

Assessment of Slope Stability and Risk Mitigation Strategies for the Lohar Gali Landslide, Azad Jammu and Kashmir

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The Lohar Gali landslide poses a significant threat to the local community and travellers by blocking the main route to Muzaffarabad, the capital of Azad Jammu and Kashmir. Situated in a seismically and tectonically active region, the area exhibits several instances of landslides. This study focused on analyzing five topographic factors slope degree, aspect, contours, curvature, and elevation derived from a high-resolution DEM using ArcGIS 10.7. The findings revealed varying slope degrees from 0.1 to 60 degrees, with the steepest slopes exceeding 55° in the depletion zone. Additionally, the majority of the landslide faces southeast, followed by east. Utilizing these topographic factors and geotechnical investigations, slope stability analyses were conducted using the FLAC Slope and Slope/W module of GeoStudio software. The Factor of Safety (FOS) determined through Finite Difference, Ordinary, Bishop, Janbu, Spencer, and Morgenstern- Price methods ranged from 1.010 to 1.075, indicating that the slope is at risk of failure, with minor changes in intrinsic or extrinsic factors potentially leading to catastrophic events. Both methods predicted a planar failure surface. Further, a parametric study was conducted by varying slope angles, internal frictional angles, and phreatic levels to understand their impact on FOS. Observations revealed that increasing slope angles decreased FOS, resulting in slope instability, whereas higher internal frictional angles enhanced FOS and slope stability. Moreover, elevating water levels decreased FOS, exacerbating slope instability. These findings underscore the critical need for proactive measures to mitigate the risks associated with the Lohar Gali landslide and ensure the safety of the surrounding communities and travelers.