Geophysical Research Abstracts
Vol. 20, EGU2018-6974-2, 2018
EGU General Assembly 2018

Rock Fall and Debris Flow Hazard and Risk Assessment along Karakoram Highway (Besham-Chilas Section), Pakistan.

Sajid Ali (1,2), Muhammad Tayyib Riaz (3), Yasir Sarfraz (3), Muhammad Shafique (4), Muhammad Basharat (3), and Klaus Reicherter (1)

(1) Neotectonics and Natural Hazards, RWTH Aachen, Germany (s.ali@nug.rwth-aachen.de), (2) Department of Earth Sciences, COMSATS Information Technology, Abbottabad, Pakistan., (3) Institute of Geology, University of Azad Jammu & Kashmir, Muzaffarabad, Pakistan., (4) National Center of Excellence in Geology, University of Peshawar, Peshawar, Pakistan.

Karakoram highway is an all-weather route connecting North Pakistan with South West China. Since its completion in 1979, traffic disruption and road damage due to slope movement is continuous phenomenon. It passes through world's highest and tectonically active mountain ranges of Karakoram and Himalayas. This paper is concerned about 200 km long Besham-Chilas section of the highway. The section runs across the Main Mantle Thrust (MMT), the Pattan Fault, the Kamila Jal Shear Zones, the Kamila Fault (strike slip) resulting in highly jointed low to high-grade metamorphic rocks of Indian plate and Kohistan Island Arc. Deeply incised gorges and long steep slopes (1-3 km) characterize the topography of the section. Rock falls, debris flows and debris slides are common processes along the section. At places, spacing of the joints led into formation of big blocks (>5m3) and lack of persistence enhanced chances of rock falls. The phenomenon of rock falls upslope led into deposition of debris/talus deposits that are highly susceptible during precipitation resulting into debris flows. Sixty-three sites along the entire section were selected through analysis of satellite imagery for detailed field investigation. Field surveys were conducted to acquire all parameters for risk assessment and evaluation. Two different risk assessment methods (for rock fall/debris slide, debris flow), based on morphological, geological, hydrological criteria of the area were used. Rock fall/debris slide hazard assessment was based on morphology (height and dip of slope), geological (kinematic analysis, susceptibility to erosion, rockmass strength), surface condition (collapsed factor, water seepages), effect of countermeasures and history and frequency of events. Whereas, the property of channel (steepness, width), geology of the catchment area, slope characteristics in catchment area (slope gradient and failures), presence and effect of countermeasures and history and frequency of events were considered for debris flow hazard assessment. According to kinematic analysis of joint data collected on rock fall sites, wedging, toppling and plane failure were found dominant failure processes. Rock falls at very high risk were found close to faults: in Jijal complex close to the MMT and between Dynter Valley Bridge and Sazin close to the Kamila Fault. Whereas, highly active debris flows are concentrated in Sazin-Chilas subsection. Only some sites were found at medium to high risk between Pattan to Dynter Valley Bridge. In last step, hazard and risk maps of the Karakoram highway (Besham-Chilas section) were produced showing areas with very high, high, medium and low risk. Based on the map, remedies and countermeasures were being proposed. This hazard and risk maps can be used for future planning and maintenance of the highway. Furthermore, this hazard and risk assessment method can be used for other areas with similar geological, geomorphological and hydrological conditions.