CANADIAN AVALANCHE ASSOCIATION

AVALANCHE NEWS

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- **Vancouver:** 604-290-9333
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The deadline for the next issue is February 15, 1995. Material may be sent to the Canadian Avalanche Centre in Revelstoke in a variety of formats. Hardcopy, Fax, ASCII, or WP5.1 are preferred for text. Diagrams, charts, & figures may be submitted as hardcopy, WMF (preferred), CGM (preferred), WPG, or TIF files. Files can be sent on disk or to the PC BBS.

Avalanche Danger Scale

For public avalanche bulletins, Canada has decided to adopt a five scale rating to describe avalanche danger . This follows developments in Europe and will lead to unified system of advising about avalanche conditions in a variety of languages for people who go into the mountains in different countries. Confusion has occurred in the past. Similar to the "frequency salad" problems during development and transition to a better frequency for avalanche transceivers there has also been a "terminology salad" for avalanche information for the public.

For public information the term "Danger" is considered appropriate, similar to warnings about levels of fire and water hazard. Snow stability evaluation is an integral part of determining the level of "danger" which expressed using the definitions outlined below.

The guidelines described in the table below should be used with judgement based on experience and local knowledge to make decisions. The Avalanche Bulletin prepared at the Canadian Avalanche Centre includes a danger rating with summary information on weather, snowpack, avalanche activity and a travel advisory for four large regions in western Canada. The avalanche forecasts and information from the National Parks and Kananaskis Country will also use the new Danger Scale.

The Avalanche Danger Scale has been printed on a plasticized wallet card.

Wallet cards are available at a nominal cost from the CAC. Organizations who would like to do a print run including their logo may contact the CAC.

Degree of Danger	Colour Code	Avalanche Activity
LOW	GREEN	On a very few steep extreme slopes, triggering is possible only with high additional loads such as a group of skiers, snow machine or avalanche blasting. Only a few, small, natural avalanches are possible.
MODERATE	YELLOW	**On some isolated steep slopes triggering is possible with high additional loads such as skiers, snow machine or avalanche blasting. Large natural avalanches are not likely.**
CONSIDERABLE	OCHRE	On selected areas of steep terrain, triggering is possible sometimes even with low additional loads such as a skier or walker. Medium and occasionally large natural avalanches may occur.
HIGH	ORANGE	**On many steep slopes, triggering is probable even with low additional loads such as a skier or walker. Frequent medium or large natural avalanches are likely.**
EXTREME	RED	Even on moderately steep slopes, triggering is likely with or without additional loads. Numerous large natural avalanches are certain.

Avalanche Bulletin Numbers

The Avalanche Information Bulletin is available by calling the following numbers this winter. Be sure to update your listings from last year

- CALGARY (403) 243-7253 [+7669]
- VANCOUVER (604) 290-9333
- ALBERTA/BC (800) 667-1105
- PC BBS (604) 837-4893
- E-MAIL gopher at University of Utah

Publications

NEW AVALANCHE SAFETY FOR SNOWMOBILERS by Bruce Jamieson. A 44 page booklet with diagrams to help snowmobilers make safe mountain decisions.

BACKCOUNTRY AVALANCHE AWARENESS - 1994 edition - by Bruce Jamieson, booklet for backcountry recreationists includes contact phone numbers for avalanche information

NEVE E VALANGHE - Italian avalanche news. Available from AINEVA, Centro Nivometeorologica, della regione Lombardia, via Milano 18, 23032 BORMIO (So), Italy. Cost is L 25 000 for 3 issues per year

NEIGE ET AVALANCHES - French avalanche news. Available from ANENA, rue Ernest Calvet, 38000 Grenoble, France. Cost F 140 for four issues per year.

ANENA Conference
International Chamonix Symposium

The International Chamonix Symposium will be held in Grenoble, France from May 30 to June 3, 1995. The theme will be "The contribution of scientific research to safety with snow, ice and avalanches". Contact:

ANENA
15 rue Ernest Calvat,
38000 Grenoble,
France.
telephone: +33 76 51 39 39
fax: +33 76 42 81 66

The Evolution of the 457 kHz Avalanche Rescue Transceiver

Nic Seaton
Snow Avalanche Technician
Ministry of Transportation and Highways

Up until the late 1980's Europe had operated their avalanche transceivers on two different frequencies (457 kHz and 2.275 kHz). Multiple frequencies presented a major problem when attempting to perform avalanche rescues. With this in mind the International Commission of Alpine Rescue, known as IKAR, recommended that the 457 kHz become the sole frequency used throughout Europe as it had a greater range than the 2.275 kHz. This decision was also accepted by the Canadian Avalanche Association and the American Association of Avalanche Professionals.

Although the transition from the 2.275 kHz to the 457 kHz was to be completed in North America by December 31st, 1991, it will be some time before all old transceivers are replaced. In Canada, an estimated 20% of the people using avalanche transceivers are still on 2.275 kHz. The main reasons for this are due, in part, to the lack of public information about the transition, and others willing to purchase the old frequency transceivers at low cost. A complete change from the old frequency is necessary, otherwise unfortunate and unnecessary accidents are just waiting to happen. If an individual frequents an area where potentially the two frequencies may be used a simple remedy is to ensure that their own party is operating on the new frequency (457 kHz) and carry a dual frequency in their pack (turned off). This would provide both a spare transceiver and a 2.275 kHz if needed in a rescue situation.

Another complication is that the United States delayed their transition completion date to December 31st, 1996. The reasoning behind this decision was that 75% of their users were still operating on the old frequency at the time when the transition was to be complete. This has forced Canadians who wish to enjoy the mountains south of the border to carry dual frequency transceivers instead of the single 457 kHz.

Although there are still several problems relating to the transition process, the actual performance and reliability of the three most popular 457 kHz transceivers has improved a great deal since the early nineties. When Pieps, Ortovox, and Option first brought their new transceivers on line the Ministry of Transportation and Highways performed several tests on them. The results were not that impressive. The range had certainly increased with the new frequency and they seemed to perform well under rigorous cold lab tests. However, a basic lack of attention to details made them an "average" as opposed to an "excellent" product. In order to improve the quality, all three manufacturers have made modifications to their original designs.

Following is a summary of the recent tests performed by the Ministry of Transportation and Highways since the modifications.

Ortovox F1 Focus

Useful features and improved modifications:

- Operating transmit light
- Battery strength indicator light
- 3 Progressional LED readout lights
- External speaker turns off when the earphone is connected

Problems encountered:

- Ergonomics are good for back country skier, but snow-plough truck drivers may find the strap system inconvenient

Search Performance:

- Good to excellent with either the Induction or Grid methods
- LED lights are very effective

Pieps 457 with Opti-Finder

Useful features and improved modifications:

- Operating transmit light
- 2 Progressional LED readout lights
- Opti-Finder with speaker is removable for easy repairs and drying
- Modifications were made to the internal antenna to prevent separation
- Increased range from previous design
- External speaker turns off when earphone is connected

Problems encountered:

- Would be nice if the volume control was on the same plain as the LED lights
- Poor quality webbing used for the harness system

Search Performance:

- Good with either the Induction or Grid methods
- Opti-Finder is effective
- Maximum usable signal range is 50 metres

Arva 8000 (Option 8000)

Useful features and improved modifications:

- Operating transmit light
- Variable pulsed LED readout light
- Audible tone for battery strength indicator
- Removable speaker cap for easy repairs and drying
- Improvements to the receive switch for easier operation
- Increased diameter of the connector pin in On/Off switch to prevent bending
- Improved speaker quality

Problems encountered:

- LED light is inconsistent while the associated clicking is a distraction
- Poor quality earphone (should also be a dual to prevent distraction)
- Speaker remains on with the earphone

Search Performance:

- Fair to good with either Induction or Grid methods
- Maximum usable signal range is 50 metres

***Note** Maximum usable signal was determined by walking towards a transmitting beacon until the signal was strong enough to work with. Although the signals were heard as far as 80 metres away it was felt that in the case of all three transceivers you could not work with the signal until you were near the 50 metre range.*

PRODUCTS

Snowlog

SNOWLOG is a software product for managing and analyzing data collected from dataloggers. The features include the ability to handle rectangular and non rectangular data files, scroll backwards and forwards through a data file, display data in spreadsheet format or create a time profile graph. SNOWLOG can act as a scheduler and interface with a data retrieval software for automated data downloads. SNOWLOG can append new data at specified intervals to build historical archive files. The software requires an IBM PC 386SX compatible and Microsoft Windows version 3.1, 2Mb of hard disk available, 4Mb of RAM, and DOS version 3.1 or greater. The price is $150.00 (US) + $5.00 shipping and handling. To order send cheque or money order to:

Judd Communications
2525 E. Evergreen Ave.
Salt Lake City, Utah
84109
ph. (801)467-2313.

Specify disk size: 5¼" or 3½".

Video

"Winning The Avalanche Game"

The Wasatch Interpretive Association is selling this avalanche awareness videotape. Proceeds are used to fund avalanche safety information and services. To order this VHS videotape send cheque or money order (payable to Wasatch Interpretive Association) to:

P.O. Box 526246
Salt Lake City, Utah
84152-6246

Or fax your credit card order to:

The Utah Avalanche Forecast Center
(801)524-4030.

The cost is $19.95 (US) + $5.00/ video shipping and handling in the U.S. or $25.00 (Cdn) + $10.00/video shipping and handling in Canada.

Five Mountain Parks Highway Avalanche Study

CHRIS STETHEM, PETER SCHAERER[1]
BRUCE JAMIESON[2] & JASON EDWORTHY[3]

Introduction

The 5 Mountain Parks Highway Avalanche Study was completed for the Canadian Parks Service in 1993. The routes studied included Rogers Pass and Kicking Horse Pass, (Trans Canada Highway), the Radium Highway, the Icefields Parkway, the Maligne Lake Road, the Sunshine Road, the Minnewanka Road, the Field Road, and the Emerald Lake Road.

Each of the avalanche programs on these routes had evolved somewhat independently within local parks jurisdictions. The Canadian Parks service objectives were to ensure their future operations were undertaken in a cost effective manner which was commensurate with the hazard on each route and the common practices of North American Highway operations.

The methodology of the Five Mountain Parks Highway Avalanche Study included:

- Calculation of the Avalanche Hazard Index & Residual Hazard Index.
- Evaluation of the economic impacts of avalanche closures.
- Identification of acceptable closure levels.
- A survey of practices in North American highways operations.
- Evaluation & costing of present programs.
- Identification, hazard evaluation & costing of future program options.

The objectives of the current paper are to provide examples of the use of avalanche hazard index, summarize the practices identified in North American operations and outline the conclusions of the Five Mountain Parks Study.

The Avalanche Hazard index

The avalanche hazard (Schaerer 1974, 1989) is the probability of damage as a result of an interaction between snow avalanches and vehicles on a road. The avalanche hazard index is a numeric expression of the avalanche hazard on a road. The index is determined by calculating the probability of moving and waiting vehicles being hit by various types of avalanches and multiplying the probability by weight according to the severity of damage. The calculation of the avalanche hazard index is described in detail by Schaerer (1989).

The avalanche hazard index is a function of:

- the frequency of avalanche occurrences;
- the width and depth of avalanches at the road;
- the number of avalanche paths at the road;
- the distance between the avalanche paths;
- the volume of traffic during the avalanche season;
- the speed of the traffic.

Residual Hazard Index

The residual hazard is the avalanche hazard that remains when avalanches and traffic have been controlled. A residual hazard exists because the time of occurrence and the size of avalanches cannot be predicted exactly, and the application of control methods that would prevent any avalanches would be uneconomical.

In the Five Mountain Parks study, the past observed frequency of avalanche occurrence was applied in calculation of the hazard indices. Detailed records of occurrence and experienced observers were available for most routes, with the term of record varying from 20 to 30 years. All avalanche occurrences were taken into account in calculation of the Avalanche Hazard Index (AHI - uncontrolled hazard), while only road open occurrences were taken into account in calculation of the Residual Hazard Index (RHI - controlled hazard). The difference between the AHI and RHI is the hazard reduction by current measures.

The Simplified Avalanche Hazard Index

The calculation of the avalanche hazard index requires data about the average width and frequency of occurrence of two types of avalanches at each individual avalanche path. Because this information often is difficult to obtain, a simplified hazard index was developed for the comparison of the hazard among roads and the control measures applied, as compiled in the survey of North American practices.

The simplified avalanche hazard, I_s, is:

$$I_s = A \times p \times N/100$$

where:

- A = average annual number of avalanches that cover the full width of the road (sum of all paths);
- p = average number of avalanche paths per road kilometre; the road length per avalanche path is limited to a maximum of 1 km.
- N = average daily winter traffic volume (vehicles per day).

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[3]Norwester Energy Systems Ltd., Box 7, Site 32, RR12, Calgary, Alberta, Canada T3E 6W3

Hazard	Detailed Index	Simplified Index
Very Low	<1	<5
Low	1 - 10	5 - 50
Moderate	10 - 40	50 - 200
High	40 - 150	200 - 750
Very High	>150	>750

Table 1: Categories of Avalanche Hazard

Analysis of Avalanche Hazard Indices

Hazard indices have been calculated for each of the Five Mountain Parks Routes. The hazard index information for those routes with a moderate hazard or greater (index >10) are illustrated in Figure1.

The Rogers Pass in Glacier Park (Glac in Figure 1) stands out in terms of hazard. The very high hazard index (214) is a function of the relatively high traffic volume (2300 vehicles per day), the large number of avalanche paths (130 paths affecting the highway at 82 sites), the short distance between paths and the heavy snowfall climate which results in frequent avalanches. In the absence of the existing structures, the avalanche hazard index would be approximately 850, 650 of which would lie on the east side of the Pass where 1500 meters of snowshed are present. The residual hazard as of 1992 was moderate. By the combination of structures, artillery and preventative closure, the overall hazard had been reduced by 96%.

In the study it was identified that approximately 44% of the Rogers Pass residual hazard was at the Beaver Valley avalanche area, where artillery control is not applicable. A structural option of highway relocation and wide road ditching at key sites was identified and has since been implemented. It is estimated that this will reduce the residual hazard in the Beaver Valley by approximately 80%.

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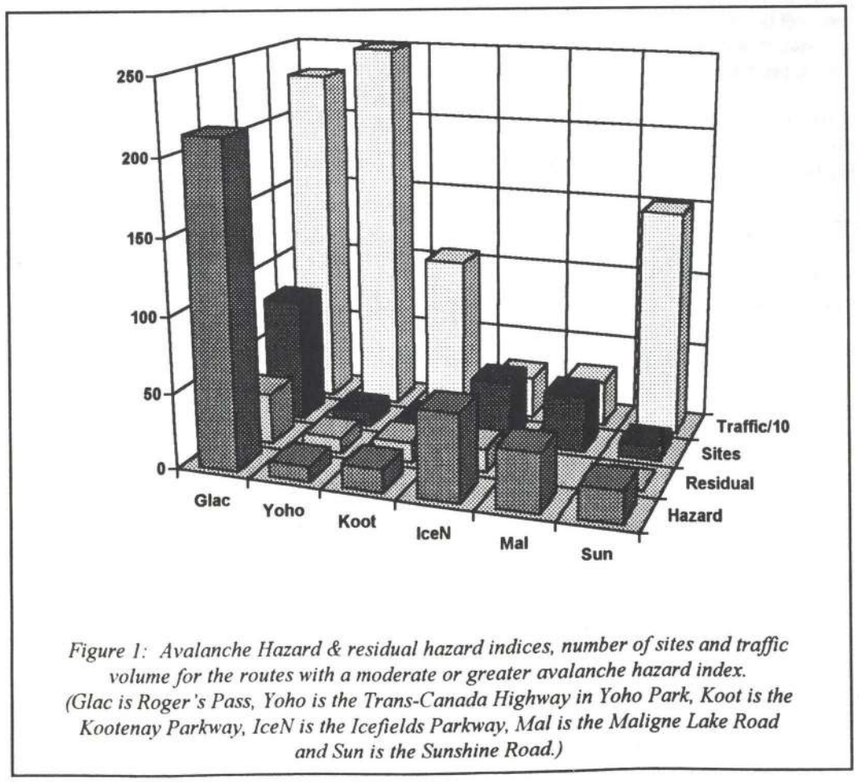

Figure 1: Avalanche Hazard & residual hazard indices, number of sites and traffic volume for the routes with a moderate or greater avalanche hazard index. (Glac is Roger's Pass, Yoho is the Trans-Canada Highway in Yoho Park, Koot is the Kootenay Parkway, IceN is the Icefields Parkway, Mal is the Maligne Lake Road and Sun is the Sunshine Road.)

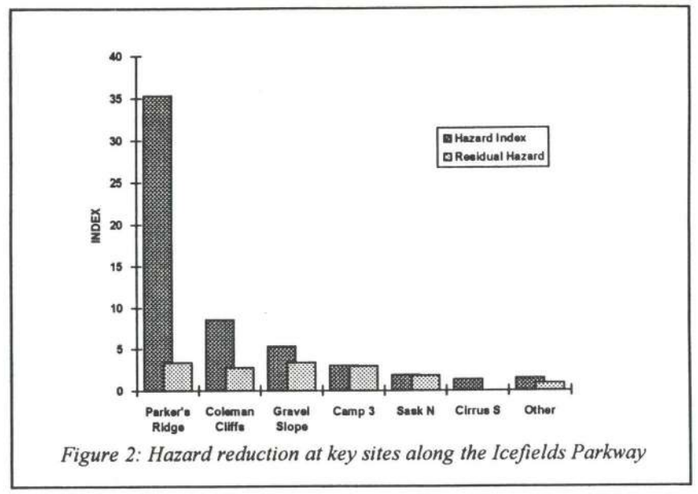

Figure 2: Hazard reduction at key sites along the Icefields Parkway

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On both the Trans-Canada Yoho Park and the Kootenay Parkway traffic volumes are relatively high, the number of sites is low and the avalanche hazard index is moderate. However, the residual hazard is only slightly reduced. Historically, occasional helicopter bombing was the only control method and closure was only usually applied after avalanches blocked the roadway. With this type of control strategy a similar avalanche hazard index and residual hazard should be expected.On the Icefields Parkway a high avalanche hazard index and moderate residual hazard were identified. A hazard reduction of approximately 74% has been achieved by intermittent explosive control by recoilless rifle, avalauncher, helicopter bombing, and closure.

Multi-day closures during major storm periods are accepted by the public, as this is primarily a recreational route. These major storms are observed infrequently.

The long term record of hazard reduction varies widely at key sites along the Icefields Parkway (Fig 2). At first glance the avalanche hazard index implies Parker's Ridge should be the key area. If, however, the question is how should future programs change in relation to the current program, then closer analysis of the residual hazard is required. Current control at Parker's Ridge is quite successful, whereas this is not the case at all sites (Fig 2). The hazard reduction at these key sites ranges from 90% to 1%. Planning of future options must therefore pay close attention to the desired reduction of residual hazard at specific sites.

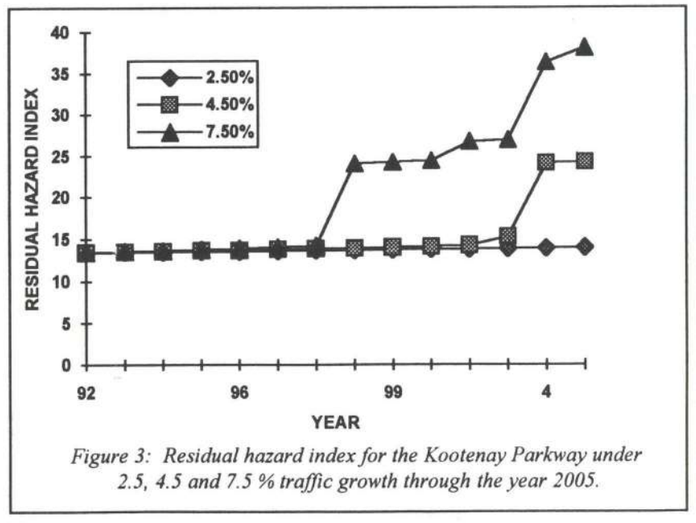

Figure 3: Residual hazard index for the Kootenay Parkway under 2.5, 4.5 and 7.5 % traffic growth through the year 2005.

The avalanche hazard index may also be used to analyze the impact of future traffic growth. When various rates of increase are applied to the model, projections of how the hazard will change result. This can be done for the entire route or specific sites.

The analysis for the Kootenay Parkway (Figure 3) shows a jump in hazard in the late 1990's under strong traffic growth (7.5%). A more detailed evaluation of the data reveals this increase is attributed to the path Assiniboine 2.

Further analysis led to the conclusion that active control and better data acquisition in the Assiniboine avalanche area would allow a low residual hazard through the year 2005. A fixed recoilless rifle and remote weather station have since been installed.

North American Practices in Highway Operations

During the course of this study, a survey of North American operating practices was done by direct communications with highway agencies, selected site visits, application of past experience and a review of published information. Thirty seven highway avalanche program areas were included. Hazard indices were calculated using both the detailed and simplified avalanche hazard index method. Practices identified in this North American survey are summarized in Table 2.

The majority of highway operations surveyed (27) were in Canada and as such there is a bias to practices in Canadian operations in the survey, especially in the low and very low hazard categories. Of that portion in Canada, the majority were located in British Columbia.

	Personnel	Explosive Control	Structures	Data	Closures
Very High	Full & part time in forecasting and control operations.	Active control operations with multiple fixed & mobile explosive systems.	Snowsheds & earthworks (mounds, diversion berms, benches, dams).	Multiple remote alpine weather stations & alpine snow plot observers.	Short control closures with occasional preventative closure.
High	**Full or part time in forecating and control operations.**	**Active control operations at all accessible sites.**	**Earthworks and wide road ditching.**	**Remote alpine weather stations.**	**Short control closures with occasional preventative closures.**
Moderate	Part time for forecasting and control operations.	Mobile or fixed explosive control at key sites.	Wide road ditching and occasional earthworks at key sites.	Remote alpine weather stations.	Preventative closures.
Low	**Maintenance staff with periodic visits by avalanche technicians.**	**Occasional heli-bombing.**	**Wide road ditching.**	**Some remote weather stations or shared data.**	**Preventative closures.**
Very Low	Maintenance staff.				Preventative closures in exceptional circumstances.

Table 2: North American Practices in Highway Operations

Costs

Costs for highway avalanche programs vary widely depending on the extent and hazard of the avalanche area, closure policy, operating methods, personnel & equipment, and the capital investment for structures. Location in regards to residential centres can also add greatly to highway maintenance costs, in the case where distances are great and camps are required. Cost comparison between programs must therefore be approached very carefully.

In Figure 4 cost per unit of avalanche hazard index (AHI) is compared to cost per unit of hazard reduction for five sites in the Mountain Parks. Sites 1, 2 and 3 have similar costs per unit of AHI to costs per unit of hazard reduction, implying that the hazard has been reduced substantially by the dollars spent. On the other hand the dollars spent per unit of hazard at sites 1 and 5 are substantially more those spent at site 2. The difference is closure policy. At site 2 longer closures are applied to control the hazard and this can be accomplished at low cost. Sites 3 and 4 on the other hand have a wide gap between the dollars per unit AHI and the dollars per unit hazard reduction. This reflects the more passive control strategy on these routes where traditionally avalanches have been allowed to block the road before the road is closed. Fewer dollars are spent on active control operations, however a greater risk is accepted. This implies that a low cost program is not necessarily the most effective option.

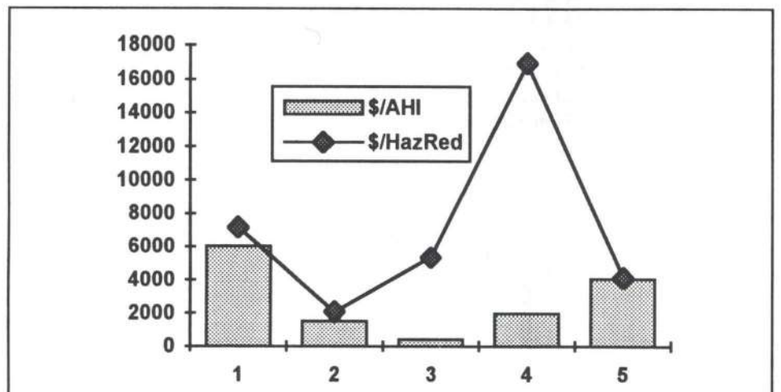

Figure 4: Cost per unit of avalanche hazard index compared to cost per unit of hazard reduction five control operations..

Conclusions

The avalanche hazard index, residual hazard and the concept of hazard reduction are valuable tools in analysis of current highway operations. This can be accomplished through use of records of avalanche observation for existing routes or through estimation by experienced observers for new highway routes. The value of the transportation network as a key economic asset has not been discussed in this paper, however, this element must be included in comprehensive cost benefit analysis. Closure policy must also be determined prior to identification of control strategy.

The general recommendations of the Five Mountain Parks Highway Avalanche Study included increased use of the 106 mm recoilless rifle, highway relocation and earthworks, maintenance and additions for snowsheds, a park wide data acquisition & management system, a training centre at Rogers Pass and an integrated traffic management plan with adjacent jurisdictions.

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References

Armstrong, B.R. A Quantitative Analysis of Avalanche Hazard on U.S. Highway 550, Southwestern Colorado, Western Snow Conference, 1981.

B.C. Ministry of Transportation & Highways: Avalanche Occurrence Data, and Avalanche Atlas Series.

Bowles, D., and Sandahl, B. Avalanche Hazard Index for Highway 210 - Little Cottonwood Canyon Mile 5.4 to Mile 13.1, 1987.

Icefields Parkway Avalanche Atlas, Jasper National Park, Environment Canada, Canadian Parks Service.

Mears, A.I. and Newcomb, R. Teton Pass and Glory Bowl Avalanche Hazard and Control Analysis. Wyoming Highway Department, 1989.

Morral, J. Ponding Area Analysis & Development of a Staged Traffic Management Plan, Glacier National Park. University of Calgary, November 1991.

Perla, R., and Martinelli, M, Jr., 1976. Avalanche Handbook. U.S. Department of Agriculture-Forest Service 1976.

Rindt E. 1989. Proposal on Km. 7.5 Relocation of TCH Glacier National Park. Public Works Canada, 1989.

Schaerer, P.A. The Avalanche Hazard Index. Annals of Glaciology 13 p. 241-247. International Glaciological Society, Cambridge, U.K., 1989.

Schleiss, V.G. Rogers Pass Snow Avalanche Atlas. Environment Canada, Canadian Parks Service. April 1989.

The authors would also like to acknowledge the cooperation of the Departments of Transportation in B.C., California, Colorado, Alaska, Washington, Utah and in particular the staff of the Canadian Parks Service.

International Commission for Alpine Rescue (ICAR) Avalanche Committee

Meeting at Autrans (France) on 29 September 1994

Summary of the business of the meeting
by Peter Schaerer (committee member for Canada).

Attendance

The meeting was attended by 30 to 35 persons (varied during the day) who represented Switzerland, France, Austria, Italy, South Tyrol, Germany, Liechtenstein, Slovenia, Croatia, United Kingdom, Norway, Poland, Slovakia, Bulgaria, Canada.

François Valla (France) chaired the meeting.

Statistics on Avalanche Accidents 1993-1994

The chairman tabled the summary of the avalanche fatalities which the individual ICAR countries had reported (table at the end of this summary). It was decided to exclude in the statistics an icefall which caused nine deaths in France.

François Valla made the following comments:

The number of avalanche victims of individual winters has varied with the annual weather, but the trend is decreasing. The total of 110 fatalities in 1993-1994 was below the 19-year average of 153. The decrease of accidents despite an increase of mountain users is commendable and demonstrates a better education of the skiers and climbers. The absence of accidents in buildings reflects a greater concern of the authorities who issue building permits. Ski touring accounted for 44% of the fatalities. This ratio has been fairly constant in past years, but the proportions of the other categories of activities have varied. An unusually large number of snowmobile fatalities were reported from the U.S.A (9), Canada (4), and Norway (2); they are included in the table under "miscellaneous".

A concern are avalanche accidents of mountain climbers in the summer. The climbers often were caught by heavy snowfalls which produced avalanches, and as a consequence summer climbers should carry transceivers. Issuing avalanche bulletins in the summer is under consideration in Switzerland and France. The bulletin may contain warnings, for example, that snowfall may be expected above the elevation 3000 m.

François Valla concluded that we must concentrate our avalanche education on the recreational users of the mountains.

The participants of the meeting discussed whether or not the accident statistics should be sub-divided into more categories, for example into snowmobiles and snow boarders, but concluded that the present table of the number of fatalities and the break-down according

to activities is adequate for the purpose of the ICAR. The individual countries may maintain their own statistics in more detail.

A few committee members wished to include the total number of avalanche involvements in addition to the number of fatal accidents and the amount of property damage from avalanches. A discussion revealed that it would be difficult to maintain a uniform standard and to define the types of involvement that should be reported. It was decided that each country should maintain the statistics that suit best its own purpose and report to ICAR only the fatalities. Property damage due to avalanches was considered a concern that does not belong to ICAR, therefore relevant statistics should be maintained by other agencies.

It was noted that an increasing number of snow boarders die in avalanches. In France, a snow boarder started an avalanche which buried and killed a skier on a slope below. A psychologist has made a study of the attitude of snow boarders in France. In Italy, avalanche courses were given to snow boarders, and special warnings were issued for snow boarders. Other countries have not approached snow boarders specifically.

Roland Meister (Swiss Federal Institute for Snow and Avalanche Research) presented an analysis of avalanche accidents in Switzerland. In the 54 years 1940-1994, on the average 99 persons per year were involved, 20 were injured, and 26 died in avalanches. It was estimated that probably the number of involvements was 10 times greater and injuries were 1.2 times more numerous. Most persons that were rescued alive were found buried less than 1 m deep (average 0.56 m), and the majority of the dead victims was found deeper than 1 m (average 1.26 m). In 1985-1994, about 75% of buried persons who were found alive were rescued by survivors. Table 1 shows the break-down of the reported means of rescue.

The statistics on the rescue alive by transceiver must be treated with caution because numerous successful rescues were not reported. One buried person was found alive by RECCO search equipment.

	Rescued Alive	Found Dead
Total Victims	**135**	**171**
Observation by survivors.	**6%**	
Victim partially dug self out.	**7%**	
Object visible on surface.	**33%**	**13%**
Voice contact.	**9%**	
Transceiver	**21%**	**33%**
Probing	**12%**	**12%**
Dog	**13%**	**32%**
Shovelling		**2%**
When snow melted.		**8%**

Table 1: Reported Means of Rescue in ICAR Countries, 1993/94

Accident Case Histories

A few significant avalanche accidents were described by delegates from various countries.

France
At the end of June 1994, an icefall at Mont Blanc buried nine mountain climbers. Because an icefall had occurred there three weeks earlier, the location was thought to be safe, but another ice block of a size about 10 m x 10 m x 100 m released and carried the victims a long distance down the glacier. The rescue was difficult because of the narrow space, danger from other ice falls, and the impossibility of probing in the ice. A dog found four victims but the others are still missing.

South Tyrol
On 23 January 1994 near the Brenner Pass, a person of a party of 7 skiers was carried down a long avalanche path that contained four benches of low incline. The survivors called by radio an organized rescue, and 40 minutes after the accident a dog was at the scene and later 120 persons probed at several areas. The search was carried out for three days, was interrupted by a change of the weather, and was successful 11 days after the accident. A power shovel which had moved over the snow found the victim in the lowest deposition zone of the avalanche under 1.5 m deep snow. The recovery area had been probed already on the first day and evidence showed that probes had hit the victim four times. Dogs had been unsuccessful for no obvious reason. The victim had died from severe injuries during the descent of the avalanche.

Italy
On 23 January 1994 a guided party of nine experienced skiers started a 0.3 m deep and 70 m wide slab avalanche in the Italian Alps at the elevation 2500 metres. The avalanche first ran on a gentle slope, then fell over steep terrain and ran out on a level area. A second group of the same climbing party initiated the search with transceivers. Three victims were found dead under 0.7 to 0.8 m deep snow after 80 minutes, two victims were injured, three were not injured, and one skier of the accident group was not caught in the avalanche. The skis of the buried and injured persons did not release. The rescuers concentrated first on the victims that were visible, then on the buried ones. Following are the conclusions for the causes of the accident:

a) mountaineering experts often are not expert enough;

b) the weather was bad, but the ski tour was made because it was on a weekend;

c) people are too ambitious and do not wait for safe conditions.

Austria
On 12 February 1994, nine persons climbed the Grossglockner on foot. During the descent through a gully with a 35°to 40° incline, a group of three men of the group slid down on their sleeping pads and released an avalanche in the middle of the gully. They could move to the side of the avalanche, but another climber was caught and carried down. The survivors, who had neither transceivers nor shovels, discovered a hand on the surface, dug out the victim with their hands, but were unable to revive her.

Avalanche Danger Scale

Experiences with the new avalanche danger scale, which was applied in Europe successfully in the winter 1993-1994, were discussed.

Switzerland
Roland Meister remarked that the term of the title of the scale is not uniform and should be agreed on; for example in the english language the terms danger, risk, and hazard have been introduced. (Note: Canada has decided to use "danger").

In Switzerland it was found difficult to apply the two columns which describe the effect on the traffic and persons in avalanche areas; the alpine clubs and guide associations still need to comment on this point.

There is a demand for more frequent avalanche bulletins and consideration is given to issue bulletins in the summer.

The Swiss Institute for Snow and Avalanche Research verified its bulletins of this past winter by means of a questionnaire. Approximately 1000 copies were distributed at courses and through the mail, and attention was drawn to them in the journal of the Alpine Club. About 75 skiers and guides returned the questionnaires and their analysis indicated:

- about 20% of the users thought the avalanche danger was lower than given in the bulletin;
- about 45% of the users found the danger rating correct;
- about 30% of the users considered the danger higher than it was given in the bulletin.

The results must be interpreted with caution, because many skiers who had not noted any unstable snow did not return the questionnaire, and those who had started or observed an avalanche probably rated the danger as high.

France
Jean Louis Tuaillon reported that in France avalanche bulletins do not recommend the action for skiers, climbers, and road users for advised levels of avalanche danger (called "risque" in France), because French people do not accept to be told what to do.

Danger Degree 3: "Considerable" was used most frequently in avalanche bulletins. Both ends of the scale with the degrees "Low" and "Very High", were applied infrequently.

Most avalanche accidents in France occurred when there was a warning for Degree 3. J.L.Tuaillon inferred that many people seem to take this danger too lightly and not dangerous enough for using precautions. As a consequence, it was recommended that warning services should inform the public that the Danger Step 3 is serious. For the same reason, France would like to see a scale that contains more than five degrees of danger.

Country	Ski Touring	Outside Skiruns	On Skiruns	Climbing	On Roads	In Buildings	Misc.	Total
Switzerland	**16**	**3**	**1**	**1**	**0**	**0**	**0**	**21**
France	*6*	*12*	*0*	*3*	*0*	*0*	*2*	*23*
Austria	**8**	**4**	**0**	**1**	**0**	**0**	**1**	**14**
Italy	*12*	*4*	*0*	*6*	*0*	*0*	*1*	*23*
Germany	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
Slovenia	*1*	*0*	*0*	*2*	*0*	*0*	*0*	*3*
United Kingdom	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**
Norway	*0*	*2*	*0*	*0*	*0*	*0*	*3*	*5*
Canada	**2**	**1**	**0**	**1**	**0**	**0**	**4**	**8**
USA	*2*	*0*	*0*	*0*	*0*	*0*	*9*	*11*
Total	48	26	1	15	0	0	20	110
Percent	44	24	1	13	0	0	18	100

Slovenia
Found a similar distribution of the frequency of danger degrees in avalanche bulletins as France.

Italy
Giovanni Peretti presented a study of the correlation between the number of fatal accidents and the degree of danger in Italy as follows:

- 30% of accidents occurred with Degree 2: Moderate;
- 50% of accidents occurred at Degree 3: Considerable; all of these involved ski tourers;
- no accidents occurred when the danger degree was 4 or 5;
- 20% of accidents occurred outside winter when no bulletin was issued or at locations where bulletins were not applicable.

Transceivers

Jean-Paul Zuanon (France) reported shortly on the transceiver tests "ARVA 94". A variety of transceivers were tested in 1990, and again in 1994 eight models of transceivers were tested in three different experimental series in the Alps. Examining minimum standards and the compatibility among different transceivers were the principal objectives of the tests.

The principal conclusions were:

a) an instrument with a wide transmission/receiving range is not necessarily the best;

b) the signal strength must vary significantly;

c) there is room for improvements, and manufacturers already have made improvements.

The test results were published (in French) in the journal Neige et Avalanches, No.67, pages 33-37, September 1994; A.N.E.N.A. Grenoble, France. A report in German may be obtained from the Federal Institute for Snow and Avalanche Research at Davos, Switzerland.

It was reported that a manual on the use of transceivers is in preparation.

The participants of the meeting asked questions about the RECCO search system. It was concluded that RECCO is useful for finding buried persons. For a live recovery, because it is a passive search system, RECCO is useful only in organized areas where the instrument is available quickly. In past years, two persons (in France and in Switzerland) were located alive with RECCO, and others were found dead.

Avalanche Dogs

Peter Ogi (Switzerland) reported on the activity of the avalanche dog group. The group held a meeting at Oberstdorf (Germany) in March 1994 for the exchange of information among dog handlers of various countries. At that meeting, the following standards for handlers and dogs were established:

A Dog Handler must;
- be a member of a rescue organization recognized by ICAR;
- have training in mountain rescue;
- own his dog;
- live close to a potential activity area;
- be available at any time;
- be not older than 40 years when taking the first avalanche dog training course.

An Avalanche Dog must;
- be weather resistant;
- have good social behaviour;
- be mobile in alpine terrain;
- be able to travel and to fly;
- be able to be trained;
- be middle size.

There are many more trained avalanche dogs than people were buried in avalanches. Some avalanche dogs are busy, others remain unemployed during their whole life, but one never knows when they might be used.

Avalanche dogs are used with increasing frequency for searches in alpine areas in the summer. They have been utilized for this task in Austria for many years, and now it is done in other countries.

Peter Ogi recommended that more dog handlers participate with the ICAR Avalanche Committee.

It was noted that at some avalanche accidents, dogs and handlers who were not members of a rescue organization and were supported by private charitable organizations, have arrived in private helicopters. The private handlers, who came inadequately equipped for outdoor work, have left a bad impression with respect to the work of avalanche dogs.

Working Group "Prevention"

A working group chaired by Nils Faarlund (Norway) is concerned with making recommendations for the prevention of avalanche accidents. The group will meet again in this coming year.

Resignations

Karl Eitzenberger (Germany) and Herman Seebacher (South Tyrol), who have served the avalanche committee for many years, have resigned. F. Valla thanked both of them for their services and dedication and invited them to join meetings in the future.

Note: The ICAR member countries Liechtenstein, Croatia, Spain, Poland, Slovakia, Czech Republic, Bulgaria had no reported fatal avalanche accidents.

The report from the United Kingdom does not include Scotland.

The category "miscellaneous" includes 15 fatalities with snowmobiles.

Avalanche Resource Agencies

Information in this resource list is updated annually. New or revised information must be received at the Canadian Avalanche Centre by September 15, 1995.

The Canadian Avalanche Association

Canadian Avalanche Centre

Box 2759
Revelstoke, BC
Canada, V0E 2S0

Alan Dennis, Manager: Tel: 604-837-2435 Fax: 837-4624
Inge Anhorn, Course Administrator: Tel: 604-837-2435
Torsten Geldsetzer, INFOEX Manager: Tel: 604-837-4425

Public Avalanche Information Bulletin:
Calgary and area: 403-243-7253 +[7669]
Vancouver and area: 604-290-9333
Toll free in Canada: 1-800-667-1105
Computer Bulletin Board: 604-837-4893

The Canadian Avalanche Centre supplies avalanche information, runs training schools, and operates an Industry Information Exchange.

The Centre is not equipped for search and rescue work.

Government Agencies

The following agencies and individuals maintain continuous observations of the snow stability and avalanche danger in their areas. They are also equipped for search and rescue work.

Parks Canada

	Telephone	Fax
Banff National Park		
Taped message:	403-762-1460	
Calgary (Western Region):	403-292-6600	
Banff Warden's Office:	403-762-4506	762-3240
Emergency (24hr):	403-762-4506	762-3240
Bob Haney The Chief Warden Banff National Park P.O. Box 900 Banff, AB, T0L 0C0	403-762-1481	
Jasper National Park		
Chief Warden (office hours):	403-852-6155	852-4775
Switchboard (24 hrs.):	403-852-6161	
Avalanche Hut:	403-852-2356	
Sunwapta Warden's Office:	403-852-5383	
Paul Galbraith The Chief Warden Jasper National Park P.O. Box 10 Jasper, AB, T0E 1E0	403-852-6105	
Mt. Revelsoke & Glacier National Park		
Taped message:	604-837-6867 (MTNS)	
Information - Rogers Pass:	604-837-6274	
Search and Rescue:		
Chief Warden - Bill Brown:	604-837-5155/7500	837-7536
Warden Office, Rogers Pass:	604-837-6274	837-6274

	Telephone	Fax
Mt. Revelsoke & Glacier National Park		
Roger Beardmore The Superintendent Mount Revelstoke and Glacier National Parks P.O. Box 350 Revelstoke, BC, V0E 2S0	604-837-5155/7514	837-7536
Yoho National Park		
Ian Syme Chief Park Warden Box 99 Field, BC, V0A 1G0	604-343-6324	343-~~6330~~ 343-6758
Kootenay National Park		
Perry Jacobsen Chief Park Warden: Box 220 Radium Hot Springs, BC, V0A 1M0	604-347-9361	347-9050
Waterton Lakes National Park		
Warden Office (off. hours):	403-859-2224	859-2279
Taped Message:	403-859-5105	
Emergency (24 hours):	403-859-2636	
Kluane National Park		
Warden Office:	403-634-2251	634-2338
Main Office:		634-2686
The Chief Park Warden P.O. Box 5495 Haines Junction, YK, Y0B 1L0		

Alberta Environmental Protection

	Telephone	Fax
Lloyd Gallagher-Alpine Specialist, Public Safety Co-ordinator		
George Field-Alpine Specialist		
~~Larry Stanier-Snow Study Observer~~		
Kananaskis Country Box 280 Canmore, AB, T0L 0M0	403-678-5508	678-5505
Peter Lougheed Provincial Park:	403-591-6300	591-7379
Emergency:	403-591-7444	

	Telephone	Fax
Bow Valley Provincial Park:	403-673-3663	
Ribbon Creek Emergency Center:	403-591-7767	
Elbow District:	403-949-3754	
Emergency:	403-591-7767	

BC Ministry of Highways

	Telephone	Fax
Main Office:	604-387-6931	356-8143
Jack Bennetto, Manager:	604-387-7523	
Gordon Bonwick, Sr. Avalanche Officer:	604-387-7516	
Mike Boissoneault, Sr. Avalanche Officer:	604-387-7514	
Peter Weir, Research Officer:	604-387-7517	
Snow Avalanche Program 4C 940 Blanshard Street Victoria, BC, V8W 3E6		
District Avalanche Technicians:		
Scott Aitken Howe Sound District Avalanche Program Box 206 Pemberton, BC, V0N 2L0	604-894-5495	
Ed Campbell 45474 Luckakuckway Sardis, BC, V2R 3S9	604-869-2401 604-869-7328	869-2961
Simon Walker Bag 4500 Merritt, BC, V0K 2B0	604-378-9359	378-9364
Coldwater Site: Summit Site:	[redacted] 604-378-6449	

	Telephone	Fax
John Tweedy Compartment 1 Lakeside Drive Group Box Nelson, BC, V1L 6B9		
Summer:	604-354-6724	
Winter:	604-354-1351	354-1298
Bruce Allen Box 710 Revelstoke, BC, V0E 2S0	604-837-7685	837-9407
Tony Moore Box 127 Stewart, BC, V0T 1W0 Tel: 604-636-2625	604-636-2625	636-2333
Snow Avalanche Technicians:		
Nic Seaton	604-987-9311	
Snow Avalanche Programs 4C 940 Blanshard Street Victoria, BC, V8W 3E6	604-387-6361 604-329-9526 (Cellular)	660-1200
Dave Smith Kootenays Region 310 Ward Street Nelson, BC, V1L 5S4	604-354-6455	354-6723
Al Evenchick North West Region 400 - 4546 Park Avenue Terrace, BC, V8G 1V4	604-638-3334	638-3587

BC Ministry of Environment, Lands, and Parks

	Telephone	Fax
East Kootenay District Box 118 Wasa, BC, V0B 2K0	604-422-3212	422-3326
West Kootenay District R.R. #3 4750 Hwy. 3A Nelson, BC, V1L 5P6	604-825-4421	825-9509
Garibaldi/Sunshine Coast Box 220 Brackendale, BC, V0N 1H0	604-898-3678	898-4171

	Telephone	Fax
Mount Robson Box 579 Valemount, BC, V0E 2Z0	604-566-4325	566-9777
Strathcona 1815 Miracle Beach Drive Black Creek, BC, V9J 1K1	604-337-5121	337-5695

BC Ministry of Solicitor General

The British Columbia Provincial Emergency Program coordinates most local search and rescue groups in the Province. Enquiries can be directed to:

	Telephone	Fax
Dave Brewer Provincial Co-ordinator (Volunteers) Search and Rescue Provincial Emergency Program 1257 Lucking Place North Vancouver, BC, V7J 3L5	604-984-4915	984-1745
Geoff Amy Manager of Land/Inland Waters Ministry of Attorney General Provincial Emergency Program 455 Boleskin Road Victoria, BC, V8Z 1E7	604-387-5956	387-9900

Provincial Emergency Program
Emergency Toll Free
Provincial Government Emergency Operations Centre
Emergency Coordination Centre 24 Hour operation

→ Telephone: 1-800-663-3456 Fax: 604-387-2957

Avalanche Films and Videos

Avalanche - 50 minutes (Film)
Avalanche Terrain - 9 minutes (Video)
Control - 15 minutes (Video)
Snow War - 25 minutes (Video)
Avalanche - 12 minutes (Video)
Snow Profile Observation - 8 minutes (Video)
Metamorphism - 16 minutes (Video)

Canadian Avalanche Centre
Box 2759
Revelstoke, BC, V0E 2S0
604-837-2435

Avalanche Dynamics: order# 719176 $90 US (Video VHS NTSC)
Snow Metamorphism: order # 719907 $90 US

University of Washington
Box 50096
Seattle, WA, USA, 98145
206-543-4050

Commercial Operations

Ski Areas

	Telephone	Fax
Steve Portman Apex Alpine Resort Box 1060 Penticton, BC, V2A 7N7	604-492-2880	292-8622
Wayne Bertrand, Ski Patrol Supervisor Big White Ski Resort Ltd Box 2039 Kelowna, BC, V1X 4K5	604-765-3101	765-8200
Matt Coutoure, Safety Coordinator Blackcomb Mountain 4545 Blackcomb Way Whistler, BC, V0N 1B0	604-932-3141	938-7532
Dave Aiken, Propatrol Fernie Snow Valley Ski Ltd. Ski Area Road Fernie, BC, V0B 1M1	604-423-4655	423-6644
James Couillard Fortress Mountain Skiing Inc. 307-1111 11th Ave. SW Calgary, AB, T2R 0G5	403-264-5825	
Niko Weis Mt. Washington Ski Resort Ltd. P.O. Box 3069 Courtenay, BC, V9N 5N3	604-338-1386	338-7295
Don Annett / JOHN THOMAS Mystic Ridge & Norquay Box 1258 Banff, AB, T0L 0C0	403-762-4421	762-8133
Tim Mellon Nakiska Box 1988 Kananaskis, AB, T0L 2H0	403-591-7777	591-7780
Hank Cuttle, Manager Red Mountain Ski Area Box 670 Rossland, BC, VOG 1Y0	604-362-7384	362-5833
Peter Fern Silver Star Mt. Resorts Ltd. Box 2 Silver Star Mt., BC, V0E 1G0	604-542-0224	542-1236
Mark Klassen Skiing Louise Box 5 Lake Louise, AB, T0L 1E0	403-522-3555	522-2095
Peter Amann, Avalanche Forecaster Greg McAuley, Assistant Avalanche Forecaster Marmot Basin Ski Lifts Ltd. Box 1300 Jasper, AB, T0E 1E0	403-852-3816	852-3533
Tim Riley Sunshine Village Box 1510 Banff, AB, T0L 0C0	403-762-6500	762-6513
Brian Leighton, Safety Manager Whistler Mountain Ski Corp. Box 67 Whistler, BC, VON IBO	604-932-3434	932-6374
Doug Yarwood Whitewater Ski Resort Ltd. Box 60 Nelson, BC V1L 5P7	604-354-4944	354-4988

Helicopter, Snowcat, & Wilderness Ski Operators

	Telephone	Fax
Russ Younger ABC Wilderness Adventures Box 811 Golden, BC, V0A 1H0	604-344-2639	344-5520
Clyde Newsome CAT Powder Skiing Inc. Box 1479 Revelstoke, BC, V0E 2S0	604-837-5151	837-5111
Canadian Mountain Holidays Inc. (CMH) Box 1660 Banff, AB, T0L 0C0	403-762-7100	762-5879
(Emergency):	403-762-7198	
CMH Snow Safety Co-ordinator Colani Bezzola	604-348-2370	348-2551
CMH Adamants Franz Fux (Erich Unterberger)	604-837-4245	837-4245
CMH Bobbie Burns Rob Rohn (Bruce Howatt)	604-348-2226	348-2226
CMH Bugaboos Jocelyn Lang (Peter Harvey)	604-346-3391	346-3391
CMH Cariboos Ernst Buehler (Dave Cochrane)	604-566-9888	566-9888
CMH Galena Bernhard Ehmann (Peter Arbic)	604-369-2235	329-2235
CMH Gothics Ian Campbell (Bryan Keefer)	604-837-4204	837-3363
CMH Monashees (Seasonal) Dominic Neuhaus (Roger Laurilla)	604-834-7223	834-7330
CMH Revelstoke	604-837-9344	837-3644
or Regent Hotel Buck Corrigan (Greg Yavorski)	604-837-2107	837-9669
CMH Valemount (Seasonal)	604-566-4487	566-4111
or Alpine Motel Stefan Eder	604-566-4471	566-4767
Battle Abbey (via CMH Bobbie Burns)		
Mark Aubrey Crescent Spur Heli-Skiing General Delivery Crescent Spur, BC, V0J 3E0	604-569-2730	569-3276

	Telephone	Fax
Alison Dakin Golden Alpine Holidays Box 1050 Golden, BC, V0A 1H0	604-344-7273	344-7273
Wayne Bingham Great Canadian Heliskiing Box 175 Golden, BC, V0A 1H0	604-344-2326	344-2316
Brent Mc Corquodale Great Northern Snow-Cat Skiing Box 220, Station G Calgary, AB, T3A 2G2	403-287-2267	
(Trout Lake):	604-369-2227	
Dan McDonald Island Lake Mountain Tours Cedar Valley Road Fernie, BC, V0B 1M1	604-423-3700	423-3700
Tad Derbyshire Kootenay Helicopter Skiing Box 717 Nakusp, BC, V0G 1R0	604-265-3121	265-4447
Mike Wiegele Helicopter Skiing, Box 159 Blue River, BC, V0E 1J0	604-673-8381	673-8464
(Banff Office):	403-762-5548	762-5846
Ron Blaue Mistaya Alpine Tours Box 809 Golden, BC, V0A 1H0	604-344-6689	344-2229
Sepp Renner Mount Assiniboine Lodge Canmore, AB, T0L 0M0	403-678-2883	
John Luttrell - Ski Guide Mountain Heli-Sports Inc. Box 460 Whistler, BC, V0N 1B0	604-932-2070	938-1852
Jim Bay Mountain Light tours Box 1789 Revelstoke, BC, V0E 2S0	604-837-6655	837-6655
Rudi Gertsch Purcell Helicopter Skiing Box 1530 Golden, BC, V0A 1H0	604-344-5410	344-6076

	Telephone	Fax
Dan Griffith R-K Heli Ski Panorama BC P.O. Box 695 Invermere, BC, V0A 1K0	604-342-3889 1-800-661-6060	342-3466
Bernard Faure, Ski Guide Robson HeliMagic Inc. Box 18 Valemount, BC, V0E 2Z0	604-566-4700	566-4333
Rudi Beglinger Selkirk Mountain Experience Box 2998 Revelstoke, BC, V0E 2S0	604-837-2381	837-4685
Peter Schlunegger Selkirk-Tangiers Heli-skiing c/o Box 59 Revelstoke, BC, V0E 2S0	604-837-5378	837-5766
(Best Western)	604-837-6161	837-5460
(Golden)	604-344-5016	344-7102

	Telephone	Fax
Allan Drury Selkirk Wilderness Skiing Meadow Creek, BC, V0G 1N0	604-366-4424 1-800-799-3499	366-4419
Neal Bedell Sno-Much-Fun Catskiing Inc. 63 Wattsville Road Cranbrook, BC, V1C 2A1	604-426-5303	426-5567
Mike Jacobsson Tyax Heliski Box 849 Whistler, BC, V0N 1B0	604-932-7007	932-2500
Herb Bleuer Tyax Lodge Heliskiing Tyaughton Lake Rd. Gold River, BC, V0K 1P0	604-238-2446	238-2446
Ken Hardy Whistler Heliski Box 368 Whistler, BC, VON 1B0	604-932-4105	938-1225

Mining Companies

	Telephone	Fax
Line Creek Resources Line Creek Mine (Upper Elk Valley) Box 2003 Sparwood, BC, V0G 2B0	604-425-3145	425-7144
Brian Spreadbury Elkview Coal RR 1, Hwy 3 Sparwood, BC, V0G 2B0	604-425-8746	425-8700

	Telephone	Fax
Ken Clark Fording Coal - Greenhills Box 5000 Elkford, BC, V0B 1H0	604-865-3248	865-3250

Dog Teams

Canadian Avalanche Rescue Dog Association

	Telephone	Fax
Whistler Region		
Bruce Brink (Pager):	1-979-4050	
Dog Name: Cody		
Anton Horvath:	604-932-3210 ext 338	
Rene Long (Pager):	604-932-20203	
Craig Ross:	604-938-7602	
Ron Stanley:	604-938-7602	
Yvonne Thornton:	604-932-3210 ext 338	
Jan Tindle:	604-932-3210 ext 338	
Bruce Watt (Pager):	1-979-8352	
Blue River (Mike Wiegele Heli-ski)		
Pat Coulter:	604-673-8381	

	Telephone	Fax
Invermere		
Russ Hendry (Pager):	1-979-9015	
(Business):	604-342-4200	
(Residence):	604-347-6575	
Dog Name: Karnak		
Fernie		
Robin Siggers (Business):	604-423-4656	
(Residence):	604-423-4892	
Dog Name: Koko		
Wardner		
Sue Boyd (Residence):	604-429-3958	
Dog Name: Sun Bear		
Jasper		
RJ Kingston	403-852-3816	
Whitehorse		
Kirstie Simpson	403-667-3862	
(Residence):	403-633-2199	

Parks Canada

	Telephone	Fax
Will Devlin	403-852-6625/6155	852-4752
Jasper National Park		
Box 10		
Jasper, AB, T0E 1E0		
(Residence):	403-852-4234	
Gordon Peyto	604-837-6274	837-6274
Glacier National Park		
Revelstoke, BC, V0E 2S0		
(Residence):	604-344-5041	
Scott Ward	403-762-4506 (24hr)	762-3240
Banff National Park		
Banff, AB, T0L 0C0		
(Residence):	403-678-5554	

Royal Canadian Mounted Police

The following dogmasters and their dogs have received special avalanche training:

	Telephone	Fax
Nelson Detachment	604-354-5160/5184	354-4841
Cpl. T. M. Barter (Terry)		
NCO i/c Nelson Sub/Division PDS		
1010 Second Street		
Nelson, BC, V1L 6B6		
Port Alberni Sub/Division	604-723-2428/2424	329-5061
Cpl. Bruce McLellan		
i/c Port Alberni PDS		
4110 - 6th Avenue		
Port Alberni, BC, V9Y 4M9		
Squamish Detachment	604-898-9611	898-4712
Cpl. C. H. Brandt (Cec)		
NCO i/c Squamish PDS		
40439 Tintalus Road, Box 1880		
Squamish, BC,		
Terrace Detachment	604-638-0333	635-7248
Cpl. L. Bretfeld (Lothar)		
NCO i/c Terrace PDS		
3205 Eby Street		
Terrace, BC, V8G 2X7		

	Telephone	Fax
Vernon Detachment	604-545-7171	545-7961
Cpl. R. T. Boal (Tim)		
NCO i/c Vernon PDS		
3402 - 30th Street		
Vernon, BC, V1T 5E5		
Calgary Detachment	403-291-6236	221-3423
Cpl. Bill Hamilton		
NCO i/c Calgary Sub/Division PDS		
920 - 16th Ave NE		
Calgary, AB, T2E 1K9		
Kamloops Detachment	604-828-3099	828-3210
Cpl. Al Sonneff		
NCO i/c Kamloops S/D PDS		
1280 Trans Canada Hwy N		
Kamloops, BC, V2C 5Y5		
Chilliwack Detachment	604-792-2711 (Emergency)	
Cpl. Bud Mercer		
NCO i/c Chilliwack S/D PDS		
2, 45924 Airport Road		
Chilliwack, BC, V2p 1A2		
(Residence):	604-793-9197	

Education

Academic Courses

	Telephone	Fax
Dave McClung	604-822-2674	822-6150
Department of Geography and Civil Engineering		
University of British Columbia		
2324 Main Mall		
Vancouver, BC, V6T 1Z4		

- Geography 408 - Snow and Ice Processes
- Civil Engineering 450 - Natural Hazards Engineering

Technical Courses

	Telephone	Fax
Canadian Avalanche Association Training Schools		
Box 2759		
Revelstoke, BC, V0E 2S0		
Courses for Professional Personnel		
Inge Anhorn - Registration	604-837-2435	837-4624

Awareness Courses

	Telephone	Fax
Federation of Mountain Clubs of British Columbia 336 - 1367 W. Broadway Vancouver, BC, V6H 4A9	604-738-7175	737-3053
Canadian Ski Patrol System T. Simper, National Avalanche Training Officer RR2, Box 1117 Okotoks, AB, T0L 1T0 (Residence):	403-938-2101 403-938-2131	938-6020
Island Sauvage 131 Beech Street Campbell River, BC, V9W 5G4	604-286-0205 1-800-667-4354	287-8840
Bear Enterprises Ltd. Box 4222 Smithers, BC, V0J 2N0 (Residence):	604-847-2854 604-847-3351	847-4533
Art Twomey Ptarmigan Tours Box 11 Kimberley, BC, V1A 2I5	604-422-3270	422-3566
Phil Hein Columbia Mountain Recreation Box 990 Golden, BC, V0A 1H0	604-344-6322	344-6322
Cirrus Mountaineering RR #1 1034 Highway 3A Nelson, BC, V1L 5P4	604-354-3820	
Stellar Consulting Services Ltd. Box 450 Rossland, BC, V0G 1Y0 or Box 1193 Revelstoke, BC, V0E 2S0	604-362-5314 604-837-5022	
Weather Tech Services Rod Gee Box 992 Terrace, BC, V8G 4V1	604-638-6640	638-8577
Snow Safe Greg McCauley Box 2891 Canmore, AB, T0L 0M0	403-678-6830	
Snowline Technical Services Bruce Jamieson 7943 48th Ave NW Calgary, AB, T3R 2A7 on CompuServe:	403-288-7541 73122,1110	
Mountain Light Tours Jim Bay Box 1789 Revelstoke, BC, V0E 2S0	604-837-6655	837-6655
Kevin Christakos Box 1224 Jasper, AB, T0E 1E0	403-852-4073	

Weather Services

Environment Canada

	Telephone	Fax
E. Anthony Regional Director General Environment Canada, Pacific and Yukon Region 700 - 1200 West 73rd Avenue Vancouver, BC, V6P 6H9	604-644-9111	
G. E. Wells Director, Environmental Services Branch Pacific Weather Centre Environment Canada, Pacific and Yukon Region 700 - 1200 West 73rd Avenue Vancouver, BC, V6P 6H9	604-664-9000	
A Wallace Manager, Mountain Weather Services Office Environment Canada 3140 College Way kelowna, BC, V1V 1V9	604-491-1510	

Weather Offices in British Columbia (area code 604)

Location	Direct Consultation	Recording - 24 Hour	Fax Number
Castlegar	**365-3132**	**365-3131**	**365-3134**
Fort Nelson	**774-2302**	**774-6461**	**774-3742**
Fort St. John	**785-4304**	**785-7669**	**785-7669**
Kamloops	**376-2160**	**374-3661**	**376-0727**
Kelowna	**491-1511**	**491-1500**	**491-1509**
Revelstoke	**837-9244**	**837-4164**	**837-6004**
Dease Lake	**771-4351**		**771-4352**
Vancouver	**664-9032**	**664-9010**	**664-9005**
Victoria	**363-6632**		**363-6674**
Port Hardy	**949-6559**	**949-7174**	**949-5933**
Prince George	**963-7552**	**963-9330**	**963-8480**
Terrace	**635-3224**	**635-4192**	**635-4192**

WEATHER OFFICES IN ALBERTA AND YUKON (area code 403)

Location	Direct Consultation	Recording - 24 Hour	Fax Number
Banff		**762-2088**	
Alberta Weather Centre	**468-7925/7927**	**468-4940**	
Calgary		**275-3300**	
Whitehorse	**667-8485**	**668-6061**	

Private Weather Services

	Telephone	Fax
The Weather Network	514-597-1700	
World Weather Watch 401 Bently Street - Unit 4 Markham ON, L3R 9T2	905-477-4120	477-0824

Snowmobile

	Telephone	Fax
Alberta Snowmobile Association Percy Page Centre 11759 Groat Road Edmonton, AB, T5M 3K6	403-453-8668	453-8553
British Columbia Snowmobile Federation Box 849 Valemount, BC, V0E 2Z0	604-566-4627	566-4622

Changes, additions or deletions to the Avalanche Resource List can be made by filling in the form below and mailing it to:
Canadian Avalanche Association, Box 2759, Revelstoke, BC, V0E 2S0
Telephone: 604-837-2435 Fax: 604-837-4624

Name: _____

Address: _____

Phone: _____ **Fax:** _____ **Bulletin Board:** _____ **Email:** _____

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 Avalanche 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.

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