Avalanche Impact Performance of a Guyed Steel Diversion Structure

Tower 4-6 138 kV Transmission Line
Snettisham, Southeast Alaska

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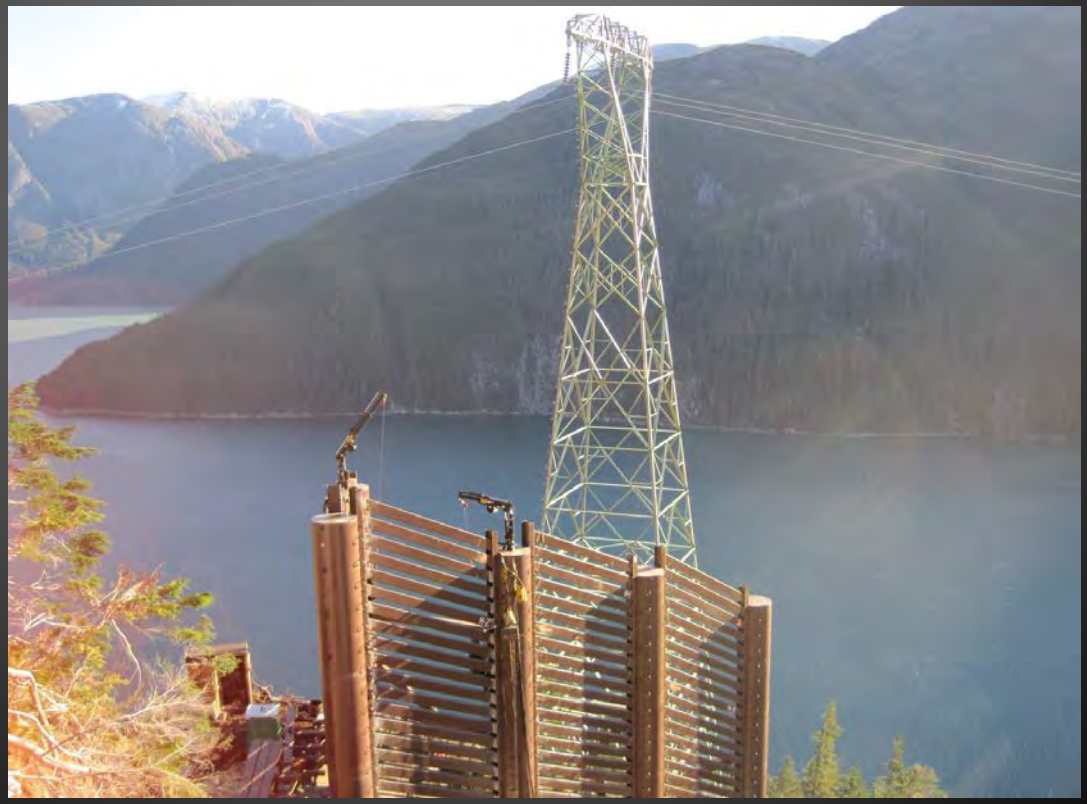
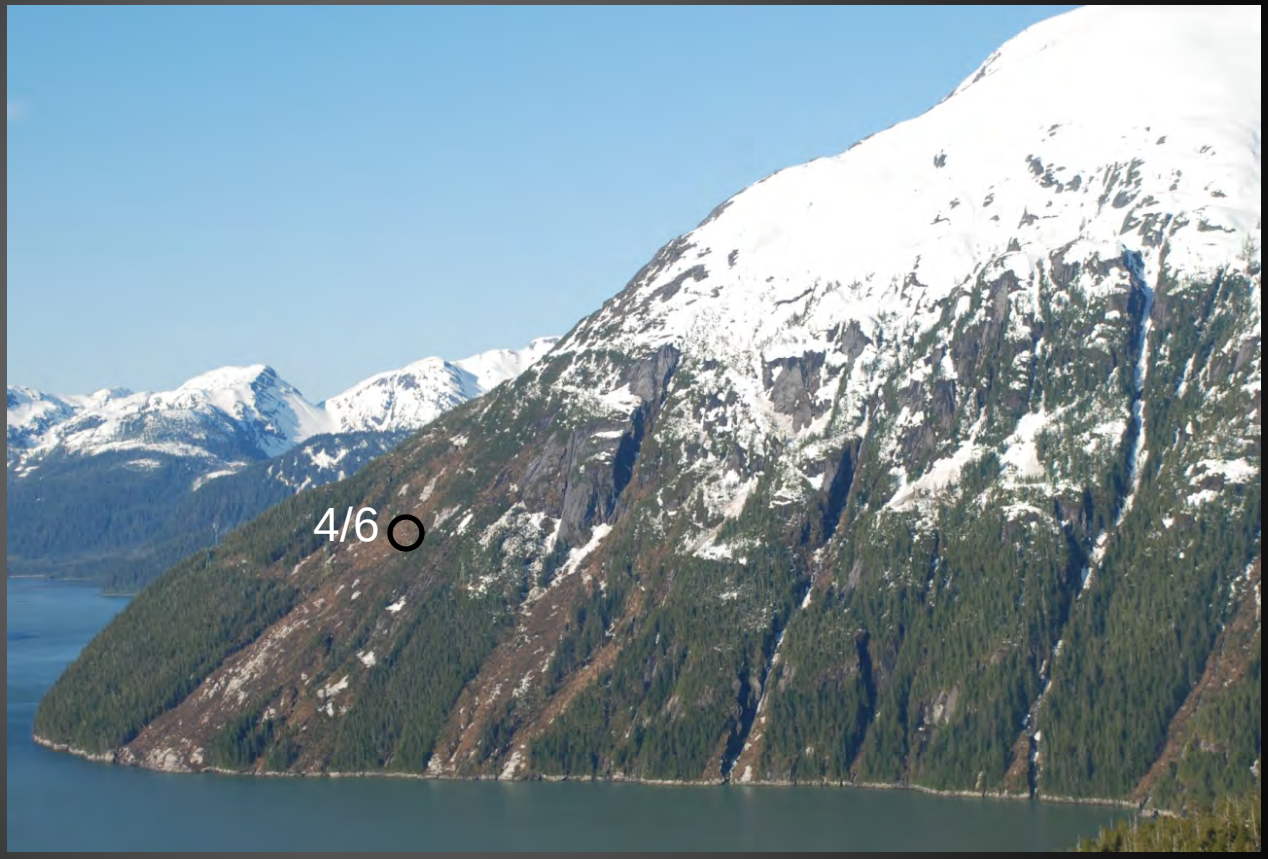


Photo: AEL&P

Snettisham Tower 4-6

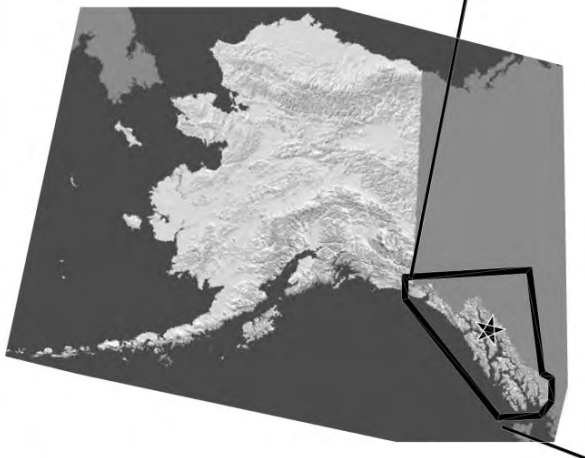
Outline

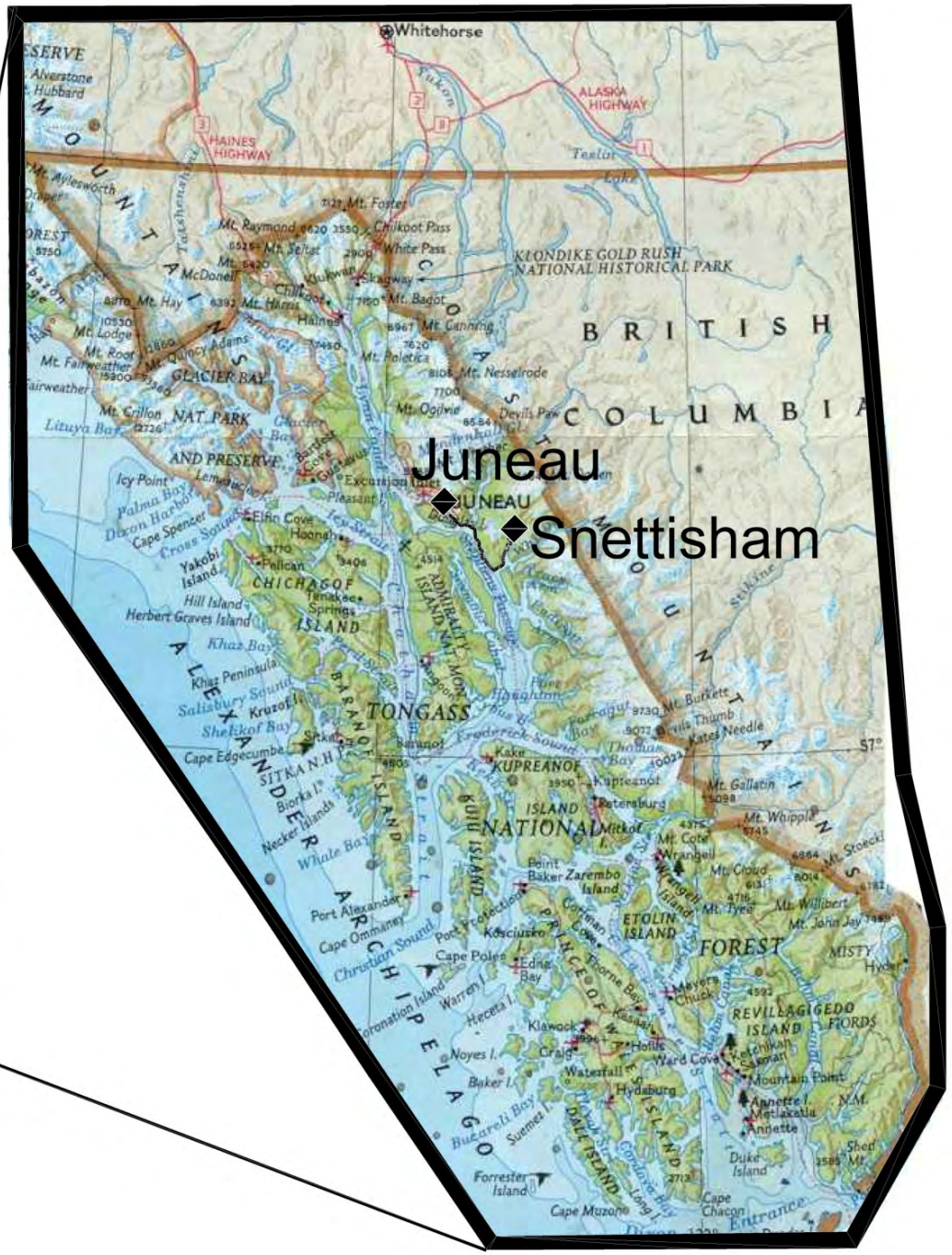
- ✓ Site & Climate
- ✓ History
- ✓ 2012 Weather & Avalanche impact
- ✓ Observations & Measurements
- ✓ Analysis – Back calculations
- ✓ Conclusions



Speel Shoulder - Photo: Don Sharaf

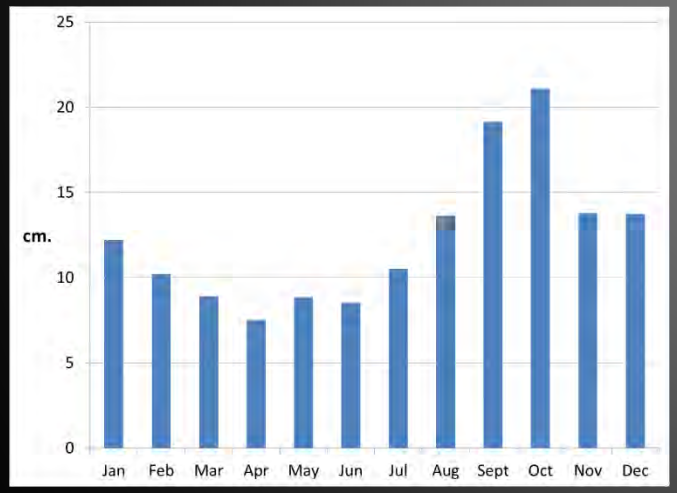
SITE LOCATION



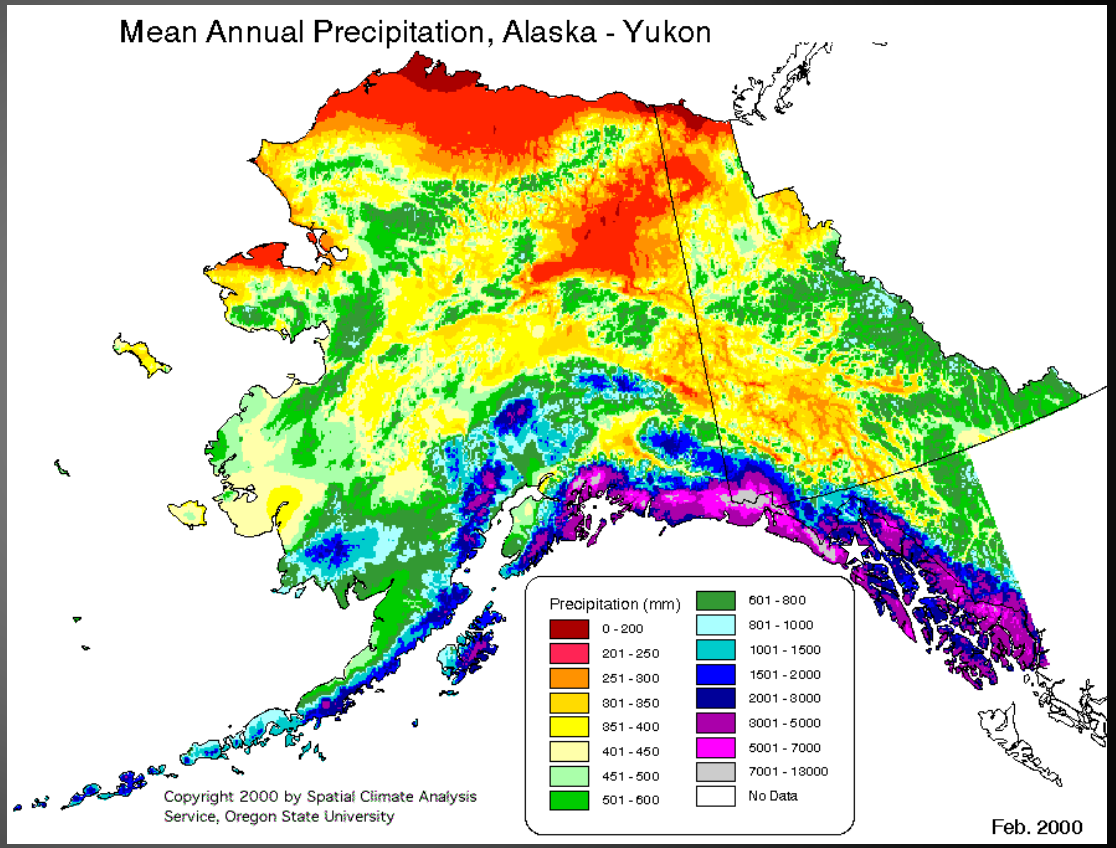


Climate

ANNUAL PRECIP.	
Anchorage	40 cm.
Juneau airport	148 cm
Juneau downtown	228 cm
Snettisham	350 cm



Avg. Monthly Precip.



Speel Shoulder circa 1921
Photo: Alaska Historical Society

HISTORY

1910 Speel Arm Paper Mill

1967-73 Transmission Line Constructed

April 1976 Avalanche

Tower 4/6 moved 1981

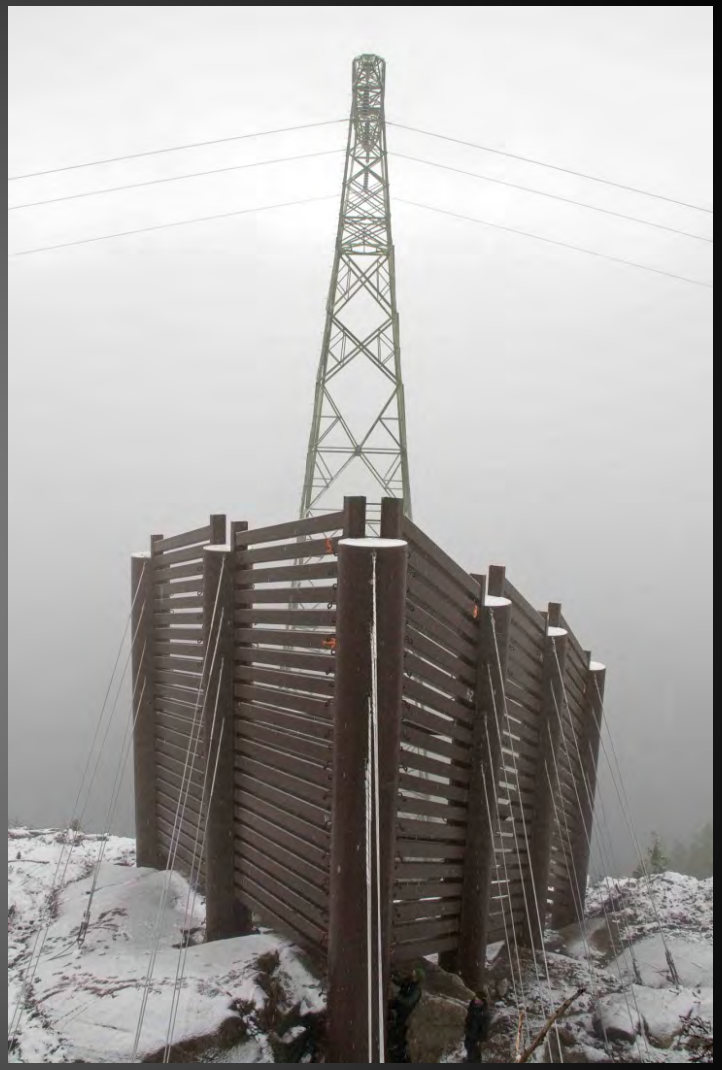
April 16, 2008 Avalanche

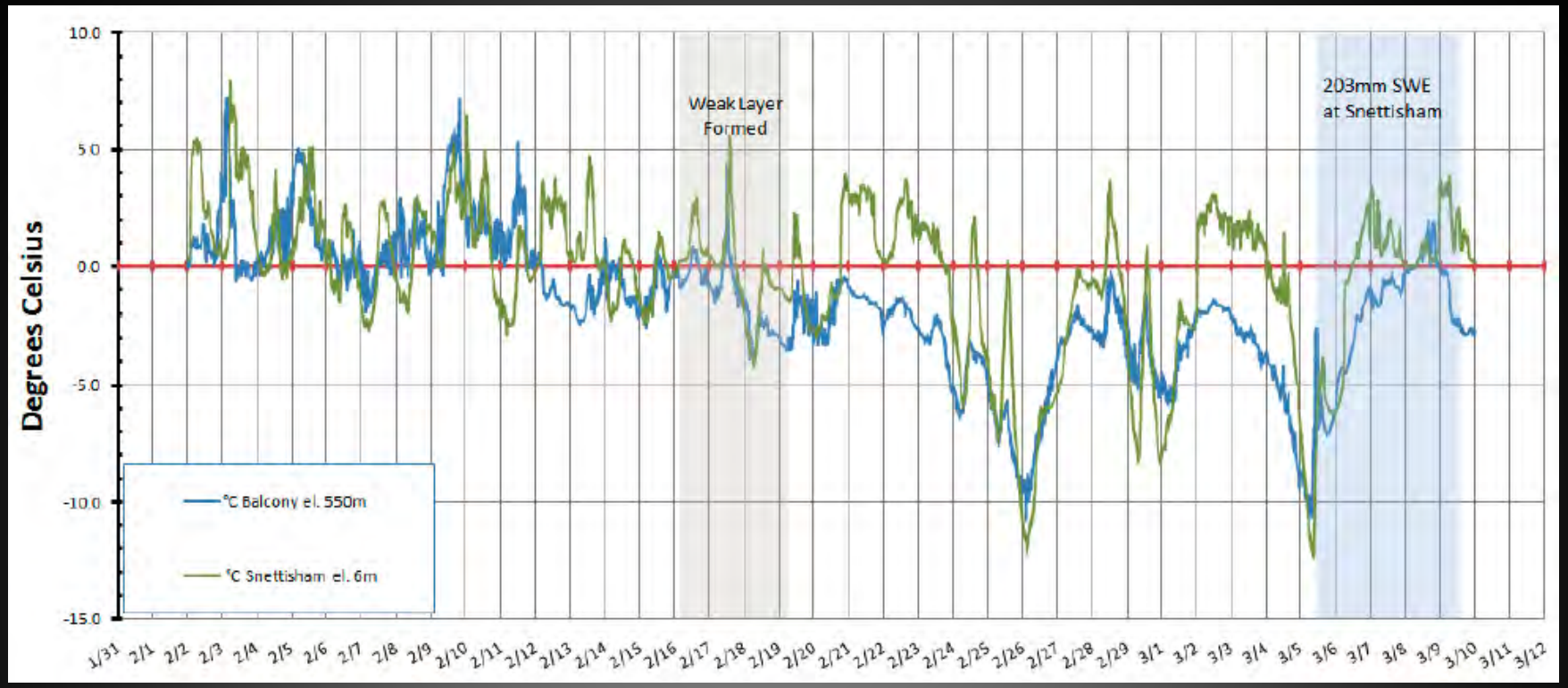
2009 Steel Diversion Structure

March 8, 2012 Structure Hit

Light-weight Guyed Porous Steel Splitting Wedge Diversion Structure

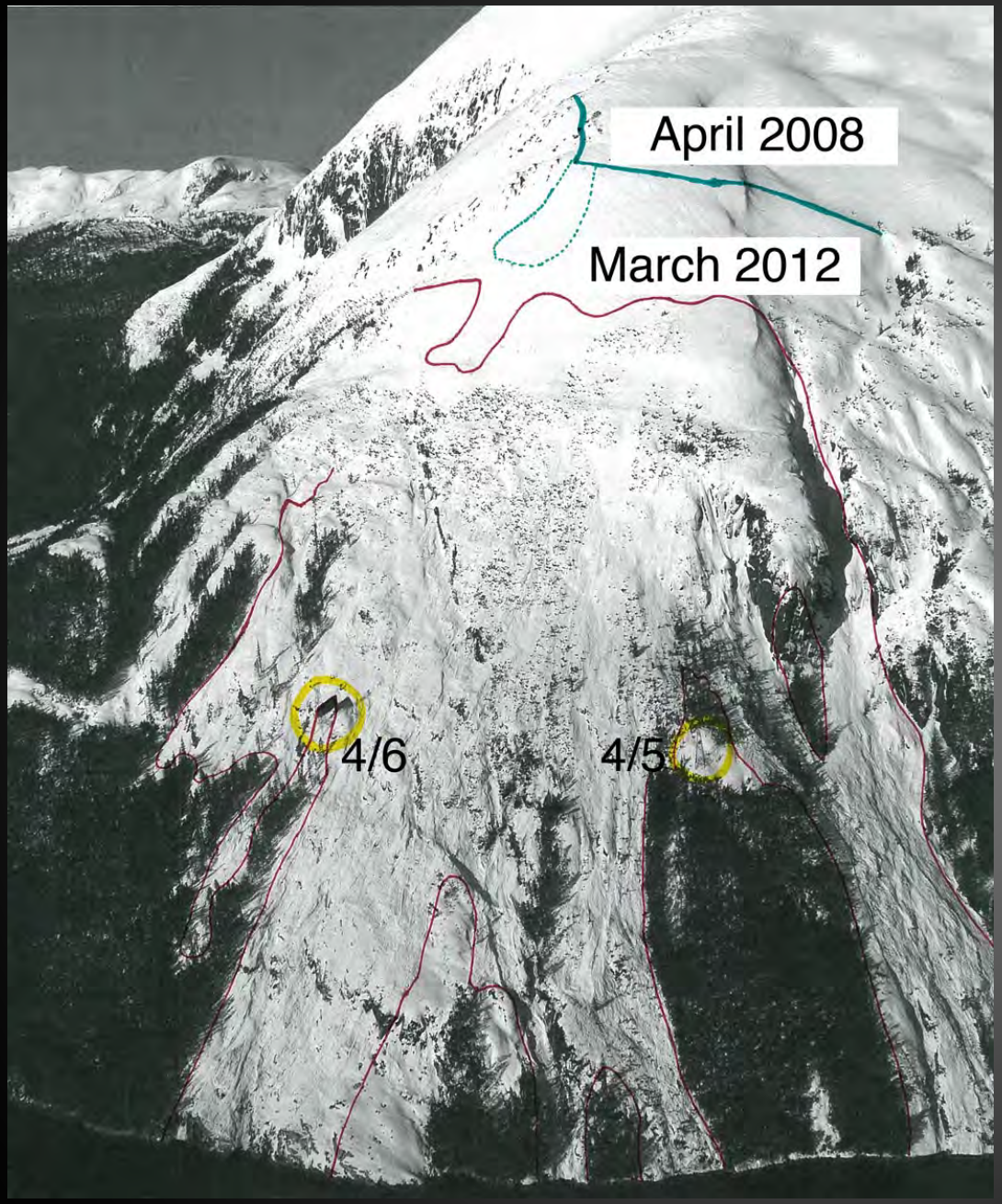
- 11 meters tall
- 37 degree apex
- Asymmetric
- Internal braces
- Steel guys
- Gaps in wings





WEATHER & SNOWPACK

- February Weak Layer
- March 20 cm SWE storm



2012 vs. 2008 AVALANCHE

Lower Elevation Crown

Colder Snowpack

Earlier Event

Lower Snow Depth

Before Impact

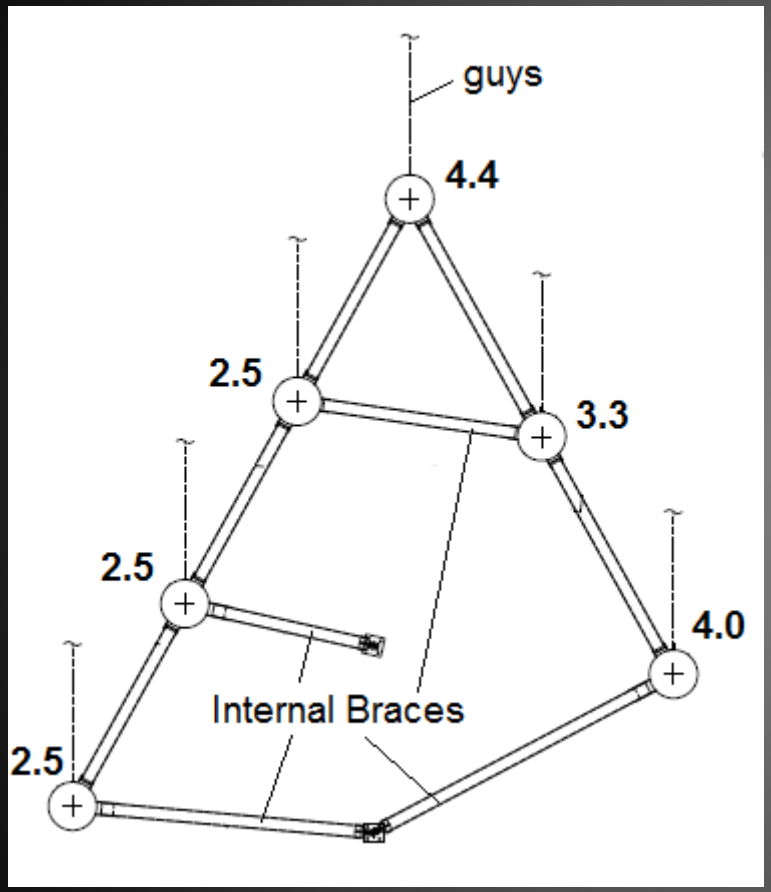
2012 DEBRIS DEPTHS

Dense Debris
3.4 to 5.5 meters

Dry snow (saltation)
1.0 to 1.5 meters

Structure Height 11 meters

Guy Cable Slack (cm)

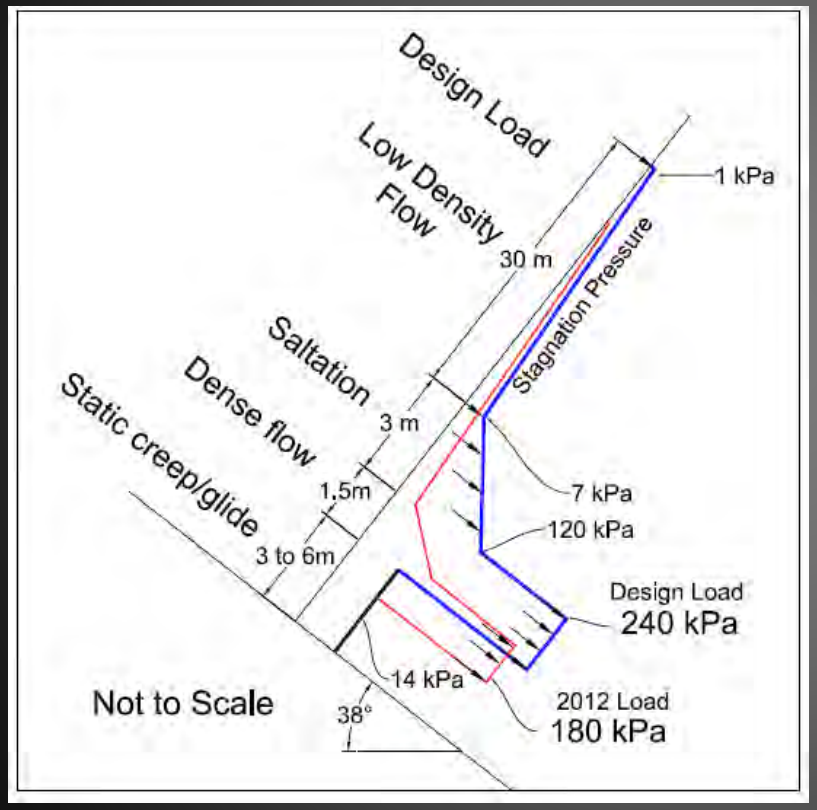


- Measured during re-tensioning.
- Non-Uniform
  leading guy
  left wing.
- Elongation < 0.5 percent

INTERIOR DEBRIS HEIGHTS (meters)

- ✓ Non-uniform
- ✓ Thicker (2m) towards back
- ✓ Thinners (1m) at apex
- ✓ No debris impacted lattice tower

2012 vs. Design Avalanche



Design snow depth

Avalanche type:
dry flowing

Flow Height

Velocity & Density
(impact energy)

Powder component
(stagnation pressure)

Conclusions

Impact Loads

Steel Guy Cables

Gaps in Wings

Internal Braces

Future Structures

Bill Glude Photo

Thank You!

Acknowledgements

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