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Assessment of Road Cut Slope Instability in the Landslide Prone Ethiopian Highlands

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The new 35km long road cut excavation along Kombolcha-Woldiya Highway, in the landslide prone Ethiopian Highlands, faced successive multiple spot rock slope failures ad pavement deformation in the last week of August 2010, after the main rain season. These failures caused twenty-six causalities and major traffic disruptions.

Detailed field observations before the failures indicated possible ground movements due to stress release and the reactivation of old landslides, as deep steep slope cut practices and some typical old landslides landform features were noted. The presence of an intercalated unconsolidated tuff unit within the basaltic trap series coupled with some adverse joint systems causes the referred danger. Besides, slope rock mass classification using Slope Stability Probability Classification (SSPC) and localized slope stability analyses were used to rationally estimate the probable effects of rain-induced saturation.

Back analyses were used to figure out the effects of rain-induced saturation at each failure spot, serving as input for simulating future conditions. Accordingly, joint pore water pressure rise is computed by designating a comparative weighting parameter to model the relative available joint pore space, which governs the possible pressure rise in the slope rock mass. The weighting parameter is then assigned to the slope rock mass, providing a proportional factor which in turn is used to correlate the computed pressure values. At last, estimates of the anticipated water pressure rises due to a given rainfall intensity are derived.

The overall outcome is further correlated to the localized slope analysis results, revealing a strong dependence of slope failure hazard on average rainfall conditions. This may significantly reduce the lifetime of the road cut.