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Assessment and mitigation of slope stability hazards along Kombolcha-Desse Road, Northern Ethiopia

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The Kombolcha to Desse road, linking Addis Ababa with Northern Ethiopia towns traverses through one of the most difficult mountainous ranges in Ethiopia. The presence of loose unconsolidated materials (colluvium materials), highly weathered and fractured basalt rocks, high relief, steep natural slopes, nature of geologic formations exposed along the road section, poor drainage conditions, occurrence of high seasonal rains and seismically active nature of the region created favorable condition for slope instability in the area. Thus, keeping in mind all above points, the present study was conceived to study in detail the slope stability condition of the area. It was realized that detailed slope stability studies along this road section are very necessary to identify critical slopes and to provide the best remedial measures to minimize the slope instability problems which frequently disrupt and endanger the traffic movement on this important road. For the present study based on the field manifestation of instability, two most critical slope sections were identified for detailed slope stability analysis. The deterministic slope stability analysis approach was followed to perform the detailed slope stability analysis of the selected slope sections. Factor of safety for the selected slope sections was determined for the different anticipated conditions (i.e., static and dynamic with varied water saturations) using Slope/W and Slide software. Both static and seismic slope stability analysis was carried out and factor of safety was deduced for each anticipated conditions. In general, detailed slope stability analysis of the two critical slope sections reveals that for only static dry condition both the slopes sections would be stable. However, for the rest anticipated conditions defined by static and dynamic situations with varied water saturations both critical slope sections would be unstable. Moreover, the causes of slope instability in the study area are governed by different factors; therefore integrated approaches of remedial measures are more appropriate to mitigate the possible slope instability in the study area. Depending on site condition and slope stability analysis result 4 types of suitable preventive and remedial measures are recommended namely; proper managements of drainages, retaining structures, gabions and managing steeply cut slopes.

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Assessment and modeling of pore network development resulting from dissolution of carbonate rocks using a surface model from image data, Subis limestone, Sarawak, Malaysia

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This paper introduces a method for assessing changes in, and modeling the development of pore network of carbonate rocks as a result of dissolution. The method is based on utilizing 3D volume rendered from image data to construct a surface model from that volume using NURBS module available in ScanIP software package. Pores were visualized in 3D volume for the same sample prior and after dissolution. Before volume rendering from CT scan data, pore volume fraction was computed using a mask applied for the purpose of image segmentation. After volume rendering, a NURBS-based surface model was constructed for limestone sample where pores were in-depth visualized and the increase in porosity was assessed. The model showed that the pattern of pores prior to dissolution are mostly individual pores, whereas post dissolution pores tend to merge through the increase in pore body rather than pore throat. Based on that, a model describing the preferred pathways for dissolution was described.

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