CONTACT: Dave Byrd
Director of Risk & Regulatory Affairs
dbyrd@nsaa.org
(720) 963-4213 office
(202) 270-3924 mobile

NSAA Ski Lift Safety Fact Sheet

LAKEWOOD, Colo., October 1, 2016—Ski areas across the United States are committed to lift safety and have an excellent safety record for uphill transportation as a result of this commitment. In fact, there is no other transportation system that is as safely operated, with so few injuries and fatalities, as the uphill transportation provided by chairlifts at ski resorts in the United States. The National Ski Areas Association (NSAA) compiles and updates this Ski Lift Safety Fact Sheet annually to provide ski areas and the public with the most current information on the ski resort industry's commitment to overall lift safety, financial investment in lifts and lift maintenance, industry education and training on lifts, and frequently asked questions about chairlifts.

Chairlift Safety in Context

Riding a chairlift, gondola, or tram while skiing, snowboarding, mountain biking (or even just sightseeing), is an exceptionally safe and secure mode of transportation. Fatalities from lift malfunctions in the United States have occurred rarely over the past several decades. Since 1973 (when NSAA began compiling industry statistics), there have been 12 deaths attributed to chairlift malfunctions,[1] a 43-year span during which the industry provided more than 16.7 billion lift rides to skiers and snowboarders.[2] Notably, the U.S. ski resort industry has not experienced a fatality resulting from a lift malfunction since 1993—a 23-year period. To put this into context, in this 43-

[1] NSAA first began tracking annual skier visits during the 1978/79 season. Therefore, for the five preceding seasons (1973/74 to 1977/78), NSAA uses a conservative estimate of 39.7 million skier visits annually (which was the lowest skier visit number from the 1980-81 season) for purposes of compiling these chairlift statistics in NSAA's annual Ski Lift Safety Fact Sheet.

[2] During this 43-season period, U.S. resorts averaged 51.8 million skier/snowboarder visits per season, or 2.22 billion skier visits since 1973. To derive the 16.7 billion lift rides during this four-decade period, we conservatively assumed that each skier visit resulted in 7.5 ski lift rides per visit, and then multiplied 7.5 lift rides by 2.22 billion.

year span, the ski industry has transported guests more than *8.36 billion miles in lift rides*—that is more than 89 trips from the Earth to the Sun.[3]

Given the exceedingly rare number of fatalities involved due to ski lift malfunctions, and the billions of miles transporting guests, the industry's fatality rate is extremely low. As of the 2015/16 ski season, which is the most current data available, the annual fatality rate per 100 million miles traveled on ski lifts was 0.14—far more safe, in comparison, than annual fatality rates of riding an elevator or in automobiles.[4] (see table 1 below). In short, a passenger is *five times* more likely to suffer a fatality riding an elevator than riding a ski lift, and *eight times* more likely to suffer a fatality in a car than from a ski lift. Bear in mind, chairlift transportation is done several dozen feet above the ground, typically in the open-air (i.e., most rides are not in gondolas or trams), during the cold winter months.

Table 1: ANNUAL FATALITY RATE COMPARISON*

	Passenger Miles Transported Annually	Average # of Passenger Fatalities per Year	Fatalities per 100 Million Miles Transported
SKI LIFTS	198,000,000	0.279	0.14
ELEVATORS	1,360,000,000	10	0.74
AUTOMOBILES	3,041,000,000,000	35,400	1.16

* *NOTE*: Because of limitations in the availability of statistics from various organizations, it is difficult to compare year-to-year statistics for chairlifts, elevators, and automobile fatalities. As a result, we use data from the most current year available for each. For example, while there is chairlift transportation data from the 2015/16 season, the most currently available data for automobile fatalities is from 2014, according to the *National Safety Council Injury Facts*, 2016 edition.

[3] If one assumes each lift ride is one-half mile long in distance traveled, on average, U.S. ski areas have transported skiers/snowboarders 8.35 billion miles during the past 43 ski seasons (16.7 billion lift rides multiplied by 0.5 miles traveled = 8.35 billion miles traveled on lifts). The distance from the Earth to the Sun is 93 million miles.

[4] U.S. ski areas had 52.8 million skier visits in the 2015/16 season. This number is multiplied by 7.5 ski lift rides per visit, with an average ride distance of 0.5 miles, resulting in 198,000,000 passenger miles during the 2015/16 ski season. With a total of 12 fatalities resulting from chairlift malfunctions over 43 years, the fatality rate in that span is 0.279 fatalities per year. The fatality rate per year, divided by passenger miles, equates to 0.14 fatalities per 100 million miles of passengers transported by ski lifts.

According to the Bureau of Labor Statistics, there are on average 10 passenger fatalities per year from riding elevators.[5] With elevators transporting passengers 1.36 billion miles per year,[6] there is an average passenger fatality rate riding elevators of 0.74 per year (per 100 million miles traveled).

"In short, a passenger is *five times* more likely to suffer a fatality riding an elevator than a ski lift, and more than *eight times* more likely to suffer a fatality riding in a car than on a ski lift."

In fact, driving an automobile is far more dangerous than riding ski lifts. In 2014, 35,400 people died in motor vehicle accidents in the United States, for a death rate of 1.16 for every 100 million-vehicle miles.[7] The fatality rate per automobiles is more than eight times the 0.14 fatality rate for transport on a ski lift.

The most recent death of a guest due a lift malfunction at a U.S. ski resort was in 1993, when a Sierra Ski Ranch detachable-grip lift malfunctioned. In 1985, there were two deaths caused by a malfunction of a lift at Keystone ski area in Colorado. There have been no other deaths related to lift malfunctions in the 1980s or 1990s at U.S. ski resorts.[8]

Furthermore, fatalities from lift-related malfunctions in the U.S. are a fraction of the number of fatalities at European ski resorts due to lift malfunctions. While there have been 12 lift-related fatalities at American ski areas since 1973, over that same timeframe, there have been at least 102

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[5] According to the U.S. Bureau of Labor Statistics (BLS), Census of Fatal Occupational Injuries, 1992-2009 data, there were, on average, 5 fatalities among passengers while using elevators at work (for proper comparison, this statistic only includes *passenger* fatalities, and excludes fatalities involving employees working on or around elevators). In addition, there were, on average, another 5 elevator passenger fatalities per year in *non-work* related passenger incidents, according to 1997-2010 data from the Consumer Product Safety Commission. Other sources indicate a much higher fatality rate for elevators (the *Los Angeles Times*, for example, reports on average 27 fatalities on elevators per year, but it is unclear whether that data includes both employee *and* repairmen injuries). But out of an abundance of caution, we are citing the lower statistic for comparison purposes with chairlifts.

[6] According to 2011 "Elevator and Escalator Fun Facts," compiled by the National Elevator Industry, Inc., at www.neii.org.

[7] According to 2014 statistics from the *National Safety Council Injury Facts*®, 2016 edition, page 104 (35,400 fatalities, and 3.041 billion miles driven).

[8] There have been a small number of fatalities involving chairlifts that were unrelated to mechanical malfunctions. Two deaths were attributed to chairlifts that occurred during non-operating hours. One fatality was an industrial accident at Copper Mountain, Colo., in August 1975 that involved an employee conducting summer maintenance (for statistical comparison purposes, only fatalities for passengers—not employees—are counted for these statistics, similar to our comparative data with elevators). The other fatality was at the Seattle Mountaineering Club, Wash., in 1997, when a child was tangled in a surface rope tow during non-operating hours at a private ski club that was not open to the public. Lastly, in 2009 at Heavenly Mountain Resort, Calif., there was a fatality when a guest fell from a chairlift as a result of an entanglement from a broken zip line retrieval chord; this death was not attributable to any chairlift malfunction.

fatalities at European resorts from lift malfunctions—nine times the fatality incidents occurring at American ski areas.[9]

To be sure, ski areas are not immune from lift-related malfunctions that cause injuries and fatalities, but they are quite rare. Below is the history of ski lift-related malfunctions in the United States that resulted in fatalities, listed chronologically:

Fatalities from Chairlift Malfunctions

SKI AREA	DATE	CAUSE	FATALITIES
Sierra Ski Ranch, CA	4/4/93	Sheave battery failure	1
Keystone Resort, CO	12/14/85	Welding failure on bullwheel	2
Squaw Valley, CA	04/15/78	High winds deroped cables	4
Vail, CO	03/26/76	Cable wires entangled gondola	4
Mount Peter, NY	02/18/73	Deropement	1

Beyond the fatalities noted above from lift malfunctions, there have been a number of other lift malfunctions at U.S. ski areas resulting in multiple passenger injuries.[10] (While NSAA began collecting industry data dating back to 1973, out of full transparency, we have included the 1972 incident at the Glen Ellen ski area in Vermont, given the large number of resulting injuries from that incident.) These multiple-injury incidents are listed here chronologically:

[9] See Reuters, Sept. 6, 2005, "Chronology—Major Accidents in Ski Resorts"

[10] The injuries reported include both those that were treated at local clinics and hospitals, as well as more minor injuries that were treated at the scene of the incident, for example, by ski patrol.

Injuries from Chairlift Malfunctions

SKI AREA	DATE	CAUSE	# INJURED
Timberline, WV	2/20/16	Cross-arm weld Failure	9
Sugarloaf, ME	03/21/15	Rollback	7
Red Lodge, MT	12/28/11	Chair Detachment	2
Sugarloaf, ME	12/28/10	Deropement	8
Devils Head, WI	12/17/09	Rollback	13
Mt. Sunapee, NH	12/15/07	Deropement / Bullwheel	1
Lutsen, MN	8/10/00	Grip failure	6
Sierra Ski Ranch, CA	4/04/93	Sheave Failure	2
Loveland, CO	1/27/92	Deropement	2
Heavenly, CA	4/1/81	Deropement	6
Hunter Mountain, NY	2/1/78	Rollback	4
Jiminy Peak, MA	1/30/77	Rollback	10
Pomerelle, ID	1/1/73	Rollback	10
Glen Ellen, VT	3/11/1972	Rollback	35

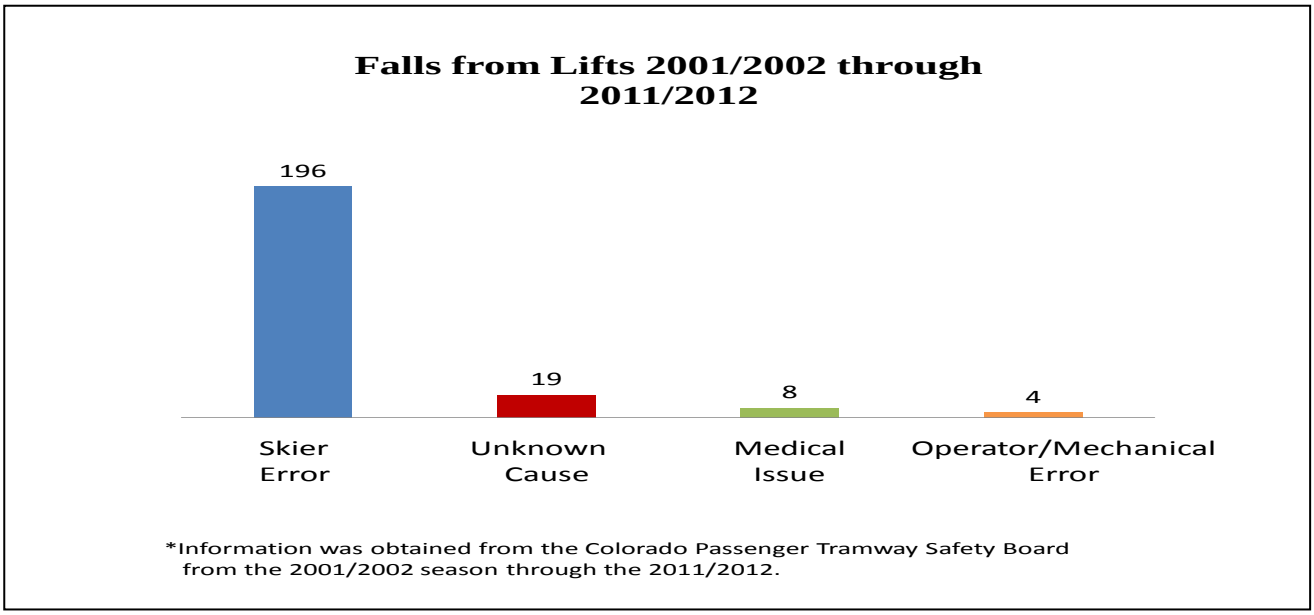
Falls from Chairlifts

It is extraordinarily rare for a fatality to occur as the result of a fall from a chairlift that is not attributed to a mechanical malfunction or operation of the chairlift. Since 2004, there have been three

fatalities resulting from falls from chairlifts (unrelated to mechanical malfunctions). On February 25, 2004, a skier died when he fell from a chairlift at Snow Trails ski area in Ohio, and it was unclear whether he died from a medical condition, or as the result of the fall. On December 18, 2011, a seven-year old boy died after falling from a chairlift at Sugarbowl, Calif., the only known fatality of a minor that has occurred as a result of falling from a chairlift in the U.S. An investigation of the incident conducted by the Placer County Sheriff's Department found the cause of the incident to be inconclusive, but the cause was not attributed to mechanical or technical error. In 2014, there was a fatality at Hunter Mountain, New York, when a woman riding a chairlift fell from the chair, but the fall was not attributed to any mechanical malfunction of the lift.

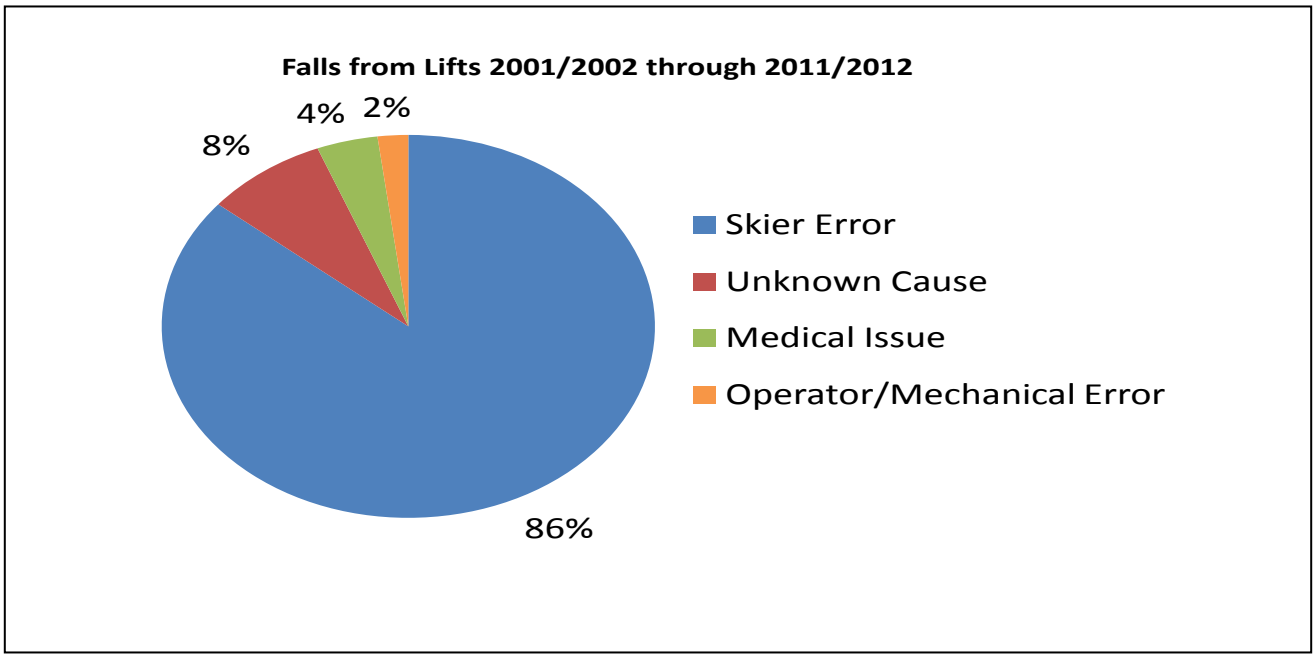
Passengers falling out of chairlifts are typically not recorded or collected by most state regulatory agencies. The best statistical information regarding the causes of falls from chairlifts comes from Colorado, which accounts for more than one-fifth of all skier visits in the country. With 27 ski areas—ranging in overall size, terrain, vertical steepness, lift capacity, age, and variety of chairlifts—Colorado is representative for the broader ski industry. Colorado law requires ski areas to report any falls from chairlifts resulting in injury, along with the cause of the fall, to the Colorado Passenger Tramway Board, a state regulatory agency that oversees chairlift safety and operation.

Through the state's freedom of information law, NSAA obtained data from the Colorado Passenger Tramway Board in order to analyze and interpret the reason and frequency of falls from chairlifts, in an effort to better understand the safety considerations for the operation of chairlifts. NSAA analyzed the Colorado data from the 2001/02 to 2011/12 ski seasons. In that 11-season

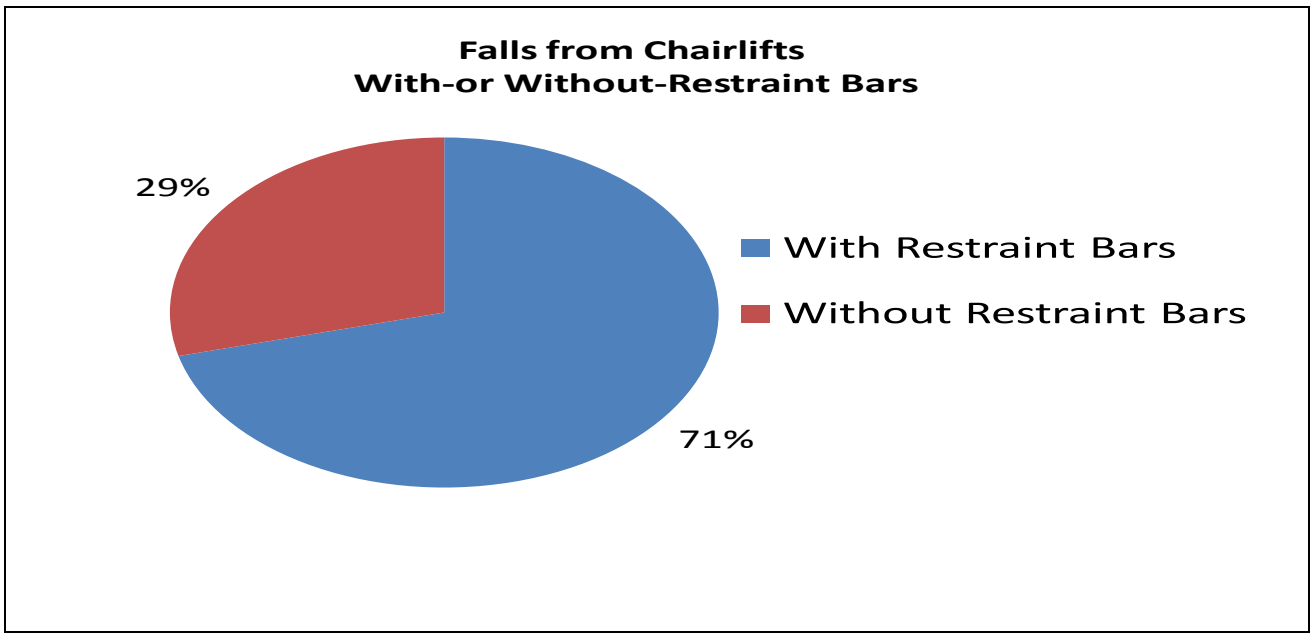


period, ski areas reported 227 falls from chairlifts to the Colorado Tramway Board, and the causes reported for the falls (human error, medical condition, operator/mechanical error, or unknown cause).

The results of this analysis establish that 86 percent of all falls are attributed to skier error and 4 percent of falls are due to medical issues of the rider. Notably, only 2 percent of all falls from chairlifts were the result of mechanical or operator error, reinforcing the overall safety of chairlift operations:



Also, 71 percent of all falls from lifts in Colorado occurred on chairlifts that had a restraint bar:



In 2002, *The Denver Post* studied years of data collected by Colorado's Tramway Safety Board regarding falls from chairlifts in Colorado. According to the *Denver Post*, "[a]n analysis of state accident reports by the *Denver Post* shows that human error—rather than mechanical problems, unsafe operation or weather conditions—is the cause of most falls from ski lifts."[11] As the *Denver Post* explained in their review of the agency's data, "[m]ost falls happen because of mistakes getting on, when skiers sit down badly or shift their weight too fast, or getting off, when skiers move forward too soon and lose their balance on the seat."

In addition to the safe operation of chairlifts by ski resorts, skiers and snowboarders have a corresponding obligation to ride and use chairlifts in safe and responsible manner. According to the ski industry's "Your Responsibility Code"—the seven-point ethics code adopted in 1965 by the ski industry and which has been codified in skier safety legislation in many states—skiers and snowboarders are personally responsible to "know how to use the lifts safely."

On very rare occasion, an individual may fall from a chairlift as a result of a pre-existing medical condition. For example, an individual may suffer a heart attack, stroke, seizure, or other medical event while riding a chairlift, which causes the person to fall. When this results in a fatality, the actual cause of the death is often undetermined (the medical condition itself, the fall, or some combination). This uncertainty is also compounded by the far lower number of autopsies being conducted today by coroners. Because these fatalities from medical conditions do not reflect the overall safety of riding chairlifts for the public, understandably, these rare incidents are not included in industry fatality data.

Lift Inspections and State and Federal Regulation

Ski areas adhere to rigorous and exacting inspections procedures for the lifts at their resorts, and the fact that there has not been a fatality due to a lift-related malfunction in the U.S. in 23 years is attributed to these meticulous inspection and maintenance programs. Ski area employees conduct their own individual inspection of chairlifts on a daily, weekly, monthly, and annual basis. This year-round maintenance regimen is conducted pursuant to regulations by state agencies, lift manufacturer requirements, federal requirements, national safety standards, and insurance company compliance policies.

[11] See "Falls from Lift a Skiing Risk, but Serious Accidents Rare," *Denver Post*, Dec. 8, 2002.

The American National Standards Institute ("ANSI")—a national, nonprofit umbrella accrediting organization that oversees standard-setting committees for nearly every industry in the U.S.—has a standards committee dedicated solely to ski lifts and passenger ropeway systems. Safety standards for ski lifts have been established by the ANSI Accredited Standards Committee (ASC) B77 ("B77" for short), which was started back in 1956 to recommend safeguards, principles, specifications, and performance objectives that would reflect the current state of the art of passenger ropeway design, operations, and maintenance. This B77 Committee is comprised of government regulators, engineers, lift manufacturers, ski area owners and operators, academics, and other members of the public interested in ski lift design, operation, and maintenance.[12] Membership on the B77 Committee is open to the public. The Committee meets several times each year to address concerns by Committee members, review new technology, analyze incidents involving lifts and ropeways, and vote on updates and changes to these safety standards on a regular basis. The current standards regulating ski lifts were most recently revised in 2012, and will be updated in the 2017 version of the B77 standard.

In turn, state regulatory agencies have adopted these B77 safety standards (and codified them into law) to govern ski lifts and passenger ropeway transportation. In addition to these B77 standards, ski areas are subject to inspection by regulators from state agencies overseeing chairlifts. Furthermore, most states and other inspection entities require impartial, third-party engineers to conduct lift inspections. In fact, many states require surprise, unannounced chairlift inspections during the course of the ski season as part of the regulatory framework for lift safety.

Additionally, ski areas operating on U.S. Forest System lands must adhere to lift-related requirements in their special use permits. The U.S. Forest Service requires certification and inspection of lifts in accordance with the ANSI B77 Committee standards. Moreover, the U.S. Forest Service has members on the ANSI B77 Committee, and the agency monitors ski lift construction and operation on public land, as well as requiring high levels of insurance coverage.

As part of ski areas' maintenance and inspection procedures, independent specialists are brought in to inspect the wire ropes (the cable that carries the chairs) and chairlift grip testing. Areas routinely inspect tower footings that support the lift equipment, the sheaves that support the haul rope on the towers, gear boxes, brakes, and the electric motors powering the lifts, as well as other components. In fact, all ski lifts are required to have auxiliary engines as back-up power sources, in

[12] Canada has a parallel standards committee, known as the Z98 standards, which are similar to ANSI B77 standards in the United States.

the rare instance of a loss of electrical power. Lastly, ski areas routinely practice chairlift evacuation drills with their ski patrols in case of hazardous conditions or lift malfunctions.

Ski Resorts Invest Heavily in New and Upgraded Lifts

Ski areas across the country invest heavily in new and upgraded lifts. During the 2014/15 season, ski areas spent $41.5 million on new and upgraded lifts (compared to $60 million in 2013/14), according to the 2014/15 *NSAA Kottke End of Season Survey*. For the 2015/16 season, ski areas spent at least $42 million on new and upgraded chairlifts, with another $43 million to be spent on lifts in the upcoming 2016/17 season, according to NSAA's *2015/16 Kottke End of Season Survey*. Capital expenditures on new and upgraded lifts are well over $1 billion going back to the 1996/97 ski season.

Technical Training and Education

The ski industry has a long-standing and exhaustive training and educational regimen for ski lift operators across the United States. The Rocky Mountain Lift Association (RMLA) is a trade association for maintenance and operation personnel for ski lifts and ropeways. Going back to 1971, RMLA has hosted an annual educational conference in the western United States, with more than 375 attendees from ski areas participating in more than 70 different educational presentations and seminars on issues relating to lift safety, maintenance, and lift operations. Also, for ski areas located in the eastern U.S., the annual Lift Maintenance Seminar (LMS) has been holding similar educational workshops each year, going back to 1976.

In addition to these two mainstays of lift training and maintenance, there are numerous other regional workshops on lift maintenance, lift safety, and lift operations. There are lift maintenance seminars and hands-on training conducted annually by the Midwest Ski Areas Association, the Pacific Northwest Ski Areas Association, the Ski Areas of New York, the Southeast Ski Areas Association, the Intermountain Ski Areas Association, as well as educational seminars during the New England Ski and Sports Summit. Furthermore, NSAA features lift operations seminars at its two annual Winter Conferences and at nine regional locations during the NSAA Fall Risk Management pre-season workshops conducted annually. In addition, the two main lift manufacturers in the United States—Doppelmayr USA and Leitner-Poma—conduct their own training and educational seminars for ski areas that have installed their lifts.

The comprehensive and exhaustive extent of training and educational opportunities for lift maintenance and safety in the industry is a testament to the high level of guest safety at ski areas across the United States.

Frequently Asked Questions

Q: How many ski lifts are there in U.S.?

A: Approximately 3,500—the overwhelming majority which are traditional double, triple, and quad chairlifts (both fixed and detachable), as well as gondolas, surface lifts, rope tows, and aerial tramways.

Q: What is the average age of lifts installed in the U.S.?

A: It is difficult to accurately establish the average age of chairlifts, particularly in light of the fact that the vast majority of lifts have received significant upgrades to their dynamic machinery and critical components since installation. However, most detachable chairlifts were installed after 1980, and survey data indicates that 83 percent of all fixed grip lifts have been installed since 1970. Less than 1 percent of fixed grip chairs lifts were installed prior to 1960. Regardless of the date of initial installation, chairlifts—like renovated automobiles—can operate safely with proper maintenance and inspection for several decades. Rapid growth and investment in the ski resort industry occurred in the 1970s, 80s, and 90s, and well into the first decade of the 21st century, when the vast majority of chairlifts, gondolas, and other uphill transports were installed.

Q: Do manufacturers or state regulators have a recommended lifespan for ski lifts?

A: There is no recognized or consensus recommended lifespan for a ski lift, either based on the manufacturers' perspective or state regulation. Moreover, the ANSI B77 Committee does not consider or evaluate the overall safety of a chairlift based on the initial date of installation. Lifts are continually maintained and inspected on a daily, weekly, monthly, and annual basis, and moving parts (such as haul rope, sheaves, controls, drive systems, motors, gear boxes, bearings, and other components) are frequently replaced or upgraded during the life of the lift. In addition, some chairlifts are operated at varying degrees of capacities (some lifts operate at full capacity all the time, some lifts are frequently idled, some lifts are operated both winter and summer seasons, etc.) In other words, the number of *hours* a lift is in operation, rather than the year it was installed, is more reflective of its overall mechanical condition. Simply

put, the date of initial installation of a lift is not indicative of the lift's overall level of safety. In fact, the last two lift malfunctions that resulted in fatalities (one incident in 1993, the other in 1985) both occurred on lifts that were less than one year old. Well maintained ski lifts—with proper maintenance and equipment upgrades—can operate effectively for decades past their date of original installation.

Like automobiles, a person would not replace a car simply because it needed new tires; likewise, a ski area would not replace an entire lift system (many of which are a half-mile in length or longer) when upgrading components (wire rope, sheaves, ball bearings, etc) will allow the lift system to continue to operate safely and effectively.

Q: How do resorts determine when to discontinue lift operations due to weather conditions?

A: It's a case-by-case basis, and there are no one-size-fits all procedure or protocol used in the industry. Usually, the decision to shut down a lift is determined by ski area management, which may include the general manager, ski patrol director, the risk manager, and/or the manager of the lifts department. Moreover, different considerations may be used for different lifts at the same resort; some lifts located at higher elevations may be more exposed to wind and other conditions than lifts closer to the base of the resort. It is not unusual for a ski area to close a lift due to weather conditions.

Q: Do some states require restraint bars on chairlifts?

A: Most states do not require chairlifts to have restraint bars installed. All seven states in the Northeast (Connecticut, Maine, Massachusetts, New Hampshire, New York, Vermont, and Rhode Island) require that chairlifts have a restraint bar installed. Vermont is the only state that requires chairlift users to ride the lift with the restraint bar lowered. While most states do not require restraint bars, both major manufacturers of chairlifts in the United States offer restraint bars as standard equipment. Furthermore, the ANSI B77 Committee is likely to pass a provision in 2017 to add a regulation to the ANSI B77 standard that will require all ski areas with newly installed chairlifts—including relocated chairlifts bought from other ski areas—to include restraint bars on these lifts.

Additional Media Resources on Ski Lift Safety and Operation

Jim Fletcher, **P.E.,** professional engineer and senior consultant with Engineering Specialties Group, a professional engineering firm, and member of the ANSI B77 Standards Committee. For the past

several decades, Fletcher has worked as an engineer on numerous transportation projects around the country, including projects in the ski industry, as an independent, outside consultant. He is not associated with or employed by any ski area.

Phone: (303) 482-3182 (office); (303) 589-2250 (cell)
Email: jimf@engineeringspecialtiesgroup.com

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THE NATIONAL SKI AREAS ASSOCIATION, LOCATED IN LAKEWOOD, COLO., IS A TRADE ASSOCIATION FORMED IN 1962 FOR SKI AREA OWNERS AND OPERATORS NATIONWIDE, REPRESENTING MORE THAN 330 SKI AREAS IN THE UNITED STATES AND CANADA.