2019 AGS-GSA MARCH JOINT LUNCHEON

TITLE

Ground Failures Induced by Seismic Shaking During the 2018 Anchorage, Alaska M7 Earthquake

ABSTRACT

Strong ground motions during the November 30, 2018 M7 Anchorage, Alaska earthquake triggered numerous ground failures in artificial fill and natural materials over a >5000 km2 area in south-central Alaska. Shaking generated by the intraslab earthquake (40 km deep) produced peak ground accelerations of 0.3-0.8 g throughout much of the greater Anchorage-Matanuska-Susitna Valley urban area. Post-earthquake aerial and ground surveys, spanning December 1–10, focused on ground failures (liquefaction, lateral spreads, and landslides) in artificial fill and natural materials. Coseismic failures in artificial fill damaged engineered road and rail embankments and buildings, particularly residential homes. Ground failures in natural materials occurred where landslides were triggered by prior earthquakes, including the 1964 M9.2 Great Alaska earthquake and the 1954 M6.4 Kenai Peninsula earthquake.

For example, landslides threatened but did not damage the Alaska Railroad at Potter Hill in 2018, adjacent to an area where landslides destroyed the railroad in 1954 and 1964. Liquefaction-related lateral spreading and sand boils occurred in tidal and deltaic environments along upper Cook Inlet and in areas of Anchorage underlain by sandy, wet soils. We also observed debris avalanches on steep slopes underlain by glacial outwash and rockfalls and snow avalanches in steeper terrain of the Chugach Mountains. Field surveys of translational landslides triggered by the 1964 earthquake identified minor cracking (≤0.01 m wide, ~32 m long) along the margins of landslide blocks and grabens, but no evidence for significant net displacement. We speculate that the duration (20–40 sec) of shaking in the 2018 Anchorage earthquake stopped short of reactivating large translational landslides that failed during much longer (4 to 5 min) shaking in 1964. Our observations will be used to empirically check the USGS ground-failure products that depict areas prone to coseismic liquefaction and landsliding.

Sediment vented by earthquake-triggered liquefaction at the mouth of the Little Susitna River.

Complex earthflow slumping along Alaska Railroad overlooking tidal flats along Knik Arm near Mirror Lake.

BIOGRAPHY

Dr. Rob Witter is a research geologist at the USGS Alaska Science Center in Anchorage. He received his undergraduate degree from Whitman College, Walla Walla, Washington and his PhD from the University of Oregon in Eugene. Dr. Witter's research emphasizes paleoseismology of active faults with a particular focus on neotectonics of convergent margins. His research interests also include: examining the range of rupture variability during subduction zone earthquakes; using paleogeodesy to estimate the amount of vertical displacement caused by past earthquakes; investigating tsunami deposits to better characterize tsunami hazards; and improving public education in geologic hazards. Prior to joining the USGS, Dr. Witter designed and implemented the tsunami hazard mitigation program for the Oregon Department of Geology and Mineral Industries. He also worked as an earth science consultant in Walnut Creek California.