



Austrian Klaus Kröll's crash during a stormy super G at the 2013 World Cup finals in Lenzerheide, Switzerland, prompted cancellation of the race and increased scrutiny of safety mandates. Kröll broke his arm and was airlifted out of the venue.

The Evolution of On-Course Safety

Tragic accidents compelled safer practices in Alpine racing.

BY EDIE THYS MORGAN

When a resort wins the bid to host the World Cup finals, it typically has two to five years to prepare. When Sun Valley, Idaho, received approval to host the 2025 finals (March 22–28), it had just 14 months to build a new downhill course and adapt the existing racing venue to accommodate the world's top athletes in all four events. In a year when injuries to stars like Mikaela Shiffrin and Marcel Hirscher have brought safety concerns to the forefront, the process had to happen at record speed while incorporating state-of-the-art safety measures.

Getting It Done

Riley Berman grew up racing for the Sun Valley Ski Education Foundation (SVSEF). He is now the competition services manager and chief of course for the upcoming World Cup events. He recalls skiing around the mountain with Tom “Cowboy” Johnston while preparing to host the 2016 U.S. Nationals. Johnston, a legend in the world of race-hill preparation and venue safety, served as a technical adviser for the past three Olympics. Together they dreamed about where a new downhill might be routed. “It was crazy talk, but it was a fun way to spend some time with him,” says Berman.

When Sun Valley got the go-ahead for the finals, resort management hit the gas. The first challenge was to create a downhill with controlled speeds on Bald Mountain's sustained steeps, where the average gradient is 35 degrees. (Italy's Bormio, the steepest course of the European classics, is 30.9 degrees.) “If you're just going to go down this mountain, you're going to be going 100 miles per hour,” says Berman. The solution was to widen the trails in places and to cut and grade two traverses between existing trails. The new terrain gives course-setters the option to “swing the athlete's speed by 30, 40, maybe even 50 miles per hour,” says Berman.



KELLY BRUSH FOUNDATION

After college racer Kelly Brush crashed into an unprotected lift tower, her family launched a foundation to promote and help fund safety upgrades.

Cutting the trails and sculpting the terrain—none of which could start until last July—was just the first step. Sun Valley also massively upgraded its permanent and portable safety equipment, which includes 12 sections of A-Net ranging from 150 meters long (500 feet) to nearly 280 meters (920 feet). Berman describes A-Net as a “vertical trampoline of red netting” that is not fun to hit, but “whatever is on the other side of it is much worse.” The netting is suspended from three different types of permanent towers, 82 in total.

The safety plan also calls for 550 rolls of B-Net—portable woven fencing clipped to plastic poles drilled 6 feet into the ground—alongside the course. A-Net and B-Net products are manufactured from braided polyethylene fiber by the Italian firm SPM. Add in 40 air fences and 200 or so Willy Bags (large canvas bags filled with loose material that pad objects like lift towers), along with 34 new snow guns to ensure a consistent, hard surface.

The Way We Were

This is a far cry from the early days of ski racing, when “protection”—if it existed at all—consisted of sandbags or hay bales, usually frozen as solid as a pile of bricks. The wooden fences lining the courses were meant as much to keep ski-



HELLY HANSEN

To increase racer safety, bright blue lines of dye have replaced pine boughs and flagging to signal terrain changes and course path, such as at the notoriously challenging Streif downhill at the annual Hahnenkamm races in Kitzbühel, Austria.

ers off the piste as to protect racers from sliding off-course. Training runs, even after the roller-derby days of mass starts, were not tightly regulated.

Skis evolved from hickory and ash to aluminum with polyethylene bases; boots shifted from leather to polyurethane. Boot and ski packing were replaced with machine grooming, and natural snow surfaces increasingly gave way to snow from compressors. As equipment design progressed, so did the speeds skiers could attain and the forces they created. Crashes grew more violent.

After Canada's John Semmelink died at the Garmisch Arlberg-Kandahar in Germany in February 1959, hard-shell crash helmets were required for FIS and Olympic downhills, but venue safety remained largely unchanged. Video of Franz Klammer's 1976 Olympic downhill run in Innsbruck shows the highest safety standards of the time: picket fencing that separated spectators from the track; bamboo gates iced into the ground; one row of hay bales lining fast corners; and pine needles sprinkled on the track to delineate it and aid visibility. More hay bales protected solid posts that framed the finish.

A New Era Begins

The 1980 Olympics in Lake Placid,

New York, saw an uptick in venue safety. Willy Schaeffler was the women's chief of course, and Ted Sutton, now a revered technical delegate and course inspector, recalls working closely with him leading up to and during those games. Schaeffler had invented the protective Willy Bag. To demonstrate its effectiveness to the jury, Schaeffler ordered Sutton to ski straight into one. “I did what Willy told me to do,” he recalls. “I just skied down and smashed into these bags. It was no problem. I didn't get hurt at all.”

The 1980 Games also marked the first appearance in the United States of A-Net, provided by a husband-and-wife team from France who provided films of their testing process as well as instructions for installing the nets in various conditions. A potential newcomer was the hinged slalom gate, invented by the Austrian-born, Vermont-based skier and coach Hermann Goellner. The distributor, Reliable Racing Supply, had secured approval to provide these “breakaway” slalom poles to the Olympics, but their use was voted down by the European teams, who had never trained with them. Nonetheless, the hinged gates—which did not dangerously splinter like bamboo and allowed skiers to pass through them with minimal impact—would soon become the standard.



THUNDERBOLT SKI MUSEUM

The finish area for the 1940 Thunderbolt race down Mt. Greylock, Massachusetts, shows the minimal safety mandates in place for racers—and spectators—of that era.

By the mid-1980s, wooden fences and hay bales were replaced by A- and B-Net systems on the World Cup circuit. A-Net is primarily used at speed venues and wherever a B-Net is insufficient to contain a direct impact. B-Net systems involve three or more 20-meter-long, two-meter-high (65 x six feet) nets that can be set in multiple layers. They absorb and disperse kinetic energy to safely decelerate athletes. Two types of B netting exist, one with small openings for speed events and a lighter version for younger racers. Slip sheets—solid coverings of plastic or Kevlar—can be added to A-Net in high-risk turns to prevent ski tips from penetrating the net.

Course setting is another key aspect of safety. A well-set course provides broad “slide zones” free of any solid obstruction along the likely trajectory of a crashing skier. Triangular net and cushioning material like Willy Bags and air pads or fences are used to provide protection from trees, rocks, posts and towers.

Accidents Lead to More Change

Unfortunately, accidents have driven safety awareness and upgrades. “Progress came through pressure,” says Canadian downhiller Ken Read.

On the World Cup, a major turning point was Brian Stemmlé’s 1989 crash at Kitzbühel, Austria. When his ski tip penetrated the A-Net at the bottom of the Streif course’s Steilhang section, the resulting injuries nearly cost Stemmlé his

life. In 1991, a similar accident in Wengen, Switzerland, did take the life of Austrian Gernod Reinstadler. In 1993, the Austrian High Court found Kitzbühel negligent in Stemmlé’s accident. “When Stemmlé won his case, Kitzbühel took the lead in venue safety,” says Read. Now, the Streif sets the bar for safety top to bottom, including slip screens that reach far up the A netting where needed. In 2008, Bode Miller skied onto the same net where Stemmlé crashed and went on to place second.

Every FIS slope is homologated, a process in which, as Sutton explains, “an inspector goes in, and his job is to certify the course, to bring it to some standard that would be equivalent to any course similar to it in the world.” Each homologated slope includes a safety plan with recommendations based on concerns like tree line, trail width, steepness, fallaway terrain and obstacles. It is up to the course jury, however, to enforce the plan.

Despite changes at the World Cup level, however, compliance at the lower levels of racing was less consistent.

A Cultural Shift

In 2006, Kelly Brush was competing for Middlebury College at the Williams College carnival. She crashed into an unprotected lift tower and would spend the next six months rehabilitating and learning to navigate her new life in a wheelchair.

Brush and her family channeled her accident into a mission to radically im-

prove skier safety. The Kelly Brush Foundation’s grant program provides funds to purchase B-netting and other safety gear or upgrades. To date, it has provided more than 80,000 feet of B-Net to more than 150 clubs. The foundation’s slogan, “ski racing safety is no accident,” is prominently posted in ski clubs throughout the country, and, together with U.S. Ski and Snowboard (USSS) it also funds a safety consultant to help educate the ski racing community. The goal was to change the culture of ski racing. Before the campaign, race organizers often focused on just trying to get the race off; the new ethic is to make safety the prerequisite. “That’s not where it was when I got hurt,” says Brush.

World Cup Supply, the exclusive U.S. distributor for manufacturer SPM, went from selling 500 nets per year a decade ago to 800 to 1,300 annually now. Burke Mountain Academy, the premier race-training venue in the East, has purchased 400 nets alone over the past eight years, at about \$500 per net. Grants from the Kelly Brush Foundation have contributed roughly half the cost. “It has made a huge difference,” says Burke headmaster Willy Booker, while Reliable Racing Supply’s John Jacobs calls the grants “a game changer for little mountains.”

Buying and maintaining adequate B-Net adds significant cost in material and manpower. Fencing needs to be set and reset many times throughout the season, and safety depends on the racing community’s cooperation. B-Net “parties” at the end of each race series—where athletes and coaches all pitch in to roll up fencing—are now part of ski-racing culture.

A Safety-First Attitude

Today’s safety experts were guided by mentors who relied on creativity and the courage of their convictions—people for whom “because we’ve always done it like this” was not an acceptable answer. When Tom Johnston began coaching in Jackson Hole, Wyoming, there was no budget for safety. He recalls using mattresses, shipping material and EZ Fence (a light, plastic garden fence) wired to bamboo poles. He even crafted ersatz A-Net barriers from old telephone poles set in 55-gallon drums of sand. Since he’s now a technical adviser with a safety mandate for USSS and FIS, race organizers have to listen to Johnston. His job is to create the track

with both appropriate terrain and a safe snow surface, build a safety plan, put protection in place, advise on course setting and train people to perform their jobs.

Safety gains also come from changing awareness. Paul Van Slyke has been a FIS technical delegate since 1997 and is U.S. Ski and Snowboard’s Alpine competition and safety consultant. He describes how precise equipment, higher speeds and harder surfaces have shifted the scope of safety. “We’re not looking for fall zones anymore, because they can happen anywhere,” he says. That means anything that’s stationary on a slope is a potential hazard. Through presentations and videos Van Slyke champions his Clean Hill Initiative, aimed at eliminating all unnecessary objects in the path of the athlete. Hazards like coaches’ skis and backpacks go outside the fences; drills, rakes and shovels are holstered or in the hands of course workers. “I think it was a lifetime of close calls,” says Van Slyke about why he formed the initiative. “I just couldn’t stand it anymore.”

Testing and Education

Testing has progressed far since the days of Ted Sutton skiing into Willy Bags. Wind-permeable breakaway panels and hinged gates in all FIS- and U.S. Ski and Snowboard-sanctioned events must meet strict standards. When the standards change, suppliers must conform.

“We send in our stuff and get a pass/fail,” says Reliable Racing Supply’s Jacobs. A- and B-Net are not homologated but are extensively tested by manufacturers to determine the force required to stretch or break the net. Says Brad Williams, owner of World Cup Supply, which has provided all the safety gear for Sun Valley, “They’ve taken a very scientific approach from day one on what safety equipment needs to do based on the forces.” World Cup Supply shares test results, as well as extensive instructions on how to properly set up and maintain net systems, on its website. “The most important thing is for us to be able to educate people and have them understand how it works,” adds Williams.

Today’s speed courses look like walls of A-Net, and everything within those walls is inspected and approved. In a recent mishap at Cortina, Italy, Austrian Stephanie Venier lost her line and passed through a super G panel that broke away



SKI AND SNOWBOARD CLUB VAIL

With massive amounts of safety netting now installed at all levels of racing, net “parties” to roll up and store gear at event’s end are now part of racing culture.

instantly. She ended the day with frustration but without a scratch.

At Kitzbühel, American Sam Morse skied onto the net and finished without incident, while Austrian Andreas Ploier crashed spectacularly on the treacherous final traverse and landed in the A-Net, unhurt. In Garmisch, American Isabella Wright slammed full speed into a padded section of A-Net yet suffered only a minor concussion.

Pine boughs scattered on the slope and flags lining the track have been replaced by blue dye marking the outside of the line and terrain changes. The finish area and major obstacles are ringed with foam pads, Willy Bags and air pads. At every level, slalom racers mow over gates without harm and Instagram is full of “funny” videos where B-netting catches racers and saves them from catastrophe.

In addition to regulation of ski-equipment design, personal safety gear requirements have also increased. Racers are required to use FIS-certified helmets, and, as of this year, wearable air bags and cut-proof base layers are mandatory in World Cup speed events. While many clubs mandate back protectors, FIS does not.

Despite the improvement in safety equipment, the fact remains that unlike in F1 auto racing, ski racers have no “survival cell” cockpit to protect them. Their vulnerability to speed and forces is unique to their sport. Despite the strides in safety and awareness, the risks continue to trouble the ski-racing community.

Looking Ahead

Last season some of the sport’s top contenders were felled by injuries. This season, the carnage continued. Mikaela Shiffrin crashed and spent nine weeks recovering after being impaled, either by her own equipment or something on the race hill. Despite ongoing efforts to control speed through course setting and trail widening, four racers were evacuated by helicopter from the Bormio super G and three from the Kitzbühel super G. The carnage prompted Markus Waldner, FIS’s chief race director for the men’s World Cup, to tell stakeholders: “We are on the limit ... For sure, something has to change. ... We need to avoid all these crashes.” Waldner called for two meetings with ski-industry engineers, head coaches and medical staff at the 2025 World Championships in Saalbach, Austria, to seek solutions.

When the world’s top skiers make it to Sun Valley to vie for crystal globes, they will do so in a venue where controllable risk has been minimized to the extent of technology. The safety plan confirmed in September “has been my bible,” says Berman, who checks in with Johnston every day while checking the snow down the entire course. “There’s a sense of pride for this community to put on a really good show, both on the mountain and off.” ❄️

Two-time Olympian Edie Thys Morgan writes frequently for Skiing History.