Selected Back Country Avalanche Myths Debunked

By Mark Moore, NWAC

"Those tracks (ski, snowboard, snowmobile, climbing track, etc) indicate that the slope must be stable..."

Strictly speaking and even not so strictly speaking, this just isn't true—at least in a variety of documented cases. It is definitely not true to assume that tracks = stability. However, in general the more tracks the more likely the slope in question is "more" but not absolutely stable. In point of fact, ski areas try to encourage skier/boarder traffic as a "de facto" and relatively effective way to limit the avalanche danger in open terrain during periods of heavy snowfall. The reasoning is that increased client traffic can help break up slabs, as well as compress and stabilize some buried weak layers. Some positive parts about this myth include:

- ✓ Tracks can and do help to "break up" a slab
- ✓ Tracks may make it more difficult for shear fracture cracks to propagate across the tracks
- ✓ With time, age hardening of the compressed snow beneath the tracks may help the slab to gain some strength
- ✓ A large number of tracks (like at a ski area) may break up the slab sufficiently that the slope does become more stable

This also assumes that the weak shear layer in question lies at or above the level of track penetration and that the tracks actually do break up the overlying slab into smaller components.

Fortunately or unfortunately, depending on your point of view, the numbers of tracks necessary to produce slope stability normally aren't there in a typical back country situation, unless you've stumbled across a very popular site (e.g., easily accessed chute, known cool snowmobile high marking slope, etc). In the avalanche photo at right, you'll notice a few things:

- the slope had already been controlled with explosives (the crater in the upper right of the photo); placement of the shot is suitable for most situations, but not for this localized slab
- the first three skiers on this slope (closely bunched, middle right) had no problems and experienced a great run
- the 4th skier (second from left) went over a small convex roll on the slope and triggered the small slab shown, presumably a location which had
  - a bit more (wind) loading
  - a bit more internal stress due to steepness change
- there is a good learning curve shown by the track of the 5th skier down, who apparently had an epiphany just above the rocks and decided that perhaps a traverse and different route was called for

- Fortunately the skier who triggered the slab was only partially buried, suffered no injuries, and was able to extricate himself and ski away

However, a significant number of documented avalanche accidents indicate that the presence of some tracks may offer misleading indications of stability or decreased danger. What avalanche professionals and snow scientists suggest might be occurring in such instances is that the first few tracks actually result in a weakening of the basal attachment of the slab to an underlying weak layer. That is, while the first few skiers or boarders or riders may not produce any visible slope fractures, the forces they have exerted on the slope may have resulted in a local failure of the slab attachment to the weak layer, well hidden from the unwary recreationalist. And then along comes the third or sixth track and the disruption from this track produces the “final” local failure that links all of the other local failures together. The slab is now held in position on the slope only by its own internal strength in tension (at the top), compression (at the base) and shear (along its flanks). If the internal tensile slab strength is not sufficient to hold it in place, shear failure within the weak layer transitions to shear fracture (the initiation crack rapidly propagates under the entire slab), which then produces tensile fracture (the common fracture line or crown face of the slab) and the ensuing slab avalanche. So the real problem with tracks is that you don’t know what hidden forces they may have begun to unleash beneath the surface of that great powder run, especially if you don’t have a good handle on the snowpack layering and the presence of buried weak layers.

“Snow stability (the avalanche danger) just doesn’t change that quickly...”

Whether you’re referring to temporal (time-wise) or spatial (space-wise) changes in snow stability, this myth may lead you far astray…and if believed, into potentially dangerous avalanche situations. Such a generic statement about temporal snow stability changes might be a little more applicable in a continental climate (where temperature changes around the freezing point are uncommon), but it definitely moves into the territory of more wishful thinking when applied to a maritime climate. In a maritime climate like the Northwest, rapid temperature changes that move through the freezing point (32 deg F or 0 deg C) are common and almost always associated with very rapid changes in snow stability. In fact, almost instantaneous natural avalanches can and do occur within minutes of a change from snow to rain—a transition typically associated with a (Cascade) pass wind shift from easterly (a colder wind blowing from the east) to westerly (e.g., a warmer west wind). Timing of such transitions can be difficult to say the least, and this timing is complicated by the fact that the wind shift and associated warming may occur at different times in varying locations and elevations. Due to the higher density of cold air (versus warm air), it typically lies near the pass level(s) with warmer air overriding it. Thus when easterly winds bringing cold air from lower elevations in eastern Washington or Oregon are overrun by warmer air ahead of Pacific storm systems, a strong temperature inversion normally results (warm air over cold air).

If a back country traveler is enjoying cold (and more stable) powder within the cold air below the inversion, they may be unaware of dramatic changes occurring just a few hundred or thousand feet above them. At higher elevations above the inversion, temperatures may have climbed above freezing with rain rapidly weakening, warming, stressing and destabilizing the snowpack. As the warm air mixes slowly downward and the winds approach a dramatic shift, this instability moves to progressively lower elevations. Once winds shift, the warmer air instantly (within minutes) spreads to all areas, with more widespread avalanching being the result of cold, low density surface snow being loaded by wet, high density snow or rain.

While temporal changes in snowpack stability can be and often are dramatic, especially in maritime climates when temperature inversions are considered, other dramatic changes in snow stability occur on a more regular basis when considering slopes facing different directions to the incoming wind. In this case, wind exposed terrain (e.g. west aspect slopes with a west wind) are typically much more stable than nearby and much more heavily loaded lee slopes (northeast aspects with a southwest wind). Snow on windward slopes may be scoured and compacted into a hardened and more stable surface while deep and unstable new accumulations of wind transported snow are lying in wait for a trigger on nearby lee terrain.

So don't be lured into a false sense of snow stability or perceived lower avalanche danger just because the temperatures are lower or the snow beneath your skis, board, snowshoes or machine seems stable...because unless you're staying aware, that current stability may be about to change rapidly and radically, all within a few minutes or meters.