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Developing a Remotely Sensed Rockfall Database and Investigating Climatic Influences on Rockfall Activity within the Thompson Fraser Rail Corridor, BC

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The Canadian Railway Ground Hazard Research Program (RGHRP) was established in 2003 with the objective to understand the natural hazards that are impacting railway operations across Canada. This study is part of the RGHRP initiative and focuses on several highly active rockfall sites in the Thompson-Fraser rail corridor in Interior British Columbia (van Veen et al. 2017). A rockfall is defined as the detachment and forward rotation or sliding of rockmass, resulting in the falling, rolling, and bouncing of the rockmass downslope (Hungr et al. 2014). Rockfalls pose a significant hazard to Canadian transportation corridors located in mountainous terrain because it is difficult to provide warning prior to large magnitude events. Operating railway infrastructure within hazardous rockfall environments results in costly consequences which can negatively impact the efficiency and safety of railway systems. A thorough understanding of the rockfall hazards and associated triggering factors is therefore required in order to prioritize mitigation efforts in rail corridors subjected to rockfall hazards.

Active rockfall sites within the Thompson-Fraser rail corridor have been monitored by the Queen's Geomechanics Research Group beginning in 2012 using Terrestrial Laser Scanning (TLS) and high resolution panoramic imagery collected at weekly to seasonal intervals. A semi-automated methodology has been developed to populate a rockfall database from sequential TLS scans. Change detection between sequential scans is used to identify areas of change on the rock slope (i.e. rockfall source zones). 3-Dimenisional rockfall objects are generated by clustering areas of the point cloud attributing to the failed rockmass. The location, shape, volume and lithology of each 3D rockfall object can be calculated and populated into the database for further analysis.

The rockfall database is used to analyze relationships between the climate and rockfall activity using data from weather stations adjacent to the rock slopes. Shape and magnitude of rockfall events are expected to vary seasonally. As more rockfall events are populated into the database, the relationships involving freeze-thaw and precipitation will become more clear. Based on preliminary analysis it is thought that increased antecedent precipitation, high frequency of freeze-thaw events, and large freeze-thaw temperature changes are factors contributing to rockfall triggering.

The presented study hopes to stimulate discussion on the role the northern latitude climate has on rockfall activity and processes. An increased understanding of these climactic influences on rockfall activity will improve future hazard identification and risk mitigation practices in a changing climate.

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