Geophysical Research Abstracts
Vol. 15, EGU2013-13461, 2013
EGU General Assembly 2013

A rockfall incident at mountainous road western Saudi Arabia

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Mountain roads were constructed across rock masses, debris accumulations, and gullies which led to the formation of hazardous areas prone to risk of various types of failures. At the western territories of Saudi Arabia, the Arabian Shield exists and characterized by a high rugged mountainous topography extends along the western coast of the Red Sea. The high rising mountains characterized by sharp escarpment, steeply dipping towards west and frequent rainfall. The rock masses were subjected to several tectonic events led to rising of the mountains and the tectonically oriented rock masses structural patterns and wadis orientations such as that at Al-Hada descent.
Al-Hada descent lies at the western region of Saudi Arabia at elevation of about 2000m, characterized by sharp cliff. Al-Hada descent road was constructed with an elevation difference of 1500m between the highest and lowest heights along the road. The road alignment is intersected by very steep gullies of almost 60 to 80 degrees. The gullies contain large quantity of mud, old levees and large rock blocks.
Al-Hada descent road hit by heavy rainfall last about 2 hours. The rainstorm initiates debris flows and rockfalls initiated from the on steep gullies, and caused them to travel rapidly down along the gully channel. Once the rock flow reaches an open area intersects with the road at the retaining wall, it partially destroys the three New Jerseys caused by a one large block, dropping from 140 m-high steep elevation. The moving rockfalls spread out, loose speed and deposited beyond the highway opposite side, and repeated the destruction journey of the lower road alignment.
Complete analysis of the rockfall trajectory, kinetic energy endpoint, jump height were made in addition to recommending the remedial measures to ensure unrepeated such incident.