

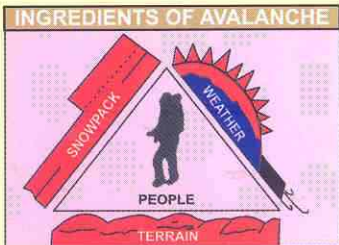
AVALANCHE

A USER'S GUIDE

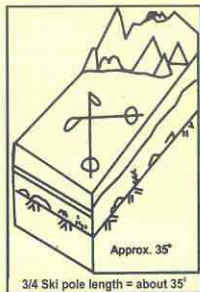


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INGREDIENTS OF AVALANCHE



TERRAIN



Avalanche danger increases with the increasing slope angle. Maximum avalanche activity is experienced from slopes between 30° and 45° . Slopes in the shade are more likely to be dangerous than sunny slopes.

- **Critical slope (Starting zone)**

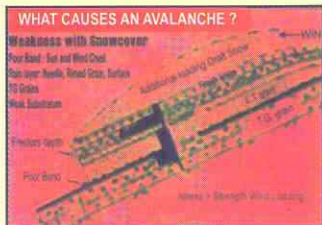
* $> 30^{\circ}$ for dry snow Slab Avalanche

* $> 25^{\circ}$ for wet snow Avalanche

$\frac{1}{2}$ Ski pole length = 27°

$\frac{3}{4}$ Ski pole length = 35°

Whole ski pole length = 45°



Sparse woods do not protect from slab avalanches

WATCH OUT : DANGEROUS SITUATIONS

- ★ New Snow with wind (10-25 m/s)
- ★ Rapid rise in temperature during storm
- ★ Weak layer within the snow cover.
- ★ First fine day after bad weather spell.
- ★ Incessant rain on snow.
- ★ Soaked snowpack : Wet snow avalanches.
- ★ Stellar crystals under calm, cold conditions produce loose snow avalanche.
- ★ Settlement of 10% or less of total new snow depth in 24h signals instability.
- ★ Spontaneous slab avalanche & releasing of avalanche from the distance.
- ★ Rumbling noises ("Whoomphs")
- ★ New snow crystals do not bond well to an ice layer.

New Snow + Wind = Danger of Slab Avalanches

**A timid person is frightened before a danger,
a coward during the time, and a courageous
person afterwards**

-Jean Pul Richter

SNOW CONDITIONS

Snow cover exerts enormous shear forces. The insufficient strength of thin weak layers of snowpack yields to the shear forces and produces avalanche. Sometimes small additional load, for example the drift snow, a single pedestrian, disturbs the balance to initiate an avalanche.

NEW SNOW DEPTH



Any major avalanche activity would start only after terrain irregularities have been filled up.

Critical quantity :

- 30-40 cm on the instable slopes.
- 40-50 cm on fairly stable slopes.
- 50-60 cm on stable slopes

SNOW TEMPERATURE

- Cold snow temperature ($< -10^{\circ}\text{C}$)
- Increased potential for slab avalanche
- Warm snow temperature (0°C)
- Increased potential for wet snow avalanche

Clues of stable snowpack structure

- Hard layers
- Small & round grain
- Well bonded snowpack

Clues of unstable snowpack structure

- Buried depth hoar, surface hoar, graupal layer.
- Loosely bonded snowpack
- Moist/Wet snowpack

WEATHER

Weather influences avalanche formation and can rapidly change avalanche situation

- **Precipitation** : Snow, rain, intensity
 - Snowfall @ 3-5 cm/h : Critical
 - Rain/ppt. @ 0.5-3.5 mm/h : Critical
- **Wind** : Speed, direction
 - Slab avalanche formation takes place, when wind speed exceeds 7 m/s.
 - Ideal state : 10-25 m/s.
 - Wind speed in excess of 25 m/s does not favour avalanche formation.
- **Temperature** : Current, anticipated development.
 - Warm snow over cold snow : Critical
- **Visibility** : Prerequisite for selection of safe route.
- **Clouds** : Trapped long-wave radiation results in increase in temperature and avalanche activity.

Discovery consists of seeing what everybody has seen and thinking what nobody has thought

- Albert Szent Gyorgyi

FIELD TESTS

Aim :

- Assess slope stability
- Plan safety measures/alternate route
- Decision : to turn back or advance

RISK ASSESSMENT

Weather/Snow

- New Snow : Critical quantity.
- Standing Snow : Terrain irregularities.
- Snow drift deposition : Identify pockets
- Temperature : Rising trend.

Terrain

- Steepness, size of the slope
- Altitude and aspect.
- Danger of fall.
- Danger of getting buried.
- Likely burial places.
- Select relevant sites for stability tests.
- Repeat tests elsewhere on same slope,
- More tests with less details are favoured.

***A thin snowpack does not imply
low avalanche danger***

● Test skilling



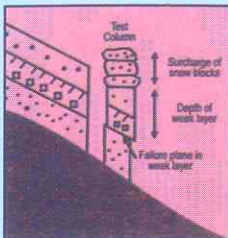
● Rutschblock Test



● Shovel shear test



● Collapse test



Load

Description of Load at Failure

1. Failure under the weight of block alone.
2. One person on skis steps carefully on the block from above.
3. The person exerts pressure on skis by making a rapid knee bend.
4. The person on skis jumps.
5. The person on skis jumps a second time.
6. A person jumps onto the block without skis.
7. No failure observed.

- **Very easy** : The column fails during cutting or insertion of the shovel.
- **Easy** : The column fails with a very low shovel pressure.
- **Moderate** : The column fails under a moderate shovel pressure.
- **Hard** : The column fails after a firm, sustained pressure.

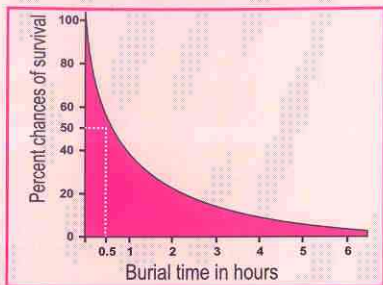
FIRST AID

- Free head and chest as fast as possible, clear breathing passages.
- Give artificial respiration (mouth-to-mouth), when circulation has stopped, massage heart simultaneously; continue resuscitation until medical doctor takes over.
- Protect from further loss of body heat.
- Lay the person correctly
- Arrange evacuation with the helicopter.

AVALANCHE ACCIDENT REPORT

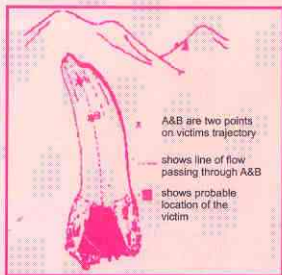
- | | | |
|------------------------|---|-------------------------|
| Who | - | Callers name, unit etc. |
| | - | Contact No. |
| | - | Location |
| What | - | Accident detail |
| Where | - | Location |
| Coordinates | - | |
| When | - | Accident happened |
| No. involved | - | How many |
| Helpers | - | At site |
| Weather | - | |
| Visibility | | |
| ★ Below 200 m | | |
| ★ Up to 1 km | | |
| ★ More than 1 km | | |
| ★ Helicopter Landing - | | Possible/Not possible |
| Remarks | | |

ONLY 4 OF 10 COMPLETELY BURIED VICTIMS CAN BE RESCUED ALIVE



When Caught

- ★ Remain calm, cool & collected.
- ★ When on edge, get away to the side.
- ★ Jump up, when on rupture line.
- ★ Hold on to something when caught.
- ★ Swim
- ★ Turn your back.



Rescue (By non-buried)

- ★ Observe avalanche action and vanishing point of the persons caught in avalanche.
- ★ Assess your safety, avoid further accidents.
- ★ Determine primary search area.
- ★ Start immediate search with transceivers.
- ★ Alert rescue service

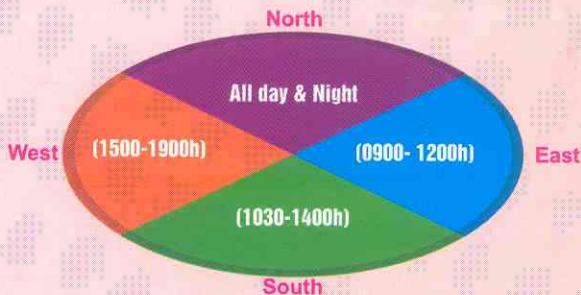
AVALANCHE SAFETY MEASURES

About 80% of all people buried by an avalanche, release it themselves

Safety Measures :

- ★ **Assess** : Weather, snow, terrain, human factor etc.
- ★ **Circumvent** : Recent accumulation of wind-driven snow
- ★ **Plan movement** : Safety main criterion
- ★ **Nominate leader**
- ★ Carry an avalanche shovel, chord, rod etc.
- ★ Set Transceivers to transmit mode.
- ★ Carry spare batteries
- ★ Carry a first aid kit.

Relationship between approximate time of release of unstable slopes and exposition of slope with respect to the Sun..



AVALANCHE DANGER SCALE

Degree of danger	Avalanche release probability from different-types of slopes, consequences and suggested precautions.
Low	Generally favourable condition. Triggering is generally possible only with high additional loads and on very few extreme slopes. Only sluffs possible and reach valley in small sizes. Valley movements are safe. Movements on slopes with care.
Medium	Partly unfavourable condition. Triggering possible from the most avalanche prone slopes with low additional loads and may reach the valley in medium size. Avoid steep slopes. Routes should be selected with care. Valley movements with caution. Movement on slopes with extreme care.
High	Unfavourable condition. Triggering possible from all avalanche prone slopes even with low additional loads and reach the valley in large size. Suspend all movements. Airborne avalanches likely.
All round	Very unfavourable condition. Numerous large avalanches are likely from all possible avalanche slopes even on moderately steep terrain. Suspend all movements. Airborne avalanches likely.

Movement with care - All safety measures shall be taken while crossing suspected avalanche paths.

Movements with Extreme care- Rescue party shall stand by.

AVALANCHE WARNING BULLETIN

Structure

- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> - Validity period - Principle cause of likely avalanche activity depends on potential of avalanche activity vis-a- | <ul style="list-style-type: none"> vis current stability and future weather conditions - Areas affected. - Suggested precautions. - Dissemination : On anticipated avalanche at 1600 from AFC's - Distribution : All users. |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Army

Para mil.

Civil adm.

AIR

Doordarshan

-- For detailed information contact :

- | | |
|----------------|-------------------------------------------------------------------------------|
| * AFC Srinagar | - 0194-2305020, 2305019 |
| * AFC Manali | - 01902-253427, 253459, 251108 |
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