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Towards a new framework for the analysis of slope movements in weathered materials

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Traditionally, analyses of the susceptibility of a slope to the effects of landslides have tended to treat the system as an essentially static entity. Three main approaches are commonly adopted in this framework: 1. To consider the forces acting on the slope and the forces resisting movement in order to determine the factor of safety; 2. To use an existing distribution of landslides to determine the key factors influencing slope stability, and then to use the combination of these factors to predict where future failures might occur; and 3. To treat the slope as a hydrological system, and to calculate where areas of high excess pore pressure might be generated. Whilst all have advantages, in general these approaches have proven to be disappointing in terms of determining susceptibility to future triggering events. On-going research at the International Landslide Centre uses a rather different approach. Here, analyses of movement records of a large number of landslides have been used to examine the patterns of acceleration associated with slope failures in both weathered and unweathered materials. It has been demonstrated that each deformation mechanism in the basal regime of the landslide can be characterised by a specific movement pattern within the landslide mass. This has been backed up by laboratory experiments, including the application of a novel back-pressured direct shear machine that allows infinitely variable control of normal stress, shear stress and sample pore pressure. This has permitted the construction of a new framework within which the behaviour of landslides can be characterised from a dynamic perspective. A series of simple direct shear experiments under genuinely representative stress conditions allows the dynamic behaviour of the system to be determined, including the conditions required for the triggering of failure and the likely

mode of movement before and after the failure event occurs. This understanding of landslide systems provides a new framework within which landslide susceptibility can be assessed, and can result in much better analyses.