

## Managing the risk from rock falls at coast and countryside

Rockfalls, landslips and mud slides are natural erosion processes that occur frequently throughout the UK's coast and countryside. Major incidents may be reported in local and national news media, particularly where the incident is dramatic, on a grand scale, or involves injury or a near miss; however, there is no national record of such incidents.



One of the largest rock falls on record was at Beachy Head in 2002.

Other incidents include:



Landslip at Black Ven, Dorset.



Rock fall in progress, Whitby, January 2005.



The Holbeck Hall Hotel in Scarborough was destroyed when a large section of cliff collapsed in 1993.



Hundreds of tons of rock fell onto a beach at the height of summer 2001 in Sidmouth, Devon.



A 160 metre section of the cliffs at St. Margaret's Bay (about 100,000 tonnes of chalk) collapsed into the sea in February 2001.



A train was derailed by falling rocks on the North Antrim Coast in 2002.

Most incidents fortunately occur without personal injury, but this is not always the case. Rockfalls are primarily a coastal risk, but could also occur in disused quarries, in river valleys, and in road, rail and canal cuttings. At popular coastal sites, the risk from rockfalls could prove a major risk to public safety. This guidance considers the risk, and suggests practical ways of managing it.

## **Legal position**

The VSCG's understanding of the legal position is as follows:

Under the Health and Safety at Work Act, an employer would have a duty to his own employees (under section 2) and to non-employees (under Section 3). The duty to employees would be relevant if an employee was required to work on or below an unstable cliff face and was subsequently injured by a natural rock fall. The duty to non-employees would apply if a work activity (such as upland footpath repair) caused a rock fall that jeopardised the safety or caused injury to the public. These scenarios are relatively straightforward. However, in the event of a significant natural rock fall at the coast or countryside, the application of Section 3 is more difficult to interpret. Ultimately it would be a matter for the relevant enforcing authority (HSE or local authority) to determine. Relevant factors that they might take into account include:

- the nature and extent of public use of the area
- the level of control by the landowner or land manager of public access to the area
- the way in which the land owner or land manager promoted and encouraged public use
- the remoteness of the area
- the history of rock falls
- the foreseeability of rock failure

Landowner's civil liability would be reduced on land designated as open access land under the Countryside and Rights of Way (CROW) Act.

Highway and railway authorities have a statutory obligation to assess the risk of rock falls at roadsides and in railway cuttings.

## Potential areas of conflict or difficulty

- Rock safety measures may conflict with policies on managed coastal retreat, and may interfere with natural geomorphological processes
- There is potential for conflict with nature conservation interests (wildlife, e.g. birds, bats; flora and vegetation)
- Risk control measures are obtrusive and often highly visible, and are likely to have an adverse effect on the natural beauty of the site
- Risk control measures may affect open access or legitimate sporting activities, e.g. climbing
- There may be difficulties with public perception/local interest/media arising from action or lack of action to manage risk
- Problems may arise through involvement of other bodies, e.g. highways authority, national trail, coast path authorities, local authorities
- Physical risk control solutions are often extremely costly

## Assessing risk

Assessing the risk will need to take account of the likelihood of a rock fall and its foreseeable consequences. For most managers, this will initially involve a subjective evaluation. In some situations, this may need to be supplemented by expert evaluation based on geological knowledge and formal monitoring techniques.

Likelihood of rock fall A subjective local in-house evaluation will be based on:

- the history of rock falls at a particular location
- visual checks for movement, cracking, collapse or slumping
- weather conditions

## Assessment of consequences

This should take account of the nature and extent of use of the site. A crumbling cliff face with a well-used beach at the base clearly presents a greater risk. The remoteness or accessibility of the location is an important factor. Is there a risk of multiple fatalities in a worst case scenario?

Perhaps the most difficult question is – under what circumstances does the site owner or manager have to go beyond a relatively simple subjective evaluation of risk, to a more sophisticated evaluation using expert opinion? It is impossible to give a definitive answer, but the need for expert opinion is more likely to be necessary when:

- The subjective assessment of risk is high
- The geology of the site is complex
- The location of the site and its usage indicates greater management intervention is justified (the VSCG risk control matrix is relevant here)
- Independent resolution of local conflicting views is needed

Expert assessment would then grade the rock face (i.e. assign a risk rating) by looking at the potential for failure and the usage of the area onto which the rocks would fall. The propensity to fall is determined by the type of rock, and the configuration of joints.

Risks to staff and contractors that will arise during implementation of any physical remedial measures should also be taken into account.

## **Risk control measures**

The range of risk control measures is extremely wide, and includes:

Physical measures:

- Rock scaling or removal (including blasting) – i.e. using rope access teams to scale the rock face with crow bars – this can be effective for rocks less than 1m<sup>3</sup>, and gives immediate stability. For a friable rock face it will need to be repeated every 2-3 years, every 5 years for a more stable rock. This type of work is done annually at Cheddar Gorge, for instance.
- Catch fencing – a deformable barrier that catches the rocks and slows them down as they descend. Computer modelling software can be used to determine the best location and height of the fence.
- Retaining banks or walls – a stronger barrier may be more in keeping with the landscape, but is not usually as high as catch fencing
- Rock netting, geogrids, soil mats – these techniques can be the most effective controls, but are also the most obtrusive and expensive. They are common at roadside locations because of the high risks to road users.
- Inspection, survey, recording and monitoring – this may be appropriate for rock types which may give some warning of further fracture.
- Rock anchors, bolting, dowels, and soil nails. Bolting and dowels are suitable for securing large pieces of rock and are less visible once done. This is a preferred method for Historic Scotland at Holyrood, Dumbarton and Edinburgh Castle. Wires can also be used but these are more obtrusive.
- Dentition, buttressing, sprayed reinforcing and other structural engineering work techniques.
- Measures to do with managing public access, such as: public exclusion, path closures and diversions (supplemented by other methods e.g. Internet, warnings at car parks)



**Retaining bank adjacent to road in Cheddar Gorge**



**Rock netting at Carnewas, Cornwall**



**Inspection of Castle Rock, Edinburgh by abseiling (Historic Scotland)**



**Use of rock bolting to protect the only roadway between quay and village on Lundy Island**



**Work on coastal defences, Scarborough**



**Spraying reinforced concrete, A55 North Wales**



**Rock fall in Lord's Rake, Scafell, Lake District**



**National Trust example of cast iron signage**



**Warning notice, Lord's Rake (supplemented by other methods e.g. Internet, warnings at car parks)**

## **Companies or organisations undertaking inspection and survey**

Where it is decided to take professional guidance in geological assessment, there are many companies with the necessary expertise. Some universities may also operate as consultants in this field. It may be better to approach professional organisations such as the Association of Consulting Engineers <http://www.acenet.co.uk>, the Geological Society <http://www.geolsoc.org.uk>, or the Association of Geotechnical and Geoenvironmental Specialists <http://www.ags.org.uk> for advice. A clear brief will need to be prepared. Companies should be able to advise on the methods and frequency of inspection.

## **Companies undertaking rock safety work**

The company undertaking initial assessment and survey may also be engaged to carry out any rock safety work. There are some advantages in ensuring some independence between the surveyor and the rock safety contractor, but some of the larger companies will be geared up to providing a complete service and it may be simpler and more cost effective to use a single company. Rock safety work should be supervised by an engineering geologist, and rope access work should be undertaken by a company that is a member of the Industrial Rope Access Trade Association (IRATA) – <http://www.irata.org>. Such work is subject to the Work at Height Regulations 2005. Method statements and risk assessments should be provided, with measures to protect the public whilst work is in progress paramount.

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