A Comparison Study of the Shredblock and Rutschblock Snow Stablility Tests

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A Comparison Study of the Shredblock and Rutschblock Snow Stablility Tests by Andy Gleason. Presented at the 1998 ISSW, and to be published in the Proceedings of the 1998 ISSW, Sunriver, Oregon.

The Shredblock test is a field test to measure the relative instability of the snowpack in a backcountry setting with minimal equipment. The Shredblock test is based on the Rutschblock test but uses a snowboard instead of skis to load an isolated column of snow.

Methods

Data were collected during 3 winter field seasons in the San Juan Mountains of SW Colorado. The study area is characterized by a continental snow climate with relatively cold temperatures and shallow snowpacks (La Chapelle, 1966). Snowpit locations were on varying aspects and elevations, and varied in depth of snow and type of snow. Information collected at each study point included slope angle, slope aspect, total depth of snowpack, and depth to failure from the surface.

A standard Rutschblock test was conducted directly adjacent to a Shredblock test. The Rutschblock test was conducted according to Fohn (1987). The Rutschblock column of snow was 1.5 by 2 meters. The Shredblock column was 1.5 by 1.7 meters to more accurately represent the length of the snowboard used to collect the data. All columns were cut to the ground on all four sides. Both tests used the standard Rutschblock numbers to gage instability of the snowpack (Fohn 1987). While conducting comparison tests of the Shredblock and Rutschblock a skier and snowboarder of approximately equal weights performed the tests.

The procedure of the Shredblock test using a snowboard is similar to the Rutschblock test using a pair of skis. A column of snow 1.5 by 1.7 meters is cut to the ground. If failure occurs during the cutting of the column, a Shredblock number of one is recorded. It is useful to make a platform of compacted snow, uphill from the isolated column, for the snowboarder to step onto the block. In soft snow conditions, using a backpack as a platform proved useful. The snowboarder then ascends to the platform uphill from the isolated column and attaches the front foot to the snowboard with the rear foot remaining unattached. A ski pole is helpful for balance when first stepping on to the block of snow. While standing with the rear foot on the platform behind the column, the snowboard is lifted up and gently placed on the upper one third of the isolated column. Note that the snowboard is placed with a step, not by sliding onto the block. The rear foot is then placed on the snowboard between the bindings. Failure at this point would constitute a Shredblock number 2. A Shredblock number of 3 would be recorded if failure occurred while gently weighting the snowboard by bending the knees. One jump straight up with the snowboard can be achieved with only one foot attached to the snowboard. Failure with one jump is a Shredblock number of 4. Some observers preferred to attach both feet to the snowboard at this stage of the test. A second jump constitutes a Shredblock number of 5. Continued jumps or putting another person on the snowboard and jumping together is a Shredblock number of 6. No failure is a Shredblock number 7.

Data were recorded by noting the depth to failure and the corresponding Rutschblock or Shredblock number associated with the failure. If there was more than one failure per test, each failure was recorded with corresponding Rutschblock or Shredblock numbers. In some instances, the Shredblock test detected more upper level(near surface) failures than the Rutschblock test. These were duly noted, but were not used in the comparison analysis. Comparisons between the Shredblock and Rutschblock numbers were only used in the statistical study if they were within 5 cm of each other in the snowpack. In other words, only failures detected by the Shredblock and Rutschblock tests at the same level in the snowpack were used for the statistical analysis.

The data were compared using the Spearman rank order correlation coefficient. The use of a non-parametric test was necessary because the data were not ordered. Forty seven pairs of variables from 35 snowpits were used in the analysis.

Results and Discussion

Thirty five snowpits with adjacent Shredblock and Rutschblock tests yielded 47 pairs of variables comparing Shredblock numbers to Rutschblock numbers for the same failure plane (Table 1). Sixty two percent of the tests indicated equal Shredblock and Rutschblock numbers. Seventeen percent of the time the Rutschblock number was greater than the Shredblock number. Twenty one percent of the time the Shredblock number was greater. Shredblock and Rutschblock numbers are strongly correlated with a Spearman rank order correlation coefficient of 0.74 ($p<0.0000$) (Table 2).

Table 1. Summation of paired variables comparing Rutschblock numbers to Shredblock numbers in which Rutschblock numbers were greater than, equal to, or less than Shredblock numbers.

	Rutsch # > Shred #	Rutsch # = Shred #	Rutsch # < Shred #
Sum of variable pairs.	8	29	10
Percentage of total	17.02%	61.7%	21.28%

Table 2. Spearman rank order correlation coefficient comparing the Shredblock and Rutscblock snow stability tests.

Pair of Variables	Valid N	Spearman R	t(N-2)	p-level
Shredblock & Rutschblock	47	0.7368	7.312	0.0000

The median Shredblock and Rutschblock numbers as well as the upper and lower quartiles were computed and graphed in a box-whisker plot (Figure 1). These data show that the Shredblock test correlates well with the Rutschblock and can be a useful tool for determining relative snowpack stability utilizing a snowboard.

In 13 out of 35 snowpits (37 %), The Shredblock test detected shallower weak layers that the Rutschblock test did not detect. Although this result depends strongly on the type of snow layering near the surface, given certain snowpack conditions, a snowboard could detect upper level weak layers that skis could miss. The most likely explanation is the ski penetration difference between skis and snowboards. Skis, which penetrate deeper into soft snow, will not always detect upper level weaknesses because they may drop down below the near surface weak layers before causing failure. A snowboard may be better at detecting upper level weak layers because penetration into soft snow is not as great as with skis. Further research would be to study penetration of skis versus snowboards in varying snow conditions.

Conclusion

The use of a snowboard for snow stability analysis using the Shredblock test strongly correlates to the use of skis in the Rutschblock test. A small variance of Shredblock numbers to Rutschblock numbers may occur, but general stability can be determined using a snowboard. In certain snow conditions, the Shredblock test may be able to detect shallower weak layers than the Rutschblock test. Further research would be to correlate snowpack variations with the results of a comparison study between the Shredblock and Rutschblock tests.

Figure 1. Box-whisker plot of Shredblock vs. Rutschblock data. The range, median and upper and lower quartiles are shown for each Shredblock and Rutschblock number.

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