

A rockfall hazard assessment for a residential area by using 2D and 3D simulation models: A case study from North Turkey

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Rockfalls are one of the most common and important mass movement type encountered throughout both the World and Turkey. In Turkey, especially in Black Sea Region, rock fall cases frequently occur due to the steep topography, lithological characteristics, improper land use and structural elements such as discontinuity density. As a consequence of rock fall cases, serious injury and loss of lives can be observed in the area.

In this study, a residential area located in Trabzon city (Northeast part of Black Sea Region, Turkey) was handled in point of rock fall hazard assessment. In the area, several rock fall cases occurred, and one of them occurred in year of 2009, resulted two people died. The last one also occurred in year of 2016, and the source of both cases are the same location. In the area, several houses and working places are available, and up to now any effective protection measurements have been installed. The area is also located near a highway connecting Trabzon city to the southeast region of Turkey, and daily vehicle number is highly considerable. Due to all these sensitive issues, the area was selected to be study location. In order to make a rock fall hazard assessment in the area to determine and propose an effective mitigation system, a 2D and 3D simulation models were applied. Initially a digital elevation model (DEM) of the area was obtained by a 1:1000 scale digital topographical sheets. By using the obtained digital terrain data, detailed cross sections of the slope profiles were created. Then, a detailed field and photo survey was carried out to detect the dangerous and hanging rock blocks that may be source for a possible rock fall cases.

The physico-mechanical properties of the intact rock material were determined so that they can be used to be input parameters for the rock fall simulation models. To create simulation models, Rocfall 6.0[®], Rockfall Analyst for ArcGIS and CONEFALL softwares were used. Using the Rockfall Analyst extension for ArcGIS and CONEFALL software, propagation and runout distances of possible rock fall cases were evaluated. By Rocfall 6.0[®] software, possible rock fall paths and proper mitigation measurements such as protection barriers or ditches were also assessed. At the end of the assessment processes, a detailed rock fall hazard map was produced for the area. With the help of this map, an important extent of area was determined to be under rock fall threat. This obtained map is also expected to be considered by the local governmental authorities to make persistent hazard mitigation measurements in the area.

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