

DIGGING DEEPER:  
UNCOVERING THE REAL ISSUES IN NORTH AMERICAN MULTIPLE BURIALS.

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ABSTRACT:

For avalanche educators, time is precious. When teaching avalanche rescue to recreationists, what takes priority? To determine what the crux issues are in companion rescues, the authors analyzed North American avalanche incidents from 1995-2008, using the American Avalanche Association (AAA) database. We then interviewed numerous individuals who took part in the more complicated rescues, including multiple burials. Our findings are that 1) slightly over half of North American avalanche victims are wearing transceivers; 2) "multiple burial" statistics are often misleading and should be cited with more precise definitions; 3) "special case" multiple burials requiring specialized techniques (or technology) are extremely rare, especially in the recreational setting; and 4) in almost all transceiver rescues, the excavation phase is more time consuming and physically demanding than the search phase. When teaching recreational avalanche courses, educators should focus on single victim searches, shoveling technique, and organizing the rescue. Specialized techniques for "special case" close-proximity multiple burials should be limited to the realm of advanced professional instruction.

KEYWORDS: Avalanche beacon, transceiver, avalanche education, multiple burial, shoveling, excavation

1. INTRODUCTION

*"Tragedy in the alpine: seven killed as massive snowslide buries guided party."*

Unfortunate headlines like this are printed all too often in North America. A single avalanche fatality is unfortunate enough; multiple fatalities are even more tragic. But as tragic as these incidents are, they can also be sensationalized by the media, manufacturers, and even avalanche educators. While epic multiple-burial scenarios like this have indeed occurred in guided parties in various alpine countries, how prevalent are complicated multiple burials in North America, especially in a typical recreational setting? What are the real issues in such cases: beacon searching, probing, shoveling, organization, or something else? How much time and effort should educators devote to teaching special techniques and technologies for performing complex multiple-victim transceiver rescues?

These are important questions for educators, who need to efficiently allocate their time when teaching courses—and for manufacturers and consumers, who must prioritize important features when designing and purchasing equipment, respectively. Finally, we must address a basic issue of terminology. When teaching transceiver rescue, should a "multiple burial" really be called a "multiple burial" if the technique used to solve the burial is no different than the technique used for a single burial?

In an effort to better define the significance of multiple burials in North America, we analyzed 13 years of incidents, from December 1995 through March 2008, listed on the database of the American Avalanche Association ([www.avalanche.org](http://www.avalanche.org)). This database was chosen because it offers extensive links to incident and media reports. However, the data obtained is most likely weighted toward worst-case incidents, as it mainly includes fatalities. In North America, most near misses and live recoveries go unreported.

The goal was to answer the questions above by determining a) how many incidents truly involve completely buried multiple victims using transceivers; b) of these, how many are "special case" multiple burials that lend themselves to a special search technique or technology. We then attempted to contact those actually involved in these

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incidents, to determine if there were complicating factors.

Our findings show that it is more valuable for avalanche educators to get their students to own beacons, master single burials, learn strategic shoveling and learn to organize a rescue than it is to invest time on special cases.

## 2. DEFINING MULTIPLE BURIALS

*“More than 50 percent of avalanche accidents involve multiple victims.”*

This is a popular statement commonly heard in the snow safety industry, most often from transceiver manufacturers, and often recited in avalanche courses. While this appears to be a valid statistic on the surface, it can be very misleading, depending on how you define a “victim.” North American statistics show that several people are often “involved” in an avalanche, but the number that are completely buried is much lower. Many of those “involved” often escape the slide or are only partially buried. Of those truly buried, there are increasingly smaller subsets involving cases with multiple victims, cases in which transceivers were used, and “special cases” where a specialized multiple-burial technique or technology could be applied.

When discussing multiple burials, it is essential to draw clear distinctions between cases involving “multiple victims,” cases involving legitimate multiple-victim beacon searches, and cases in which a special multiple-burial technique or technology could be applied:

“Multiple victim” incidents should be defined as cases in which more than one victim is completely buried, with no surface clues that could aid in locating the victim. It should be noted that in many databases—including frequently cited Swiss statistics—a victim is considered “completely buried” if the head and chest are beneath the snow surface, even if an extremity is showing.

Legitimate multiple-victim beacon searches should be defined by the following conditions:

- 1) More than one victim must be completely buried, with no visual clues above the surface:
- 2) More than one completely buried victim must be carrying a transceiver; and

- 3) At least one searcher with a transceiver and shovel must be on scene within 15 minutes.

Even when the above conditions are met, all victims can be found by the basic practice of locating and excavating the nearest victim, turning off his or her beacon, then proceeding to search for the next closest victim. Or, if there is more than one rescuer, then they can operate “in parallel,” each locating and excavating a separate victim.



*Figure 1: In most cases, the technique for a multiple victim transceiver search is the same technique that is used for a single victim search. By moving systematically through the debris, a digital transceiver will isolate each signal as the searcher gets closer. Only in special cases involving close-proximity burials should this technique change.*

Additional factors must be present to be defined as a “special case” multiple burial that could make use of a special technique or technology:

- 1) Searcher cannot turn off beacon: If the rescuer is alone, he or she cannot turn off the first victim’s beacon once the airway has been established, either because the beacon is too difficult to access or the victim is too deep to excavate within the window of survivability.
- 2) Second rescuer: If a second rescuer is available, then one can begin excavating while the other begins searching for the next victim; and
- 3) Close proximity: The victims must be buried close enough together so both of their signals are

captured at once and both searchers are led to the same victim. From here, it can be helpful to use a special technique or use a “marking” function to find the next victim. If they are located farther apart, then each searcher can simply isolate and excavate the victims “in parallel,” as described above.

For purposes of clear terminology, we call any case meeting all of these criteria a “special case multiple burial.”

### 3. ANALYSIS

To classify and analyze the North American incidents, we hired a computer scientist to develop a database, flow chart and algorithm to sort the data found at [www.avalanche.org](http://www.avalanche.org). This was also done for incidents in Tyrol, Austria (Stopper et. al., 2008), which was chosen for its more detailed database than that of the well-known Swiss Federal Institute for Snow and Avalanche Research. The North American results are shown in the pie charts below.

In numerous cases, when incident reports and further research did not provide enough information to classify the incident, it was classified as having “insufficient information.” These cases were always removed from the numerator and denominator when calculating proportions. To perform an analysis as complete as possible, some of these cases are included in the analysis at later stages if they are relevant at that stage.

Of 508 North American incidents involving people reported from 1995 to 2008, about half could be interpreted as “involving” more than one person. Of these 508 incidents involving people, only 314 had one (or more) confirmed complete burial. Of these 314 incidents with confirmed burials, 45 (14 percent) included more than one complete burial.

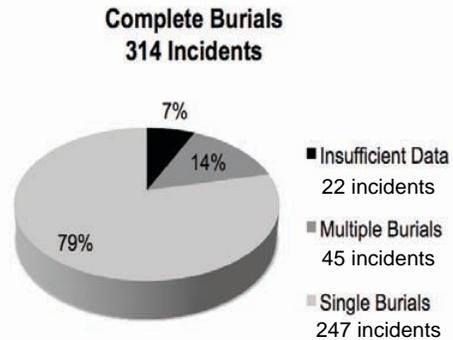


Figure 2: Complete multiple burials in North America.

Of these 45 multiple burial incidents, only 18 (40 percent) involved victims using transceivers. In two cases, the victims had transceivers, but the searchers did not. A third case had insufficient information.

### 4. RESULTS

#### 4.1 Multiple Burial Searches

In summary, of 456 total incidents “involving people” with sufficient information (508 total incidents minus 52 with insufficient information), a multiple victim beacon search was only possible in 15 of them, or 3.3 percent. Of 297 complete burial incidents with sufficient information,\* this amounts to 5.1 percent.

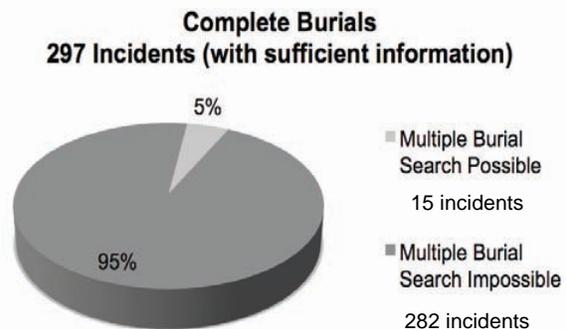


Figure 3: Complete burial incidents with sufficient information.

\*Five incidents classified as having insufficient information in Figure 2 are now identified as being relevant at this stage after checking for transceiver use and searcher availability.

Of these 15 incidents, 5 were in guided groups. It's possible that some of these incidents involved "special cases" that might have benefitted from a special technique or technology.

#### 4.2 Transceiver Use

Transceiver use is increasing in North America, from 52 percent of victims from 1995-2002 to 57 percent of victims from 2003 to the present. However, beacons are less widely accepted in the U.S., where only 43 percent of victims were wearing transceivers compared to 79 percent of victims in Canada. One reason for the higher percentage in Canada is that the majority of multiple burial incidents in Canada occur in guided groups, 100 percent of whose participants use transceivers.

#### 4.3 Motorized Versus Non-Motorized

Snowmobilers account for about one-third of all complete burial incidents in North America. This percentage has decreased slightly from 39 percent from 1995-2002 to 34 percent from 2003 to the present. Transceivers are more likely to be used by non-motorized users (55 percent) than motorized users (44 percent).

#### 4.4 Canada Versus U.S.

Multiple burial searches are more common in Canada than in the U.S. Of 297 complete burial incidents in North America with sufficient information, 18 percent involved multiple beacon searches in Canada and 2.4 percent involved multiple beacon searches in the U.S.

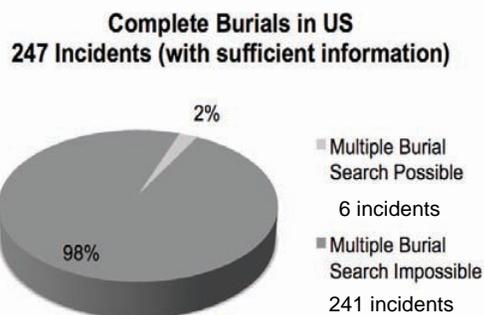


Figure 4: Complete burials in the United States with sufficient information.

Complete Burials in Canada  
50 Incidents (with sufficient information)

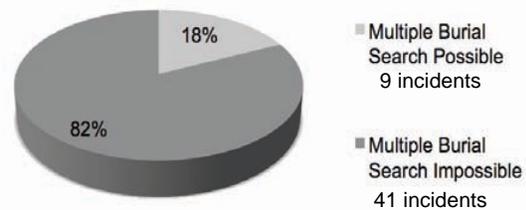


Figure 5: Complete burials Canada with sufficient information.

#### 4.5 Guided Versus Non-Guided

Since the purpose of this study is to help educators prioritize what to teach students in recreational avalanche courses, then guided groups theoretically should not be included in this analysis. In Canada, where mechanized guiding is more prevalent than in the U.S., a professional guide normally performs the transceiver search; guests are not expected to perform "special case" multiple burial searches. If guided groups were removed from the analysis, then the proportion of multiple burial searches as a percentage of incidents would be lower in North America, with Canada approaching the U.S. in relative percentage of multiple burials.

#### 4.6 The Real Issue:

##### Multiple Burials Require Multiple Shovelers!

The grim reality is that in all multiple complete burial incidents, there is invariably at least one fatality. This is because shoveling requires strategy, hard work, and manpower. When performing further research on the confirmed multiple beacon search incidents, there was a clear message from witnesses that beacon searching was the "easy part." The most difficult and time-consuming aspect of the rescue is invariably the excavation phase, which was described as "hell" on more than one occasion.

Recent research by Jarry (2008) and Genswein (2008) emphasize that there should be at least two shovelers available per buried victim for that victim to have a reasonable chance of survival in a complete burial. According to Jarry's statistics from avalanche incidents in France, most recreational groups have insufficient shoveling manpower to recover all victims alive in a multiple burial. Having the latest technology is not sufficient in itself to solve a multiple accident: "at some point," Jarry states, "the rescuers have to decide to dig!"

This further supports that shoveling strategy and manpower are the crux of all multiple burial rescues—not beacon searching.



Figure 6: For the victim to have a reasonable chance of survival, there should be at least two shovelers for each buried victim (Jarry, 2008).

## 5. CONCLUSION

The most recent 13 years of North American avalanche statistics show that incidents involving multiple victims with transceivers are rare, especially in the non-guided, recreational setting. “Special cases” where a special technique or technology could come into play are even less common. The greater issue is that not enough recreational backcountry users own avalanche beacons, shoveling manpower is often very limited in recreational incidents and, until recently,\* avalanche educators have not emphasized shoveling strategy and technique in recreational courses. The fundamentals of beacon searching, probing, shoveling, and organizing a rescue should be taught and mastered in recreational avalanche courses. Special-case multiple burial techniques should be addressed only at the professional level.

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\*“Strategic shoveling” and the “V-shaped conveyer method” are increasingly being taught in recreational avalanche courses. A case study from Fernie, B.C. shows that shoveling education is beginning to show a positive influence on survivability (Edgerly et. al., 2008).

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