Avalanche News
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AVALANCHE NEWS

CANADIAN AVALANCHE ASSOCIATION

In This Issue:

Snow & Avalanches 1992/93

The early winter of 1992 - 93 to March 1 was generally cold and dry throughout the mountain regions of western Canada. The cold and dry conditions prevailed through January & February when well below normal precipitation and in some cases record low monthly precipitation was measured.

In March and April temperatures were milder than average with snow falling on many days in the alpine elevations in the Rockies and Interior Ranges. Some of the best ski conditions on the Coast were during new snowfalls in the second half of March. Snowpack height at alpine elevations increased at many stations during April but overall the only areas with above average snowpack were the Okanagan, slightly above average and the Yukon River basin with extremely heavy snowpacks. [thanks to the BC Ministry of Environment, Hydrology Branch for permission to quote their snowpack summary. Ed]

Ideal conditions for persistent slab instabilities occurred in the early winter. The very cold temperatures and thin snowpack produced a steep temperature gradient and weak basal layers were formed. These weaknesses were widespread by area (aspect and elevation) and region (the Coast and Interior ranges had persistent instabilities usually associated with the Rockies). Weak surface hoar interfaces were also a widespread concern by area and region.

A review of the avalanche involvements follows showing fatalities and incidents as related to the reported weaknesses.

In the Rockies the number of incidents was probably reduced by the stern warnings issued by the Rocky Mountain Parks and the cold temperatures in February which reduced recreational use of avalanche terrain.

Although the height of snowpack was below average and many areas reported fewer natural avalanches, some highway and backcountry ski operations had long periods of poor stability with difficult avalanche forecasting conditions effecting operations from November through April.

The two most widespread periods of direct action avalanche activity occurred at the end of January on the Coast & the Interior and in late February in the Interior. The Coastal cycle produced large avalanches in and adjacent to ski areas, these ran long distances on early winter weaknesses. The Interior cycle produced widespread avalanches but not as large as in deeper snowpack seasons.

Overall the scale of avalanche activity was below average but the potential for involvements was greater.

Avalanche Involvements in Canada

WINTER 1992-1993

by Chris Whalley

Introduction

The Canadian Avalanche Centre (CAC) is responsible for collecting statistics on avalanche incidents. The information assists in drawing attention to avalanche hazards and in educating professionals and the public about safety measures. The details of any incident are confidential; the annual summary gives only the information shown below. Additional information may be used for research and education but further details will not be released to the public without permission.

Number of Incidents

The incidents in the winter 1992-1993 may be stratified according to mountain ranges as follows:

- 22 in the Coast Range
- 22 in the Columbia Mountains
- 16 in the Rocky Mountains
- Total: 60 reported incidents

Number of Persons and Objects

- 41 skiers in backcountry
- 13 skiers adjacent to ski area
- 2 skiers doing avalanche work
- 1 snowboarder adjacent to ski area
- 22 persons on foot
- 7 persons on foot doing avalanche work
- 20 snowmobilers in backcountry
- 10 vehicles on road
- 2 incidents with damage to static property (powerlines)

Suffering and Damage

- 36 caught, ended on surface, uninjured
- 2 caught, ended on surface, injured
- 1 caught, ended on surface, killed
- 48 partly buried, uninjured
- 2 partly buried, injured
- 1 partly buried, killed
- 10 completely buried, uninjured
- 6 completely buried, killed
- 2 vehicles drove into avalanche, undamaged
- 1 vehicle drove into avalanche, damaged
- 5 vehicles hit, undamaged
- 2 vehicles hit, damaged

The total estimated property damage was $1,060,000 of which the main component was damage to a powerline near Kemano.

NOTE: Snowmobile involvements were categorized (partly buried, etc.) according to what happened to riders, not machines.

Search Summary

Of the persons who were completely buried and survived:

- 2 were located by transceiver (burial time 4 & 15 min.)
- 3 were located after making holes to the surface; two were then seen and one heard (a few minutes to 10 min)
- 2 were located by last seen point (few

minutes)
- 1 was located by sound while still completely buried (3 min)
- 1 was located by movement felt by another partly buried victim (7 min)
- 1 extracted himself while alone (1/2min)

Of the persons who were completely buried and found dead:
- 1 was found by transceiver (burial time 15-20 min)
- 1 was located by dog? (Sicamous) (4 hr)
- 1 was located by object on surface; his snowmobile (50 min)

One person was partly buried and found dead: his partner was completely buried, and was rescued first (the deceased was partly buried head-down for 30 min).

One person ended on the surface and was found dead: hanging on climbing rope in a crevasse; site not reached until several days after accident.

Two persons had not been found as of June 1993 but are declared dead:
- 2 climbers in Columbia Icefields

The Canadian Avalanche Centre encourages all information about avalanche involvements be submitted on either the short or detailed report forms which are available from the Centre.

The cooperation of all groups, agencies and individuals both professional and recreational who have submitted reports is acknowledged gratefully. It is only through their effort that the accident information can be presented.

Accidents with Fatalities

Owl Head Mt, near Sicamous

On December 13, 1992, around 1430h, a party of 9 snowmobilers were homeward-bound through the ecological reserve south-east of Sicamous. Seven were caught by a large avalanche as they made a downward traverse across a bowl. One was buried and lost. The party had no beacons, shovels or probes, and he was not found until the rescue party arrived four hours later. A dog located the body in 5 minutes, 1m deep and 3m downhill of his machine.

The avalanche was a size 2.5 soft slab, 50-80cm deep, 250m wide. It occurred on a cold NE aspect, and failed in old snow (mid-pack 2cm layer of fist hardness 2mm facets). Although it was early in the season, both temperature and snowfall had been less than normal. This accident pointed to the heightened threat from facetting in the snowpack, which came to characterize the 1992-93 season.

Australian Gully, near Cypress Bowl

On December 19, 1992, two downhill skiers were skiing out of bounds behind the ski area when a large avalanche released above them carrying them down the gully. The survivor was buried up to his neck and pinned against a tree, but was able to extract himself. His companion was carried below him into steep and difficult terrain. Despite a long search staying out over two nights he was unable to locate him. By now days had been lost and continuing snowfall was impeding travel. A subsequent rescue party using dogs were also unsuccessful in locating the victim.

The avalanche was a size 2.5 soft slab, about 50cm deep, failing on an icy crust. The accident happened during a period of significant snowfall. The 50cm which avalanched had been deposited in the few days before the accident, and another 50cm fell during the days of the search.

Parkers Ridge, Jasper National Park

On December 25, 1992, two ski tourers were caught in a large avalanche. In 10 minutes, a witness had dug out one victim who was completely buried. Together they searched for the other victim, who was found about 100m away with her lower legs showing. However, she was already dead after having her head and torso buried for half an hour.

The avalanche was a size 3 slab which failed on large facets in the middle of the 1m snowpack. Facetting was extremely pronounced throughout all but the top layers. Although typical of the northern Rockies, these conditions were exaggerated by unusually low temperatures and snowfall this season.

Bourne Glacier, west side of Lake Revelstoke

On March 13, 1993, a party of snowmobilers was making a far- ranging trip under good travelling conditions. At about 1530h, as a side-trip, two of the party were seeing how high they could climb a steep rocky gully. They were several hundred meters up the gully, when it released a large avalanche carrying them about 500 m. One snowmobiler was buried, and was located 20 minutes later. The victim was wrapped around his snowmobile which was standing vertical with one ski tip showing. It took another 30 minutes to dig him out, by which time he had died of suffocation.

No avalanche professional observed this site, so technical details are lacking. It was a 20 meter wide, 40 degree slope, east facing gully which avalanched, with a fracture of up to a meter and a half deep. It ran 500m and the deposit was up to 5m deep.

Bruins Pass, Glacier National Park

On March 17, 1993, two experienced European ski tourers were ascending one of the areas commonly used from Rogers Pass They had been warned that there was an active instability in the snowpack. Around 1300h, when they had almost reached the pass, the slope they were on released as a slab and carried them down. One freed himself and started a transceiver search for the other. He was located in 15-20 minutes, under one half meter of snow, but did not respond to CPR.

This avalanche failed 50cm down on a layer which produced dramatic activity in the Glacier Park backcountry, peaking on this day. It was associated with an old surface which was both crusted and facetted, and recently loaded by two snowfalls. The instability was recognized, but its pronounced fragility around the date of the accident caught even experienced professionals off guard. Low temperatures were prevalent at the time.

Snow Dome, Columbia Icefields, Jasper National Park

We will probably never know exactly what happened, but on March 20, 1993, a party of three climbers fell from the east face of the mountain, and the indications are that they were carried by an avalanche. Because of bad weather, it was several days before a search party could inspect the site from the air. One body could be seen, but the others have not been located, despite a ground search later in the season.

The clues to the avalanche are indirect, but a backcountry user reported a fracture line above the site. There was a recognized instability at the time, due to wind-loading on N and E aspects.

PUBLIC AVALANCHE INFORMATION BULLETIN

The Public Avalanche Information Bulletin (PAIB) was issued twice per week by the Canadian Avalanche Centre and gave summary conditions on weather, snowpack, avalanches, stability and a travel advisory. The four geographic zones described were the South Coast/Vancouver Island, North & South Columbia Mountains and the Rockies. On the 800 number service the areas above were available as well as the avalanche forecasts of the Rocky Mountain National Parks and Kananaskis Country. The caller can choose the area of choice by entering the appropriate number on a touch tone phone.

The following numbers show the use of the PAIB compared to the first winter of operation:

	91-92	92-93
800 number calls	533	5006
Bulletin Board calls	20	150
Fax distribution	208	1330
PROFS (internal e-mail)	?	6407

Thirty-five Bulletins were issued during the winter and the fax distribution network was to 38 stations where the Bulletin was posted.

The following contributors paid towards the service and their support is gratefully acknowledged. Next winter a rate structure for commercial users of the Bulletin will help recover the costs of providing this public safety service.

CONTRIBUTORS TO PAIB

•ALBERTA PARKS
•BIGHORN PRINTING & DESIGN
•BC FOREST SERVICE
•BC PARKS
•CWSA
•EVANS FOREST PRODUCTS
•ALPINE CLUB OF CANADA
•ACC-VANCOUVER SECTION
•BROOKS EQUIPMENT BOMBARDIER
•CARLETON RECREATIONAL & RESCUE EQUIPMENT
•EVANS FOREST PRODUCTS
•FEDERATION OF MOUNTAIN CLUBS OF BC
•HOSTEL SHOP
•INFORMATION EXCHANGE SUBSCRIBERS
•MONOD SPORTS
•MOUNTAIN EQUIPMENT CO-OP
•MOUNTAIN MAGIC
•NATIONAL SEARCH & RESCUE SECRETARIAT
•ORTOVOX
•REGENT HOTEL
•ROBSON HELIMAGIC
•SELKIRK COLLEGE
•SNO MUCH FUN
•SUNSHINE SKI AREA
•TOTEM OUTFITTERS
•UNIVERSITY OF CALGARY
•VALEMOUNT HOTEL
•VANCOUVER SUN

EDITORIAL NOTE

The intention of *AVALANCHE NEWS* is to assist communication among persons and organizations engaged in snow avalanche work in Canada. Short articles cover accidents, upcoming and past events, new techniques and equipment, publications, personal news, activities of organizations concerned with avalanche safety, education and research.

The editor welcomes and expects contributions; all reasonable comments and discussions will be printed. The articles in *AVALANCHE NEWS* reflect the views of the authors; only when it is specifically stated do they represent the opinion of the Canadian Avlanche Association.

No paid advertisements are carried. Suppliers who wish to draw attention to their products should send information to the editor who will publish a note when equipment has value in avalanche work and safety.

***AVALANCHE NEWS* is published three times per year. There is no subscription fee. Requests for copies and changes of address should be sent to the publisher.**

1992/93 CAA TRAINING SCHOOLS

In the winter of 1992-93 the CAA again organized avalanche courses for professionals. The average number of students per year is about 200. This year was the highest number of students in any year with 232 people registered. Most of the students take the course as requisite training for their work. Highways avalanche operations, ski areas, parks and back country ski operations all require personnel well trained in avalanche safety techniques.

The courses continue to evolve in order to meet the requirements of the various industries. The comments from students and instructors, this winter, are used to revise course content in an effort to maintain their high standards.

1992/93 Course Overview

Transportation & Industry
Nov. 30 - Dec. 4: Creston, 19 students, (1 failed).
Dec. 7-11: Revelstoke, 24 students.

Ski Operations Level 1
Nov. 28 - Dec. 4: Blue River, 23 students.
Dec. 5-11: Whistler, 23 students.
Jan. 3-9: Island Lake Lodge, 25 students.
Jan. 17-23: Lake Louise, 19 students.
Jan. 25-31: Mistaya Chalet, 11 students.
Lake Louise, 16 students. Whistler, 23 students, (2 failed).
Jan. 24-30: Blue River, 18 students, (in-house for Univ. College of Cariboo)

Operations Level 2
Dec. 5-12: Blue River, 12 students, (1 failed).
Jan. 9-16: Lake Louise, 19 students, (2 failed).

Total
12 courses: 232 students, (6 failed).

NATIONAL AVALANCHE FOUNDATION USA

The 13th National Avalanche School will be held in Reno, Nevada on November 7 - 11, 1993. For information and an application, write to:

National Avalanche Foundation
133 South Van Gordon St, Suite 100
Lakewood, CO, USA 80228

Proposed 1993-94 CAA Courses

Transportation & Industry
Dec. 6-10: Rogers Pass.
Dec. 13-17: Meziadin.

Ski Operations Level 1
Nov.28 - Dec. 4: Blue River
Dec. 5-11: Whistler
Jan. 2-8: Island Lake
Jan. 15-22: Boulder
Feb. 6-12: Lake Louise

Level 2
Jan. 8-15: Whistler
Jan. 22-29: Lake Louise

Refresher Level 2
Feb22-24: Lake Louise

The brochure for the courses will be available in September. There is one new course scheduled. This is a refresher course for people who did a Level 2 a number of years ago. This course will review the standards for observations and bring students up to date on the application of those observations with emphasis on the use of new and refined snow stability tests.

Avalanche Awareness Talks

In AVALANCHE NEWS 38 June 1992, a request was made for suitably qualified and interested people to be a part of an avalanche awareness course resource list. Since then the Canadian Avalanche Centre has received many requests for Avalanche Awareness Talks.

This talk would typically be to a group that have had no avalanche awareness training, is about 1 -2hours long and is an introduction to subsequent avalanche training.

Suitably qualified people are invited to submit their names for inclusion on this expanded list for avalanche awareness training.

This list will be a part of the Resource List published in November.

CANADIAN AVALANCHE ASSOCIATION

SUMMARY OF THE MINUTES OF THE ANNUAL GENERAL MEETING

by Jim Bay

The meeting was called to order at 1330h, May 6, 1993..

Elections

The election was conducted by Buck Corrigan. All existing Directors agreed to stand for re-election. There were no nominations from the floor. The Directors of the Association were voted in by acclamation as follows:

President:	Bruce Jamieson
Vice President:	Colani Bezzola
Secretary Treasurer:	Jim Bay
Membership Chairman:	Bernie Protsch
Director at Large:	Jack Bennetto
Director at Large:	Dave Skjonsberg

Nominations and elections were conducted for the following positions:

Membership Committee:	Bruce Allen, George Field
Associate Members:	Dan MacDonald
Alberta Auditors:	Brad White, Mark Klassen

Special Resolution For Membership Criteria

The resolution as submitted to the members was voted on and passed with one abstainer and none against.

Treasurer's Report

The financial report as prepared by Ken McLean of Action Accounting Services (Revelstoke) was presented by Mr. McLean and Jim Bay. The figures show no significant variances from the operating budget. The unit cost distribution, used to allocate expenditures, is working well and reflects a more realistic picture of the cost of operating the different services of the Avalanche Centre.

The Statement shows that the present cost of running the activities of the Avalanche Association is greater than the income of the Association. This is largely due to the increased level of involvement by the Centre Coordinator and his staff in public activities. We may have to consider the possibility of an increase in membership dues in the near future if this situation continues.

A possible solution may be to create a category of operations (Financial Statement) called Public Services. This category would encompass all activities that interact with the public (e.g., Avalanche News) and could be the target of funds earmarked for the public services of the CAA.

Proposed Budget for the Current (1993/94) Year

The proposed budget for the current year - 1993/94 was introduced to the membership by Jim Bay for review and approval.

Directors Report

The CAA official Alberta address is Bruce Jamieson's home address in Calgary.

A letter of appreciation will be sent to Geoff Freer thanking him for his contributions to the Association over the years.

A digital standards committee was formed to establish a standard for remote and manual weather observations to be ready for next winter.

Fundraising is a major issue that occupies a significant amount of the Directors time. Jack Bennetto has offered to work directly with Alan Dennis on fundraising projects and finding new sources of revenue.

Membership Committee Report

Bernie Protsch submitted his report. Twenty-two new members were welcomed into the Association.

New Active Members: Brian Cusak, Kirby Villeneuve, Gerald Campbell, Don Annette, John Mellis, Jon Schleiss, Thierry Cardon ,Richard Marshall, Al Munroe, Peter Clarkson, Steve Portman, Bernard Wiatzka, Karl Nagy, Mike Jakobbson, Pat Coulter, Dave Scott, Bill Mark, Karen Martin

New Associate Members: Sage Wilderness Experience, Ortovox Gmbh, ICI Explosives, ABC Wilderness Adventures.

Education Committee

Peter Schaerer reported no problems with last seasons courses. Financially the courses finished with a $5000 surplus. The course schedules for the coming season are not yet final but will be basically the same as last year.

Explosive Use Committee

The report submitted by John Tweedy was summarized by Jack Bennetto. There were no meetings between the committee and WCB last year. A couple of unannounced site inspections were conducted last year with no problems found. It was recommended that because of problems with the 'new' plastic avalauncher baseplates, they not be used, and operators replace them with the metal ones.

Jack also reported on the M.O.T.H. testing of 'SnowFrac', a new explosive product distributed by ICI. They found it to be a big improvement over other previously used products although not completely without problems. A big advantage is that it does not require taping.

Code of Ethics

Jack Bennetto discussed his work on producing a method of handling Code of Ethics violations. He gave a summary of the procedures which he has submitted to the Directors for review.

Technical Committee Report

Dave McClung reported on the adoption of the new International Classification for Snow on the Ground. The committee recommends that the Canadian industry stop using specific gravity and adopt density, which is the International Standard.

The committee again recommends adoption of the basic system for use in Canada with the use of sub-classes optional as necessary.

The consensus of the group was to go along with these recommendations.

The Committee members are: Dave McClung, Bob Sayer, John Tweedy.

Associate Members

Bruce Jamieson addressed the issue of Associate representation. In the Constitution an Associate member is an organization; not an individual. When selecting a representative for the Associate members an organization must be elected, which will then provide a spokesperson.

New Business

Avalanche News: Bruce Jamieson discussed the status of the Avalanche News, presently publishing 2 issues per year. Bruce feels that three or four issues per year is necessary for the publication to be an effective vehicle for communication in our industry.

A request was made for contributions and editorial assistance in producing the News. Dave Skjonsberg and Jack Bennetto committed their agencies to supplying articles for forthcoming issues. Dan Nixon and Garry Walton have also indicated that they will contribute, while Karl Klassen has offered assistance in editing and graphics for the News. Bruce Allen cautioned that the extra publications do not overextend the Centre staff and the Committee members.

Snow Profile Plotting Software: Jack Bennetto indicated that the M.O.T.H. plotting software would be made available to the CAA for sale in the near future.

New Membership Categories: Bruce Jamieson suggested changes in the membership categories that would allow past members of the Association to remain as members in some capacity. Various possibilities were presented and there were strong sentiments expressed that the standards for membership not be reduced. As the discussion progressed it appeared that the 'Inactive' member category includes these past members but the title 'Inactive' is not suitable. The Membership Committee will produce a special resolution for review and approval at the next AGM.

Guidelines Committee: Chairman is Dave McClung. This committee is to work closely with the Digital Standards Committee to ensure compatibility.

Reduced Quorum: A special resolution will be presented for approval at the '94 AGM to reduce the required quorum percentage to 25%.

I.S.S.W. '96: C. Stethem and T. Daffern form the steering committee for this conference. The seed money required for this event will be $7000 which will be used from now until the conference date. This year $2000 has been budgeted; the primary expense being the deposit for the conference hall. This is perceived as an investment; the last conference held in Canada produced a surplus of $3000 on a $5000 investment.

Date and Location of the next AGM

The next AGM will be held in Penticton, B.C. on May 4th and 5th with the instructors meeting on May 3rd.

CANADIAN AVALANCHE ASSOCIATION

SUMMARY OF THE MINUTES OF THE FIRST PUBLIC MEETING

by Jim Bay

The first Public meeting held in conjunction with the Annual General Meeting of the Canadian Avalanche Association was held in Revelstoke, B.C. at the Anglican Church Hall. The meeting was called to order at 0830h, May 5, 1993. Attendance throughout the day was approximately 120 people. The Trade Show attracted a lot of interest and was appreciated by the participants; representatives from AES, Sporting & Rescue goods retailers, explosive manufacturers, and radio communications companies were on hand to promote their products.

Summary of Presentations

The president, Bruce Jamieson gave his opening remarks and was followed by Mr. Roger Beardmore, the Superintendent of Mt. Revelstoke/Glacier National Parks. Mr. Beardmore welcomed everyone to the Revelstoke area and encouraged them all to take advantage of the local recreational opportunities.

Public Avalanche Hazard Information

Alan Dennis - Coordinator of the Canadian Avalanche Centre - introduced the Public Avalanche Information Bulletin (PAIB), giving an overview of the aim, operations, contributors, and costs of running the project.

The new feature for last winter was the introduction of two bulletins per week.

The summary of cost of operations showed a significant loss of funds compared with the previous season (covered by the N.S.R.S. grant). This is actually a good sign as it indicates a great increase in public awareness and acceptance of the service and should assist in the fund raising effort.

J.L. Tuaillon, Chairman of A.N.E.N.A.(French equivalent of the C.A.A.) presented an overview of the operations of their Public Avalanche Information Bulletin. They have over 100 ski resorts that send snow and weather data to their centre twice daily. Their hazard rating scheme currently has eight categories, however in an effort to standardize between European countries they think they will settle on a five level scheme similar to the Canadian system.

When they began charging for the phone calls into their service they found that the number of calls remained about the same. Apparently the loss of callers was balanced off by the increasing demand for the service.

Presentation To Jack De Bruyn

Clair Israelson and George Field summarized Jack's contributions to public avalanche safety and awareness. Jack was largely responsible for the formation of the Alberta Avalanche Safety Association. He was also instrumental in the introduction of a 1-800 phone number for Public Avalanche Information in Alberta - the first of its kind in Canada.

Bruce Jamieson presented Jack with a plaque recognizing his achievements over the years.

Persistant Slab Instabilities

Bruce Jamieson reported on the most recent project of the University of Calgary and cooperating agencies. This project began in the Fall of 1993 to assess and refine shear frame and rutschblock tests for persistent instabilities and to develop a model to predict changes in strength of such persistent layers.

Study sites in the Caribou, Selkirk, Purcell, and Rocky mountains were used for this project. The project involved returning to the same study sites throughout the winter and conducting shear frame and rutschblock tests on layers judged to be potentially persistent. The changes in strength characteristics of these layers were then tracked through the winter and plotted against avalanche activity releasing on that layer.

A good correlation was found between rutschblock scores and slab avalanche failures on 'persistent layers'. The grain type of the persistent layer was also determined as an important factor and reinforced the need to combine these tests with other factors such as snow profile information.

The limitations of these tests on bumpy/rocky terrain were also discussed. The variations in snowpack depth on these slopes requires familiarity or extensive probing to achieve valid test results.

Rutschkeil Test

Reto Kellor reported on his experience with the rutschkeil test over the past season. Reto described the technique and associated hazard rating scheme for this test which, like the rutschblock was originally used in Switzerland. Comparisons against the r.block showed a bit more sensitivity and consistency with the rutschkeil. The test takes about ten minutes less time to conduct than the rutschblock.

Snowprofile Plotting Software

Peter Weir presented a software package developed by the B.C. Ministry of Transportation and Highways for snow profile plotting. The software, for use with MicroSoft Windows uses the new International classification system and is complete, versatile, and easy to use.

Avalanche Involvements

Chris Whalley presented a new format for representing avalanche incidents using a 'scatter diagram' to illustrate the severity and density of incidents by date and region. A detailed report of this summary is included in this issue of Avalanche News.

Throughout the day a number of case history and general interest reports were submitted by various members. Incidents reported included ski touring, snowmobiling, and Industrial activities.

Weather Forecast Services

Al Wallace, manager of the Kelowna Weather Centre gave an update of the status of the Kelowna office. Beginning this Fall, all Mountain weather products will be available, 24hrs/day from Kelowna. Regarding the issue of cost for services, in the near future some specific products used for specific purposes may cost the user.

Canadian Ski Patrol System

Ted Simper gave a historical overview of the C.S.P.S. involvement in avalanche activities. They are a strictly volunteer organization and conduct their avalanche training on an in-house basis. Their instructors are members who are mountaineers, graduates of their in-house courses, and the four day course taught by Clair Israelson.

The C.S.P.S. teaches 75-150 people yearly in Alberta and B.C. in 2-day awareness courses involving basic snowcraft, hazard recognition, and search & rescue.

Future plans are to have a member at each ski area setting up periodic search & rescue practices and to continue to upgrade the quality/content of their courses.

Search And Rescue

Gordon Burns submitted a report on a burial in a large land slide at Green Hills mine in SE B.C. A magnetometer was used to locate the vehicle which was buried under 25 feet of debris. Gordie suggested that this might be a useful tool for avalanche rescue in certain situations. Dave Skjonsberg mentioned that a similar device is located in Rogers Pass and available for rescue work.

457 Beacon Frequency

Mark Ledwidge reported that of 455 backcountry registrations, 8% were using 457, 67% dual frequency, and 25% 2.275 (last year 40%).

Mike Mortimer of the Hostel shop in Calgary stated that the consumer trend is strongly to the 457 units. Also, the Calgary and Edmonton chapters of the A.C.C. will not allow the 2.275 units on any future trips.

Simon Walker reported a number of 'off the shelf' quality problems with the Arva Option 8000 units, e.g., squealing speakers and lights not working.

A written report from Kobi Wyss indicated that the Ortovox units have a relatively heavy battery consumption and that the original batteries seem to have the longest life. Bob Sayer stated that Mike Wiegele Heli Skiing replaces all batteries after 3-4 weeks of daily use.

C.A.R.D.A.

Jan Tindle reported on association activities of the last year. They had a busy season with certification courses. The handler assessment by Parks Canada was discontinued and the guiding community took on that role for the course at the Durrand glacier.

The first official 'call out' for C.A.R.D.A. was to respond to a missing skier (avalanche incident) out of Cypress Bowl ski area.

C.A.R.D.A. will be conducting a training/assessment course at Whistler in January '94 and an advanced course in Blue River sometime in the winter of '94.

IKAR

Peter Schearer attended the 1993 Annual meeting in Europe and reported on the French proposal of a standard flagging system on avalanche rescue sites. The various member countries have been asked to respond with their feelings on the concept. The consensus of the group attending the meeting was that we should support the idea.

Conclusion

A raffle of some highly prized items such as avalanche probes donated by S.E.A.R. and the Hostel Shop was the last item on the agenda. The meeting was closed at 1600 with remarks by the President. The meeting was declared a success and it was hoped that the Public Meeting will be continued as a part of the AGM.

DALE GALLAGHER

Dale Gallagher died on March 29, 1993. His scientific, operational and technical contributions to the avalanche community are significant.

In Canada, he will be particularly remembered for his advice to the British Columbia Ministry of Highways when their avalanche programs were being established. Many students who feared and enjoyed the Avalanche Simulator on CAA Courses did not know that Dale had adapted this technique from the US Forest Service.

There are many fond memories of working with Dale as his involvement with the avalanche community extended over nearly forty years.

We express our deepest sympathy to his family.

CANADIAN AVALANCHE ASSOCIATION

SUMMARY OF THE MINUTES OF THE TECHNICAL MEETING

by Peter Schaerer

In the morning of May 6th, the members of the Canadian Avalanche Association met at Revelstoke for an exchange of technical information. Following is a summary of the topics that were presented and discussed.

Hand Charge Regulations and Testing

Chris Stethem informed about the actions with respect to the problem of pre-arming hand charges. The Workers Compensation Board of British Columbia has rejected an application of the Canadian Avalanche Association for an industry-wide variance that would allow the arming of hand charges prior to going to the blasting site and individual industry applications were also rejected.

The Canadian Avalanche Association is now obtaining test data that could serve as a basis for re-consideration. Tests are carried out in co-operation with Energy, Mines & Resources Canada at the Explosives Testing Laboratory at Ottawa. They include sensitivity tests, drop tests, and firing projectiles against assemblies of dynamite, cast primers, emulsions, and their combinations with fuses and multiple detonators made up as hand charges. The sensitivity tests have the objective of determining whether or not a detonation is possible when a skier falls with pre-armed charges (at different temperatures and with or without the cushioning effect of a pack).

The test program is funded by users (ski areas, Highways, and Canadian Avalanche Association). It will be completed on 31 July 1993, and the results shall be made available to the Workers Compensation Boards of British Columbia and Alberta and the explosives suppliers.

Canadian Avalanche Centre

Alan Dennis and Chris Whalley reported on the activities of the Information Exchange, Public Avalanche Information Bulletin, Training Schools, and Membership Service. The demand for all services was strong in the past year. Details are reported under a separate heading in this issue of AVALANCHE NEWS. Because funding is the principal concern, the members at the meeting made various suggestions for promotion and funding.

American Association of Avalanche Professionals

John Montagne, the President of the American Association of Avalanche Professionals (the equivalent of the Canadian Avalanche Association in the U.S.A.) was welcomed as a special guest. John outlined the organization of his non-profit society which presently has 480 members in a variety of membership categories. The publication AVALANCHE REVIEW is the main product of the association, which is distributed to all members. A governing board, eleven committees, and a paid secretary (new this year) carry out the business. The Association has in the past and wishes in the future to share problems with the Canadian Avalanche Association, for example standards, guidelines for operations and education, and concerns about explosives application. The members of the Canadian Avalanche Association are invited to attend meetings which usually are held in conjunction with other events such as the International Snow Science Workshop and the National Avalanche School.

Expert Systems

David McClung reported on his project concerning the development of computerized avalanche hazard forecasting. The project is funded by the Ministry of Transportation and Highways of British Columbia, the B.C. Science Council, and the Natural Sciences and Engineering Research Council of Canada.

The technique involves the processing of a combination of numerical and non-numerical data. Mathematical relationships between numerical observational data and historical avalanche occurrence data were developed by applying a discriminant analysis, Bayesian statistics, and cluster analysis. In the next step of the project, the numerical analysis will be linked with an expert system. Dave has applied the initial results at the Kootenay Pass, and at the meeting presented an example of a print-out of the weather and observed avalanche occurrences based on the nearest neighbour.

Liability Insurance

Doug Bannert of Marsh & McLennan informed about the state of liability insurance. Marsh & McLennan specializes in selling ski-related insurance through its offices in Calgary and Vancouver. In 1992, the world-wide Property/Casualty Insurance Industry sustained catastrophic losses due to floods, hurricanes, earthquakes, and riots, and in addition, ski-related liability claims have put pressure on insurances. This means, and because the underwriters spread the losses, the rates have increased for all types of insurance and they will continue to go up, even to the point of applicants not being able to obtain insurance. Important for keeping the rates at a reasonable level, is for the insured to work hard on controlling the risks.

All avalanche course instructors should have liability insurance toward the students, and it is recommended that courses have waivers. Doug pointed out, that waivers must be presented to the clients very clearly and in the same manner every time.

Mountain Weather Forecast

Vello Puss of the Pacific Weather Centre of the Atmospheric Environment Service summarized the climate at the Pacific Coast in the winter 1992-1993. In general it was a dry winter with the mean temperatures in December-February 1°C to 2°C below normal. The monthly precipitation, in percent of normal precipitation, were: November 110 %, December 70 %, January 30 to 40 %, February 10 %, March 110 %, and April 200 %.

Of significance to the avalanche industry is the news that the Vancouver Weather Office and the Pacific Weather Centre have merged their offices, and that the mountain weather forecast for the Interior of British Columbia is made at the Kelowna Weather Office since December 1st, 1992. Suggestions for the content of the mountain weather forecast shall be discussed at the 19 May annual meeting of the committee that includes representatives of the industry, the Canadian Avalanche Centre, and the weather offices.

A large number of the participants of the technical meeting were in favour of attending a weather seminar in the Fall of 1993 (at a cost).

Compression Test

submitted by Peter Clarkson
CPS-Jasper

In addition to the shovel shear and rutschblock tests, the compression test has been found to be a valuable tool for evaluating snow stability in the Canadian Rockies. Essentially the test, shock loads the snowpack to determine the force and/or the loading required to initiate a failure in the weak layers or bonds between the layers. In that respect it is similar to the rutschblock test, except that the individual sample size of the snowpack is much smaller. One advantage over the rutschblock test is that it can be conducted on both flat and inclined terrain.

Used in conjunction with other snowpack observations, the compression test can serve to highlight major snowpack instabilities, particularly if those instabilities generate both a compression and shear failure. For example, any layer which has an easy shear and easy compression is likely of poor to very poor stability. In that sense the compression test can be used to corroborate or refute other test results. The compression test can also be used to compare the strength of various layers since the weakest layer will collapse first and successively stronger layers require increasing amounts of force before failing.

Research has identified the difficulties associated with measuring the strength of persistent instabilities buried within the snowpack. The compression test is another method for evaluating those weaknesses and, in that respect, is a positive addition to the snow science tool chest.

METHOD

1. Identify weak/suspect layers using standard techniques.

2. Proceed as a shovel test by isolating a 30 x 40 cm column. The back wall should be cut down to the ground. A failure initiated while the column is being cut is rated as "Very Easy."

3. Place the shovel bottom squarely across the surface of the column. **Note:** gently compress any fresh, fist-hard snow at the surface. This creates a platform for the shovel blade and ensures that any subsequent shock is transmitted through the column.

4. Begin by tapping the shovel blade with your finger tips. Use only enough force to bend your hand at the wrist. A failure at this stage would be rated as "Easy."

5. Again tapping with your finger tips, apply the force generated from bending your arm at the elbow. A failure here is rated as "Moderate."

6. Using an open palm (or closed fist), lift your arm from the shoulder and tap the shovel. A failure here is rated as "Hard."

Publications

Munter Werner, 1991.

Neue Lawinenkunde - Ein Leitfaden fur die Praxis (in German); or Le Risque d' Avalanches - nouveau guide pratique (the same book in French); 200 pages with numerous figures. Verlag Schweizerischer Alpen Club, Bern, Switzerland. ISBN 3-85902-116-8.

The publication is a very instructive handbook on avalanche safety written by an experienced mountain and ski guide who had in mind the backcountry skier. In addition to the chapters that are usually found in avalanche handbooks: formation and nature of avalanches, metamorphism of snow, weather that influences avalanche releases, evaluation of snow stability, safety measures, and rescue, the author has included a description of the Rutschkeil test (glide wedge), a list of most frequent errors, an interesting discussion of risk assessment, and legal aspects. The book is a modern treatment of the matter that provokes much thought.

SVI CAI & AINEVA, 1993

Serie diapositive SCI Alpinismo: Neve et Valanghe. This slide set with descriptive booklet (in Italian) is available at a nominal cost from the Servizio Valanghe Italiano del CAI, via E Fonseca Pimentel ,7 - 20127 Milano, Italy.

This set of numbered slides with matching booklet is a useful avalanche awareness training tool with some excellent photographs.

Mears A I 1992

Snow-Avalanche Hazard Analysis for Land-Use Planning and Engineering. Colorado Geological Survey, Department of Natural Resources, Denver, Colorado; Bulletin 49. 55p 1992.

The handy publication contains guidelines for estimating the effects of avalanches for the purpose of locating and designing buildings, structures, roads, and other facilities. In a concise form are described the avalanche phenomena, identification of avalanche paths, and the various calculations of avalanche runpout distances and velocities. A chapter includes a menu of means of structural protection with a description of the advantages and disadvantages of each one.

Available from the: Colorado Avalanche Information Centre, 10230 Smith Road, Denver, Colorado, USA, 80239.

ISSW '92

The Proceedings of ISSW '92 includes the papers and information on the poster and commercial presentations of the International Snow Science Workshop held at Breckenridge, Colorado in October 1992.

Copies are available for $15 US plus postage: $2 in US, $3 to Canada & $3.50 to other countries. Send cheque or money order in US dollars payable to ISSW '92 to: Knox Williams, 240 West Prospect, Fort Collins, CO, USA, 80526.

McClung D M & P A Schaerer 1993

Avalanche Handbook, the latest edition will be available in early September '93 from: Mountaineers Books, 1011 Klickitat Way SW, Seattle, Washington, USA, 98134.

VIDEO PRODUCTIONS

The following is information on videos distributed by the Canadian Avalanche Centre:

- •Avalanche Terrain $50
- •Snow Profile Procedure $50
- •Avalanche Control Series 1-3: Avalauncher, Cornice and Hand Charging $90
- •Avalanche Control Series 4: Helicopter Bombing $50
- •Avalauncher Maintenance: no longer available

The prices do not include shipping & handling costs, $5 each in North America and GST in Canada only. PAL versions are available, please enquire for current cost of conversion.

A Progress Report on Studies of Persistent Slab Instabilities[1]

May 1993

Bruce Jamieson and Colin Johnston
Dept. of Civil Engineering, University of Calgary

A recent study of fatal avalanche accidents in Canada between 1972 and 1991 (Jamieson and Johnston 1992) indicates that approximately 99% of accident avalanches are slab avalanches, 87% are dry, 82% include layers of snow deposited prior to the most recent storm and 91% fail on layers of surface hoar, facets or depth hoar. Apparently, accident avalanches are unlike most slab avalanches that run naturally during storms and fail on layers of new or partly settled snow. Such results imply that existing forecasting techniques work better for naturally triggered storm snow instabilities than for skier triggering of persistent, often deeper, instabilities consisting of surface hoar, facets and depth hoar.

The Persistent Slab Instabilities Project began in the fall of 1992 to:

•assess and refine shear frame stability indices for persistent instabilities,

•assess and refine the rutschblock test for persistent instabilities, and

•develop a model to predict the changes in strength of such persistent weak layers based on weather and snowpack conditions.

The project is financially supported by the Natural Sciences and Engineering Research Council (NSERC), Canadian Mountain Holidays and Mike Wiegele Helicopter Skiing. These two helicopter skiing companies, as well as the Canadian Parks Service and the Ministry of Transportation and Highways provide access to study areas and logistical support, and most importantly, provide the skilled staff to do the field tests.

To ensure that a variety of persistent weak layers were tested every winter, the following study sites were selected in cooperation with the private and public sector participants:

Participant	Location
•Mike Wiegele Helicopter Skiing	Cariboo Mtns near Blue River
•Canadian Mountain Holidays	Bobby Burns in the Selkirk Mtns
•Glacier National Park	Rogers Pass in the Selkirk Mtns
•Jasper National Park	Parkers Ridge in the Rocky Mtns
•Banff National Park	Bow Summit in the Rocky Mtns
•Yoho National Park	Lake O'Hara in the Rocky Mtns
•B.C. Ministry of Transportation and Highways	Kootenay Pass in the Selkirk Mtns

Dr. Colin Johnston of the Civil Engineering Department at the University of Calgary directs the project and Bruce Jamieson of the same department supervises the field work. Jill Hughes and James Blench conducted full time field studies in the Cariboos and Bobby Burns, respectively. At the other sites, field tests are done by regular employees of the public sector participants, typically once per week.

At the various study areas during the last winter, approximately 200 profiles, 200 sets of 7 shear frame tests and 260 rutschblock tests were completed. Although we have not analyzed many data yet, the following graphs and discussion, which are based on preliminary analysis of some data, show progress towards the project's objectives.

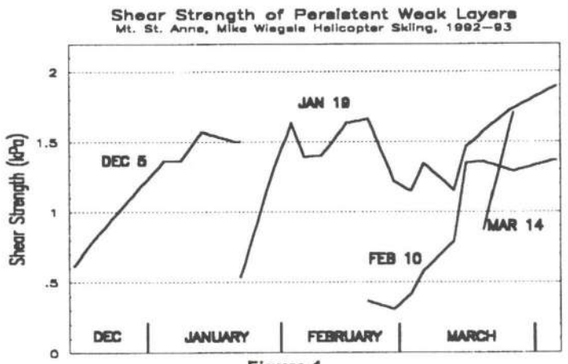


Figure 1

Changes in Strength Based on Shear Frame Tests

By returning to a study plot or slope to measure the shear strength of persistent weak layers, changes in strength of these layers can be monitored. In Figure 1, the shear strength of the prominent persistent weak layers in the Mt. St. Anne Study Plot in the Cariboos near Blue River is plotted for the winter of 1992-93. Shear strength is corrected for frame size (Sommerfeld 1980, Föhn 1987a).

The layers buried on December 5, January 19 and February 10 initially consisted of surface hoar. After several weeks, many grains in these layers resembled facets. When the January 19 layer was last tested, it consisted of rounded facets and surface hoar.

The December 5, and February 10 layers showed periods of strength gain and periods with little or no strength change. The January 19 layer shows several small apparent increases and decreases in strength that may be caused by variability of the shear frame results or by variability of the layer within the study plot. Nevertheless, the January 19 layer shows a loss of strength in the later part of February when cold temperatures increased the temperature gradient within the snowpack. Also, in late March and early April, the January 19 layer gained strength while strength of the February 10 layer was relatively steady. Data such as these should be very valuable for developing a model to predict strength changes of persistent weak layers based on easily measured parameters such as temperature, temperature gradient, grain structure and grain size.

[1] Presented at the Public Sessions of the Canadian Avalanche Association, May 5, 1993

Changes in Stability Based on Shear Strength and Slab Weight

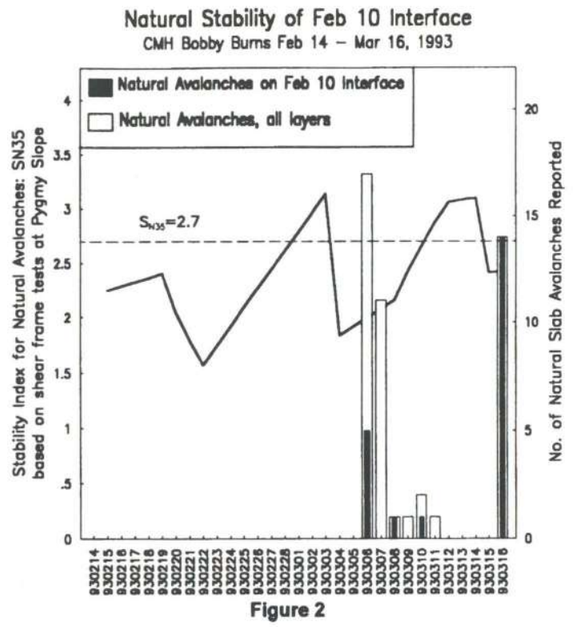


Figure 2

Various stability indices based on the ratio of shear strength of the weak layer to the weight of the overlying slab, can be calculated from the shear frame tests of the weak layer and density measurements of the overlying slab.

Föhn (1987a) derived stability indices for natural and skier triggering that we denote by S_N and S_S respectively. Both these indices adjust for frame size, normal load and slope angle. Both are intended as indicators of stability *for the slope tested with the shear frames*. However, by calculating S_N for a 35 degree incline, we obtain S_{N35} that can be applied to surrounding slopes. Based on three winters of shear frame tests in the Cariboos near Blue River, S_{N35} was comparable as a predictor of class 1.5 or larger dry natural slab avalanches (Jamieson and Johnston, in press) to the index SF used in Canada (Schleiss and Schleiss 1970, Stethem and Tweedy 1981, NRCC/CAA 1989). Dry slab avalanches are uncommon when SF is greater than 1.5 or, equivalently, when S_{N35} is above 2.7 (Jamieson and Johnston, in press).

Shear frame tests were made regularly at two level sites and two sloping sites in the Bobby Burns. S_{N35}, based on shear frame tests on the February 10 interface at the Pygmy Study Slope in the Bobby Burns, is plotted against time in Figure 2. Between test days, we assumed that the shear strength changed at a constant rate. Since the shear strength of this layer did not lose strength between February 14 and March 16, the decreases in S_{N35} apparent in Figure 2 are due to increases in slab weight (snowfall).

The number of dry natural slab avalanches reported during this period is also plotted in Figure 2. Some of these avalanches were believed to have failed on the February 10 interface and in the remaining cases, the failure plane was not reported. Until March 4, 1993, the February 10 layer was only buried by 20-25 cm of snow and, in most areas this snow was not "slabby." Dry natural slab avalanches were only reported when S_{N35} for the February 10 layer was below 2.7. It seems likely that some of the avalanches for which the failure plane was not reported, also failed on the February 10 interface. At least for this particular location and weak layer, S_{N35} was a useful indicator of dry natural slab avalanches.

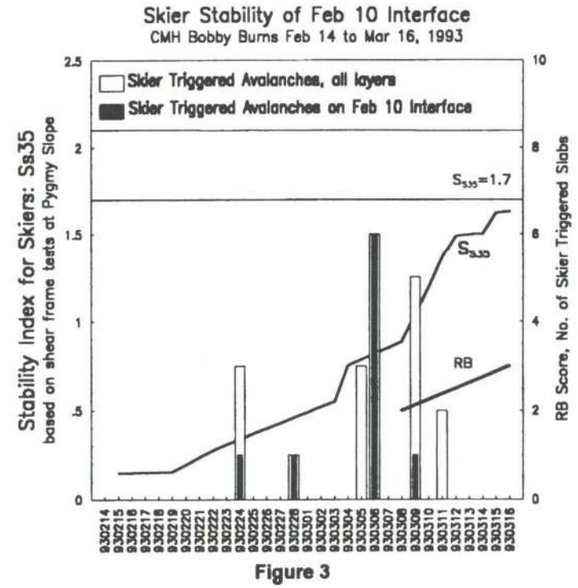


Figure 3

Just as S_{N35} is S_N calculated for 35° incline and used as an indicator of natural stability on surrounding slopes, S_{S35} is S_S calculated for a 35° incline and used as an indicator of stability for skier triggering. For the period February 14 to March 16, S_{S35} and the skier-triggered avalanche activity are plotted against time in Figure 3. The critical value of S_{S35} above which skier-triggered slab avalanches become uncommon has not been determined but probably approximates 1.7. During this period from February 14 to March 16, S_{S35} remained below this level and 20 skier-triggered avalanches were reported. Nine of these were reported to have slid on the February 10 interface. Rutschblock results were not possible prior to March 8 because the tester's skis penetrated to, or through, the weak layer. From March 8 to 16, median rutschblock scores (RB) at the Pygmy Slope increased from 2 to 3, values consistent with skier-triggering of slab avalanches. Although all the skier-triggered avalanches occurred when S_{S35} and RB were below critical, it was not possible to continue the field tests after March 16. Hence, at this study area we were unable to assess the effectiveness of S_{S35} and RB when their values indicated that skier-triggered slabs were unlikely.

Fracture Line Studies

Shear frame and rutschblock tests at representative sites beside or above fresh slab avalanches permit the interpretation of stability indices and rutschblock scores to be refined.

In Figure 4, the percentage of skier-triggered slab avalanches is plotted against the median rutschblock score for the same slope. Each of the three lines show a general decrease in skier-triggered avalanche activity with an increase in rutschblock score. In particular, about half as many slopes with a median score of 4 were skier triggered compared to slopes with a median score of 3. This

decrease and the further decrease to approximately 10% for rutschblock scores of 6 and 7 support Föhn's (1987b) interpretation of rutschblock scores: slopes with rutschblock scores of 3 or less are usually unstable for skiers, slopes with scores of 4 and 5 are of marginal stability, and there is a low (but not negligible) risk of skiers triggering slabs on slopes with a median score of 6 or 7.

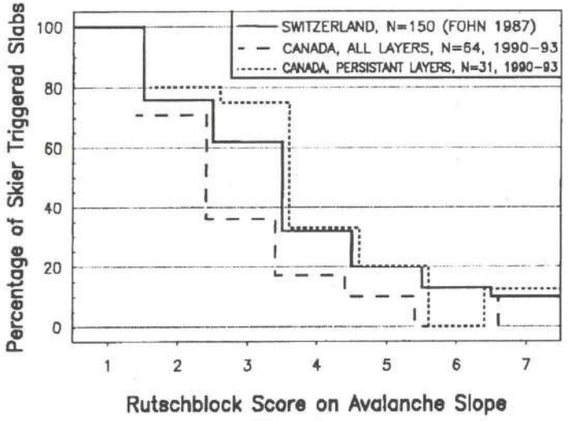


Figure 4

snow profiles.

For the avalanche slopes tested with skiers and rutschblocks, Figure 5 shows the slab thickness. The median rutschblock score was above 5 for ten slopes that were not triggered by skiers and for two slopes that were triggered by skiers. These two slopes had median rutschblock scores of 5.5 and 7 and depths of 80 and 100 cm, respectively. This raises questions about the effectiveness of the rutschblock test for relatively thick slabs. The selection of test sites is, however, a complicating factor that is discussed in the final section of this report.

Like rutschblock scores, values of the stability index for skier triggering of the test slope, S_s (Föhn 1987a), can be below critical (skier triggering likely), be transitional, or be above critical (skier triggering unlikely). Using 1 to 1.5 for the transitional range (Föhn 1987a), Figure 6 shows slab thicknesses and values of S_s for 12 slopes that were skier triggered and 19 that were not. In 7 of 9 cases when S_s was less than 1, skiers triggered slab avalanches, and in 13 of 17 cases when S_s was above 1.5, skiers did not trigger slab avalanches. While these success rates of approximately 75% are consistent with Föhn (1987a), they are clearly inadequate as a sole basis for stability evaluation. S_s should only be used with other factors to assess slab stability. Further, in the four cases in which skiers triggered slabs and S_s was above 1.5, the depth of the slabs ranged from 65 to 100 cm (Figure 6). Hopefully, improved formulas for S_s can be developed based on current Swiss studies of snowpack stresses caused by skiers and on this project's field studies.

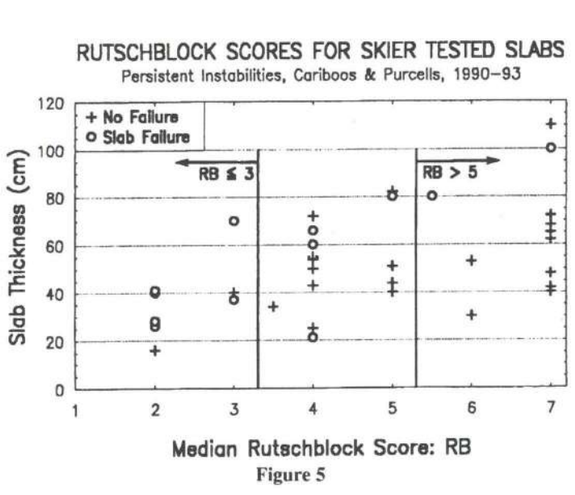


Figure 5

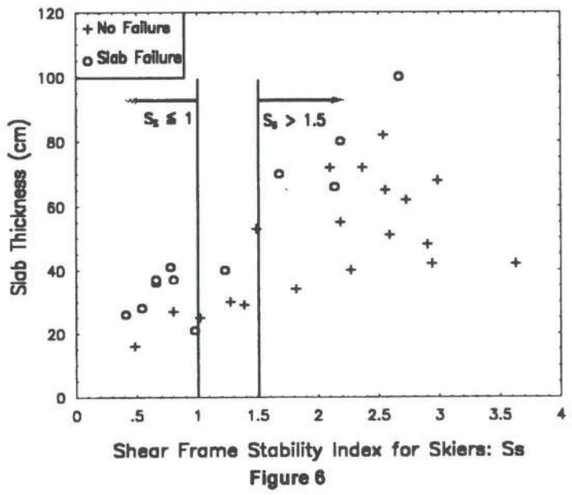


Figure 6

The dashed and dotted lines are for avalanche slopes in the Cariboos and Purcells tested between 1990 and 1993. While the dotted line only includes tests done on persistent weak layers, the dashed line also includes tests done on layers of new snow and partly settled grains. For any rutschblock score except 6, a higher percentage of slab avalanches with persistent instabilities were triggered than for a larger data set that also included the less persistent weak layers. It appears that skier triggering is more likely for a given rutschblock score if the weak layer involves a persistent grain type. This indication supports the idea of combining rutschblocks with

A Problem with Site Selection on Bumpy Terrain

In Figures 5 and 6, there are several examples of skier-triggered slab avalanches in spite of high rutschblock scores and values of S_s that suggested stability. The highest values were for a 1 m thick slab with a rutschblock score of 7 and a S_s of 2.7. The failure of S_s and RB to predict the unstable slab illustrates a point about site selection and the limitations of snow stability testing.

On March 17, 1993, one day after the avalanche, project staff did one rutschblock test and 7 shear frame tests along with a fracture line profile located approximately 2 m above the crown fracture (point A). At this location, the snowpack was 2 m thick (Figure 7).

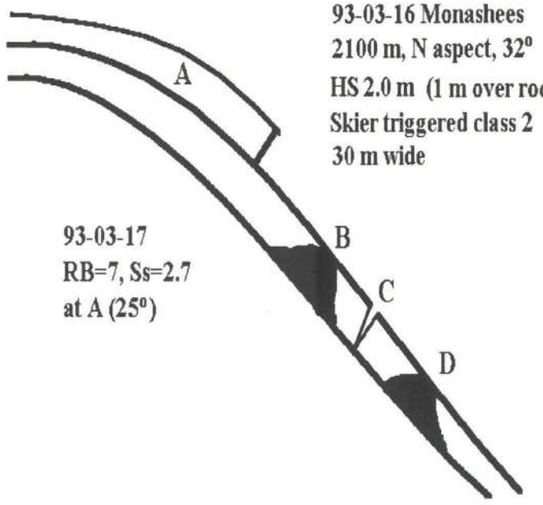


Figure 7

The failure plane consisted of 2 mm facets and 2-3 mm surface hoar that clearly showed rounding. The rocks exposed on the bed surface (points B and D) indicated that, prior to the avalanche, the snowpack had been only 1 m thick over the bumps and boulders. Not surprisingly, weak depth hoar surrounded the exposed rocks on the bed surface. It seems likely that the slab was triggered where the snowpack was only 1 m thick (points B or D) and where the failure plane was much weaker than at the test site. Another possibility, suggested by a crack in the bed surface (point C) is that the fracture may have initiated below the bed surface before spreading along the bed surface. In either case, it seems likely that the fracture began at a localized weakness associated with the bumpy moraine. This suggests that any stability tests done where the snowpack was of average thickness (2 m) would be misleading. Detecting the underlying bumpy moraine would have required familiarity with the area in summer or extensive probing. Since some weaknesses capable of initiating slab failure are very localized, unquantifiable terrain factors may, in some cases, be more important for decision-making and route selection than careful snowpack tests, especially where the snowpack is thin.

Acknowledgements

Our thanks to the Natural Sciences and Engineering Research Council, Mike Wiegele Helicopter Skiing and Canadian Mountain Holidays for financial support. Written support for the project was received from Yoho, Glacier, Jasper and Banff National Parks and the B.C. Ministry of Transportation of Highways at Kootenay Pass. These public sector participants also provided cooperation and skilled field staff approximately one day per week. James Blench conducted the full time field tests in the Bobby Burns. Jill Hughes conducted the full time field work at Mike Wiegele Helicopter Skiing and helped compile the field data. Many thanks.

References

Föhn, P.M.B. 1987a. The stability index and various triggering mechanisms. *In* Salm, B. and H. Gubler, eds. *Avalanche Formation, Movement and Effects*, International Association of Hydrological Sciences Publ. 162 (Symposium at Davos 1986), 195-211.

Föhn, P.M.B. 1987b. The rutschblock as a practical tool for slope stability evaluation. *In* Salm, B. and H. Gubler, eds. *Avalanche Formation, Movement and Effects*, International Association of Hydrological Sciences Publ. 162 (Symposium at Davos 1986), 223-228.

Jamieson, J.B. and C.D. Johnston. 1992. Snowpack characteristics associated with avalanche accidents. Canadian Geotechnical Journal 29, 862-866.

Jamieson, J.B. and C.D. Johnston, in press. Shear frame stability parameters for large scale avalanche forecasting. *Annals of Glaciology* 18.

McClung, D.M. 1987. Mechanics of snow slab failure from a geotechnical perspective. *In* Salm, B. and H. Gubler, eds. *Avalanche Formation, Movement and Effects*, International Association of Hydrological Sciences Publ. 162 (Symposium at Davos 1986), 475-507.

NRCC/CAA. 1989. Guidelines for weather, snowpack and avalanche observations. National Research Council of Canada and Canadian Avalanche Association, *Technical Memorandum* 132, NRCC no. 30544.

Roch, A. 1966a. Les déclenchements d'avalanche. *In International symposium on scientific aspects of snow and ice avalanches*. International Union of Geodesy and Geophysics, International Association of Hydrological Sciences Publ. 69, 182-195.

Schleiss, V.G. and W.E. Schleiss. 1970. Avalanche hazard evaluation and forecast, Rogers Pass, Glacier National Park. *In Ice Engineering and Avalanche Forecasting and Control*, National Research Council of Canada Technical Memorandum 98, 115-122.

Sommerfeld, R.A., R.M. King and F. Budding. 1976. A correction factor for Roch's stability index of slab avalanche release. *J. Glaciol.* **17**(75), 145-147.

Sommerfeld, R.A. 1980. Statistical models of snow strength. *J. Glaciol.* **26**(94), 217-223.

Stethem, C.J. and J.W. Tweedy. 1981. Field tests of snow stability. *In Proceedings of Avalanche Workshop* (Vancouver 1980). National Research Council of Canada Technical Memorandum 133, 52-60.

Professional Geoscience Practice

Submitted by Dave McClung

Effective July 1, 1992, the practice of professional geoscience can only be carried on by individuals registered as professional geoscientists with the Association of Professional Engineers and Geoscientists of the Province of British Columbia. An Order in Council has been signed by the Lieutenant Governor proclaiming the addition of the practice of professional geoscience to section 18, *Prohibition on Practice,* of the Engineers and Geoscientists Act.

All individuals practising geology, geochemistry, or geophysics as described in the definition of practice of professional geoscience in section 1 of the Act, will be in contravention of the Act from July 1, 1992 unless they are registered with the Association as a professional geoscientist. The two-year "grandfathering" period allowing present practitioners to apply will end December 31, 1992. After that date all applicants will be required to undergo the full academic and experience requirements for registration as professional geoscientists.

The legislation will have an effect on avalanche consulting work in the Province of British Columbia. Geoscience registration represents expansion of regulations to cover geoscience activities and is analogous to professional engineering status. In particular, avalanche consulting projects almost sure to be included are those technical activities requiring application of geoscience or engineering principles. Examples may include: application of avalanche dynamics, dimensioning and placement of avalanche protective defenses, zoning, runout distances, risk mapping, specification of avalanche impact forces, creep and glide forces and structures, and others. It is not clear whether the mandate extends to avalanche forecasting.

At the University of British Columbia, almost all students in Earth Sciences now tailor their programs to eventually obtain geoscience registration. The disciplines include: geology, geophysics, geochemistry, and physical geography. The prediction is that legislation in B.C. will eventually be duplicated all across Canada.

Note from the CAA Directors:

Our thanks to Dave McClung for drawing our attention to this legislation and for an interpretation of its effects on avalanche consulting and forecasting.

On behalf of the members, the Directors of the CAA will pursue further clarification of this Act and its impact on those involved in avalanche work.

For further information, please contact Dave Skjonsberg, c/o the Canadian Avalanche Centre.

PRODUCTS

SNOW DENSITY CUTTERS

An improved snow sampler, which was developed in Canada for scientific research, is now available for commercial distribution. The wedge design allows sample extraction from the snowpit wall without the tedious digging required with tubular samplers. The sampler can be used with top-loading digital scales or with the conventional hanging spring scales. The samplers are available in 1000 cc and 250 cc models. The product is available from:

SNOWMETRICS
Box 52
Wilson, Wyoming
USA 83014

Cost in US Dollars for Cutter and Lid:

1000cc $120.00+$7.00 S&H
250cc $75.00+$5.00 S&H
spare 1000cc lid $25.00+$5.00 S&H

Price for orders to Europe/Other overseas countries is the same as above but Shipping and Handling is $15.00/ $12.00/$10.00 respectively.

CAA T-SHIRTS

A reminder that T-shirts sales help raise funds for the Canadian Avalanche Association. T-Shirts are still available for $21 plus GST & PST. Send your orders to the Canadian Avalanche Centre, P.O. Box 2759, Revelstoke, B.C. V0E 2S0

Avalanche Artillery Users of North America Committee Meeting

May 13 - 15, 1993
Truckee, California

by Mike Boissonneault

The Avalanche Artillery Users of North America Committee (AAUNAC) is comprised of avalanche control programs throughout Canada and the United States who utilize artillery as part of their methods of avalanche control. The AAUNAC was formed several years ago to address a common problem, specifically what to do about the dwindling supply of surplus artillery ordnance being supplied by the US Army. In the several years since this group has been holding annual meetings we are on the threshold of soliciting for requests for proposals to develop an artillery round designed specifically for avalanche control purposes.

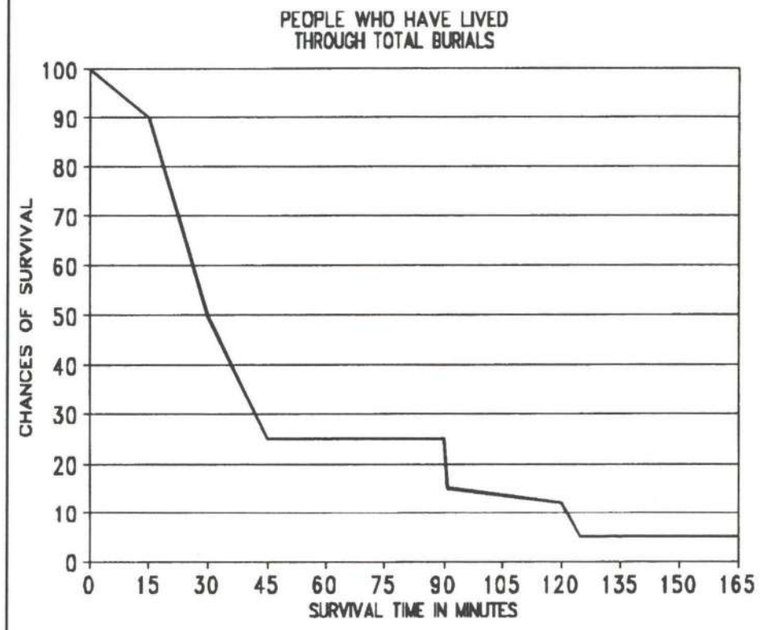
Other developments include a confirmation that the US Military has 109,000 106mm recoilless rifle rounds which they are prepared to release to the AAUNAC, providing sufficient storage for this ordnance can be arranged. This arrangement could provide a necessary supply of ammunition for many programs until the avalanche rounds development project has reached its production phase (winter of 1995).

At the most recent meeting in Truckee, California, the manufacturers of the Locat (which uses compressed air to fire projectiles up to 5000 meters) revealed plans for the production of a rounds with three pounds of RDX explosive filler along with a proximity fuse. The description of this round may sound like the ultimate weapon against avalanches, at this time its performance still requires testing.

The recoilless rifle has proven to be a very effective weapon in initiating avalanches. It is the intention of the members of the AAUNAC to continue using this very versatile device while pursuing the development of a round specifically designed for avalanche control purposes.

Chances of Surviving a Burial

submitted by J. Tindle
Avalanche Forecaster, Whistler, B.C.



This Probability of Survival graph was compiled from avalanche accidents in Switzerland between 1981 and 1989. The data consist of 332 burials. The previous IKAR statistic was a 64% chance of survival after 15 minutes burial time.

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