



British
Geological
Survey

Assessing slope stability hazards

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In Britain, the most dramatic landslides tend to be on the coast; a recent example being the spectacular landslide near Scarborough in June 1993 which involved an overnight cliff retreat of 135 m and the destruction of the Holbeck Hall Hotel. Coastal cliffs are shaped by and dependent upon landslide activity and in many locations landsliding needs to be accepted as a necessary process, despite loss of land. Thankfully, it is only rarely that sudden cliff collapses or rockfalls lead to loss of life and serious injury. Indeed coastal landslides play an important role in supplying sediment to beaches, sand dunes and mudflats on neighbouring stretches of coastline. These landforms absorb wave and tidal energy and can form important components of flood defence or coast protection solutions.

Away from the coast, the majority of landslides are ancient features, inherited from the late Pleistocene i.e. periods of glacial and periglacial activity about 10 000 years ago. Widespread landsliding occurred on glacially over-steepened valley sides, the flanks of hills and along escarpments. As the climate ameliorated, these landslides became dormant. In consequence, a legacy of ancient

Photo: courtesy of Dyfed-Powys police.



Reactivated ancient inland landslide in drift deposits (indicated by dashed line), May 1994, St. Dogmaels, Dyfed, Wales.

landslides exists, often concealed under ground that has become degraded and vegetated or superficially remodelled by later events. Therefore, in inland areas, the greatest hazard is associated with the often unexpected reactivation of these features during prolonged heavy rainfall or as a result of human interference. Reactivation of pre-existing landslides rarely involves dramatic, fast-moving events and presents only a minor threat to life. However, the cumulative effects of slow movements pose a very real threat to construction and development, causing damage to buildings and infrastructure. The effects of these slope movements can lead to expensive remedial measures, costly route re-alignments or, where repair is uneconomic, to abandonment and loss of property.

Over the period 1977-1980, a 'milestone' regional study of landsliding in the South Wales Coalfield, commissioned by the Department of the Environment (DoE) in collaboration with the Welsh Office, was undertaken by the BGS which mapped and databased information on nearly 600 landslides. For the first time, the nature and pattern of landsliding in the area was systematically documented, thereby providing an information base essential for informed assessment of landslide hazard and the planning of more detailed studies targeted at resolving site specific problems. Over the past 16 years, the BGS has continued to map, inventurise and database landslide information for various parts of the UK as an integral part of commissioned applied geology

mapping projects geared to highlighting earth science factors relevant to planning and development issues and public safety. *The Applied Geological Mapping of the City of Bradford Metropolitan District*, for example, published in 1996, has mapped and databased information on over 200 landslides. Similar slope stability studies are currently being carried out for local authorities in the Kirklees and Calderdale districts.

The presentation of landslide information in a form readily understandable by users is a key consideration of the BGS. In addition to providing maps and databased details of individual landslides, digital information retrieval packages based on geographical information systems (GIS) have been developed to enable potential risk from landslides and other geohazards to be assessed. The GHASP (Geohazard Susceptibility Package) system enables average landslide susceptibility to be rated within each postcode sector, whilst the ALGI (Address-Linked Geological Inventory) system generates a geological report for a specified property address, providing information on the presence of any mapped landslides and/or on stability characteristics of local slopes.

The adage "prevention is better than cure" is particularly applicable to slope instability problems and the cost-benefits of identifying areas of currently and potentially unstable slopes prior to development has been proved time and again. The BGS expertise in landslide recognition and analysis is directed to achieving this aim.