

USING SNOWMOBILES FOR SLOPE SCALE TESTING AND MITIGATION

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ABSTRACT: As organizations like the Canadian Avalanche Association (CAA) and the Canadian Motorized Backcountry Guides Association (CMBGA) work to uphold high professional standards for snowmobiling within the avalanche industry, some procedures are still lagging in an industry historically oriented towards skiing. While best practices and risks of ski cutting are fairly defined by previous research and professional guidance (Jamieson, 2021; Jamieson et al., 2019; Stimberis, 2018), the use of snowmobiles for slope cuts remains inconsistent and informal across sled-based operations. In these operations, practitioners rely on snowmobiles to access terrain and inform slope-based decisions, yet there is little formal guidance on procedures for using the sled as a slope-scale tool for data collection or hazard mitigation.

This paper is motivated by the perceived inconsistency of field practices and the absence of guidance for sled cuts within the industry. It explores whether sled cutting can be summarized in a structured, intentional way that aligns with established principles of ski cutting, while acknowledging the unique risks, opportunities and limitations of snowmobile travel. This paper approaches sled cutting in two parts; sled cutting as data collection (slope-scale observation) and as a control measure (defensive cuts).

The guiding question is: **Are sled-based practitioners approaching the use of sled cuts with enough consistency to define a set of guidelines for the industry?**

The paper draws on an internal policy development at Avalanche Canada to adapt an existing ski cutting framework for mechanized use as the start of a broader discussion. The conversation is expanded to subject matter experts through a survey process to identify both the common ground and discrepancies between practitioners. It presents this as a proof of concept rather than a prescriptive standard. Key takeaways highlight the application, advantages, risks and limitations of sled cutting. The goal is to prompt dialogue and support collaborative progress toward guidance on best practices for practitioners.

KEY WORDS: Snowmobile, Sled Cutting, Mitigation, Slope-Test.

1. INTRODUCTION

In November of 2025, I was asked to present on general procedures for sled cutting to Avalanche Canada's Warning Service as part of their Annual Training. At the time, I had recently helped co-author Avalanche Canada's Safe Work Procedures (Avalanche Canada, 2025) for snowmobile operations and was tasked with discussing sled cutting as a supplementary topic.

The issue was that we had not specifically defined a Safe Work Procedure (SWP) for sled cutting. We did however, have a SWP for ski cutting that discussed general safe practices: like the intention of ski cuts, the need for a spotter, and moving from one position of safety to another (Avalanche Canada, 2025). It did not have documented guidance addressing the unique opportunities, considerations, and hazards associated with using a snowmobile as a slope-scale test or hazard mitigation tool.

As I prepared for that presentation, I found myself trying to set defined procedures for a practice I had used regularly throughout my career, but had yet to consider formally. Rather than searching for a published standard, my instinct was to compare my approach with that of other practitioners. If other experienced sled-based avalanche professionals approached sled cutting in similar ways, would it validate the approach I intended to present? This question became the basis of the present study. Rather

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than proposing a set procedure for sled cutting, this paper examines whether one may already be emerging through current professional practice.

This guiding question is:

Are sled-based practitioners approaching the use of sled cuts with enough consistency to define a set of guidelines for the industry?

2. METHOD

To begin diving into this issue, an exploratory questionnaire was distributed to fifteen experienced sled-based avalanche practitioners. Participants in the survey represented a variety of operational backgrounds, including avalanche forecasting, education, guiding, industrial programs, search and rescue, and public safety organizations. Professional avalanche and snowmobile experience in this group ranged from 10 to 20+ years. The group included CAA Professional Members, CMBGA Snowmobile Guides, ACMG Ski Guides, AST educators, forecasters, CAA ITP instructors, and snowmobile-based program managers. While limited to Western Canada, these 15 practitioners represent experience in a range of snowpacks from the thin continental snowpack of the Rockies to the deep coastal snowpack of the North West Coast. This purposefully selected group was aimed at representing a strong depth of experience, rather than a statistical representation of all motorized practitioners.

The questionnaire consisted of eleven open-ended questions focused on defining the practice of sled cutting through its application, procedures, hazards, and exposure management. Practitioners were also asked directly about their perception of consistency across the practice of sled cutting. Responses were then reviewed for recurring themes rather than individual answers. Ideas that appeared in a majority of individual responses, or recurred across multiple questions, were identified as themes. Areas of common ground or divergence were then identified and compared across practitioner backgrounds.

3. FINDINGS

3.1 *Defining a Sled Cut*

Respondents shared the view that it was the intention to attempt to initiate an avalanche, rather than the exact procedures of the maneuver, that defined a sled cut. This distinguished sled cuts from actions such as high marking, bowties, or descents, which were described as “just riding” (Respondent 2) rather than as snowpack tests or mitigation tools. This was well defined by one practitioner as, “...the sled cut is specifically utilized to provoke a response in the snowpack... A highmark or other action typically assumes a level of snowpack stability where a release is not expected.” (Respondent 12).

All the respondents stated they used sled cuts within their practice, but very few had any form of written or formalized procedure. Most respondents said they differentiated between sled cuts used for snowpack evaluation and those used as hazard mitigation measures. While the technical execution of the maneuvers were often described as similar or the same, practitioners commonly identified differences in terrain selection, acceptable exposure, consequence, and operational intent.

The most common use of sled cuts was as part of their overall snowpack assessment. This slope-based observation was used alongside other snowpack observations and tests conducted according to OGRS (Canadian Avalanche Association, 2024) to interpret and apply an avalanche forecast or safety plan. Many practitioners described sled cuts as a rapid slope-scale observation that could be used repeatedly across different elevations, aspects, and terrain features. They reported using sled cuts routinely while travelling through terrain, often multiple times throughout a day. This function was primarily focused on the reactivity of new snow instabilities in the upper snowpack such as storm or wind slabs.

In contrast, sled cuts used as defensive hazard mitigation measures were reported less frequently across the group. Many respondents described defensive cutting as an uncommon or last-resort tool reserved for situations where terrain selection, group exposure, or other operational needs justified the additional risk. It was frequently stated that an advantage of the snowmobile was its ability to move quickly through terrain, changing slope elevation and aspect quickly. This meant it was a common perception that alternative mitigations, such as terrain management and avoidance, should be exhausted first and that a defensive cut had often meant mistakes in earlier terrain choices or risk assessments. Defensive cuts were described as a proactive measure when entering an area, recovering a stuck sled, or reducing risk in an industrial operational setting in only a few responses.

The strongest area of commonality between practitioners involved risk management. This, more than a set of rigidly defined maneuvers, appears to be the strongest area of shared practice among respondents for sled cutting. Regardless of professional background, respondents consistently described their methods as including the following risk mitigation measures:

- Moving from one position of safety through the intended trigger point to another area of safety.
- Selecting low-consequence terrain with a planned entrance and escape route. Respondents generally framed consequence in terms of terrain, terrain traps, obstacles and escape options rather than potential avalanche size alone.
- Limiting the size of the anticipated avalanche, with Size 2 commonly identified as an upper boundary.
- Avoiding terrain traps and obstacles that could increase the consequences of a mistake.
- Exposing only one rider to the slope at a time with a designated spotter in a safe spot ready to respond for companion rescue.

Absent from this shared view were formal maneuvers that defined a specific direction of travel. While some respondents mirrored the downward, diagonal movement of a traditional ski cut, others referenced multiple directions of travel. The intention to initiate an avalanche and the mitigation of risks are the consistent themes of the responses.

3.2 Strengths and Weaknesses

When asked about the strengths and weaknesses of sled cutting, respondents identified mobility and efficiency as the primary strengths of sled cutting. The ability to test multiple slopes while travelling through terrain was repeatedly cited as a significant advantage over more time-consuming forms of assessment. They also allowed for more options in the approach and exit points, thanks to the use of engines rather than gravity to produce momentum. Many respondents perceived the greater weight and track penetration of a snowmobile as potential advantages when attempting to load weak layers within the upper snowpack.

Practitioners often viewed sled cuts as limited in their terrain use. Sleds are harder to maneuver in tight spaces, so it can be unsafe to access some narrow or enclosed slopes, as well as blocked start zones that a skier can. This means snowmobiles are more effective at cutting in open alpine or treeline terrain. It is also much harder to protect someone on a sled cut using methods like belays. A further limitation repeatedly identified was rider skill. Respondents noted that the success and safety of a sled cut are heavily influenced by the practitioner's experience and riding ability. This also came up as a perception of a rider's skill and experience playing a role in false negatives, overconfidence, or the misjudgement of slope hazards. It was also noted that problem types with the potential to fail deeper or propagate higher on the slope than anticipated were of higher concern and largely avoided.

While avalanche involvement was consistently identified as a primary risk, many practitioners noted that the snowmobile itself introduces significant additional hazards not present in ski cutting. Common concerns included collisions with obstacles like rocks or trees, and trauma associated with becoming entangled with the machine during a rollover or avalanche release. As one practitioner stated, "*Sled cutting has the additional hazard of rolling the sled over the rider in the case of a fall. 450 pounds of steel can make a mess of a fragile human*" (Respondent 8). Several other respondents suggested that these machine-related hazards may represent one of the most important distinctions between sled cutting and ski cutting from a risk-management perspective.

3.3 Variability Among Practitioners

In general, the variability identified by respondents involved terminology and technical execution rather than any fundamental differences in risk-management philosophy. Across their answers, most respondents reported following repeatable procedures despite the absence of formal written guidance. Some practitioners described sled cuts as direct analogues to ski cuts involving movement between positions of safety at the top of a slope. Others viewed sled cutting as a broader category that could include alternate approaches such as lower-slope cuts, multiple cut techniques, jumping a sled down onto a slope, or other forms of machine-based snowpack testing. One statement that captures this theme of

variability well is when asked: where do you see the greatest variability in how different practitioners use sled cuts, they replied, “*The biggest variability is we have no written set of guidelines for this practice. Everyone has their own way of doing tests and we don’t really talk about the procedure.*” (Respondent 9).

4. DISCUSSION

Looking across the responses as a whole, a broader pattern begins to emerge. Sled cutting is an established practice that is missing formal articulation. This study suggests that the absence of formal sled-cutting guidance does not reflect an absence of professional practice. Rather, practitioners appear to have developed a relatively consistent set of risk-management principles through experience, while remaining inconsistent in defining exact terminology and maneuvers. Sled cutting is not simply an adaptation of ski cutting to a snowmobile; it has its own additional hazards and unique capabilities. The questionnaire results suggest that practitioners possess considerably more shared views than might be expected given the absence of formal guidance. Practitioners consistently described similar objectives, hazards, exposure management practices, and operational limitations despite coming from different regions, organizations, and professional backgrounds.

The primary areas of divergence involved specifics on terminology, approach, and procedural scope. This means that the commonality of professional practice is in the management of risk, not the technique. Several respondents questioned whether practitioners currently share a sufficiently consistent understanding of what constitutes a sled cut. This points to the unique hazards and capabilities of a sled cut as more than a simple adaptation of the ski cut methodology. These concerns were not generally presented as opposition to future guidance, but rather as arguments that snowmobile-oriented definitions should be established before any prescriptive procedures are developed.

An interesting distinction also emerged when I looked further into the gap between practitioners who approached sled cutting through traditional ski-cutting concepts and those who viewed it as a unique motorized practice. This was actually less of a divide in overall procedures than anticipated. While there were differences in terminology and technical execution, both groups described remarkably similar approaches to managing exposure, vulnerability, and consequence. Taken together, these findings suggest that the development of future guidance may be less constrained by disagreement over safety principles and more limited by uncertainty in sled-specific terminology and a need for adaptability in procedures.

5. LIMITATIONS

There are several important limitations to these findings that should be acknowledged. First is the limited scope of the survey response. This study represents the opinions of fifteen experienced practitioners and does not constitute an observational study of field practices or a consensus across the avalanche industry. This study was exploratory in nature, standing as a proof of concept for a larger study with hopes of narrowing the focus of future discussion. Responses were qualitative and conversational in nature. This focused on practitioner experience rather than measured operational outcomes. In addition, as the author, I participated in the questionnaire prior to reviewing other submissions and retained my own response as part of the dataset.

6. CONCLUSION

The implication is not that a single standardized sled-cutting technique should be adopted, but that the common principles underlying existing practice may provide a defensible foundation for practitioner guidance. Respondents demonstrated substantial common ground regarding the purpose of sled cuts, their primary application as a snowpack assessment tool, and the risk-management principles used to control practitioner exposure.

At the same time, important differences remain regarding terminology and the technical execution of sled cuts. These differences do not appear to represent competing philosophies so much as differing interpretations of a practice that has evolved largely through experience and mentorship rather than formal standardization or education.

Rather than indicating a lack of shared practice, the results suggest a need for further discussion. The findings support the idea that sufficient common ground exists in this experienced group of avalanche professionals to begin exploring practitioner guidance, while also highlighting the need for continued work defining the terminology and scope of sled cutting within the avalanche industry. A next step could

be an expanded consultation with a wider group of sled-based avalanche practitioners. This would allow for a wider range of experiences to be included in the study. With a broader set of responses, education bodies like the CMBGA or CAA ITP could work toward defining shared terminology and guidelines for sled cutting. Such guidance could be incorporated into operational procedures and safety plans for a variety of avalanche-based applications, including snowmobile guiding, industrial work, public safety, and education.

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