

Basic **AVALANCHE KNOWLEDGE**

# **SAFETY ACADEMY**

## Guide Book

for **BACKCOUNTRY SKIERS, FREE RIDERS** and **SNOWMOBILERS**



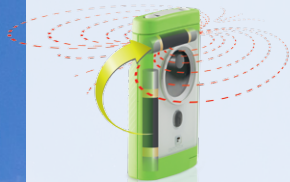


# IMPROVING YOUR SAFETY

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The **SMART-ANTENNA-TECHNOLOGY** analyzes the position of the antennas in the avalanche and **AUTOMATICALLY** switches to the optimal transmission antenna.

**THE RESULT:** 43% more range, regardless of the beacon used for searching.



Tested and recommended



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by the  
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Our short handbook should not be seen as a miraculous solution against avalanches.

It should at most impart and consolidate **BASIC KNOWLEDGE** and give people an understanding of the **LAWS OF NATURE**.

No matter whether you go **BACKCOUNTRY SKIING** or **FREE RIDING** or **SNOWMOBILING**, you will never be able to fully eliminate the risk.

**CONSIDERED BEHAVIOR** alone will give you years of pleasure to come in your sport.

**PETER GEYER**  
VDBS



# AVALANCHES AND HOW THEY ARE CAUSED

A look at the photo tells the attentive observer many factors about the cause of this avalanche:

**WEATHER** — A lot of new snow combined with wind and cold temperatures.

**TERRAIN** — Untouched and steep. Probably 30° or more.

**SNOW COVER** — A snow slab becomes unstable when there is a weak layer in the snow cover.

**HUMAN** — Even when highly motivated, people should always act responsibly and in a predominantly defensive manner. The prevalent risk was not detected here.



The picture shows the most dangerous type of avalanche for winter sportspeople, the **SLAB AVALANCHE**.

PHOTO: Ralf Hochhauser

## 4 **AVALANCHES AND WHAT CAUSES THEM**

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**print production**

By carbon neutral printing, **ORTOVOX** gives a small contribution to the preservation of our planet.



# SLAB AVALANCHES



In case of a slab avalanche, snow masses usually come loose with a linear crack in floes, which suddenly slip down on a sliding layer.

## CONDITIONS FOR SLAB AVALANCHES



- + Compact snow (often drift snow)
- + Poor bond to the layer underneath (low shear resistance = weak snow layer)
- + Steepness ( $>30^\circ$ )

# HOW SLAB AVALANCHES ARE TRIGGERED

An avalanche can be triggered just from the low additional load of one person on the snow surface.



## ASCENT

1 – 2 times body weight.



## KICK TURN

2 – 3 times body weight.



## SHORT TURN

4 – 5 times body weight.



## FALL

6 – 7 times body weight.



**BEAR IN MIND:** The weight of new snow, rain, warm temperatures or intense sunshine can also lead to avalanches being triggered naturally!

# AVALANCHE FACTOR Weather - Precipitation

Whether or not snowfalls influence the risk of an avalanche depends on the conditions during the period of precipitation:



## CRITICAL AMOUNT OF NEW SNOW

in the last  
1 – 3 days

**10 – 20 CM** (4 - 8") in case of unfavorable conditions

**20 – 30 CM** (4 - 12") in case of average conditions (mixture of favorable / unfavorable)

**30 – 60 CM** (12 - 24") in case of favorable conditions

## FAVORABLE CONDITIONS

No or little wind

—  
Temperatures just below 0° C (32° F), especially when snow starts falling

—  
Rain turning to snow



## UNFAVORABLE CONDITIONS

Strong wind (around 50 km/h / 30 mph)

—  
Low temperatures

—  
Poor layer composition (melt-freeze crust, snowed-in surface hoar, hard ice or very old layers)





## AVALANCHE FACTOR Weather - Temperature

One of the general conditions to be noted during and after snowfall is the temperature. Cold, warm air and sunshine have a huge influence on the processes of change in the snow cover and also on the avalanche risk.

### **MASSIVE WARMING**



It is very critical, but its effects can be easily evaluated.



### **SLOW, MODERATE WARMING**



Helps to set the snow cover and the bond between the layers.

### **WARMING DURING DAY - COOLING AT NIGHT**



Causes the snow cover to compact perfectly, yet attention must be paid to the avalanche situation deteriorating during the course of the day from east to west. (Attention in case of snowfall after such a phase; a critical weak layer is often formed)

### **COLD**



Preserves existing risks and delays the setting process.

### **LONG-LASTING MAJOR COLD SPELL**



Fully eases the avalanche situation, as the structure of the crystals change and become loose.

## AVALANCHE FACTOR Weather - Wind

Wind is the ultimate architect of avalanches. Just small amounts of snow combined with strong wind can lead to a critical avalanche situation.



**BEAR IN MIND:** On the mountains you should avoid **GULLIES**, **TROUGHS** and **BOWLS**, as snowdrifts accumulate here. Just as dangerous are the **LEE AREAS** behind ridges, as well as the **CORNICES** above them that are in danger of breaking off.

### ON THE LEE SIDE

— Behind ridges

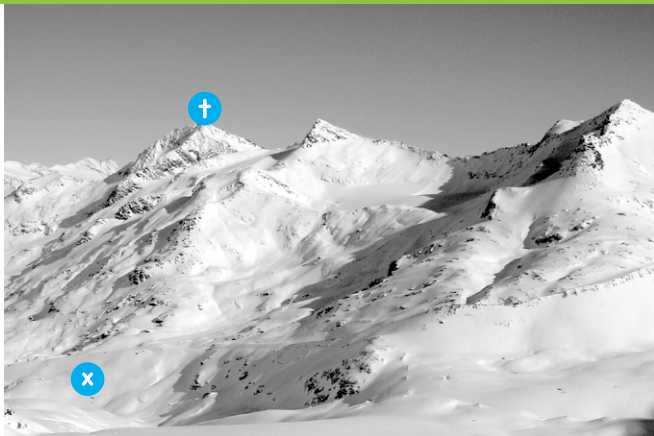
— Under inclination changes

### ON THE WINDWARD SIDE

— At the foot of steep ridges

— In troughs and gullies

## AVALANCHE FACTOR Terrain - Slope shape



### TASK

Trace a route on the terrain picture that presents the lowest avalanche risk for you and your party.

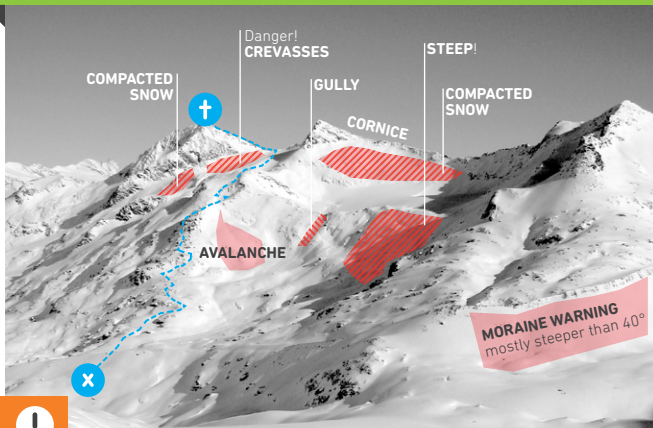
Solution on the next page.

Terrain shapes influence the formation of avalanches because they have a crucial influence on the wind direction and speed and also on the extent of snow fractures.

**GULLIES, TROUGHS** and **SLOPE CHANGES** encourage avalanches. These shapes of terrain help to form snowdrifts on the lee side and compacted snow build-ups on the windward side.



## AVALANCHE FACTOR Terrain - Slope shape



The **IDEAL ROUTE** makes the best use of the terrain shapes that are safe from avalanches:

**RIBS**, as the snow is often blown off them and snowdrifts hardly accumulate there

**BROAD RIDGES**, as the wind hardly ever allows snowdrifts to form here either

**DEPRESSIONS**, as they support the snow cover by means of small slope shapes

### THE TOUR AVOIDS:

**STEEP SLOPES**, staying away from riskier avalanche-prone areas by maintaining appropriately safe distances.

**BOWLS & GULLIES**, since these are areas where snowdrifts can often accumulate.

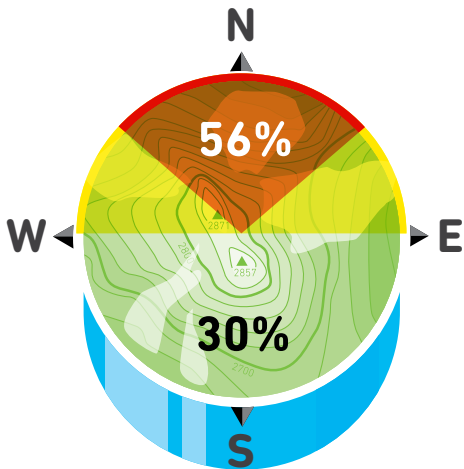
**CORNICES**, because they can break off unexpectedly at any time. On the leeward side, underneath the cornice, one often finds accumulations of dangerous snowdrifts.



## AVALANCHE FACTOR Terrain - Slope direction

**70%** of all avalanche accidents happen on **NORTH-FACING SLOPES** (W to E) and **56%** in the pure **NORTH SECTOR** (NW to NE).

The reason for the frequency of accidents on these aspects is that the snow cover **SETS MORE SLOWLY** due to the **LOW AMOUNT OF SUNSHINE**. Powder, but also the danger, therefore, remains in place longer.



Due to longer periods of sunshine, **SOUTH-FACING SLOPES** often have a more stable snow cover composition.

Only **30%** of all avalanches go off on a **SOUTHERN ASPECT** (SE to SW).

**BEAR IN MIND**, however, that a **CRITICAL AVALANCHE** situation often relates to **ALL ASPECTS!**



# AVALANCHE FACTOR Terrain - Slope steepness

Around **97%** of all avalanche accidents happen on slopes with an inclination **OF OVER 30°** (designated in the avalanche report as steep slopes).

In the case of **84%** of accidents, the steepest part of the slope is **AT LEAST 35°**.

When determining the steepness of a slope, the steepest part of a slope that measures at least 10 x 10 m (30 x 30 ft) is looked at.

As a guideline, the following slope steepness can be seen as safe subject to the avalanche report:

1

Apart from extremely steep terrain, conditions **GENERALLY SAFE** from avalanches.

2

- **AVOID EXTREMELY STEEP TERRAIN**
- **KEEP YOUR DISTANCE** on slopes that are so steep that kick turns make them easier to ascend.
- **CROSS SLOPES OVER 30° ONE AT A TIME**

3

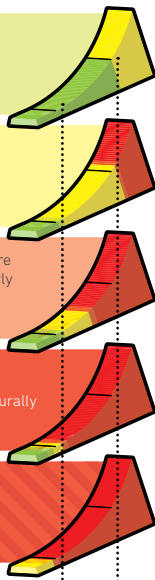
- **AVOID SLOPES OVER 35°** in those sloping areas that are mentioned in the avalanche report or appear particularly dangerous.
- In addition, in all sloping areas: Behave as at Level 2

4

- **AVOID SLOPES OVER 30°.**
- Even in flatter areas, bear in mind the possibility of naturally triggered avalanches from catchment areas above.

5

Backcountry skiing, free riding and snowmobiling are **GENERALLY NOT POSSIBLE**.



Steepest part of the slope according to topographic map

30° 40°

## AVALANCHE FACTOR Snow cover

A snow slab becomes unstable when there is a weak layer in the snow cover.

The following circumstances have a positive influence on the stability of the snow cover:



### KNOWLEDGE OF THE GROUND UNDERNEATH

The more grassy / flattened the ground underneath, the higher the risk of ground avalanches (usually in spring). Knee timber, rocky terrain or forest with trees very close together reduce the risk.



### NUMBER OF CROSSINGS

Heavily used slopes over the whole area before the last snowfall can reduce sliding layers and ensure greater stability.

## AVALANCHE FACTOR Human



**HUMANS** represent the **MOST IMPORTANT AVALANCHE FACTOR** in recognizing and avoiding the risk of an avalanche. **EXPERIENCE, KNOWLEDGE, PERSONAL ABILITY** and **APPROPRIATE BEHAVIOR** are contributing factors for triggering avalanches. That is why conscientious **ROUTE PLANNING**, attentive observation and risk-conscious decision making are an essential part of any off-piste activity.



## PLANNING A TOUR

The basis for preparing any tour is the information from the **AVALANCHE REPORT, WEATHER REPORT, TOUR GUIDES** and **TOPOGRAPHIC MAPS**.

## PLANNING A TOUR Avalanche report

**AVALANCHE REPORTS** are normally issued every day in the relevant months and provide data from observers, monitoring stations, snow section recordings and local experts. Just looking at the danger level is **NOT ENOUGH**.

The avalanche report contains all the relevant information about the **WEATHER, SNOW COVER, ASSESSMENT OF THE AVALANCHE RISK** (danger areas, additional load, trigger probability) and a forecast of the expected development.



**TIP:** On [ortovox.com](http://ortovox.com) you can find all the relevant information at a glance!

### LEVEL

### SNOW COVER

1

low



Generally well compacted and stable.

2

moderate



Only moderately compacted on some steep slopes, otherwise generally well compacted.

3

considerable



Only moderate to weak compact on many steep slopes.

4

high



Unstable in most places.

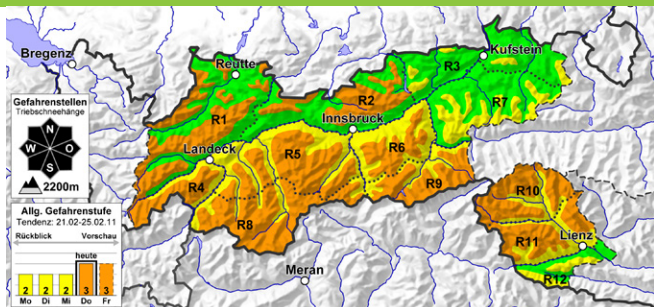
5

extreme



Is generally unstable.

# PLANNING A TOUR Avalanche report



## TRIGGER PROBABILITY

Avalanches can generally only be triggered in case of large additional loads in isolated places on extremely sloping terrain. Only small natural avalanches are possible.

Possible particularly in case of large additional loads, especially at the specified steep slopes. Large natural avalanches are not anticipated.

Avalanches may be triggered by just a small additional load, especially at the specified steep slopes. Some medium, but also big natural avalanches in isolated cases are possible.

Avalanches are probable from just a low additional load on many steep slopes. Many medium, but also big natural avalanches in isolated cases can be expected.

Many large natural avalanches can be expected, even on moderately steep terrain.

## PLANNING A TOUR Selecting your destination

**ortovox.com** as well as the **ORTOVOX MOUNTAIN TOURS APP** (Bergtouren App) offers you many destinations, which you can choose according to a wide variety of criteria. The topographic maps shown there are no substitute for conventional maps, however, with as **SMALL A SCALE** as possible.

When planning, it is essential to choose a route suitable for the avalanche situation. **SLOPE STEEPNESS, ASPECT** and **AVALANCHE TERRAIN TRAP** must be checked in case of any danger situation.



**TIP:** Slope steepness can be read from tour maps with a scale of **1:25000** with the aid of the **MARK ON THE SIDE**.



### **ALTERNATIVE DESTINATION**

If the conditions found on the terrain do not match your assumptions, then an alternative destination planned out in advance is the safe solution.

### **TIME PLANNING**

Always allow extra time. The reality in the mountains is usually different from plans made on the sofa.

### **NEVER GO ALONE**

Even minor accidents can have fatal consequences..

### **GROUP SIZE**

The smaller the group, the more flexible you are. 8 persons is seen as the maximum.

### **GROUP APPEARANCES**

Always act responsibly and do not be misdirected into more risk.

### **CONSIDERATION**

Always act with the weakest skier in mind and show consideration



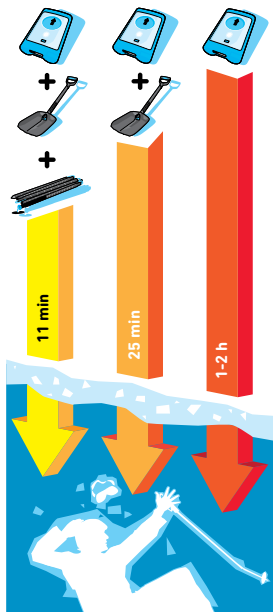
## PLANNING A TOUR Emergency avalanche equipment

A **COMPLETE SET OF EMERGENCY AVALANCHE EQUIPMENT** enables you to locate and save your friends in case of emergency.

Emergency equipment cannot prevent an avalanche or potential burial.

### CHECK LIST

- AVALANCHE TRANSCIVER**  
3 antennas and a flagging function are standard.
- SHOVEL**  
A hacking function saves you invaluable time.
- PROBE**  
A quick and stable quick-assembly system is essential.
- BACKPACK**  
Make sure it has an emergency compartment.
- HELMET**  
Now part of the standard equipment on the slopes.
- FIRST-AID KIT AND BIVOUC SACK**  
Can save lives and make emergencies more bearable.
- MOBILE PHONE**  
You can alert the rescue by dialing 112 (Europe) / 911 (US)



### IMPORTANT

Only a complete set of emergency avalanche equipment enables you to locate and save your friends in case of emergency. Emergency equipment cannot prevent an avalanche or potential burial.



At the starting point of the tour, the transmitting and receiving function on all avalanche transceivers should be checked:

### GROUP LEADER CHECK

1. He switches his transceiver to transmit.
2. All others to receive.

### GROUP CHECK

1. Leader switches to send, all others to receive.
2. The group members walk past the leader one by one 5 m (16 ft) interval.
3. After a successful check, the leader also switches to transmission mode.

### BEFORE EVERY TOUR

The batteries should be checked and replaced immediately if necessary.

# ON THE SLOPES

1

Adapt your route to the terrain. **GULLIES, TROUGHS** and unnecessary **STEEP SLOPES** should be **AVOIDED**, as they may hide danger.

2

Go around **SNOWDRIFTS** and **ACCUMULATIONS OF COMPACTED SNOW**

3

Actively watch out for **ALARM SIGNALS** or systematically analyze the snow cover (Page 27).

4

Get your bearings regularly both on the **TERRAIN** and on the **MAP** and keep a regular check on your tracks.



5

Check whether the **SLOPE STEEPNESS** matches the danger situation (see Page 19). A slope measuring device, the **ORTOVOX S1+** or your ski poles can be used as measuring instruments (pendulum method: **ortovox.com**). You can basically tell when ascending slopes from approx. **30°** or more, as you will automatically switch from arcing to kick turns.

6

You should either ascend **STEEP SLOPES ONE BY ONE** or keep a **DISTANCE** of at least 10 m (30 ft).

7

**RECENT AVALANCHES** are clear indicators of a **HIGH RISK OF AVALANCHES**. Be sure to keep a safe distance away by giving the area a large berth.

## ON THE SLOPES Alarm signs

### NATURALLY TRIGGERED AVALANCHES

usually occur when there is a high avalanche risk. Especially when the weather warms up in the daytime in spring, they serve as an indicator for danger. Heavy **PRECIPITATION**, particularly rain, **RISES IN TEMPERATURE** or **WIND** can lead to an increased avalanche risk.

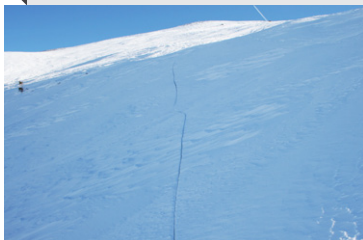
### WHUMPING OR SETTLING NOISES

the dull whumping sound, when the snow settles, indicates the biggest danger of all. You should abort the tour immediately and return to safe terrain.



### CORNICES

are a sign of high winds. Dangerous snowdrifts accumulate on the lee side.



### CRACKS

on the snow cover signal that it is ready to break.



**WATCH OUT:** If you are **UNSURE** of the danger, you should assess the layers of snow by means of a systematic **SNOW COVER ANALYSIS**. If there are still safety concerns, **TURNING BACK** is the only right decision!

Since the winter of 1998/99, "**SYSTEMATIC SNOW COVER DIAGNOSTICS**" have been taught in our training courses run by the Bavaria Avalanche Warning Service.

An attempt is made here, using individual **SPOT TESTS** ("small block test"), to transfer certain processes and properties of weak layers to the area or the individual slope and to then evaluate them.

This kind of diagnosis is **VERY QUICK** and **MEANINGFUL**.

You can find the comprehensive descriptions of the systematic snow cover analysis online at:

**ortovox.com**

## ON THE SLOPES Basic descent principles

It is possible to descend in a group only under very safe conditions. A **SAFETY INTERVAL** of approx. 50 m (160 ft) is recommended on any descent.

In case of less clearly safe conditions, skiers should descend **ONE BY ONE**. The leader should go first and **WAIT** at regular intervals **AWAY FROM THE DESCENT LINE** at a safe and protected place (assembly point).

In case of **POOR VISIBILITY** and **POOR SNOW**, skiers should descend **IN THE TRACKS** at safe intervals one after the other.

Members of the group should **WATCH OUT FOR ONE ANOTHER**.

The leader is **NOT TO BE PASSED**.



**BEAR IN MIND:** Falls impact the snow cover with **6-7 TIMES BODY WEIGHT** and should be avoided particularly in ridge areas and steep sections!

# AVALANCHE ACCIDENT



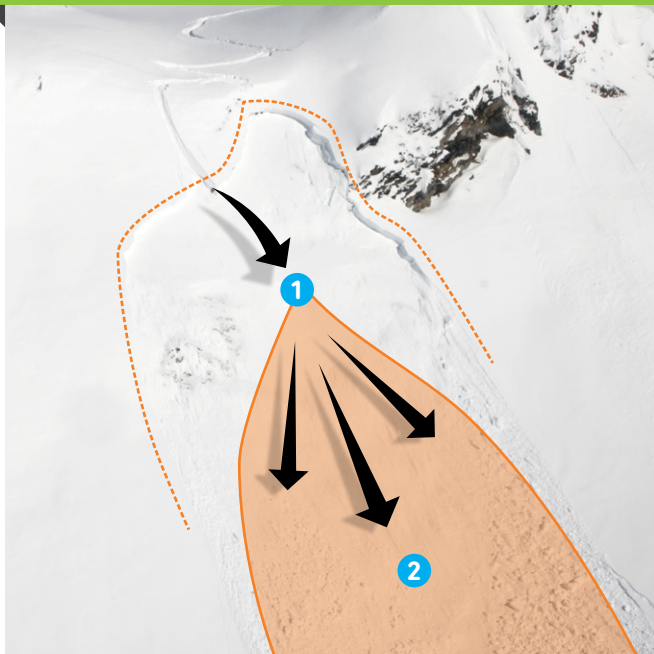
The chance of survival in the **FIRST 15 MINUTES** is relatively high at **90%**, but after that drops drastically. Only with:

— **COMPLETE EMERGENCY EQUIPMENT**

— **A FAST RESCUE OPERATION**

— and lots of **TRAINING** do you have a realistic chance of rescuing the victim.





If the accident was observed, you should note the **POINT OF DISAPPEARANCE 1** and coordinate the rescue operation without delay.

If there are several helpers, **ONE** alerts the rescue service (**EU 112 / US 911**).

**ALL** helpers **SWITCH** their transceivers to **SEARCH**.

The search area **2** starts at the **POINT OF DISAPPEARANCE 1** or at the **AVALANCHE BACK-UP AREA**.

## AVALANCHE ACCIDENT Help from companions – Signal search



First, you should search the avalanche deposit with your **EYES AND EARS** for objects or partially buried victims.

At the same time, start the signal search.

Depending on the number of helpers, the avalanche deposit is searched in **PARALLEL** (search strip width approx. 40 m, or 130 ft), or by **MEANDE-RING** with one person searching.



Modern, digital 3-antenna avalanche transceivers will show you the direction.

—  
You just have to follow the **DIRECTION ARROW!**

—  
Distances that get smaller indicate that you are getting closer to the victim.





When 2 - 3 meters (**6 - 10 FEET**) away from the victim, you have to use the device to search as **CLOSE** as possible **ABOVE THE SURFACE** of the snow **CROSSWAYS AND IN STRAIGHT LINES**, until you have found the lowest value.

—  
The value displayed equates to the victim's depth and you **MARK** the point **WITH CROSSED POLES**.

## AVALANCHE ACCIDENT

Help from companions – Pinpoint location (probing)



Starting from the **CROSSED POLES**, you now probe systematically from the **INSIDE OUTWARDS** until you locate the victim.

— The probe remains in place and is used for **ORIENTATION** purposes.

— Make sure that a possible **BREATHING HOLE** is not trodden on.

— **TIP:** Always probe at a **90° ANGLE** to the surface of the snow

## AVALANCHE ACCIDENT Help from companions – digging out



Read of the victim's **DEPTH** from the probe ① and walk down the slope by this figure and start shovelling in a V-shape.

With **SEVERAL HELPERS**, replace the shoveller at the top after **1 MINUTE** at the latest.

The positions should be taken as follows: **CUT OUT BLOCKS, SHOVEL**, and **CLEAR SNOW AWAY**.

**TIP:** Shovels with a **HACKING FUNCTION** can save valuable time here.

### FIRST AID



**CLEAR SNOW** from the victim's mouth and **AIRWAY** immediately and initiate life-saving measures (airway, breathing, circulation – **ABC** of life-saving)

Do not move the victim too much and **WARM** them **GENTLY** or protect them from getting colder.

Feed with warm, sugary **LIQUID**

Careful **REMOVAL**

