

AVALANCHE EDUCATION AND COURSES FOR OPERATIONAL PERSONNEL

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Introduction

Education in avalanche safety is available through numerous programs, using a variety of means which differ by the extent of information covered. All programs, however, have in common three major components: recognition of safe or unsafe terrain and snow conditions; safety measures; and action to be taken in case of accidents. In this paper, the various means of education are summarized and the courses for operational personnel in Canada are described.

Types of Avalanche EducationPublications

Avalanche literature may be grouped into survival pamphlets, pocket books, technical literature, and magazine articles.

Survival pamphlets are issued by large organizations, among them the U.S. Forest Service, the National Parks Service, and the British Columbia Outdoor Recreation Council. Their objective is generally to give a few basic guidelines both for recognizing avalanche terrain and weather conditions that usually produce avalanches, and as to the safety measures that should be applied. The brochures do not cover the complexities of avalanche formation, but rather concentrate on creating a respect for avalanche hazards.

Survival pamphlets seem to have inherited traits. Most of them not only have similar formats but also contain information copied from older ones along with mistakes and outdated knowledge. For this reason all new pamphlets should be written, or at least edited carefully, by a person who is familiar with the latest knowledge of avalanche safety.

Pocket books, usually aimed at the recreational mountain traveller, treat the subject in greater detail with a large number of photographs, drawings, and case histories.

Technical literature such as handbooks and research papers is aimed at the professional and specialist. Individual publications may cover a range of subjects or may treat a narrow topic only.

Magazine articles are useful in drawing attention to avalanche hazards, because they reach a wide readership, but usually they only partially cover the subject. Often they tend to be too sensational, which might be the fault of the people who provide the information to the writers.

Films

Films and slide collections can illustrate in a short period of time characteristic avalanche terrain, snow conditions, avalanches in motion, and safety measures. Unfortunately, films often give too much emphasis to the glamorous side, for example, control by explosives or ski stabilization in deep powder snow. There is a lack of good training films dealing with back country safety and proper behaviour in avalanche terrain.

Awareness Talks

Talks to clubs, and on radio and television have the same objectives as survival pamphlets. In order to be successful, speakers must be able to answer questions from the audience and must have experience gained by travelling in the mountains, evaluating avalanche hazards, and observing avalanches.

Engineers, foresters, geologists, surveyors, mine supervisors, and other technical personnel who often encounter avalanche hazards in their work, must be able to recognize hazardous terrain and know where assistance can be obtained. Probably the best method of educating these types of professionals is to include a few lessons on avalanches in their curriculum at universities and technical colleges.

Training Courses

Training courses force the learners to become more deeply involved than they will by reading publications or watching films. Depending on the learner population, training courses have different formats.

Information Courses

The topics covered in information courses are those contained in survival pamphlets and pocket books. At the end of an information course the participants should be able to:

1. recognize avalanche terrain;
2. state how avalanches are formed and the hazards involved;
3. apply personal safety measures; and
4. participate usefully in avalanche search and rescue.

Information courses are best held for specialized groups; for example, cross country skiers, mountain climbers, volunteer ski patrollers, snowmobilers, and emergency measures organizations.

About 40 information courses per winter are given in Western Canada by ski patrol organizations, government agencies, mountaineering schools, public schools, and individuals.

Operational Courses

Operational courses, also called professional courses, are intended for field staff and supervisors who are concerned with an operation; for example, a ski area or a highway that requires evaluation of avalanche hazards every day of the winter. Because numerous roads, railways, mines, ski areas, and ski guiding organizations operate in avalanche areas, and because no central avalanche warning service exists, the demand for operational avalanche training is strong in Canada. In response to this need, the National Research Council has given special attention to operational courses.

Academic Courses

In Switzerland and Austria a snow mechanics and avalanche control course is part of the curriculum of forestry and civil engineering students. It has not been found necessary to include similar courses at American or Canadian universities, because, unlike Western Europe, in North America, avalanche control by structures has little application, and avalanche safety and control work is usually carried out on a technical rather than an academic level.

Some universities in the U.S.A. and Canada offer education on the formation, dynamics, and effects of avalanches during courses in snow science, snow physics, atmospheric sciences, or geomorphology, but the scope of material covered usually depends on the special interest of the lecturer.

In-House Training

A good operational avalanche safety program includes training of the staff. Patrollers, lift operators, ski instructors, and supervisory staff of a ski area must be familiar with the avalanche safety program and be trained in rescue work. The same applies to the maintenance staff of highways, mines, and other industrial operations.

At the beginning of the winter, the following topics should be discussed during a training session:

1. the location of avalanche paths;
2. the safety plan;
3. personal safety measures, including the use of rescue transceivers;
4. the location and use of rescue equipment; and
5. the weather conditions usually responsible for avalanches.

The introductory lesson should be followed by two or more practice sessions in the field. It is beneficial to invite not only the in-house personnel, but also others who would be involved in avalanche search and rescue; for example, the local police, emergency measures organizations, dog handlers, and helicopter pilots.

Operational Courses in Canada

Sponsors

Operational courses are intended for personnel of organizations that must evaluate avalanche hazards daily and apply safety measures. The first such course in Canada was held in November 1971 at Rogers Pass and was attended by 21 participants from the mining industry, ski areas, and railways. It was sponsored jointly by the National Research Council and Parks Canada with staff members of the two organizations providing the instruction.

By the winter of 1973-74, when the number of courses had increased to four and the total number of students to 136, it became impossible to continue the administration with the resources of the National Research Council. The Continuing Education and Industry Services Division of the British Columbia Institute of Technology has now assumed the responsibility for the administration and the instructional standards, and the Division of Building Research of the National Research Council for the content of the courses. The continuing demand was reflected in 1980-81 when twelve courses were conducted with a total of 227 students participating.

Training Objectives

The objectives of the courses were defined in discussions between avalanche safety personnel of the industry and course co-ordinators of the British Columbia Institute of Technology. The discussions produced a needs analysis which is essentially a list of skills that the participants are expected to have upon completion of the courses. The co-operation between users and educational staff, the latter being experienced in defining course objectives, proved to be most beneficial.

In the Level I, or introductory courses the students become familiar with the avalanche phenomenon, the tools required for making observations, and safety measures. At the end of the course the participants are expected to be able to:

1. identify avalanche terrain;
2. take preventive safety measures;
3. assist in the collection of weather, snowpack and avalanche activity data;
4. state avalanche hazards; and
5. perform search and rescue.

In the Level II or advanced courses the knowledge acquired in the Level I course is applied to practical problems. Candidates who have successfully completed the course will be able to:

1. identify hazardous terrain and choose safe routes;
2. reliably collect data on weather, snowpack and avalanche occurrences;
3. state how snow stability and avalanche hazards are evaluated;
4. implement personal and public safety measures; and
5. direct search and rescue operations.

Although the training needs are essentially the same for all users, the courses are divided into three groups: ski areas, ski guiding, and transportation/industry. These categories allow emphasis of safety measures pertinent to specific industries. For example, ski area courses are held at a ski area where an active avalanche safety program can be demonstrated, ski guiding in the back country where terrain can be more extensively covered, and the transportation/industry courses near a highway location where traffic control can be discussed.

Course Content

Because the courses are intended for personnel working in areas where avalanche hazards are evaluated on a continuous basis, stress is placed on making and recording observations of weather, snow, and avalanche occurrences. A weather observation plot containing sets of thermometers, snow boards, snow stakes, precipitation gauges, and other equipment is set up at each course location and standard observations are carried out twice daily. Each student must maintain a field book which is checked at the end of the course.

More emphasis is placed on field applications during the Level II courses, than during the Level I courses where the instructional time is equally divided between classroom work and field activity.

All students of the Level II courses take the "hot seat" of the accident simulator operated by staff of the B.C. Ministry of Transportation and Highways. In the simulator session the student views a section of terrain on a screen and co-ordinates the rescue of people buried in an avalanche. Since the operation does not run smoothly, the student is required to continuously re-evaluate the situation and make appropriate decisions. During the exercise, each student assumes the function of a rescue co-ordinator, something which is not possible in field exercises due to lack of time.

The duration of the courses is: five days for Transportation and Industry Level I; seven days for Ski Areas and Ski Guiding Level I; and eight days for Level II.

Evaluation of the Students

There is no prerequisite for participants taking a Level I course for Transportation and Industry. The participants of the other Level I courses must be intermediate or advanced skiers, be equipped to make a day ski tour in variable terrain, and have a basic knowledge of avalanche terrain.

Participants who enter a Level II course must have completed a Level I or equivalent course--for example, Phase 1 and Phase 2 of the U.S. Forest Service National Avalanche School--and have applied the knowledge during at least 100 days of field work.

At the end of a Level I course the students take an examination in which they are rated as follows:

Making a set of weather observations	20 points
Observation of a test snow profile	20 points
Questionnaire about the characteristics of avalanches and safety measures	20 points
Field book	10 points
Evaluation of terrain	20 points
Attitude and effort displayed during the course	<u>10 points</u>
Total	100 points
Pass mark	71 percent

The students of a Level II course are examined and rated as follows:

Entry examination of the knowledge acquired in the Level I courses	15 points
Quiz during the course	5 points
Making a set of weather observations at the end of the course	6 points
Complete snow profile at the end of the course	18 points
Stability evaluation at the end of the course	6 points
Field book	5 points
Evaluation during field trips	<u>45 points</u>
Total	100 points
Pass mark	71 points

The evaluation during field trips by the group instructors concerns the following:

1. knowledge of terrain and skill in route selection;
2. skill in observing the snow, the weather, and avalanche hazards; and
3. ability to make decisions and use common sense.

Instructors

The success of the course depends on three basic qualifications of the instructors: thorough knowledge of the topic; the ability to teach; and the willingness to work with the other instructors as a team. The instructors must have experience with avalanche safety operations. For example, an instructor discussing weather observations must have carried out frequent standard observations and applied them in avalanche hazard evaluation, and an instructor of search and rescue techniques must have been in charge of a rescue group and have been a leader in numerous practices.

All instructors must attend a one- or two-week long instructional techniques course at the B.C. Institute of Technology. These courses have proved to be of great assistance in preparing instructional aids and improving the classroom performance of instructors.

An important requirement is that instructors cooperate with other instructors and teach the generally accepted standards. This may sound trivial but the mountains and the snow attract persons who are individualistic in character, who are defensive of their ideas, and who find it difficult to work in a team.

The qualifications for instructors, drafted at a meeting of avalanche personnel in Canada, are included in the Appendix. The instructors are selected and evaluated by their seniors and the course co-ordinator. A candidate is an assistant instructor for at least two years before he becomes a full instructor. Assistant instructors who prove to have insufficient knowledge and experience, are unable to teach, or are incapable of team work, are not retained for future courses.

The requirement that instructors be experienced in an avalanche safety operation severely restricts the recruiting base. Although many persons qualify, most of them are unable to leave their own operations for an extended period of time during the winter. The standard complement of a Level I course is two full instructors, one of them being the course leader and two assistant instructors. The Level II courses usually are instructed by three or four full instructors.

Experience in the field has shown that an instructor should lead a group of six but not more than eight students, and that the number of students in a course should not exceed 25.

Locations

A location suitable for avalanche courses should have:

1. readily accessible avalanche terrain;
2. practise areas that are accessible in bad weather and when avalanche conditions prevail;
3. reliable snow conditions;
4. an active avalanche safety program;
5. good classroom facilities and a separate room for the accident simulator;
6. low-cost accommodation;
7. short travel distance for the students; and
8. short distances between accommodation, classroom, and practise areas.

The ideal location does not seem to exist in Canada. Because many courses must be held in November and December, reliable snow conditions in the early part of the winter are the most important consideration in choosing a location, but in past years this has meant a trade-off with unsatisfactory classrooms or marginal touring terrain.

Cost

The cost of information courses and operational courses is high. The heavy budget items are preparation and administration, and instructors' time because of the high instructor/student ratio.

The true cost of the courses is about \$100 per student and instructional day, but the fees are lower because supporting agencies such as the National Research Council, the British Columbia Ministry of Transportation and Highways, Parks Canada, the ski areas, and helicopter ski operators make their staff available free of charge and also provide free services. A further reduction is possible through subsidies by the B.C. Ministry of Education, the B.C. Ministry of Lands, Parks and Housing, and Canada Employment and Immigration.

The free services and subsidies allowed the 1980-81 course fee to be set at \$150 for the five-day Transportation and Industry courses and \$250 for the seven or eight-day ski area and ski guiding courses. These prices compare favourably with those charged for industrial training programs, but seem to reach the limit of acceptability for students who work in the recreation industry. Conversely the fees do not seem to deter a large number of students who have no professional interest, but participate in order to satisfy their own curiosity.

Future

One would expect a saturation of training after a few years, because the need for avalanche personnel in government, industry, and private business is limited. The growing number of registrations for avalanche courses, however, refutes this idea. One reason is the heavy turnover of staff in road maintenance and ski patrols requiring continuous training of new staff; another is the shift of avalanche problem areas. Ten years ago the operation of numerous mines in avalanche terrain in Western Canada necessitated that mine personnel and inspectors take avalanche training. Later, ski area and highway management became concerned about avalanches, and, in recent years, a strong interest in back country skiing has required the training of mountain and ski guides. A recent surge of development of mines in the mountains might renew the cycle.

The operational avalanche courses serve both government and industry. For this reason industry, government agencies, and skiing and guiding associations are encouraged to assist the National Research Council and the British Columbia Institute of Technology by defining training needs and commenting on the types of courses, programs, and methods of instruction that they see as necessary.

Acknowledgement

The success of the avalanche courses in Canada is the result of the dedication of the instructors and the staff of BCIT, and the support of agencies and organizations. Special thanks are due to the Superintendents of Glacier, Banff, and Jasper National Parks, the Ministry of Transportation and Highways of British Columbia, the management of Whistler Mountain Ski Corporation, Red Mountain and Marmot Basin ski areas, Canadian Mountain Holidays, and others.

This paper is a contribution from the Division of Building Research, National Research Council and is published with the approval of the Director of the Division.

AppendixInstructor Standards for Operational CoursesPrincipal Instructor

The person is the leader of an operational course and must:

- be an acknowledged expert in all aspects of the avalanche field;
- be an administrator;
- currently practise in the field;
- know the area of the course;
- have successfully completed an instructional techniques course.

Full Instructor

Full instructors teach a major topic (for example, rescue, control) in the classroom, and--together with assistant instructors--conduct the work in the field. The person must:

- have been an assistant instructor in operational courses for two years;
- have extensive experience in mountain travel;
- know the students' areas of interest;
- know the current avalanche safety and control practices;
- have two seasons continuous experience in making observations of the snow, weather, and avalanches; and in the analysis of snow stability;
- have participated in frequent rescue practices;
- have demonstrated leadership qualities;
- have successfully completed an instructional techniques course.

In addition, a full instructor must be experienced in his specialty; this would usually be achieved by being active in an operation during four seasons in the following capacity:

- conducting snow, weather, and avalanche observations and stability analysis on a continuous basis (for instructors of snow observations and stability analysis);
- undertaking extensive travelling in avalanche terrain as a leader (for instructors of safety measures and terrain evaluation);

- undertaking control work (for instructors of avalanche control);
- organizing frequent search and rescue practises (for instructors of search and rescue);
- preparing hazard zoning (for instructors of terrain courses).

Assistant Instructor

Assistant instructors lead groups in field work and present short topics in the classroom. Usually they do not instruct Level II operational courses. The person must:

- know the course material and have completed an operational avalanche course Level II (or equivalent);
- have three seasons experience in ski touring as party leader;
- have been a leader of three avalanche rescue practises;
- be recommended by an existing instructor;
- have the ability to instruct, demonstrated as an assistant instructor or instructor at an information course;
- participate in one five-day operational course or teach one two-day information course each year;
- have made weather, snowpack, and avalanche observations in an operation for two winters.