Avalanche Safety Plan Template for Snowmobile Clubs

A Guidance Document for Avalanche Professionals and Snowmobile Clubs in British Columbia
The Canadian Avalanche Association

The Canadian Avalanche Association (CAA) is a non-profit association whose vision is to ensure the Canadian public has the highest degree of confidence in the avalanche safety programs and services delivered by CAA members.

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The CAA would like to thank the workshop team who brought together members a diverse community of stakeholders in September 2012 in Kelowna, BC to commence in the dialogue that led to document:

Grant Statham, Alpine Specialists Consulting
Janice Johnson, AF Certified Professional Facilitator
Particular thanks are due to Grant Statham for developing the first draft of this document based on the workshop.

Appreciation is also owed all the workshop participants:

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PREFACE
This guidance document is intended to assist both snowmobile clubs and avalanche professionals in their preparation of Avalanche Safety Plans (ASP). It provides a template outlining the structure of ASP’s and where appropriate, contains explanatory notes to clarify specific details pertaining to ASPs for snowmobile clubs.

The information contained within this document has been prepared based upon the Canadian Avalanche Association’s (CAA) Recommended Generic Table of Contents – Avalanche Safety Plans (2008). The structure and contents of this template were then modified based upon a stakeholder workshop held in Kelowna, BC on September 12-13, 2012.

WHO SHOULD USE THIS TEMPLATE?
This ASP template is intended for avalanche professionals and snowmobile clubs that operate grooming or other services on resource roads or trails with fixed start and end locations, and where the exposure to avalanche terrain on these roads is limited to low frequency, or ATES Class 1 (Simple) terrain only. Where operational conditions deviate from the description above it is likely the ASP will need more resources than are described in the plan below. These limitations are described below and referred to at several points within this document.

THE TEMPLATE APPROACH AND ITS LIMITATIONS
The avalanche professional, the snowmobile club and other stakeholders must be aware of the limitations of the template approach provided here. Responsible access to avalanche terrain requires a balanced approach between applied forecasting and risk assessment resources and limitations on the access to the benefit (travel, resource extraction or other). In general, where continual access to avalanche terrain is desired the more forecasting, risk assessment and treatment resources are required.

For instance, the BC Ministry of Transportation’s avalanche program has two operational objectives. The first is to deliver avalanche safety for highway users; the second is to minimize avalanche-related traffic interruptions on the province’s highways. The safety target could be achieved by closing mountain passes for the winter and few resources would be required to do so. Meeting the second goal of near continual access to the highways that pass through avalanche terrain requires a different tactic. Constant monitoring and application of safety measures by avalanche professionals, who have considerable resources, and the skills to accurately assess avalanche conditions are employed. Temporary highway closures do still occur when avalanches are expected to reach the highway but having in-house avalanche forecasters helps ensure that closures only last as long as the avalanche events require.

Where fewer forecasting resources are available to address avalanche uncertainty, stakeholders cannot have the same expectation of near continual access. The avalanche professional and the snowmobile club must engage in a dialogue that strikes an achievable balance between the club’s
desire to access the avalanche terrain and their ability to ensure the safety of their workers. The limiting factor will often be the resources available to the club (training in hazard assessment, access to expert snowpack assessment, access to weather resources, etc.) The goal should be to create an ASP that provides responsible access to avalanche terrain for the worker (trail groomers or others), based on the resources available to assess and/or mitigate risk.

To move along the continuum of responsible access to avalanche terrain, appropriate steps must be taken to address uncertainty as it increases. Uncertainty about avalanche danger increases with terrain complexity, snowpack complexity, weather and other factors. The template approach suggested here is for simple terrain. The professional and the snowmobile club must work with the shared understanding that as the complexity of the avalanche context increases (additional terrain complexity, high regional avalanche danger ratings, or rapidly changing weather) either more resources must be applied to reduce uncertainty, or access must be reduced. The primary goal is to reduce the risk of uncertainty facing the worker. Reducing uncertainty around closure frequency and duration must be accepted as a secondary goal. Sending workers into situations of unaddressed avalanche risk to reduce risk of trail closures is not acceptable.

At the workshop in Kelowna, snowmobile clubs, representatives of Recreation Sites and Trails BC, avalanche professionals and other stakeholders identified that many snowmobile clubs require an ASP that addresses worker safety for grooming or other services on resource roads or trails with fixed start and end locations, and where the exposure to avalanche terrain on these roads is limited to low frequency, or ATES Class 1 (Simple) terrain only. This ASP template is designed only for use by Recreation Sites and Trails BC Partnership Agreement holders. This ASP template is NOT intended for snowmobile operations that ask workers to move through avalanche terrain that significantly deviates from the ATES Class 1 (Simple) terrain described above, such as unbounded, challenging or complex terrain. Nor is it designed for operations that offer guided services. As stated above such operations require more detailed mapping and risk assessment work. This document points out these limitations at several junctures.
WHO NEEDS AN AVALANCHE SAFETY PLAN?

In BC, the Occupational Health and Safety (OHS) Regulation is overseen by WorkSafeBC (WSBC). OHS Regulation 4.1 states that “A workplace must be planned, constructed, used and maintained to protect from danger any person working at the workplace.”\(^1\) The planning and maintenance described above is done within the context of a safety plan, in this case an avalanche safety plan. The requirement for creating and maintaining such safety plans is placed clearly upon employers. In the case where a snowmobile club employs workers, the club must ensure those workers are protected “from any danger in the workplace” including hazard from avalanches. WorksafeBC uses the Workers Compensation Act (WCA) to define a worker. In the most basic sense, the WCA states a worker is “any person who is in a contract of service or apprenticeship, written or oral, express or implied.” Clubs should review the full definition offered by the WCA to determine if additional clarifications from the WCA apply to define workers within club operations.\(^2\)

Snowmobile clubs will want to consider to what degree OHS legislation applies to their activities and individuals carrying out those activities.

Recreation Sites and Trails BC acknowledges that many volunteer partnership agreement holder snowmobile clubs may not use “workers” as defined by the Workers Compensation Act of BC. The use of volunteers is key in delivering the RSTBC program. In the case of this Avalanche Safety Plan template, RSTBC recommends implementation of this standard for both workers and volunteers.

\(^1\) [http://www2.worksafebc.com/publications/OHSRegulation/Part4.asp - SectionNumber:4.1](http://www2.worksafebc.com/publications/OHSRegulation/Part4.asp - SectionNumber:4.1)
\(^2\) The definition of a worker is fully in two sections of the BC Workers Compensation Act – [Part 1](http://www2.worksafebc.com/publications/OHSRegulation/Part1.asp - SectionNumber:106) and [Part 3, Section 106](http://www2.worksafebc.com/publications/OHSRegulation/Part3.asp - SectionNumber:106)
WHO CAN PREPARE AVALANCHE SAFETY PLANS?
WSBC has provided employers with the following guidance: “Employers should rely on qualified persons—those knowledgeable of the work, the hazards involved and the means to control the hazards, by reason of education, training, experience or a combination thereof—in the identification and control of avalanche risks.”

Clubs need to work with a person “knowledgeable of the work, the hazards involved and the means to control the hazards, by reason of education, training, experience or a combination thereof.” The burden is on the employer to determine if potentially qualified persons meet these standards; a number of CAA Professional Members will have the skills and training necessary to prepare snowmobile ASPs. A list of CAA Professionals who offer services including the development of safety plans can be found on the CAA’s website³.

Conversely, snowmobile clubs and other employers approaching CAA members should have confidence that the member will be honest and forthright about their abilities and experience. The CAA’s Code of Ethics, Section 3a states the members of the CAA “will only undertake those assignments for which (he/she) is qualified by experience.”⁴ CAA members who have questions about this aspect of self-assessment relative to producing avalanche safety plans should contact the association.

DETERMINEING IF THE TERRAIN REQUIRES AN ASP

Initially a preliminary avalanche potential assessment must be made to determine if avalanches may affect the work area. If a preliminary assessment identifies an avalanche risk zone, no work may be conducted in the avalanche risk zone when snow conditions have the potential to create an avalanche unless an ASP has been developed and implemented.

If no expertise exists within the snowmobile club to undertake an initial identification of potential avalanche hazard, then the flowchart in Figure 2 can be applied to determine the need to bring in further expertise.

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³ https://www.avalancheassociation.ca/search/
⁴ https://www.avalancheassociation.ca/?page=Governance
If the club determines that there is potential avalanche hazard, and the club has groomers or other workers exposed to this hazard, then the club requires an ASP and will need to work with a qualified person to prepare and implement this plan.

The following pages demonstrate the recommended structure for this type of ASP.
SUGGESTED TABLE OF CONTENTS FOR A SNOWMOBILE CLUB ASP

Approval Page

Section 1 – Establishing the Context
1.1 The Snowmobile Club and its History
1.2 Club Structure and Accountabilities
1.3 Operational Description and Objectives
1.3 Scope of the Avalanche Safety Plan

Section 2 – Avalanche Risk Assessment
2.1 Avalanche Risk Identification
   2.1.1 Snowmobile Club Operating Area
   2.1.2 Elements at Risk
   2.1.3 Geography and Climate
   2.1.4 Avalanche Terrain Mapping
2.2 Avalanche Risk Analysis
   2.2.1 Avalanche Hazard
   2.2.2 Exposure to Avalanche Hazard
   2.2.3 Vulnerability
   2.2.4 Characterization of the Risk
2.3 Avalanche Risk Evaluation
   2.3.1 Risk Target
   2.3.2 Comparison of Risk Analysis with Risk Target

Section 3 – Avalanche Risk Treatment
3.1 Hazard Monitoring and Record Keeping
3.2 Operational Procedures
3.3 Worker Qualifications and Training
3.4 Equipment and Infrastructure
3.5 Communications
3.6 Accident and Near-Miss Reporting
3.7 Emergency Response
ASP's should be developed collaboratively between the snowmobile club and the avalanche professional. The approval described below demonstrates that the avalanche professional and the snowmobile club have worked in good faith to:

1. Develop a safety plan that describes the evaluation process and the procedures the club will follow in order to protect workers and;
2. Achieve a balanced approach to delivering worker safety and accept that interruption of access is likely to be necessary in order to achieve the desired worker safety goals and;
3. The resources necessary for delivering the avalanche safety program described in the safety plan have been considered and are both accessible and acceptable.

Imaginary Valley Trail Avalanche Safety Plan

This Avalanche Safety Plan has been reviewed and approved by:

_________________________________  ____________________
Mr. John Doe  Date
CAA Professional
[ or similarly qualified person]
Consulting Company Ltd.

_________________________________  ____________________
Ms. Sally Smith  Date
President, Imaginary Valley Snowmobile Club

This plan is valid as long as the operational conditions described below remain constant. Changes in operational conditions that may warrant a review of the plan include but are not limited to: changes in terrain; conditions of tenure; number of workers exposed to avalanche terrain; changes in Occupational Health and Safety Regulations affecting this plan; or, other factors that may diminish the ability of this avalanche safety plan to protect from danger any person entering the workplace described in this document. If any such change occurs, the snowmobile club commits to consulting a qualified person to determine whether changes in the plan are required.
Section 1 – Establishing the Context
Context describes the circumstances that surround the club, and establishes the environment in which the organization seeks to achieve its objectives. It is important that the club and the avalanche professional discuss the club goals and objectives ahead of time to ensure a solid working relationship and to establish shared expectations.

1.1 The Snowmobile Club and its History
This section provides an introduction to the club and describes its culture and history. Include any logos, mission statements or other information that can inform on the context of the club itself.

1.2 Club Structure and Accountabilities
This section should describe the organizational structure of the club, including an organizational chart if that is helpful. Additionally, it is essential to identify who is responsible and accountable for decision making with regards to risk management. Who owns the risk that the club assumes? What position or person in the club will be responsible for ensuring that the safety measures described in the ASP are consistently carried out in the workplace? All parties should be aware of the responsibilities they have undertaken relative to the risks avalanches pose to operational objectives. It is critical to note that the employer is ultimately responsible for worker safety under OHS regulations irrespective of insurance arrangements.

1.3 Operational Description and Objectives
Define the objectives of the club, and describe any agreements in place with land managers, partner organizations, or contractors. Describe the operations of the club and the strategies used to reach the objectives. This is where the avalanche professional and the club management must begin to achieve an understanding of the balance between meeting operational objectives and the resources required to meet those objectives. Options may be developed that help both parties explore the likely cost/benefit or operational objective/resource availability factors that will ultimately shape the final ASP. This is an iterative process that primarily relies on the avalanche professional to guide the club toward an acceptable balance.

1.4 Scope of the Avalanche Safety Plan
Describe the scope of this avalanche safety plan, and any other parameters that are important to establish in considering the risk management (e.g., if there is significant public use of this land, but the ASP is for staff only, then this should be highlighted). This is an important section of the ASP because it establishes the limits of the plan’s authority.
Section 2 – Avalanche Risk Assessment
Risk assessment is the overall process of risk identification, risk analysis and risk evaluation.

2.1 Avalanche Risk Identification
This area is where all sources of avalanche risk and areas of impact are identified. With respect to avalanches specifically, this section describes what is at risk, and the source of that risk.

2.1.1 Snowmobile Club Operating Area
Describe the operating area of the club in detail, and include an overview map to illustrate area boundaries. Ensure all important features are located on the map (parking areas, jurisdictional boundaries, resource roads, cabins, weather stations, rescue caches, generalized location of avalanche terrain considered in the safety plan, closure points, etc.). Reference any formal agreements in place with land managers and adjacent operations.

From this map and accompanying description, it should be clear exactly where the club operations occur, and where any facilities or infrastructure is located.

Specifically identify the geographical limits of the ASP. The club may have tenure over a large area but the ASP may be only applicable to employees while they are on the normally traveled portion of a single road with clearly defined avalanche area start and end points.

2.1.2 Elements at Risk
This section should include all elements of value that could be exposed to avalanche risk for which the snowmobile club is responsible. The list of elements at risk to be considered may include:

- People – workers, operating groomers, snow hosts, volunteers etc;
- Equipment - groomers, snowmobiles etc.; or,
- Infrastructure - cabins, bridges, etc.

These items are offered here as examples only; actual elements at risk will vary from club to club.

The avalanche professional and the snowmobile club will find that infrastructure elements are not easily considered under ATES as they are in a different class of elements at risk. Unlike people and machines, infrastructure cannot be readily removed from danger in most cases. Accordingly, fixed facilities will not readily fit the template style of ASP development that is the focus of this document, and will likely need to be addressed by other means.

2.1.3 Geography and Climate
Include here an overview of the geography that identifies the mountain range, drainage and terrain where the club operates. Include any unique characteristics specific to this particular area, reference points such as latitude/longitude, and the relative distances from recognizable urban
areas. A general map is important to place the region into context with surrounding operations, and the rest of the province.

A description of the typical climate is important and should include either statements or data to support typical snowpack depths, temperature regimes and wind patterns. Apply any local knowledge that demonstrates climate differences across the region. Discuss common weak layers, snowpack properties and patterns in avalanche activity.

2.1.4 Avalanche Terrain Mapping
Mapping is an essential component of any ASP, and is the most important risk identification method. The process of avalanche terrain mapping requires a detailed study of all avalanche terrain affecting the elements at risk, and locating them precisely for reference on a map. Following the mapping, signage should be installed on the road delineating entry and exit points of each avalanche path or group of paths. As this ASP is for situations that are similar to a transportation route, common practice is to sign avalanche paths or close groupings of paths with an “avalanche area no stopping” sign and an “end avalanche area” sign. While such signs are primarily risk identification tools for workers in the field, they have secondary benefit as warning for recreationists.

There are various methods of avalanche terrain mapping. For straightforward linear roads, either locator maps or avalanche atlas maps are appropriate. While this document focuses on ATES Class 1 (Simple) terrain, it bears mentioning that the level of mapping detail required depends on the combination of terrain complexity and the proposed activity.

Figure 3: Hypothetical example of a locator map. Arrows show the direction of flow and the location of impact on the road (B Gould, Alpine Solutions)
Another commonly applied technique for terrain mapping is the use of the Avalanche Terrain Exposure Scale (ATES). This method is most appropriate for areas of unbounded backcountry terrain, or for resource roads affected by just one or two avalanche paths with a frequency of greater than once every 30 years (ATES Class 1 – Simple), in combination with locator maps.

In some regions of BC, public ATES mapping is available. While it is appropriate to include these maps in an ASP, it is important to recognize that this mapping was done for recreational trip planning purposes and the specific terrain that affects the road should be studied in more detail. Any use of ATES maps requires supplementary information to identify specific path locations on the maps. Kilometre markers to delineate path locations are the most basic method.

Figure 4: Two hypothetical examples of avalanche atlas mapping using contour maps or oblique photographs to identify path boundaries and specific locations of impact on the road (B Gould, Alpine Solutions)

Figure 5: An example of a public ATES map produced for recreational trip planning purposes. Used in an ASP, these maps must be supplemented by specific avalanche path locations (CAC).

http://www.lauegi.conselharan.org/files/ATES%20ISSW%202004.pdf
2.2 Avalanche Risk Analysis
This area is where the specific components of avalanche risk (probability, magnitude, exposure and vulnerability) are analysed in detail. Depending on the problem, either qualitative or quantitative techniques may be used. Typically in low frequency or ATES Simple terrain, qualitative techniques are sufficient.

2.2.1 Avalanche Hazard
An analysis of avalanche hazard potential includes considerations of the frequency of avalanche occurrences reaching the road, and the destructive potential (size) of the avalanche. This section should describe that analysis and its results.

2.2.2 Exposure to Avalanche Hazard
Analyze the interaction between the elements at risk, and the avalanche hazard. Consider both the length of time and number of people exposed to the hazard. The speed at which workers are able to move through the area of exposure by various means (e.g., groomer, snowmobile) is a factor to be considered here. As an example, on a single trip along the road a snowmobile will normally travel at a higher speed than a snowcat so the snowmobile is in the avalanche path exposed to the hazard for less time.

2.2.3 Vulnerability
Analyze the vulnerability of the elements at risk to the hazard. For example, while a person on foot or on a snowmobile may be vulnerable to a size 2 avalanche, a groomer in a snowcat may not be. This is an important area to carefully consider and articulate the protection afforded by enclosed vehicles.

2.2.4 Characterization of the Risk
This is a summary area which describes the risk (e.g., worker in a snowcat is exposed to two large, infrequent avalanche paths for short periods during trail grooming three times per week). Terrain considerations and other factors that affect the consequences of being involved in an avalanche can be considered here. For instance, we could consider the same worker in a snowcat with the same rate of exposure but shift the character of the risk from only avalanche burial/impact to include the consequence of an open body of water directly below the road or a section of road between two road cuts that increases depth of avalanche deposits.

In some cases it may be possible to characterize the risk as low, medium or high. Quantitative techniques provide a more specific measure of risk, but require context in order to explain their relevance.
2.3 Avalanche Risk Evaluation

In this section the ASP should identify how the information in the previous sections combines and can be applied in the snowmobile club’s specific working environment. The avalanche hazard (2.2.1), exposure (2.2.2), vulnerability (2.2.3) and the character of the risk (2.2.4) all contribute to this evaluation. This will guide the decisions on the amount of (forecast) avalanche activity that triggers a specific safety measure in the matrix (risk treatment) that will be developed later in this document.

For instance, if the club has workers traveling through the avalanche area on snowmobiles and also in snowcats the matrix may identify that when size 2.0 avalanches are expected (forecast) to reach the road workers on snowmobiles are no longer allowed to travel through the avalanche area. Another step in the matrix may identify that when avalanches greater than size 2.0 are forecast to reach the road it is also closed to snowcat operations. This example recognizes an evaluation of vulnerability done earlier in the plan that should be included in this section.

If the same road traveled directly above a 10m high cliff the matrix might close the road to snowcats when size 2.0 avalanches are expected. This example now includes the character of the risk that was evaluated earlier and this should be included in this section.

2.3.1 Risk Target

Snowmobile clubs with employees that work in avalanche terrain have an obligation to meet WSBC’s OHS Regulation 4.1 that requires “workplaces to be planned, constructed, used and maintained to protect from danger any person working at the workplace” and this is the risk target that employers must meet. This requires an honest and thoughtful discussion by those accountable for the risk.

It is important to recognize that the objective of risk management is not specifically about the elimination of risk. Good risk management recognizes the benefits of risk, and strives to reduce the risk to as low as reasonably possible. Elimination of risk is often impossible given the operating context. Nevertheless, the club and the avalanche professional or similarly qualified person must develop, in good faith, an ASP that provides the employer with a plan that, when followed, can reasonably be expected to deliver appropriate safety measures for workers and therefore meet the regulatory requirement to protect workers.

2.3.2 Comparison of Risk Analysis and the Risk Target

This section will compare the results found in the risk analysis to the objective of achieving the risk target. Risk Treatment measures can then be identified that will close the gap between the risks identified in the risk analysis and the risk target. As noted earlier in section 1.3, this is an iterative process where the avalanche professional will be able to guide the club toward safety measures that provide an appropriate balance between achievement of the safety goals, the resources that can be applied and the amount of access or service interruption that is required to meet the safety goals.
This section would also include identification of the residual risks that may remain after all the treatment measures have been implemented.

After the risk treatments (identified and documented below) are in place the plan must achieve the objective of the WSBC OHS Regulation requiring the plan “protects from danger any person entering the workplace.”

Section 3 – Avalanche Risk Treatment
Describe the measures that are implemented to reduce the avalanche risk.

3.1 Hazard Monitoring and Record Keeping
If an operation has any degree of avalanche risk, then some level of hazard monitoring, assessment and record keeping must be undertaken. This can range significantly, from basic checking and saving the public avalanche bulletin, to a more detailed daily analysis of weather and snowpack. For low risk operations, following the public avalanche bulletin, supplemented with a basic set of local weather and avalanche observations, may be appropriate.

It is essential to recognize the limitations of public avalanche bulletins. These products are produced for recreational purposes, and generally apply to vast regions. Significant variation within each region is common. The bulletin is not intended for use at night. There is an expectation that those using the bulletin will take additional measures to determine the validity of the bulletin in the situation and terrain they are using (e.g., ATES, Avaluator, avalanche safety training). While a single danger rating may appear to be a useful measurement of hazard, local ground truthing is required. This means that some system of checking the bulletin and then confirming it against local conditions is necessary.

The basic requirement for a weather station are: maximum/present and minimum thermometers, snow stakes to measure snow depth, snowboard to measure recent snowfall and a field book to record those observations and personnel that are trained to use this equipment.

The ASP will provide detailed descriptions of the monitoring and record keeping requirements that the club will undertake.

3.2 Operational Procedures
This section specifies the procedures used to control the avalanche risk to workers. Typically this will describe a process for monitoring the hazard as described in section 3.1, along with a decision making system that specifies the safety measures workers will follow.

Figures 6 and 7 show two examples of a very simple rule-based decision making system that can be useful for clubs developing an ASP for specific low frequency or ATES Class 1 (Simple)
terrain. This system offers clear guidance founded upon simple input parameters that make them easy to use. This is not the only type of decision making tool available, the avalanche professional you are working with will advise you if other options are suitable.

The first example, shown in Figure 6, relies on snowmobile club personnel using the CAC Public Avalanche Bulletin danger rating to determine when to apply specific safety measures. In this example the safety measures are quite conservative because they need to accommodate the relatively high degree of uncertainty caused by applying the regional forecast from the bulletin to the local avalanche terrain that the ASP is applicable to. Use of the North American Avalanche Danger Scale also adds to the uncertainty as it is not intended as a tool to determine where natural avalanches will runout in relation to a specific section of road.

A second example is shown in figure 7. In this case the club will consult their avalanche professional when the CAC Public Bulletin is at or higher than Considerable. The avalanche professional is able to provide a prediction of the likelihood and character of avalanches reaching the road in the terrain identified in the ASP. This example provides some increase in the access to the sections of road that are exposed to avalanches and still meets the safety target.

**These are only examples** and neither of the examples can be simply adopted as shown in this document. The process of terrain, hazard and risk evaluation and development of balanced risk treatments must always be undertaken in order to determine the safety measures that are reasonable for the natural environment the club operates in and the type and amount of access to the avalanche terrain that can be achieved with the resources available.
<table>
<thead>
<tr>
<th>North American Public Avalanche Danger Rating from CAC Bulletin</th>
<th>Safety Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5 Extreme</strong> – Large to very large avalanches in many areas</td>
<td><strong>Closed to all workers</strong></td>
</tr>
<tr>
<td><strong>4 High</strong> – Large avalanches in many areas, or very large avalanches in specific areas</td>
<td><strong>Closed to all workers</strong></td>
</tr>
</tbody>
</table>
| **3 Considerable** – Small avalanche is many areas, or large avalanches in specific areas, or very large avalanches in isolated areas | **Snowcat Operations:**  
- restricted to non-stop travel through avalanche areas;  
- do not exit vehicle in avalanche area;  
- travel in tandem or check-in at entrance & exit of each avalanche area;  
- each operator wears avalanche transceiver  
**Snowmobile Operations:**  
- restricted to non-stop travel through avalanche areas during daylight;  
- travel in tandem AND check-in at entrance & exit of each avalanche area;  
- each operator wears avalanche transceiver |
| **2 Moderate** – Small avalanches in specific areas, or large avalanches in isolated areas | **Snowcat Operations:**  
- do not exit vehicle in avalanche area;  
- each operator wears avalanche transceiver  
**Snowmobile Operations:**  
- restricted to non-stop travel through avalanche areas;  
- travel in tandem;  
- each operator wears avalanche transceiver |
| **1 Low** – small avalanches in isolated areas or extreme terrain | **Snowcat Operations:**  
- do not exit vehicle in avalanche area;  
- each operator wears avalanche transceiver  
**Snowmobile Operations:**  
- restricted to non-stop travel through avalanche areas;  
- travel in tandem;  
- each operator wears avalanche transceiver |

**Level of Training**  
Basic in-house training as prescribed in ASP

*Figure 6: An example of a safety measures matrix based on the public avalanche bulletins.*
<table>
<thead>
<tr>
<th>North American Public Avalanche Danger Rating from CAC Bulletin</th>
<th>Professional Forecast for the specific avalanche areas used by the snowmobile club</th>
<th>Safety Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Extreme - Large avalanches are expected to reach the road</td>
<td>Closed to all workers</td>
<td>Snowcat Operations:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• restricted to non-stop travel through avalanche areas;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• do not exit vehicle in avalanche area;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• travel in tandem AND check-in at entrance &amp; exit of each avalanche area;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• each operator wears avalanche transceiver</td>
</tr>
<tr>
<td>4 High - Large avalanches are not expected to reach the road</td>
<td>Snowmobile Operations are CLOSED:</td>
<td>Snowcat Operations:</td>
</tr>
<tr>
<td>And Small avalanches harmful to persons outside of vehicles may reach the road</td>
<td></td>
<td>• do not exit vehicle in avalanche area;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• travel in tandem or check-in at entrance &amp; exit of each avalanche area;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• each operator wears avalanche transceiver</td>
</tr>
<tr>
<td>3 Considerable - Large avalanches are not expected to reach the road</td>
<td></td>
<td>Snowcat Operations:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• restricted to non-stop travel through avalanche areas;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• travel in tandem AND check-in at entrance &amp; exit of each avalanche area;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• each operator wears avalanche transceiver</td>
</tr>
<tr>
<td>2 Moderate – Small avalanches in specific areas, or large avalanches in isolated areas</td>
<td>No consultation required</td>
<td>Snowcat Operations:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• do not exit vehicle in avalanche area;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• each operator wears avalanche transceiver</td>
</tr>
<tr>
<td>1 Low – small avalanches in isolated areas or extreme terrain</td>
<td>No consultation required</td>
<td>Snowcat Operations:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• do not exit vehicle in avalanche area;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• each operator wears avalanche transceiver</td>
</tr>
</tbody>
</table>

Figure 7: An example of a safety measures matrix based on the public avalanche bulletins and consultation with an avalanche professional when bulletin indicates elevated hazard.

3.3 Worker Qualifications and Training
This section should provide specific guidance on what qualifications or training is required for snowmobile club workers and for the avalanche professional participating in avalanche forecasting with the club.

In many cases the avalanche safety training needs for most of the snowmobile club personnel could be met with an annual training session of about eight hours. The content should be tailored to the avalanche terrain and the access situations addressed in the club’s ASP. It is the
employer’s responsibility to ensure that workers are trained to implement the safety measures in the ASP.

Key concepts to be included in such in-house training are:

- Avalanche terrain awareness and familiarity
- Operational procedures – Safety Measures
- Communications procedures
- Avalanche rescue training (with follow up rescue practices during the winter)
- Use of personal protective equipment

The avalanche professional designing the ASP may identify a benefit from some of the club workers also taking a more general avalanche safety course such as the Canadian Avalanche Centre’s Avalanche Skills Training.

The CAA offers a five-day Resource and Transportation Avalanche Management course which may be an option in certain cases.

Pre-existing courses that club workers have already taken should be examined relative to the knowledge and skills required to fulfil their role in the ASP. Ultimately, the avalanche professional working with the snowmobile club to ensure the training is relevant and appropriate to the risks faced by workers under the ASP.

3.4 Equipment and Infrastructure

The type of equipment related to avalanche safety, its location and maintenance schedules should be listed specifically in this section, and could include the following:

- Personal protective equipment – avalanche transceivers, shovels, probes, warm clothing
- Rescue equipment carried on snowmobiles and in snowcats
- Communication – radios, satellite phone, SPOT, cell phones, computers.
- Weather stations – thermometers, snow stakes, rulers.
- Signage – avalanche area entry and end points, avalanche path names, km markers, hazard markers, public maps, info
- Record book/computer – what equipment is used to keep the records
- Avalanche rescue caches – specific inventory and location of caches
- Grooming equipment – type and number of snowcats, snowmobiles
3.5 Communications
Communication protocols are essential for the safe functioning of any operation. However, significant challenges exist in remote areas and in operations where people are working alone or in isolation (the employer should consider their responsibilities under WSBC OH&S Part 4). This section of the ASP should describe in detail the communication protocols and equipment the club will use in their operations. Here are a few basic concepts:

- Trip plan – should be registered for any field work undertaken
- Check-in protocols – regular two-way communication check-in with a responsible person or co-worker is mandatory
- Protocols for missed check in – a response plan is required and may simply be a primary stage of the club’s search and rescue Plan.

3.6 Accident and Near-Miss Reporting
Documenting and reporting accidents or near-miss events is an important part of risk management. This is a club responsibility, and workers should be encouraged to report these incidents to the club.

<table>
<thead>
<tr>
<th>Accident or Near-Miss Recording Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
</tr>
<tr>
<td>Weather:</td>
</tr>
<tr>
<td>Description of Event:</td>
</tr>
<tr>
<td>Number of people involved:</td>
</tr>
<tr>
<td>Number of fatalities:</td>
</tr>
<tr>
<td>Description of injuries:</td>
</tr>
</tbody>
</table>

Recorded by:

Figure 8: An example of a basic near-miss or accident reporting format
3.7 Emergency Response

An avalanche rescue plan must be developed separately from the ASP, and practiced by all club members and staff who use this plan. Basic checklists and simple steps are essential for gathering important information and making good decisions under duress. This section of the ASP template provides some examples.

For many snowmobile club operations, two scenarios are possible:

1. Workers in the field are involved in, witness or come upon an avalanche accident, or
2. Base station staff receive notification that there has been an avalanche accident

The following protocols provide basic examples of response instructions for these scenarios.

**AVACANE RESPONSE – WORKER FINDS AVALANCHE ON THE ROAD**

**If you encounter an avalanche down on the road:**
1. Stay in your snowcat.
2. Communicate with your base station to give the location and estimated size of the avalanche (length on road and approximate depth).
3. Try to determine if anyone may be caught (Is the avalanche large enough? Is anyone missing?)
   - **IF SOMEONE MAY BE CAUGHT, INITIATE A RESCUE IMMEDIATELY**
     - Contact base and have them initiate an avalanche rescue call-out.
     - Evaluate upslope hazards (Will more snow come down?)
     - Determine safe areas and an escape route – appoint a spotter if possible
   - **IF YOU DETERMINE THAT IT IS SAFE FOR RESCUERS TO ENTER THE AREA:**
     - Expose a minimum number of people to the hazard
     - Ensure transceivers are on and take communication equipment (contact base and advise them you are going and to call you back every 5 min)
     - Conduct a quick search of the deposit looking for visual clues, probing likely burial spots and listening for transceiver signals.

Figure 9: An example of a laminated rescue card that should be carried by every worker, in every vehicle glove box, and in every avalanche rescue kit. This is a step-wise checklist for initiating a field based avalanche rescue.
Additionally, consider producing laminated cards to be carried by all workers travelling in avalanche terrain to provide a quick reference for action in the case of an avalanche, as shown in Figure 10.

<table>
<thead>
<tr>
<th>THERE HAS BEEN AN AVALANCHE.</th>
</tr>
</thead>
<tbody>
<tr>
<td>REMAIN CALM.</td>
</tr>
</tbody>
</table>

**Step 1** - Count: How many people are missing

**Step 2** - Call out for help (provide exact location, nature of accident and numbers missing).

**Step 3** - Is there any remaining hazard? Will another avalanche come down?

**Step 4** - Turn avalanche transceivers to SEARCH (ensure all party members are on SEARCH)

**Step 5** - Assemble probes and shovels

**Step 6** - Locate victims, extract victims

**Step 7** - Treat with first-aid, move to safe location, keep warm and prepare to evacuate

**CALL XXX-XXX-XXXX FOR HELP**

Figure 10: Contents of a laminated rescue card to be carried by all workers.

All base stations must maintain an avalanche rescue plan, and this must be a stand-alone document separate from the ASP. A basic plan would contain maps with location of avalanche paths, rescue caches and other important landmark, as well as a callout list with current contact information. The plan provides a basic set of instructions for the operator to follow to initiate an avalanche search and rescue response. It is typical to notify the RCMP and Emergency Management BC and request assistance at an early stage of the rescue.

The avalanche rescue plan must be updated annually or more frequently if personnel and resources change to ensure contact information is current. In addition, the club should run a minimum of one rescue practice at the start of each winter to test the system and ensure the communication and callout system is working.

The example shown in Figure 11 provides a base station operator with a template for recording the priority information, and then a prioritized list for callouts. Locations should be as specific as possible, using km numbers, avalanche path name or number or lat/long coordinates. These locations are marked on a map ahead of time for ease of reference.
## Avalanche Response Plan
You have received a call that there has been an avalanche accident. Remain calm and follow the steps below to gather information and call for a rescue.

<table>
<thead>
<tr>
<th>Date:</th>
<th>Time:</th>
<th>Reporting Person:</th>
</tr>
</thead>
</table>

**Exact Location of the Accident:**

**Location of the nearest rescue cache:**

**Location of mustering point for rescuers:**

<table>
<thead>
<tr>
<th>Number of people missing:</th>
<th>Number of people searching:</th>
</tr>
</thead>
</table>

**Contact numbers:**

- **RCMP:**
- **Emergency Management British Columbia:**
- **Adjacent operator 1:**
- **Adjacent operator 2:**
- **Local helicopter company 1:**
- **Local helicopter company 2:**
- **Avalanche dog:**

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Figure 11: *Base station information for recording avalanche accident information and call-out information.*

The avalanche professional that guides the development of the ASP will be able to advise the snowmobile club on the content of the Avalanche Search and Rescue Plan best suited to their operations.

The ASP will have a section that describes how the Avalanche Search and Rescue Plan will be updated and how to ensure that only current plans are distributed and in circulation.