



## Structure and Components of the Warning and Emergency Response System at Turtle Mountain, Alberta, Canada

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Since 2003, a series of over eighty sensors have been installed at Turtle Mountain, site of the 1903 Frank Slide. The purpose of these instruments is both to characterize and provide warning for a second large rock avalanche from the eastern face of the mountain, where various unstable masses have been identified. Although studies continue on the mountain to better understand the deformation patterns and interpretations of the slope kinematics, significant effort has been expended to develop a structure for the warning and emergency response that clearly outlines not only responsibilities and communications protocols during an emergency, but also day-to-day operational responses and procedures to ensure that the system remains operational.

From a day-to-day operational perspective, a systematic and repeatable set of procedures is required in order to ensure that not only are data trends reviewed and reported on, but that scheduled checks of system functionality are undertaken. An internal Roles and Responsibilities Manual has been developed to clearly outline responsibilities for geo-engineering, IT and management staff to ensure that system checks are completed and that support is in place on a 24/7 basis should components of the system cease to operate properly or should unacceptable deformations require review. In addition to that, a clear and concise troubleshooting manual was developed, this document provides simple diagnosis of problems within the system and a clear roadmap of how to fix each component.

On the other hand, from a warning and emergency response perspective, a series of colour coded alert conditions has been developed should unacceptable deformations be observed. At each alert level, clear responsibilities for actions and communications have been identified for geo-engineering staff, provincial emergency management authorities, municipal official and first responders. This has been documented in the Emergency Response Protocol.

All documents described here are ‘living’ documents that are updated on a regular basis as changes to the system are made, with an annual mock warning exercise developed and run in order to test responses to a hypothetical emergency and generate updates to the system documentation.