

# Crystal Mountain—Employee Housing Chutes Avalanche Accident

## Crystal Mountain, WA

February 17, 2001

Summary—One out of bounds skier triggered and caught by slide, swept through trees, partially buried and injured—fractured arm (radius) and fractured jaw.

### Slide details—

Date—2/17/01, Time ~1330 PST

ENE exposure, 6210 ft, SS-AS-2-F; 40 degree slope angle

Vertical fall ~320 ft, victim traveled ~110-120 ft vertical before stopping just below tree line; toe of slide stopped another 200 vertical feet below victim.

Slab dimensions—65 ft wide by ~3 ft deep (32-44 inches)

Slide occurred in currently closed and uncontrolled area within permit boundary.

Summary of snowpack layering: Recently deposited wind slab slid on low density stellars from early in storm with bed surface of a denser old snow surface.

Accident and Rescue narrative provided by Chet Mowbray, Crystal Mountain Professional Patrol

### Accident Narrative

*On Saturday 2/17/2001 two long time skiers of Crystal Mountain Bruce and Maurice ducked the Gun Tower Ridge rope closure,(their track passed within one foot of a closed disc) an area that had not been open all year due to low snow conditions. Their intent was to ski an area called upper Employee Housing. Avalanche control work had been done in the North Back area that morning but not in this area due to the closure. The previous 48 hours brought 30" of new snow with a water equivalent of 1.43". Although the bulk of the precipitation came in the first 24 hours out of the south west averaging 20 to 25 mph, the second period switched to a more south easterly averaging 25 to 35 mph with a one hour average of 50mph. Temperatures ranged between the high teens and mid twenties. Maurice and Bruce both claimed to have extensive heli-skiing experience and avalanche training. Upon reaching the top of the slope Maurice claims he poked his ski pole in the slope feeling the dense snow over a potential sliding layer . He then proceeded to traverse back toward the open area. Maurice then stopped and turned around seeing a large volume of snow moving down the hill. Not seeing Bruce he then cut out to the tree line and proceeded down yelling several times for his partner. Not getting a response Maurice proceeded intercepting a patroller shortly thereafter. Upon receiving the call of a potential avalanche burial three patrollers and a dog were dispatched immediately. Arriving at the site the saw a 65' wide crown averaging 32" and 44" at its peak. It was an ENE aspect and the bed surface was 40 degrees. Upon evaluating the remaining hazard Jane Morris a CM Pro took the avalanche guard position near the crown and Gregg Burnworth another CM Pro proceeded down the right side*

*of the path through the trees to access the site. Gregg immediately found Bruce directly below a dense tree band 400' below the crown. Bruce was not buried but was struggling in the deep snow. He had multiple head and facial lacerations, a swollen jaw, and what appeared to be a fractured arm. Bruce was complaining of dizziness, confusion, and upper body pain. At this point I arrived on site and continued the transceiver search although Bruce was quite sure he was the only one involved. Also at this time the avi dog and handler began working the site. After completing the transceiver search a probe team began working the upper tree band then immediately moved down to the bulk of the deposition. Due to the depth of the debris we dispatched another probe team to due a fine probe for the rule out. Just prior to this all medical equipment arrived and the patient was backboarded and prepared for transport. Also during this time explosives were brought to the site to control the exit route for rescue personnel. Upon completing a fine probe of the deposition which averaged 3' to 4' I called the search off.*



**Figure 1. Fracture line of slab that released on 40 degree slope and caught, partially buried and injured a skier near Crystal Mountain, WA. The three foot ( 1 m) wind slab released on weak stellar crystals deposited early in the storm.**



**Figure 2. View looking downhill from fracture line above. Slide continued through heavy timber in photo and stopped approximately 200 ft vertical below trees. After being carried through and slowed by impacting the trees, the victim was found on the snow surface just below the tree line.**

### **Ancillary Avalanche and Weather Information—**

Provided by Mark Moore, Northwest Weather and Avalanche Center

Analysis of the Crystal Mountain Remote Weather Station Data for three days prior to accident indicates that indeed some lower density snowfall occurred late on the afternoon of the 15<sup>th</sup> between about 4 and 6 PM, and this was followed by increasingly heavy snowfall rates along the moderate to strong winds throughout the night of the 15<sup>th</sup> and into the morning of the 16<sup>th</sup>. Even though precipitation stopped around mid-day on the 16<sup>th</sup>, with a slight downturn in winds that afternoon, strong south-southeasterly ridgetop winds redeveloped late on the 16<sup>th</sup> and continued relatively unabated through the morning of the 17<sup>th</sup>, creating a relatively hard wind slab on lee slopes and setting the stage for the accident on this apparently cross loaded and previously uncontrolled slope.

### **Related Mountain Weather Data—**

Crystal Mountain, Wash		02/16/01		0400 PST						
DATE	TIME	TEMP	TEMP	RH	WIND SPEED (MPH)	WDIR	PREC	PREC	SNOW	
MmDd	(PST)	DegF	DegF	%	MIN	AVG	MAX	AVG (1HR)	ACCUM 24HR	TOTAL

	6870	4450	4450	6870	6870	6870	6870	4450	4450	4450	4450
02/16 0400	19	18	92	19	30	46	262	.06	.94	16	59
02/16 0300	18	18	91	13	25	37	257	.08	.88	15	58
02/16 0200	17	19	91	16	26	39	248	.08	.80	13	56
02/16 0100	18	19	92	15	27	44	241	.09	.72	12	53
02/16 0000	18	20	91	13	26	41	229	.08	.63	8	50
02/15 2300	18	21	91	14	25	36	218	.11	.55	8	51
02/15 2200	19	22	90	14	25	40	215	.10	.44	7	50
02/15 2100	21	26	92	12	24	44	241	.08	.34	5	49
02/15 2000	22	27	93	11	22	37	231	.08	.26	4	47
02/15 1900	21	28	95	5	19	37	227	.05	.18	2	46
02/15 1800	22	28	95	2	10	25	190	.05	.13	1	45
02/15 1700	25	28	93	1	7	13	102	.03	.08	0	44
02/15 1600	23	29	89	1	6	15	317	.00	.05	0	44
02/15 1500	22	31	82	3	13	29	330	.00	.05	0	44
02/15 1400	25	32	69	1	7	19	315	.00	.05	0	44
02/15 1300	26	32	73	1	5	14	280	.00	.05	0	43
02/15 1200	25	31	78	1	5	15	248	.00	.05	0	44
02/15 1100	24	29	83	1	3	8	284	.00	.05	0	44
02/15 1000	26	28	86	1	5	12	214	.00	.05	0	44
02/15 0900	21	26	92	2	8	23	346	.00	.05	0	44
02/15 0800	17	24	96	4	14	31	14	.02	.05	0	44
02/15 0700	15	24	96	4	18	34	319	.02	.03	1	44
02/15 0600	17	25	97	3	17	32	340	.00	.01	1	41
02/15 0500	17	25	97	8	23	49	345	.01	.01	1	43

DATE	TIME	TEMP	TEMP	RH	WIND	SPEED	(MPH)	WDIR	PREC	PREC	SNOW	
MmDd	(PST)	DegF	DegF	%	MIN	AVG	MAX	AVG	(1HR)	ACCUM	24HR	TOTAL

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Crystal Mountain, Wash					02/17/01			0400 PST				
DATE	TIME	TEMP	TEMP	RH	WIND	SPEED	(MPH)	WDIR	PREC	PREC	SNOW	
MmDd	(PST)	DegF	DegF	%	MIN	AVG	MAX	AVG	(1HR)	ACCUM	24HR	TOTAL
		6870	4450	4450	6870	6870	6870	6870	4450	4450	4450	4450
02/17	0400	24	26	87	27	50	70	125	.00	.51	8	63
02/17	0300	25	26	89	24	46	65	112	.00	.51	8	63
02/17	0200	26	27	92	21	46	63	108	.00	.51	8	64
02/17	0100	24	26	94	25	46	59	84	.00	.51	8	64
02/17	0000	25	26	98	15	39	64	43	.00	.51	8	64
02/16	2300	26	25	98	15	32	49	116	.00	.51	8	64
02/16	2200	26	27	97	10	24	41	135	.00	.51	8	64
02/16	2100	26	27	97	9	19	28	126	.00	.51	8	64
02/16	2000	29	28	95	6	16	23	126	.00	.51	8	64
02/16	1900	24	28	97	10	17	23	133	.00	.51	8	65
02/16	1800	23	27	96	2	12	18	130	.00	.51	9	65
02/16	1700	25	29	92	4	15	25	166	.00	.51	9	62
02/16	1600	25	30	91	8	19	37	138	.01	.51	9	64
02/16	1500	25	31	87	5	18	34	125	.02	.50	9	65
02/16	1400	28	30	88	6	20	37	154	.02	.48	8	64
02/16	1300	26	27	87	6	23	50	111	.04	.46	8	65
02/16	1200	25	25	85	8	27	52	106	.06	.42	7	64
02/16	1100	24	23	89	11	27	51	86	.06	.36	5	63
02/16	1000	23	21	89	9	26	49	86	.04	.30	4	62
02/16	0900	22	20	85	8	30	56	140	.04	.26	3	63
02/16	0800	20	18	89	9	32	57	150	.05	.22	2	61
02/16	0700	21	19	87	10	34	51	247	.05	.17	1	62
02/16	0600	20	20	89	13	32	51	270	.06	.12	0	60
02/16	0500	20	20	91	15	31	45	271	.06	.06	17	60

DATE	TIME	TEMP	TEMP	RH	WIND SPEED (MPH)			WDIR	PREC	PREC	SNOW	
MmDd	(PST)	DegF	DegF	%	MIN	AVG	MAX	AVG	(1HR)	ACCUM	24HR	TOTAL

Crystal Mountain, Wash      02/18/01      0400 PST

DATE	TIME	TEMP	TEMP	RH	WIND SPEED (MPH)			WDIR	PREC	PREC	SNOW	
MmDd	(PST)	DegF	DegF	%	MIN	AVG	MAX	AVG	(1HR)	ACCUM	24HR	TOTAL
		6870	4450	4450	6870	6870	6870	6870	4450	4450	4450	4450

02/18	0400	23	30	92	6	21	50	329	.02	.13	2	61
02/18	0300	24	31	91	5	24	51	271	.03	.11	1	60
02/18	0200	25	30	95	11	29	60	275	.00	.08	1	61
02/18	0100	25	28	93	14	32	58	263	.01	.08	1	61
02/18	0000	23	27	94	9	27	46	203	.05	.07	1	60
02/17	2300	23	28	92	11	29	40	197	.02	.02	1	61
02/17	2200	26	28	88	21	37	47	179	.00	.00	0	61
02/17	2100	28	29	86	20	37	51	178	.00	.00	0	61
02/17	2000	27	27	95	23	38	55	182	.00	.00	0	61
02/17	1900	26	28	90	25	36	48	162	.00	.00	0	61
02/17	1800	27	28	90	24	38	53	155	.00	.00	0	61
02/17	1700	25	30	85	13	28	43	162	.00	.00	0	62
02/17	1600	28	31	84	14	27	38	159	.00	.00	0	62
02/17	1500	27	34	76	16	28	39	154	.00	.00	0	61
02/17	1400	32	35	73	20	33	49	142	.00	.00	0	62
02/17	1300	29	34	74	16	35	50	139	.00	.00	0	62
02/17	1200	29	33	76	26	44	62	130	.00	.00	0	62
02/17	1100	28	30	84	27	49	67	105	.00	.00	0	62
02/17	1000	29	26	83	24	50	70	112	.00	.00	0	63

02/17	0900	27	21	88	25	47	70	82	.00	.00	0	63
02/17	0800	25	20	91	23	41	57	88	.00	.00	0	63
02/17	0700	22	20	93	20	40	59	133	.00	.00	0	63
02/17	0600	23	22	88	23	43	64	135	.00	.00	0	63
02/17	0500	24	26	86	27	49	69	136	.00	.00	8	63

DATE	TIME	TEMP	TEMP	RH	WIND SPEED (MPH)			WDIR	PREC	PREC	SNOW	
MmDd	(PST)	DegF	DegF	%	MIN	AVG	MAX	AVG	(1HR)	ACCUM 24HR	TOTAL	

**Related Back Country Avalanche Forecast—**

On the morning of the incident, the following forecast for considerable to high danger for the central and southern Washington Cascades had been issued for back country avalanche conditions. Since the area involved was largely uncontrolled, the layering near the accident site probably approximated back country conditions....

ZCZC SEASABSEA

TTAA00 KSEA DDHHMM

WAZ012-017-018-019-025-042-ORZ011-181700-

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NORTHWEST WEATHER AND AVALANCHE CENTER

NWAC Program administered by USDA-Forest Service with cooperative funding and support from Washington State Department of Transportation National Weather Service National Park Service Washington State Parks and Recreation Commission Pacific Northwest Ski Area Association and other private organizations

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BACKCOUNTRY AVALANCHE FORECAST FOR THE OLYMPICS, WASHINGTON CASCADES AND MT HOOD AREA

These forecasts apply to back country avalanche terrain below 7000 feet. They do not apply to highways or operating ski areas.

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0845 AM PST Saturday, February 17, 2001

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ZONE AVALANCHE FORECASTS.....

WASHINGTON CASCADES FROM STEVENS PASS SOUTHWARD. . .OLYMPICS. . .

Considerable avalanche danger below 7000 feet gradually increasing Saturday afternoon through Sunday morning, possibly becoming high above 3 to 4000 feet and considerable below. Danger slowly decreasing Sunday afternoon and night and becoming considerable above 4 to 5000 feet and moderate below.

WASHINGTON CASCADES NORTH OF STEVENS PASS. . .

Considerable avalanche danger above 5 to 6000 feet and moderate below gradually increasing Saturday afternoon through Sunday morning and becoming considerable above 4 to 5000 feet and moderate below. Danger decreasing Sunday afternoon and night and becoming considerable above 5 to 6000 feet and moderate below.

MT HOOD AREA. . .

Considerable avalanche danger above 6000 feet and moderate below gradually increasing Saturday afternoon through Sunday morning and becoming considerable above 5000 feet and moderate below. Danger decreasing Sunday afternoon and night and becoming considerable above 6000 feet and moderate below.

MONDAY OUTLOOK. . .

Gradually increasing danger is expected mid-late Monday, mainly from the central Washington Cascades southward, with relatively little change in the danger further north.

SNOWPACK ANALYSIS.....

Moderate to heavy snowfall-heaviest in the Olympics and Washington Cascades from Stevens Pass southward--and moderate to strong winds late Thursday and Friday were followed by decreasing showers but continued relatively strong winds late Friday through early Saturday. Although this allowed for a slight decrease from the recent high danger in the south-central Cascades, a considerable danger remains below 7000 feet with unstable wind slabs ranging up to 1 to 3 feet probable in wind loaded terrain- primarily west through northwest facing slopes. During the past 24 hours, field reports indicate significant wind transport of new snow in most areas, and sensitive slides of 1 to 2 feet or more quickly ran long distances during avalanche control Friday. Although some settlement of these slabs has occurred, many of these newly developing and generally higher density wind slabs were deposited over and remain poorly bonded to weak snow layers or snow surfaces that include an old melt-freeze crust, surface hoar or weak low density snow received early Wednesday. Also, moderate to strong winds early Saturday are continuing to build larger slabs, with some hollow sounding hard slabs likely forming over weak snow below ridges. Finally, recent cold temperatures in the north-central Cascades, Cascade passes and Cascade east slopes should be once again allowing for more faceting and weakening of snow near several buried crusts and near the recent surface snow that had warmed substantially last Wednesday. This faceting should help keep much of the upper part of the snowpack relatively weak, and susceptible to stress failure and fracture if future heavy loading is received, such as that being experienced currently from strong wind transport. Hence surface slide releases of the most recently deposited snow may trigger some isolated larger slides involving all of the snow since early-mid January, with isolated releases of 2-4 feet or more possible in heavily wind loaded terrain. Generally less snowfall received in the north Cascades and Mt Hood areas since mid-week is producing a slightly lower danger, however a similar unstable snow structure exists and a considerable danger exists on lee slopes above about 5000 feet in the north Cascades and above 6000 feet in the Mt Hood area. At lower elevations in these areas less winds are resulting in a moderate danger with smaller slabs possible in wind affected terrain-mainly northwest through northeast exposures near Mt Hood and north through west exposures in the north Cascades.

SATURDAY. . .SATURDAY NIGHT. . .

Increasing clouds are expected Saturday morning with light rain or snow developing in the south mid-day or early Saturday afternoon, spreading northward later Saturday afternoon and evening. Light to moderate rain or snow is expected Saturday night and early Sunday, heaviest in the south-central Cascades and along the Cascade east slopes. Along with slight warming and moderate winds, this should result in gradually increasing danger as new soft wind slabs are deposited over an already unstable snowpack including some rather unpredictable hard slabs. Greatest danger should continue on northwest through southwest facing slopes near the Cascade passes and northeast through northwest exposures elsewhere, and back country travel is still not recommended on steeper terrain showing evidence of recent wind transport.

SUNDAY. . .

Although light to moderate rain or snow should decrease and become more showery Sunday morning, further slight warming is also expected with the effects being most pronounced near the Cascade passes. This should help to further slightly increase existing avalanche danger with a high danger possibly developing above 3 to 4000 feet, especially near the central Cascade passes. In areas near the Cascade passes, most slopes have been under the influence of a cold easterly pass flow since early Thursday, and a pass wind shift to briefly warmer westerly may substantially increase the danger as brief wet snow or rain is possible below 3 to 4000 feet. Gradually decreasing winds mid-late Sunday through early Monday along with slightly lowered freezing levels-mainly in the north--should allow for a slow decrease in the danger as new wind slabs slowly settle. However, travelers should continue to assess snowpack stability often and travel on wind loaded terrain is not recommended.

MONDAY. . .

After a brief decrease in showers and some partial clearing, increasing clouds and light to occasionally moderate rain or snow should spread northward mid-late Monday. However, most of this precipitation should remain in the south-central Cascades and Mt Hood area with only light showers expected further north. Along



with only a slight rise in freezing levels and mostly light to moderate winds this should only produce a slight increase in the danger, mainly in the southern and central Washington Cascades and Mt Hood area where further small wind slabs should develop. Further north, mainly light showers and little or no warming are expected to produce little change in the avalanche danger.

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Backcountry travelers should be aware that elevation and geographic distinctions are approximate and a transition zone between dangers exists. Remember there are avalanche safe areas in the mountains during all levels of avalanche danger. Contact local authorities in your area of interest for further information.

NWAC Mountain Weather Forecasts and mountain weather data are also available by visiting our Web site at [www.nwac.noaa.gov](http://www.nwac.noaa.gov).

Moore/Forest Service Northwest Weather and Avalanche Center

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