Study of the Hooskanaden Slide Using LiDAR Technology

By Audrey McHugh Britton
2019 Symposium by the Sea
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Region 3 – Southwest Oregon
Hooskanaden Slide
Background

- Mountain snow event in Coast Range
- Coastal rain event
  - 12 inches in 2 days
- Several highways in the region closed
Aftermath
Approach

- How did the slope surface change?
- What is the extent of the slide?
- What are the characteristics of the slide?
  - Can we prevent it from happening again?
- How much roadway material was moved?
## Approach

<table>
<thead>
<tr>
<th>Mobile LiDAR</th>
<th>Terrestrial (Static) LiDAR</th>
<th>Aerial LiDAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High point density</td>
<td>• High point density</td>
<td>• Lower point density</td>
</tr>
<tr>
<td>• Direct view of vertical faces</td>
<td>• Not restricted to roadway</td>
<td>• Larger footprint</td>
</tr>
<tr>
<td>• Restricted to roadway</td>
<td>• Coverage dependent on positioning</td>
<td>• Not limited to visibility from roadway</td>
</tr>
<tr>
<td>• Closer to ground/objects</td>
<td>• Gaps from obstructed areas</td>
<td>• Direct view of roads/roofs</td>
</tr>
</tbody>
</table>
DOGAMI Aerial LiDAR

2008 Data
UAS LiDAR

Photo courtesy of Oregon State University
UAS LiDAR

Graphic courtesy of Oregon State University
UAS LiDAR

2019 OSU DEM
UAS LiDAR

- Ability to process a 0.5 m DEM with minimal data gaps to fill
- Ground point density typically ~30 ppsm
- Steep terrain and dense vegetation
- Turn around ~1-2 weeks
Terrestrial (Static) LiDAR

- Collected by Oregon State University for slope study
- Collected new data after the slide
Terrestrial (Static) LiDAR

Hooskanaden Landslide Event
Exaggerated Displacements (x3) estimated from Comparison of Terrestrial Lidar from October 16, 2018 and March 3, 2019

Terrestrial (Static) LiDAR
Mobile LiDAR

- Data collected summer 2018
- Temporary alignment placed
- ~15,000 cubic yards of material used
Mobile LiDAR
Mobile LiDAR

2018 Data
Mobile LiDAR

Post-slide data with 2018 line work
Results

- Point cloud data
  - Real latitude, longitude and elevation information
  - Vector analysis
  - Cross-sectional information
- Bare-earth DEM
  - Visualization/characterization of the slide
  - Difference in slope surface over time
Results

- Redesign in progress
- Reinforcement of slope drainages
  - Prevent obstruction in the event of more movement
- Ongoing maintenance
  - Difficult to prevent movement
Ongoing Monitoring Efforts

- **ODOT**
  - Site visits

- **Oregon State University**
  - Terrestrial LiDAR scans every 6 months
    - Only capturing bluff and area along the road
  - UAS LiDAR
    - Occasionally flown, depends on funding
Future Monitoring?

- UAS LiDAR Surveys of the entire slope
  - Ideal for hazardous areas and project sites
  - DOGAMI LiDAR not updated frequently
  - Road and bluff scans only
Questions?
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