GRANITE MOUNTAIN (5629') AVALANCHE INCIDENT March 10, 2002

Narrative provided by John Stimberis— WSDOT Avalanche Technician, Snoqualmie Pass

Accident Narrative

On March 10, 2002, two Seattle area men headed east on Interstate 90 toward Snoqualmie Pass for a ski tour. Their destination was Granite Mountain, about three miles west of the Pass. The south face of Granite Mountain is a large basin made up of several gullies separated by small ridges. The south face is moderately steep with slope angles in the upper thirty-degree range, and the gullies are subjected to cross loading during most storm events. Avalanches occur on this side of the mountain quite frequently throughout the winter and spring. The men, Matt C, 27 and Michael R, 31, had never been to Granite Mountain before, but they had read about it in a ski tour guidebook. While getting ready at the trailhead, Michael realized that he had forgotten his transceiver and shovel, although Matt had remembered both shovel and beacon. They ascended the mountain on foot via a ridge and went about halfway up between timberline and the summit of Granite. They turned back here and enjoyed some fine powder skiing on their telemark gear. Once back at timberline they decided to go to the summit. On this ascent, they took the next ridge to the East. Once they reached the summit, they took about a half-hour break at the fire lookout station. They described the conditions at the summit as cold and windy.

Around 1400 hours they began their descent. The upper part of the mountain was icy and Michael even slid about thirty feet once when he fell. About five hundred feet below the summit the two decided to traverse to the East to the next ridge, which is a little less steep than the one they were descending. Matt crossed the gully first, with Michael spotting him in case he was caught in a slide. Matt noticed that the snow in the gully was much deeper than the ridge and had become quite heavy since their first run. He made two turns near the far side of the gully and then fell. He waited a minute to catch his breath before getting up. Michael, who was watching, noticed that Matt began to slide down the slope. At first he thought it was the ice below the new snow that was causing the slide, but then he saw all of the snow around Matt moving and realized that it was an avalanche. As Matt disappeared from view, Michael used his cell phone to call 911 and get search and rescue on the way. The dispatcher told him to stay put, but Michael knew that he needed to go help his ski partner. Michael descended the ridge on foot for fear of triggering another avalanche. He stated that the slide propagated along the traverse that Matt made when he entered the gully. He estimated that the slide was about 12-18" deep and 300 feet wide. Michael continued down the ridge until he reached the avalanche debris, and then began to walk on the debris looking for Matt. While yelling Matt's name, he heard a response and went to the location. Matt was buried deeply with only his face and forearm exposed in a hole. It was estimated that his head was about five feet below the snow surface on the upslope side and a foot or two on the downhill side. Apparently, Matt had been pushing the snow into a mound when he stopped moving and the slide continued to move in around him.

Matt stated that he was on top of the slide most of the time. When he did go under he said that snow was immediately crammed down his throat and up his nose. He then resurfaced and the slide began to stop. It was at this point that he started to hold back the snow and create the large pile above him. Eventually the snow filled in around him leaving only his face and forearm exposed. The debris was wet, heavy, and set up around him quite quickly. Matt and Michael each estimated that the slide carried Matt about 1500 vertical feet. It took Michael about fifteen minutes to reach Matt and another thirty to dig him out. At first he dug with his hands until he could reach Matt's pack, then he used Matt's shovel. He stated that the shovel was one of the disc models and was very ineffective in the heavy debris. Matt was a little bruised, but otherwise unharmed. He lost a pole, a mitt, his goggles and prescription glasses in the slide. His skis remained on throughout the entire slide.

The week leading up to the slide had some of the best skiing of the season at all elevations around Snoqualmie Pass, with some twenty-five inches of snow at an average of six percent water equivalency along with cool temperatures. The day of the 10th saw the first significant warming of the week at higher elevations. The 24hr period ending at 0600 on the 11th reported eight inches of new snow at twenty-five percent density. Precipitation rates were heaviest on March 10th between 1100 and 1600 hours, with snow changing to rain at 3000'. Temperatures recorded from nearby automated instrumentation at the 5400' level rose throughout the day from 25 in the morning to near 30 late in the afternoon. The gullies on the south face of Granite are heavily cross-loaded throughout the winter and have been the site of numerous avalanche incidents over the years.

Report compiled by John Stimberis, Avalanche Control Technician-WSDOT, through phone interviews with both members of the party.

Ancillary Snowpack, Weather and Avalanche Information

-provided by Mark Moore, NWAC

As is evident from the avalanche forecast issued by NWAC on the 9th of March and reinforced on the morning of the 10th (shown below), a rather marginal snow pack stability situation existed. A generally increasing and considerable avalanche danger was expected both on the 9th and 10th, with unstable wind slabs probable and a very poor bond between existing snow or developing wind slabs and either a recent sun crust, wind crust and/or the late February rain crust....

NWAC Forecast for 3/09/02

OLYMPICS...WASHINGTON CASCADES NEAR AND WEST OF THE CREST NORTH OF MT RAINIER.... Moderate avalanche danger below 7000 feet Saturday morning. Gradually increasing avalanche danger Saturday afternoon and night becoming considerable below 7000 feet through Sunday.

WASHINGTON CASCADES NEAR AND WEST OF THE CREST FROM MT RAINIER SOUTH..... MT HOOD AREA.... Considerable avalanche danger above 5000 feet and moderate danger below Saturday morning. Gradually increasing avalanche danger Saturday afternoon and evening becoming considerable below 7000 feet through Sunday.

EAST SLOPES WASHINGTON CASCADES.... Moderate avalanche danger above 4000 feet and low danger below Saturday morning. Gradually increasing avalanche danger Saturday afternoon and night becoming considerable above 5-6000 feet and moderate below through Sunday.

SNOWPACK ANALYSIS.....

Since the recent clear spell ended last Monday, new snowfall amounts have ranged from 13-35 inches near and west of the Cascade crest, with significantly less new snow in the Olympics and along the east slopes of the Washington Cascades. The recent snow, which fell at very cold temperatures, is poorly bonded to the underlying snow surface, which consists in some areas of shallow wind crusts or a recent sun crust formed last

weekend. In all areas, these surface snow layers overly a hard crust that formed after heavy rains in late February. In the Olympics and north-central Cascades, recent snowfall generally fell with light winds and very low freezing levels, which created loose unconsolidated surface snow. Field reports from Thursday and Friday indicated that the new snow remained unconsolidated with slab avalanches unlikely and loose avalanches possible on slopes of 35 degrees or greater. However, in wind-affected areas, mainly near ridge crests, some soft slabs were reported Friday. In the Washington Cascades from Mt Rainier south and in the Mt Hood area, recent snowfall was accompanied by moderately strong winds which built unstable wind slab snow, especially on southeast through northeast exposures at higher elevations. Field reports indicate that relatively sensitive wind slabs of 1 to 2 feet have released from ski cuts, with some remotely triggered slides causing sympathetic slide releases. Along the Cascade east slopes, only very light amounts of recent snow have been received resulting in a generally lower danger, however some shallow slabs are still possible on lee slopes at higher elevations, especially near the crest. In addition, scouring down to the old hard smooth crust along the Cascade east slopes may have created a very stable though dangerously slick surface.

SATURDAY....

Gradually rising snow levels and moderate winds Saturday morning should combine to consolidate existing loose surface snow into a slab-like structure and build new wind slabs, especially on lee north to east facing slopes. Increasingly strong winds expected Saturday afternoon should build additional unstable wind slabs, especially on lee north to east facing slopes at higher elevations and lee west facing slopes near the Cascade Passes. Increasing precipitation Saturday afternoon and evening should accentuate avalanche dangers as heavier new snow, or rain at lower elevations in the south, loads and stresses the weak bond at the base of this week's new snow. Weather conditions Saturday should produce a significantly increasing avalanche danger, especially Saturday afternoon and evening. As the probability of human triggered avalanches increases Saturday, back-country travelers are urged to use increasing caution, proper route selection and to perform stability tests often as snow conditions change. With recent snow very poorly bonded to the underlying snow surface, back-country travelers should avoid slopes where snow slabs exist.

NWAC Forecast for 3/10/02

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.

OLYMPICS...WASHINGTON CASCADES NEAR AND WEST OF THE CREST...MT HOOD AREA...AVALANCHE WATCH..... Considerable avalanche danger below 7000 feet Sunday, increasing significantly later Sunday night and Monday and becoming high below 7000 feet. Avalanche danger slightly decreasing later Monday mainly lower elevations becoming high above 4 to 5000 feet and considerable below Monday night.

EAST SLOPES WASHINGTON CASCADES.... Considerable avalanche danger above 5 to 6000 feet and moderate below Sunday, gradually increasing Sunday night and Monday and becoming high above 6000 feet, considerable from 4 to 6000 feet and moderate below 4000 feet late Monday.

SNOWPACK ANALYSIS.....

In the Olympics, Mt Hood area and most areas near and west of the Cascade crest in Washington, gradually increasing amounts of new relatively low density snow were received last week--with amounts ranging from 1 to over 3 feet, with slightly higher density snow received in most areas on Saturday. While much of the earlier snowfall was accompanied by relatively light winds making for relatively stable and excellent skiing, snowboarding or snowmobiling, in most instances the new snow formed a relatively weak bond with either the old rain crust formed in late February or a more

recent sun or melt-freeze crust from early last week. In lower elevation wind sheltered areas where wind action has been minimal and where a slightly better bond of new snow to the old surface exists, relatively cohesionless and soft surface snow still exists above the crust with most avalanche activity confined to small loose sluffs or small slabs with little propagation. However, in most other areas where winds have increased of late, much more cohesive soft slabs have developed with higher density snow lying over very low density snow over a crust. Also, some faceting of the snow has occurred near and just above either of the old crusts and this has helped to further weaken the attachment of the recent snow to these relatively smooth bed surfaces. While on most sun-exposed slopes recent surface hoar was destroyed prior to burial, small areas of hoar frost may still exist near the crust on wind and sun sheltered slopes. As a result of this overall snow pack structure, a considerable avalanche danger exists in most of the Olympics and Cascades near and west of the crest, with soft slabs of 1 to 2 feet probable in most steeper wind loaded terrainmainly southeast through northeast exposures near higher ridgelines. Near the Cascade passes shifting winds during the last few days may have loaded both east and west exposure slopes. Field reports indicate that several 1 to 2 ft wind slabs were triggered by skiers and snowboarders Thursday through Saturday and more are probable on slopes showing evidence of wind transport. Although less new snowfall along the Cascade east slopes is resulting in a slightly lower danger, some shallow slabs are still probable near higher ridges and possible at lower elevations.

SUNDAY....CORRECTED....

Light to moderate showers should increase Sunday morning and early afternoon to light to moderate snow. Along with increasing ridge top winds and slightly rising freezing levels this should maintain or slightly increase existing avalanche danger with wind slabs of 1 to 2 feet or more remaining probable on wind loaded slopes, especially east and northeast exposures near higher ridges. Briefly decreasing showers and slightly lowering freezing levels are expected later Sunday afternoon and evening. However, moderate ridge top winds should help maintain existing danger with a slight decrease only expected at lower elevations as recent snowfall and shallower slabs begin to settle.

SUNDAY NIGHT....MONDAY....MONDAY NIGHT.....CORRECTED...

Light to moderate rain or snow should spread into the Olympics Sunday night and the Cascades early Monday, with moderate to heavy rain or snow likely Monday morning and early afternoon. Along with increasingly strong winds and rising freezing levels, this should produce a substantially increasing avalanche danger- especially near and west of the Cascade crest where generally high danger is expected. With higher density snow or rain falling on an already relatively unstable snow pack, increasingly sensitive and gradually larger slabs of 2 to 3 feet or more are expected with both natural and human triggered slides likely. Most slides should release much of the recent snowfall down either to the old late February crust or the melt-freeze crust from early last week, and while greatest danger should develop on northeast through southeast exposures, unstable snow may be found on a variety of aspects and slope anglesespecially at lower elevations receiving rain. While the expected strong winds may scour the snow down to the crust on higher elevation wind exposed terrain, nearby lee slopes should be heavily loaded and probably lower in the path than normal. Slides that do release should quickly run relatively long distances on the relatively smooth sliding surface. As a result, back country travel in avalanche terrain is not recommended Monday with safest travel on windward ridges of lower angle slopes without steeper terrain above. Lowering freezing levels and more showery precipitation expected later Monday and Monday night should allow for a slight decrease in the danger at lower elevations. However moderate to heavy snow or snow showers should maintain generally high danger above 4 to 5000 feet where natural or human triggered wind slabs should remain likely. Although most slides expected after Monday afternoon should involve only the most recently deposited snow since the warming mid-day Monday, especially at lower elevations, isolated larger slides above 4 to 5000 feet may still involve all of the snow accumulated over the late February crust-which by now may total 4 to 5 feet or more in heavily wind loaded areas.

Remote Mountain Weather Data

Remote Weather data from both nearby Alpental ski area (about 1 mile to the east of the accident site) and

Snoqualmie Pass showed that in general rising air temperatures and intermittent wind transport probably contributed to the snowpack instability, with increasingly heavy snowfall at the time of the incident (~1400 hours on the 10^{th}). It is also possible that the wind speed sensor, which is unheated, may have been intermittently rimed during some of this reporting period.

Mountain Weather data from the Alpental Ski Area site

	qualmie nd sens		· -		Wash. ay rime	,	/09/02		2300) PST			
DATE MmDd	TIME (PST)	TEMP DegF 5400	TEMP DegF 4300	TEMP DegF 3120	RH % 3120	WIND MIN 5530	SPEED AVG 5530	(MPH) MAX 5530	WDIR AVG 5530	PREC (1HR) 3120	PREC ACCUM 3120		DEPTH Total (in.)
03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09	2300 2200 2100 1900 1800 1700 1600 1500 1400 1300 1200 1100 0900 0800	23 23 22 22 21 21 21 22 23 23 24 22 22 22 21 20 18	24 24 23 23 23 24 24 25 26 27 25 25 25 21 20	28 28 28 29 31 31 32 33 35 36 34 33 32 28 25	98 97 95 90 78 77 71 68 64 65 70 71 72 83 90	2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	12 9 6 4 4 5 4 3 4 4 3 3 3 0 0 0	24 25 19 20 18 16 13 11 16 22 15 14 17 10 1	119 115 100 109 138 296 49 175 53 112 97 93 157 150 48 39	0.02 0.02 0.01 0.01 0.00 0.00 0.00 0.00	$\begin{array}{c} 0.09 \\ 0.07 \\ 0.05 \\ 0.05 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \\ 0.04 \end{array}$	1 1 0 0 0 0 0 0 0 0 0 0 0 0 0	123 122 123 122 122 124 124 124 124 124 124 123 124 122 124 122
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MmDd	(PST)	DegF	DegF	DegF	8	MIN	AVG	MAX	AVG	(1HR)	ACCUM		

					2								
DATE	TIME	TEMP	TEMP	TEMP	RH	WIND	SPEED	(MPH)	WDIR	PREC	PREC	SNOW	DEPTH
MmDd	(PST)	DeqF	DeqF	DeqF	9	MIN	AVG	MAX	AVG	(1HR)	ACCUM	24hr	Total
		5400	4300	3120	3120	5530	5530	5530	5530	3120	3120	3120	(in.)
03/10	2300	30	31	33	100	5	25	55	257	0.05	0.97	6	129
03/10	2200	30	31	33	100	8	29	54	257	0.02	0.92	6	130
03/10	2100	30	31	33	100	10	32	58	256	0.01	0.90	6	130
03/10	2000	29	31	33	100	8	29	64	255	0.02	0.89	6	130
03/10	1900	30	31	33	100	6	27	54	253	0.02	0.87	6	130
03/10	1800	30	30	33	99	8	26	48	251	0.05	0.85	6	130
03/10	1700	29	29	33	98	7	23	41	250	0.05	0.80	5	130
03/10	1600	30	28	33	97	5	23	43	243	0.05	0.75	5	130
03/10	1500	29	28	33	97	4	15	29	183	0.11	0.70	5	129
03/10	1400	28	27	32	97	2	13	24	138	0.13	0.59	5	130
03/10	1300	27	27	31	98	0	8	22	122	0.12	0.46	4	126
03/10	1200	26	26	31	97	0	4	14	114	0.08	0.34	2	126
03/10	1100	26	26	30	98	0	3	15	88	0.07	0.26	1	125
03/10	1000	26	25	30	97	0	7	21	76	0.01	0.19	0	125
03/10	0900	25	24	30	97	0	5	26	76	0.00	0.18	0	125
03/10	0800	25	24	29	97	0	3	11	82	0.00	0.18	0	124
03/10	0700	26	24	28	98	0	4	21	103	0.01	0.18	0	124
03/10	0600	25	24	28	99	0	3	13	118	0.01	0.17	3	125
03/10	0500	26	24	28	98	0	4	16	128	0.00	0.16	3	124
03/10	0400	26	24	28	98	0	5	18	230	0.00	0.16	3	125
03/10	0300	26	24	28	98	2	14	29	254	0.00	0.16	3	125
03/10	0200	26	24	28	98	1	20	43	242	0.01	0.16	3	125
03/10	0100	24	24	28	98	5	16	34	193	0.08	0.15	3	124
03/10	0000	23	24	28	98	3	15	27	118	0.07	0.07	2	124
DATE	TIME	TEMP	TEMP	TEMP	RH	WIND	SPEED	(MPH)	WDIR	PREC			DEPTH
MmDd	(PST)	DegF	DegF	DegF	90	MIN	AVG	MAX	AVG	(1HR)	ACCUM	24hr	Total

03/10/02 2300 PST

<u>Mountain Weather data from the Snoqualmie Summit site</u> for the 9th and 10th of March leading up to the accident showed little precipitation on the 9th but considerable east wind transport probably occurring at the lower elevations (3-4000 ft) along with slowly rising air temperatures. However, on the day of the accident, increasing moderate to heavy snowfall occurred late morning through the remainder of the day of the event, along with moderate winds and further rising air temperatures.

Snoqualmie Pass			(Summi	t), Wa	sh.	03	3/09/02		23			
DATE MmDd	TIME (PST)	TEMP DegF 3800	TEMP East 3700	TEMP DegF 3000	WIND MIN 3800	SPEED AVG 3800	(MPH) MAX 3800	WDIR AVG 3800	(1HR)	PREC ACCUM 000	24-hr	DEPTH Total in.)
03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09 03/09	2300 2200 2100 1900 1800 1700 1600 1500 1400 1300 1200 1100 1000 0900 0800 0700 0600 0500 0400 0300 0200	25 25 24 24 25 26 26 27 28 28 28 28 25 24 21 21 20 20 20 20 20 21 21	25 25 26 27 27 29 30 32 31 29 28 25 23 22 22 22 21 21 21 21 22	28 28 29 30 31 33 36 33 31 27 24 24 23 24 24 23 24 25 24	7 5 4 6 5 6 6 5 11 5 8 9 9 8 11 10 9 8 11 8 9 5	11 10 9 10 12 20 20 20 20 20 20 20 20 20 2	16 16 15 32 34 35 34 22 23 23 18 19 15 17 17 14 13	109 115 108 104 142 120 119 125 113 120 118 109 110 100 108 101 102 114 115 116	0.04 0.01 0.00 0.00 0.00 0.00 0.00 0.00	0.09 0.05 0.04 0.03	//// //// //// //// //// //// //// //// ////	99 100 100 100 100 100 100 100 100 100 1
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DATE MmDd	TIME (PST)	TEMP DegF	TEMP East	TEMP DegF	WIND MIN	SPEED AVG	(MPH) MAX	WDIR AVG	PREC (1HR)	PREC ACCUM	SNOW 24-hr	DEPTH Total

Snoqualmie Pass			(Summi	t), Wa	sh.	03	03/10/02		2300 PST			
DATE MmDd	TIME (PST)	TEMP DegF 3800	TEMP East 3700	TEMP DegF 3000	WIND MIN 3800	SPEED AVG 3800	(MPH) MAX 3800	WDIR AVG 3800	PREC (1HR) 3	PREC ACCUM 000	24-hr	DEPTH Total in.)
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DATE MmDd	TIME (PST)	TEMP DegF	TEMP East	TEMP DegF	WIND MIN	SPEED AVG	(MPH) MAX	WDIR AVG	PREC (1HR)	PREC ACCUM	SNOW 24-hr	DEPTH Total