

The role of science in support of the response to the Oso, Washington, USA, landslide disaster

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On 22 March 2014 a large, rapidly moving landslide impacted the community of Steelhead Haven, near Oso, Washington, USA, killing 43 people. The slide displaced about 8 million cubic meters of sand and silt from a 200-m high glacial terrace destroying 40 homes and burying more than 1.0 km of State Route 530. The landslide deposits temporarily dammed the North Fork of the Stillaguamish River flooding an area of about 1.4 square km. The unusually long travel distance, in excess of 700 m from the base of the slope, and speed, in excess of 60 km/hr contributed to the great loss of life and destruction. Landslide science was critical in supporting the response to the disaster. Landslide monitoring, process understanding, pre- and post-event high-resolution digital topography, and numerical simulations were used to advise search operations. Recognizing that buildings and their contents were swept tens to hundreds of meters from their original locations, maps of deposit thickness and estimates of landslide trajectories were used to develop safer and more efficient search strategies. Teams of county, state, and federal scientists, engineers, and specialists were formed to: (1) assess the stability of the landslide dam, (2) monitor stream flow and the level of the lake impounded by the slide, and assess the geomorphic response of the river to the landslide, and (3) provide a threat assessment of additional landslide activity to search operations. The threat assessment team's activities included establishing a communications protocol among landslide watch officers and search operations, and deploying instrument platforms (Spiders) that remotely detect both ground movement using GPS technology and vibrations indicative of landslide movement using seismometers. The team was responsible for monitoring and integrating data from the Spiders and other instruments and determining the potential for additional landsliding during daylight hours, 7 days a week, until the conclusion of active search operations on 28 April 2014. Landslide understanding, data collected prior to and during the response, and modeling results proved critical for informing search operations, decision makers, and the community, underscoring the value of effective partnerships and the need for unbiased technical information during crisis response.