NOASC Avalanche Terrain Risk Scale (NATRS) 2009.

Developed by Ross Carty and NOASC Backcountry Staff

The NOASC Avalanche Terrain Risk Scale (NATRS) was developed through a need for a logical methodology for prioritizing the steps to identify variable risk avalanche terrain for our backcountry operations. This scale is based on the philosophy put forth by the internationally recognized scale for grading rivers, which is a scale that our guides have an existing understanding, knowledge and experience in the use of, through their summer adventure guiding which includes whitewater raft guiding.

NOASC looked at other terrain risk scales including the Avalanche Terrain Exposure Scale (ATES) developed by Grant Statham and Bruce McMahon, 2004, Parks Canada Agency, and the Avalanche Terrain Scale (ATR) proposed by Dick Penniman and Rene Boisselle, 1996 Decision-making on variable Risk Terrain, International Snow Science Workshop (ISSW), Banff Canada. We have incorporated ideas, concepts, and terrain features used in both of these scales in developing our risk scale. In order to help decrease any subjectivity with interruption of the scale and to reduce an ambiguity problems, we have tried to use easily recognizable/measurable terrain features, assigning quantitative values to them.

NOASC uses this scale to assign a class to all our backcountry courses based on the quantifiable terrain features outlined in the scale and features present on the course. By using the weather conditions around the time of the backcountry tour, winter history of the proposed course area, and our guidelines for backcountry tour operations, we make decisions on what possible course (s) can and cannot be used on the day of the tour, based on the class of the course.

Once in the field, we further make decisions on course selection, etc., based on local microclimates and snow pack stability, so as to minimize avalanche risks to the backcountry tour party, as much as is practically possible. If the risk level cannot be controlled inline with the tour's goals by using both snow stability tests, and route/slope selection using the NATRS scale, the guide in the field always has the authority and ultimate responsibility, to cancel the backcountry trip.

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Slope Class	Precautions:	Potential Outcomes of proceeding on these class slopes:	Quantifiable Terrain features
Class 1	● Minimal need to look at the stability in the snowpack, risk of an avalanche occurrence is low. ● Precautions needed are low. ● These slopes commonly used as test slopes to help assess the snow strength on higher risk slopes with similar aspects at similar elevations. ● Some notion of the potential for the snowpack to fail is helpful. ● Precautions necessary to help avoid injury from a simple fall in that event should be taken. ● The risk of severe injury or death from deep burials on Class 1 slopes is effectively zero.	1) No injury or no deep burial is likely; self rescue is highly probable. 2) Small potential starting zone, 3) Minimal destructive forces (less than 15 metres of vertical). 4) No deep burial potential. 5) No exposure on run outs.	1. Slopes Angles of less than 25 degrees. 2. Uniform slope 3. Less than 15 metres of vertical drop between potential avalanche starting zone and end of run out zone. 4. No potentially injurious terrain features (rocks, trees, etc). 5. Small, consistent avalanche run out zone. 6. Many options for route selection.
Class 2	● Need to analyze the snow pack for strength to reduce risk. ● The precautions listed for Class 1 slopes as well as standard personal precautions for potential burial are recommended. These would include potential victims securing openings in clothing, loosening pack and pole straps. At least a ski pole test or hand test of snow layering, or tracing of the desired	1) Shallow burial potential only; rescue is highly probable, 2) Small potential starting zone, 3) Small destructive forces (15 to 50 metres of vertical)	1. Slope angles of between 25-35 degrees. 2. Mainly a uniform slope with little variations in slope shape. 3. Between 15 – 50m of vertical drop between potential avalanche starting zone and end of run out zone. 4. Potentially injurious terrain features on less than 10%. 5. Gradual, consistent run out (no deep burial potential). 6. Many options for route selection with at least 2 route

	slope to be skied and some notion of the potential for the snowpack to fail is advised by the first skier down the slope. ● The group should be prepared for a shallow burial rescue. ● Rescue skills should be good. ● The risk of severe injury or death from deep burials on Class 2 slopes is low	4) Small deposition area for beacon search. 5) Limited exposure crossing run out paths or run out zones.	selection options of a class 2 route.
Class 3	● Need to analyze the snow pack for strength to reduce risk. Results from snow stability tests should be recorded to build more detailed history of the area. ● The precautions listed for Class 2 slopes as well as, at least one representative compression test should be conducted before accessing the slope, or hiking up slopes to evaluate snow strength (stability test results on hike ups should be used to extrapolate potential risks on steeper slopes above). ● If compression tests or other indicators suggest potential failure planes, the group should expect and be prepared for a potentially deep burial rescue. Route selection should be revised looking	1) Deep burial potential; rescue is questionable, 2) Moderate sized starting zone, 3) Moderate destructive forces (50 to 100 metres of vertical). 4) Moderate sized deposition area for beacon search. 5) Isolated exposure to start zones and run out paths. 6) Options still available to avoid avalanche paths and starting zones.	1. Slope angle of between 30-40 degrees. 2. Slope shape varies with valleys, ribs, and/or convex areas being present. This variation is less than 20% of the main slope area. 3. Multiple slope aspects within main slope, but still 1 well defined run out zone. 4. Between 50 – 100m of vertical drop between potential avalanche starting zone and end of run out zone. 5. Potentially injurious terrain features on less than 30%. 6. Abrupt transitions in flat or depressed avalanche run out zone. 7. Many options for route selection with at least 2 route selection options of a class 2 route.

	for a route of less risk to the party. ● Rescue skills should be very good. ● The risk of severe injury or death from a deep burial on Class 3 slopes is moderate.		
Class 4	● Must analyze the snow pack for strength to reduce risk. Results from snow stability tests must be recorded to build more detailed history of the area. ● The precautions listed for Class 3 slopes as well as, one or more representative compression tests should be conducted whether or not weakness is evident or suspected. ● Special attention should be given to potentially variable snow pack stratigraphy across the starting zone (example areas under tension, rock outcrops, beside trees, and assumed snow loaded areas). ● Representative compression test(s) should be conducted before accessing the slope if variable conditions in the starting zone are suspected. A Extended Column compression test is advised to test for fracture propagation risk. ● Knowledge of performance history (snow pack data for the area through the winter) under a variety of	1. Deep burial and/or serve injury is probable; rescue is doubtful. 2. Large potential starting zone. 3. Large potential destructive forces (more than 100 metres of vertical). 4. Large deposition area for beacon search. 5. Exposure to start zones and run out paths. 6. Limited chances to reduce exposure through route selection.	1. Slope angle of between 35-45 degrees. 2. Slope shape varies with valleys, ribs, and/or convex areas being present. This variation is less than 50% of the main slope area. 3. Multiple slope aspects within main slope and 2 or less run out paths. 4. More than 100m of vertical drop between potential avalanche starting zone and end of run out zone. 5. Potentially injurious terrain features on less than 50% of slope. 6. Abrupt transitions in flat or depressed avalanche run out zone(s). 7. Steeper slope above. 8. 3 - 5 Route selection options with at least 1 route selection option of less than a class 4 route.

	snowpack conditions including those that exist at the time is helpful. ● Rescue and evacuation skills and pre-planning should be excellent. ● The risk of severe injury or death from deep or lengthy burial, impact with obstacles, and/or strong avalanche forces on Class 4 slopes is high.		
Class 5	● Must analyze the snow pack for strength to reduce risk using various methods, and record findings. ● All precautions listed for Class 4 slopes should be observed as well as, one or more representative compression tests should be conducted whether or not weakness is evident or suspected. ● Numerous representative compression tests in all potential starting zones on all ascents / descents are advised on a periodic basis throughout the winter to document changes in snow stratigraphy. ● A performance history under a variety of snowpack conditions including those that exist at the time should be known. ● Representative compression test(s) should be conducted before accessing the slope if variable	1) Deep burial, severe injury and/or death is virtually certain; rescue is highly improbable, 2) Large or multiple potential starting zones at various elevations, 3) Potentially devastating destructive forces (more than 200 metres of vertical) 4) Potentially injurious terrain features on over 50% of the slope, 5) Large or multiple	1. Slope angle of between 40-50+ degrees. 2. Slope shape varies with valleys, ribs, and/or convex areas being present. This variation is more than 50% of the main slope area. The main slope may also consist of cliffs, hidden slopes above gullies, cornices above. 3. Multiple slope aspects within main slope and multiple run out paths (more than 2). 4. More than 200m of vertical drop between potential avalanche starting zone and end of run out zone. 5. Potentially injurious terrain features on over 50% of slope. 6. One large or depressed avalanche run out zone or multiple converging run out paths leading into one flat or depressed run out zone.

	conditions in the starting zone are suspected. A Extended Column compression test is advised to test for fracture propagation risk. ● Ready access to advanced life support (AED) and rapid evacuation should be available. ● Preparation for body recovery is advised. ● The risk of severe injury or death from deep or lengthy burial, impact with obstacles, and/or strong avalanche forces on Class 5 terrain is extremely high.	deposition areas for beacon search. 6) Frequent exposure to start zones and run out paths. 7) Avoidance of avalanche paths and starting zones not possible.	7. Multiple steeper slopes, or cliffs located above the main slope area. 8. Only two or less possible routes; option route may not be of a lesser class.

NOTE:

If steeper slopes exist above the slope, the class should be upgraded by one class. For example, a class 2 slope goes to a Class 3 slope when slopes of steeper than 25 degrees exist above. If there are steeper slopes below the slope, the slope class should be upgraded by using the "+" notation. The reasoning here is that the steeper slopes above, represents a greater risk to the potential of an avalanche occurring. While if an avalanched occurred, the consequences of steeper slopes below will also increase the risk of injury, or even death to a person caught in such a slide, thus the class rating of the slope is increased.