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Identification and prioritization of rock-slope hazards at the railway subdivision scale using 3D remote sensing data

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Many studies over the last decade have proven the value of ground-based stationary remote sensing platforms such as Terrestrial Laser Scanning (TLS) or Oblique Terrestrial Photogrammetry (OTP) for assessing rock-slope hazards through change detection to monitor/predict movement, identify failure mechanisms and to quantify risk [1][2]. However, in the case of highly variable, steep, vegetated terrain such as that of the study area along the Canadian National Railway (CN) corridor between Hope and Yale, British Columbia, hazardous slopes are not always accessible or visible from terrestrial vantage points and are therefore difficult to assess using these techniques. Airborne remote sensing platforms such as Aerial Laser Scanning (ALS) offer a great deal of otherwise inaccessible 3D information in such environments. These platforms can collect data over large areas despite difficult and/or prohibitive conditions on the ground [3]. However, conventional ALS is limited in terms of its resolution compared to the above-mentioned terrestrial methods. Moreover, in the case of near-vertical terrain, ALS is often unable to provide complete data due to its downward facing point of view [4]. This study looks to identify the limits of conventional ALS in evaluating susceptibility to rockfall in steep, mountainous terrain.

The study area consists largely of natural slopes which may have the ability to produce rockfall. This study assesses rockfall susceptibility with the goal of providing insight to decision makers as to where management and mitigation efforts should be focused and/or where more data collection may be possible and beneficial. We have found that predictive statistical analysis of 3D point cloud data generated from aerial platforms is an effective means for identifying geologic features such as outcroppings and talus deposits. In this case study, we first use such techniques to build a geomorphological inventory for the study area. We then semi-quantitatively assess the likelihood of a hazard occurring on a given slope using the information from the inventory. Finally, we prioritize slopes throughout the corridor in terms of their potential to source rockfalls and identify sites which can benefit from further characterization through remote sensing data collection.

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