriers must be positioned in the area of the potential detachment of the snow. It may be necessary to install various rows of structures, on the upslope and downslope sides of a potential failure point. This limits the propagation of the shear failure and the resulting movement of the mass of snow.

**Mesh snow nets** may be easily adapted to ground surface irregularities and therefore represent an excellent solution even in situations where the ground alignment is very variable, where it would be very difficult to adopt more rigid structures.

An advantage of mesh snow nets is the **reduced environmental impact** due to their limited visibility, during both the winter and summer.

These barriers consist of a few components which make them both simple and efficient: steel tubular struts, steel cable panels, steel mesh fitted to main cable panels, upslope and downslope anchors (as well as end point anchors) in order to guarantee the stability of the system.

## NEW: BAFU OMOLOGATION!!!

**OM snow nets** have been certified by the Swiss Federal Institute for Snow and Avalanches of DAVOS, approved by the Federal Expert Commission on Avalanches and Rockfall (EKLS) and have obtained the homologation of the Federal Office for the Environment (BAFU-FOEN) in March 2009.

## Forces which act inside a layer of snow and possible detachment points

Elements characterising the detachment zone

- Slope angle
- Orientation with respect to wind direction
- Exposure to sun's rays
- Altitude
- Morphology
- Presence of trees
- Surface area of slope

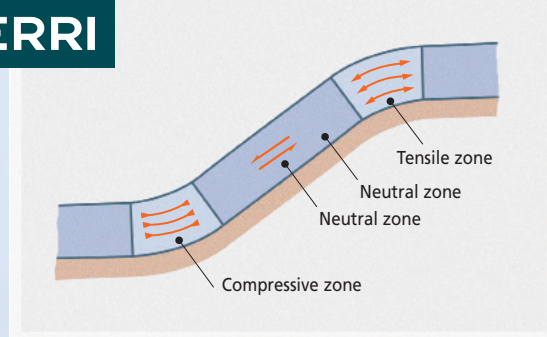
The triangular mesh snow net produced by Officine Maccaferri has been designed on the basis of the "Directives for the construction of avalanche protection works at the detachment zone" edition 2006 issued by UFAFP (Federal Management of Swiss Forests) and FNP (Swiss Federal Institute for Study of Snow and Avalanches).

## Technical characteristics

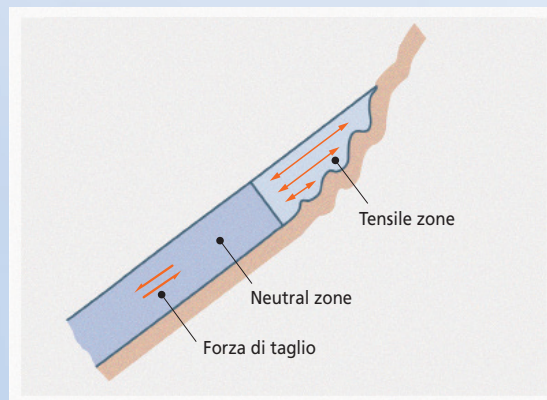
It is an elastic and modular structure, consisting of the following main elements:

- containment structure:** consisting of triangular shaped panels made of steel cables. There are two types of triangular mesh panels: one with the horizontal side on the ground and the vertex at the top and the other with the vertex on the ground and the horizontal side at the top. The dimensions of the panels vary for each model and depend on the thickness and the specific weight of the layer of snow.
- support structure:** consisting of steel tubular struts, fixed to the ground at the base by means of a universal ball joint and at the top by means of the triangular mesh panels and the downslope braces.
- connection structure:** consisting of steel cables to distribute the loads transmitted by the containment structure and to transfer the loads to the ground by means of the anchoring structure.
- anchoring structure and foundation:** this transfers to the ground the loads transmitted by the containment, support and connection structures and, depending on the element connected, it consists of upslope and downslope anchors made of double spiral cables or by micro-piles or foundation plates for the struts.

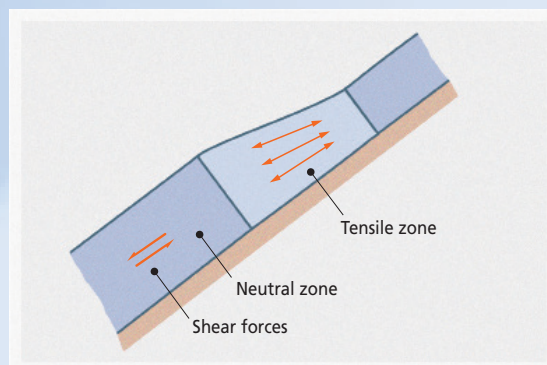
The components of the snow net barrier enable assembly even under harsh conditions. The snow net has been designed manufactured and marketed in accordance with the quality control requirements of ISO 9001.



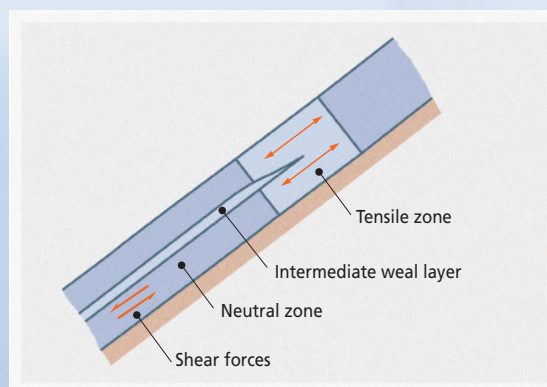
Neutral zone with shear forces. Tensile and compressive zones depending on a greater or lesser slope angle.



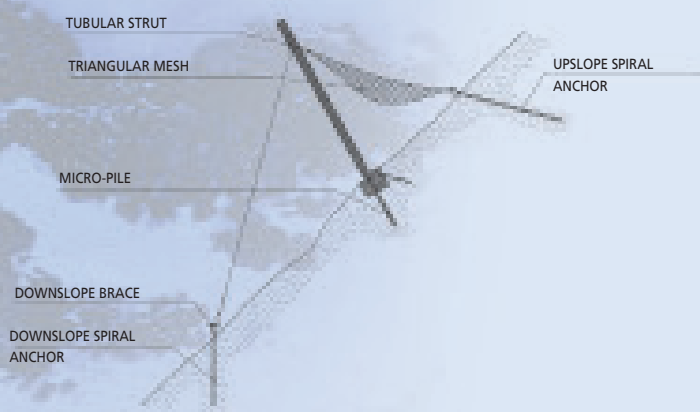
Tensile zone depending on the anchoring of the snow to the side of the mountain



Tensile zone depending on the increase in the height of the snow.



Tensile zone caused by the formation of an intermediate weaker layer further down the slope.

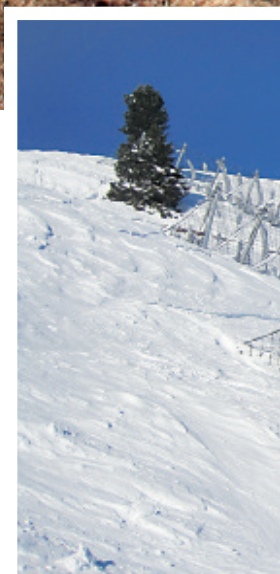
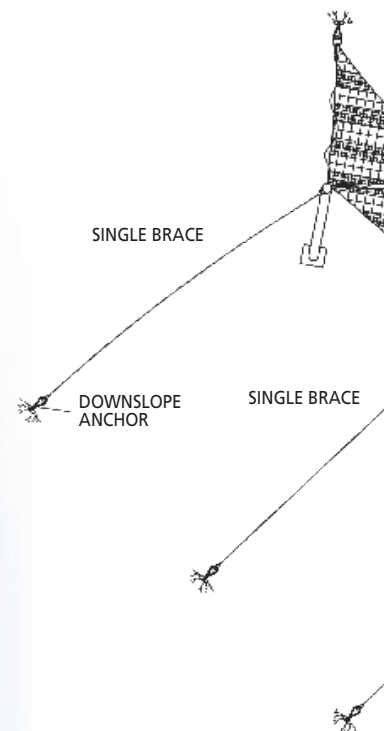




An avalanche occurs when a mass of snow suddenly starts to move downhill due to a breakdown of the snow's equilibrium conditions. The movement of the snow may be the result of natural causes (e.g. the wind) or accidental reasons (e.g. skiers on the slope, etc.). As it moves downhill the avalanche may drag other snow with it, becoming increasingly large, and it can travel at speeds of more than 300 km/h. Almost all mountain valleys may be considered to be subject to this hazard.

"Avalanche hazard" means the possibility of a dangerous event occurring, maybe in a remote area high up in the mountains, where there are no persons or objects: there is a clear hazard but no risk.

However, "avalanche risk" means that there is a real hazard and there are persons or objects at risk.



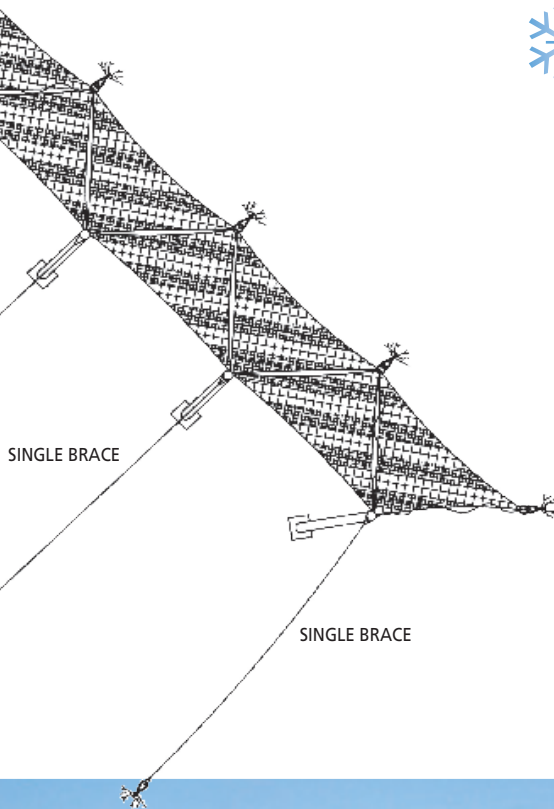


## INSTALLATION



### Snow nets:

- Adapt themselves to the acting loads
- Cover a wide range of snow thicknesses (2.5 m – 4.0 m).
- Are lightweight structures (approx. 70 kg/m).
- Do not interrupt the continuity of the blanket of snow
- Also resist dynamic type impact (falling rock masses) even though they are not designed for this purpose
- May be adapted to any type of ground alignment
- Have a low visual impact





# Officine Maccaferri Group Profile

Founded in 1879, **Officine Maccaferri** soon became a technical reference in the design and development of solutions for erosion control and retaining structures. Since then, through technological innovation, geographical expansion and focussed diversification, Maccaferri now offers solutions at a global level for a wide range of **civil and environmental engineering** applications.

## Consultancy and Partnership

Maccaferri's motto is 'Engineering a Better Solution'; We do not merely supply products, but work in **partnership** with our clients, offering technical expertise to deliver versatile, cost effective and environmentally sound solutions. We aim to build mutually beneficial relationships with clients through the **quality of our service and solutions**.

Officine Maccaferri is at the heart of the Maccaferri Industrial Group. Its continued growth is based upon long-held values of innovation, integrity, excellent service and respect for the environment.

Maccaferri's vision is to become a leading international provider of advanced solutions to the civil engineering and construction market. Implementing a strategy of vertical integration, Maccaferri researches, manufactures, designs, supplies and constructs solutions within its target markets. The capability of the business continues to expand due to a strategic plan to open new markets and grow existing ones; Maccaferri now offers advanced engineered solutions from **beach nourishment to reinforced soil structures** and from **rockfall mitigation to tunnelling systems**. With over 2000 employees, 26 manufacturing facilities and local operations in 100 countries around the world, Maccaferri can truly claim to have a global presence with local focus.

**Maccaferri: Engineering a better solution**



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