Rock Fall Monitoring and Analysis

ILRIS Application Note: IL-003 Rev B

Public safety and rock fall monitoring at Yosemite National Park

A massive rock fall at Glacier Point, Yosemite National Park, occurred on October 7-8, 2008, just above the Curry Village campground and cabins. The rock fall caused a few injuries but no deaths; however, some guest cabins were damaged.

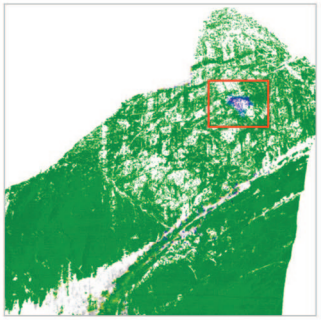
This area of the park has always been prone to rock falls, but until this rock fall no scientific evidence had been presented to the National Park Service (NPS) on how to manage the campground and protect the public. Therefore, the ability to characterize and monitor the rock face of Yosemite's sheer walls became vital for the NPS to ensure the public safety of the park.

Solution: ILRIS-3D baseline scan (2007) and post-fall scan (2008)

In October 2007, a year before the rock fall, Optech deployed its ILRIS Terrestrial Laser Scanner to perform a scan of the rock faces at Glacier Point as a baseline measurement for park geologist Dr. Greg Stock.

Dr. Stock wanted to know if lidar scanning can be used to image Yosemite's sheer walls and to analyze rock fall dynamics. One year after the first scan, Dr. Stock's foresight was confirmed when the massive rock fall occurred in October 2008.

Eight days after the rock fall, Optech performed a second scan of Glacier Point. Both pre- and post-rock fall scan data sets are now available for further study and action.



Scan statistics
Total no. of points: 6.7 million
Scan range area of interest: 1,200 m

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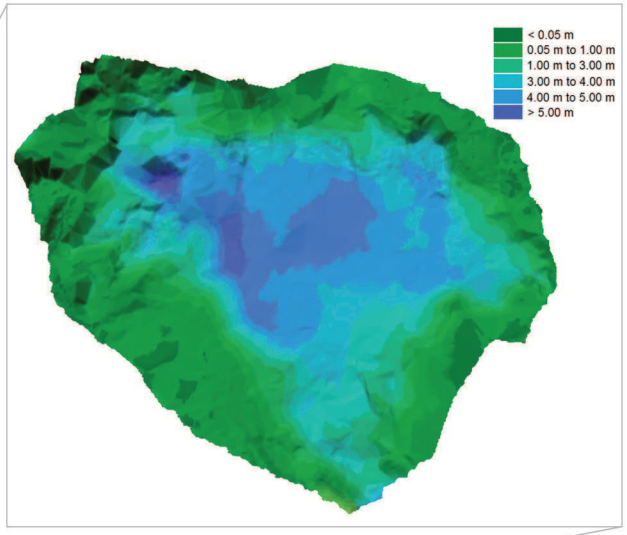
Rock fall model using PolyWorks

With PolyWorks, the following analytical tools were generated:

- 2007 and 2008 data from a TIN (Triangulated Interpolated Network) model
- Change detection:
  - Overall error map of 2008 model generated based on the 2007 baseline model, showing changes of ~5 m (purple area)
  - Rock fall area error map encompassing just the fall area (right).

The rock fall was quantified: Cross-sections through combined TIN models and surface-to-plane measurements estimated the volume of the rock fall to be 5738.8 m^3.



Yosemite National Park

Scientific evidence for analyzing rock fall dynamics

- High-resolution baseline topographic data against which to compare future rock fall events
- Error map to characterize fall and measure area/volumes

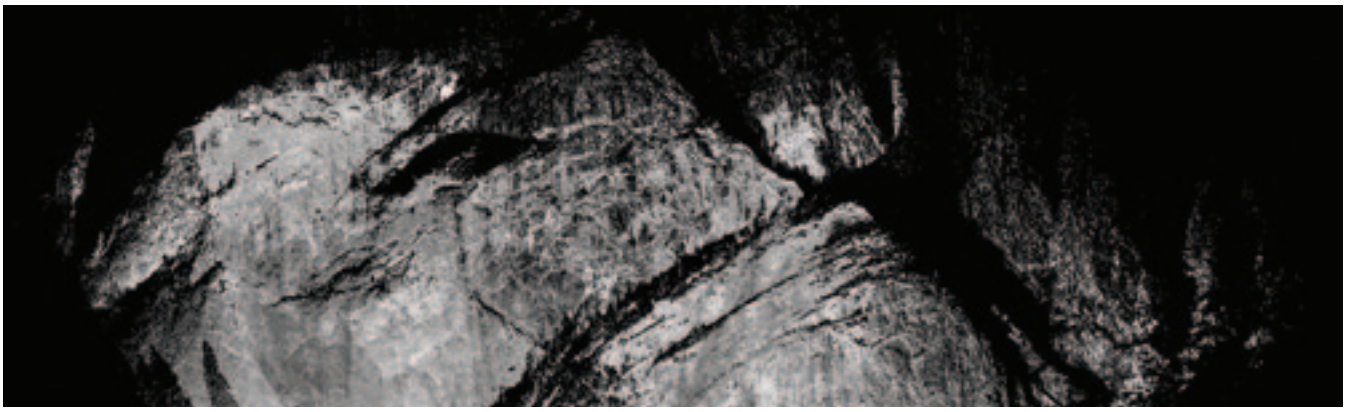
Quantified rock fall statistics

- Maximum length: 69.9 m; maximum thickness: 4.45 m
- Volume: 5738.8 m^3
- Event: Planar failure (exfoliation) along surface-parallel sheeting, joint oriented at 26.7°/89.7° (dip direction/angle)

Success: Improved park safety

The NPS is now able to monitor and improve the safety of the Curry Village campsite for users and tourists:

- Dr. Stock recommended a no tent/cabin zone in Curry Village
- Over 300 cabins and tent spaces have been closed at Yosemite.



Lidar image of the rock fall area

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