TESTING THE SNOWPACK IN THE FIELD

- What avalanche problems are you dealing with?
- Where are these problems located?

Informal Stability Tests

- Pole Test
- Hand Shear
- Switchback Test
- Jump on a small rollover

All of these are looking for a recipe for an avalanche and how reactive that recipe is.

SNOW PITS

Introduction:

What do you expect to find?

- Have a defined goal for the hole you dig – Know what information you are looking for.
- Develop a routine and stick with it.
- The big picture. Remember that you are looking at one small spot in a very large world. Your extrapolation to the larger picture should depend more upon your general observations.

Spending less time in more locations is far better than spending more time in one location.

General Snow Pit Guidelines

1. Choose appropriate pit locations. Safe, representative, and polite. Look for areas with average snow cover or target weak areas. Avoid large wind pillows, which tell you little about the slope.
2. Probe your pit area for potentially buried rocks and trees.
3. Do your crystal ID, hand hardness, and temperatures on a shaded side wall. The snow will change less rapidly and will leave the front wall open for stability tests
4. Brush your front wall with diagonal strokes to bring out layering, brush your side wall with vertical strokes to bring out layering.
5. Fill in your pit when you are done, so the next storm can fill in and round over any edges.
6. This is one data point. Don't use only one piece of information to make an assessment or decision.

Test Pit Procedure:

Site Selection:

SAFE, Representative, Polite (lower angle is OK), and Seeking Instability.

- Probe first, ideally away from trees, 120cm wide by 100-120cm deep
- Target the site for the anticipated avalanche problem(s)
- Deep slab avalanche problem – probe for thinner areas to assess
- Be sure your pit has a right-angle corner, smooth walls and vertical cuts

Questions to Ask:

- Where is the weakest layer?
- Does the weak layer fail or break easily?
- Does it propagate?
- Do we have a path of least resistance? What's the structure?

Hand hardness test:

- Particularly of the most significant weak layer, potential bed surface, and potential slab.

Perform CT and ECT: (with saw and/or cord)

- Have the right tools and know where they are in your pack

Snow grain ID:

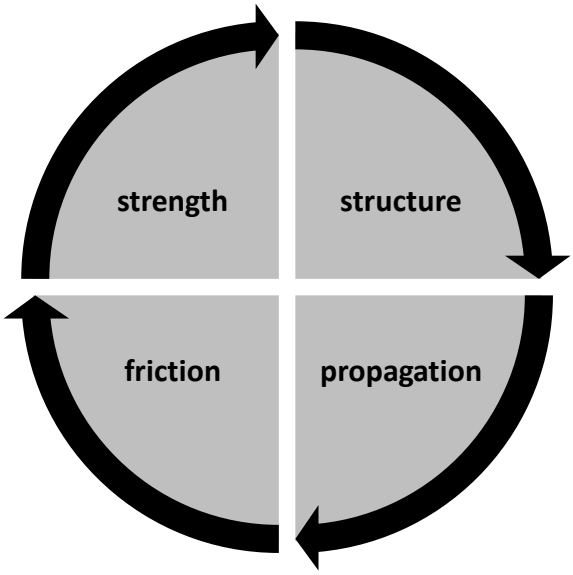
- Identification of the most significant weak layer and the layers immediately above and immediately below that layer.

Interpreting Results:

- **STRENGTH** – how much force to make the layer fail – This is often spatially variable
- **STRUCTURE** – 5 Lemons – concentrate on weakest layer and slab above. Season History - should be able to correlate significant weather events to major layers within the snowpack
- **PROPAGATION** – ECTP = big red flag regardless of strength. For mixed messages and softer slabs consider using the PST
- **FRICTION** – Shear Quality/Fracture Character

Avalanches, Whumpfing/Collapsing, Cracking overrule pit info

STABILITY WHEEL



Strength

Derived from stability tests.

Structure

Derived from lemons.

The 5 Lemons are:

- ➔ **Weak Layer within one meter of the surface.**
- ➔ **Hardness difference of one step or more between adjacent layer.**
- ➔ **Grain size difference of one millimeter or more between adjacent layers.**
- ➔ **Weak layer thickness of 10 centimeters or less.**
- ➔ **Persistent grain type (facets, depth hoar, and surface hoar).**

4-5 Lemons indicate a poor structure which may be a path of least resistance for a failure to travel along.

Propagation Propensity

Derived from ECT & PST

Propagation or no propagation

Friction

Derived from fracture character or shear quality

Fracture Character

SP **Sudden Planar** Planar fracture suddenly crosses column with one loading step and the block slides easily on the weak layer.

SC **Sudden Collapse**
Fracture suddenly crosses column with one loading step and causes noticeable slope normal displacement.

RP **Resistant Planar**
Planar or mostly planar fracture that requires more than one loading step to cross column and/or block does not slide easily on weak layer.

PC **Progressive Compression**
Fracture usually crosses column with one loading step, followed by gradual compression of the layer with subsequent loading steps.

B **Non-planar Break (B)**
Irregular fracture surface.

Stability Test Comparison

CT	ECT	PST
small area 0.09m^2	medium area 0.27m^2	medium area 0.30m^2
tests fracture initiation (strength) of weak layer	tests initiation and propagation propensity	addresses propagation propensity
quickest test - easy to repeat	good for weak layers ↑ 90cm	good for deep weak layers
finds upper level weaknesses	doesn't work well with upper level soft slabs	doesn't work well with super soft slabs
30 - 90 cm +/-	30 - 90 cm +/-	30 -250 cm +
subjective forces, small test area	limited to approx. top meter of snowpack	requires pre-selecting the weak layer to be tested
highly spatially variable	greater spatial uniformity	greater spatial uniformity
	Fewer false stable More false unstable	More false stable Fewer false unstable
Abundant data - broadly known	New test - limited data	New test - limited data - still in development
Effective for: Storm, wind, persistent slabs	Effective for: Storm, wind, persistent slabs	Effective for: Storm, wind, persistent, deep slabs

How do we sort all this information as practitioners?

Most Important → **Least Important**

Class 1 Data
- Avalanches
- Cracking
- Collapsing
- ECTP

Class 2 Data
- Snow pit results
- Snowpack structure (PHD)
- Thin grey lines in pit wall
- Active loading

Class 3 Data
- Weather reports/forecast
- Avalanche forecast
- Weather history