COLORADO
Department of Transportation
Division of Transportation Development

Research Brief
Office of Applied Research

Study Title
Seismic Avalanche Detection for the Turnagain Arm Transportation Corridor

Brief Type
Final

Date
May 2025

Study Timeline
Dec 2025 – May 2026

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Seismic Avalanche Detection for the Turnagain Arm Transportation Corridor (CDOT-2026-02)

Study Objectives
There is a need for road level/trackside avalanche detection for transportation agencies. This study looked at one technology from Viotel Pty Ltd (Australia) to see if it is feasible and tested in Alaska.

Additionally, these systems are not quick or easy to set-up, or take down and re-deploy.

Background
There are expensive avalanche detection systems that scan the avalanche path for signals from an avalanche event; these are either doppler radar or infrasonic detection systems. These systems can give differing degrees of avalanche occurrence details, but they can not always determine if avalanche debris made it to the transportation corridor.

Avalanches threaten the Seward Highway and Alaska Railroad through the Turnagain Arm region near Hope, Alaska. Current detection relies on visual observation and manual reporting. An automated, real-time detection system could improve safety response times.

Methods
Three inexpensive ultra-low-noise MEMS accelerometers were deployed along the corridor for 145 days (December 2025 - May 2026). Continuous 62.5 Hz vibration data was uploaded via cellular telemetry. A hybrid classification algorithm combining machine learning and rule-based detection was developed to automatically distinguish avalanches from trains, earthquakes, and sensor artefacts.

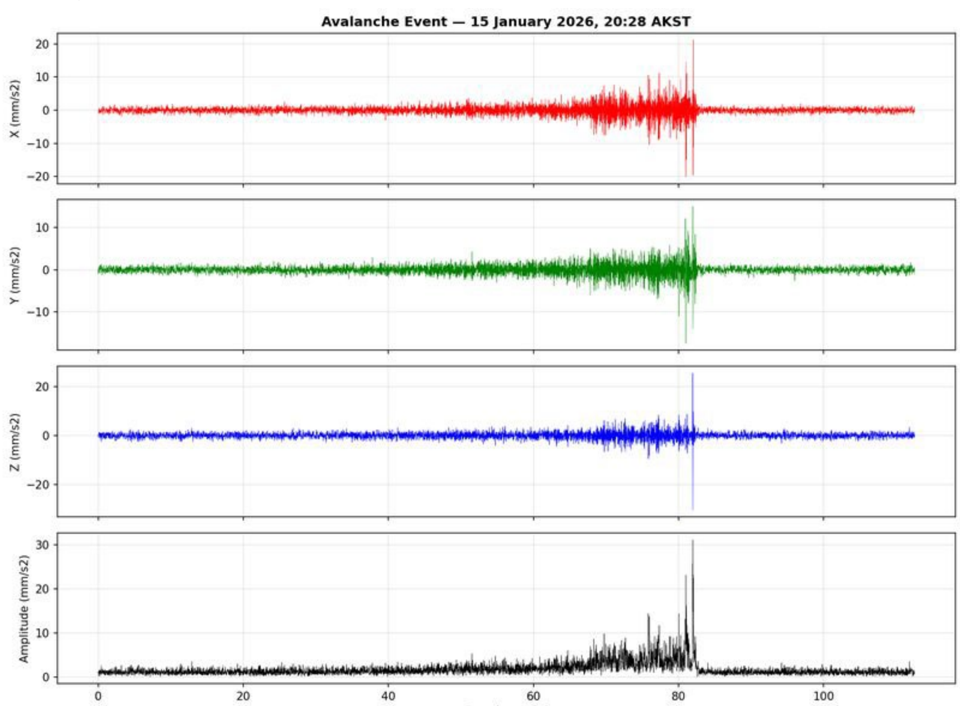

Figure - Three-component accelerogram of the confirmed (second) avalanche event (15 January 2026, AKST). Note the gradual onset, extended duration, and brief high-amplitude burst.

Key Findings

- **Avalanches are detectable.** One confirmed avalanche (15 January 2026) produced a clear signal with 13:1 signal-to-noise ratio at 30 ft range.
- **The avalanche signature is distinctive.** High spectral centroid (18 Hz), very high crest factor (15.9), and gradual onset separate it from all other sources.
- **Classification accuracy is 94.7%** (cross-validated) for non-avalanche events.
- **Zero false alarms** over 145 days of continuous monitoring.
- **Sensors are reliable.** >99% uptime over a full Alaska winter with no maintenance visits.
- **Detection range:** Confirmed at 30 ft; not detected at 1.3 miles. Further work needed to characterise the detection radius.

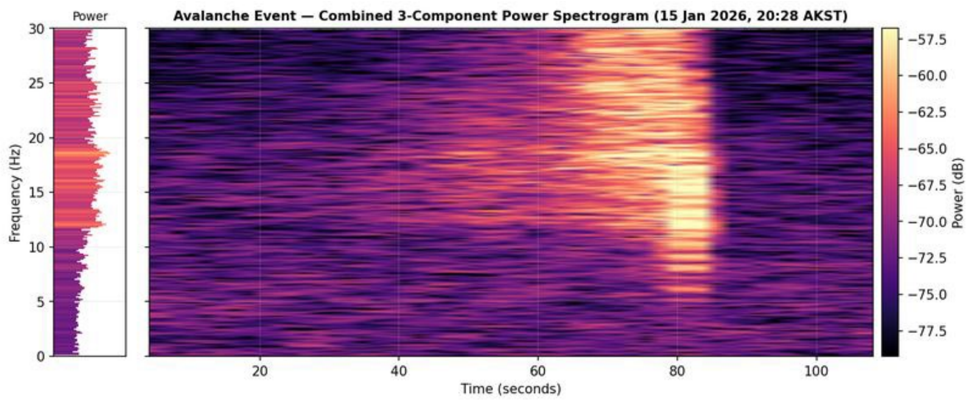

Figure - Spectrogram of the avalanche event. The dominant energy is concentrated around 18 Hz, though broadband energy is visible during the peak amplitude burst.

Limitation

Only one avalanche was recorded. The algorithm cannot be statistically validated from a single event.

Next-Steps

We will continue monitoring through the 2026-2027 winter season to collect additional avalanche examples and validate the detection algorithm. Replace the buried sensor to restore three-station geometry.