



Landslide Hazard Assessment for National Rail Network

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Abstract

There have been a number of high profile reports of landslides on the national rail network of Great Britain (comprising England, Scotland and Wales) over recent years. Events range in size from small wash out failures (St. Bees, Cumbria) to well publicised large failures causing major longer term disruption (Hatfield Colliery, South Yorkshire). In conjunction with negative media attention, derailment and damage to railway infrastructure, failures along the rail network have the potential to cause injury and loss of life.

The national rail network comprises ten strategic routes that cover a variety of terrains and geologies. The British Geological Survey (BGS) have produced, for Network Rail, a high level susceptibility model of landslide hazard from Outside Party Slopes adjacent to the strategic rail network. This assessment was compiled based on Geographic Information System (GIS) techniques and historical landslide records (landslide inventory). The model was designed to give a high level overview of potential landslide hazard to Network Rail senior management and individual Route Asset Managers.

The national study adopted a fixed buffer style analysis of each 5 chain section (~100 m length) of the entire railway network. It included event data from the BGS National Landslide Database superimposed on mapped data from the BGS GeoSure land instability susceptibility model and geologically mapped landslide polygons. The National Landslide Database is the most comprehensive inventory of landslide events in Great Britain. The BGS GeoSure slope instability layer provides a scientifically based 1:50 000 scale assessment of national susceptibility to natural slope failure.

The results of this study have been provided as a spatially attributed dataset with total hazard susceptibility scores A (low)–E (high). Maximum hazard scores are attributed for both up and down-track and 5 chain length for the full network. A high score indicates where conditions imply a significant potential for future landslide hazard. Further refinement of the hazard layers are being developed by BGS to include specific landslide processes such as Rockfall, Earthflow and Debris Flow hazards.

Keywords: Landslide hazard assessment, Geographic Information System (GIS), Rail infrastructure, Asset Management

1 Introduction

When compared with an international context, landslide events within Great Britain (GB) (comprising England, Scotland and Wales) are not a catastrophic phenomenon. GB does not experience the same massive life-claiming natural disasters as reported in countries such as China (Yin, et al., 2009) or the frequency of events as countries such as Italy (Guzzetti, et al., 2006); however, occasional loss of life is sadly reported (Gibson, et al., 2013) but these are isolated incidences. Nonetheless, GB does have abundant relict landslides (remnant features from a post-glacial climate), numerous failure-susceptible lithologies, exposed coastal sections, aging infrastructure slopes and changing weather conditions. This means that landslides still have a significant impact on economy and society; including transport infrastructure.



Figure 1: Network Rail tracks affected by Hatfield Colliery landslide. Photograph taken 23rd February 2013. T. Dijkstra ©NERC

Between 2012- 2014, GB experienced abnormally wet winters. The numbers of reported landslides increased dramatically; in part, a direct result of the affect that they were having on the infrastructure network causing road blockages, commuter disruptions and infrastructure damage (Pennington & Harrison, 2013). A number of high profile events caused specific disruption to rail travel, derailment and major damage to critical railway infrastructure. Examples of such high profile cases were documented in the Rail Accident Investigation Branch Landslips Class Report 2012/13, published in 2014 (Department of Transport, 2014). Events ranged in size from small wash out failures (St. Bees, Cumbria) to well publicised large failures causing major, longer term, disruption (Hatfield Colliery, South Yorkshire; Figure 1). Events such as these gain high levels of media interest and negative attention.

On inspection, a number of these events were declared the result of landslide material failing from upper slopes, and, in some cases, slopes beyond the Network Rail (NR) boundary. Further failures along the rail network have the potential to cause further infrastructure damage, serious injury and even loss of life. It was thus recognised by NR that information on their own property holdings (including engineered embankments and cut slopes) were recorded, however, slopes adjacent to their own land were an unknown potential hazard. Within the NR network there are ten national strategic routes that cover a variety of terrains and geologies. Individual manual assessment of each section of track is not a viable option, and direction is needed in order to ascertain the sections of track having a higher potential for landslide hazard.

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