



GROUND ENGINEERING

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FIRST DEFENCE

Kent rail line protected
by the UK's longest
rock fall catch fence

Record-breaking rocks

The site of the UK's largest man-made explosion is now the location of the country's longest rock fall catch fence. Claire Smith visited Samphire Hoe to find out how the two records are linked.

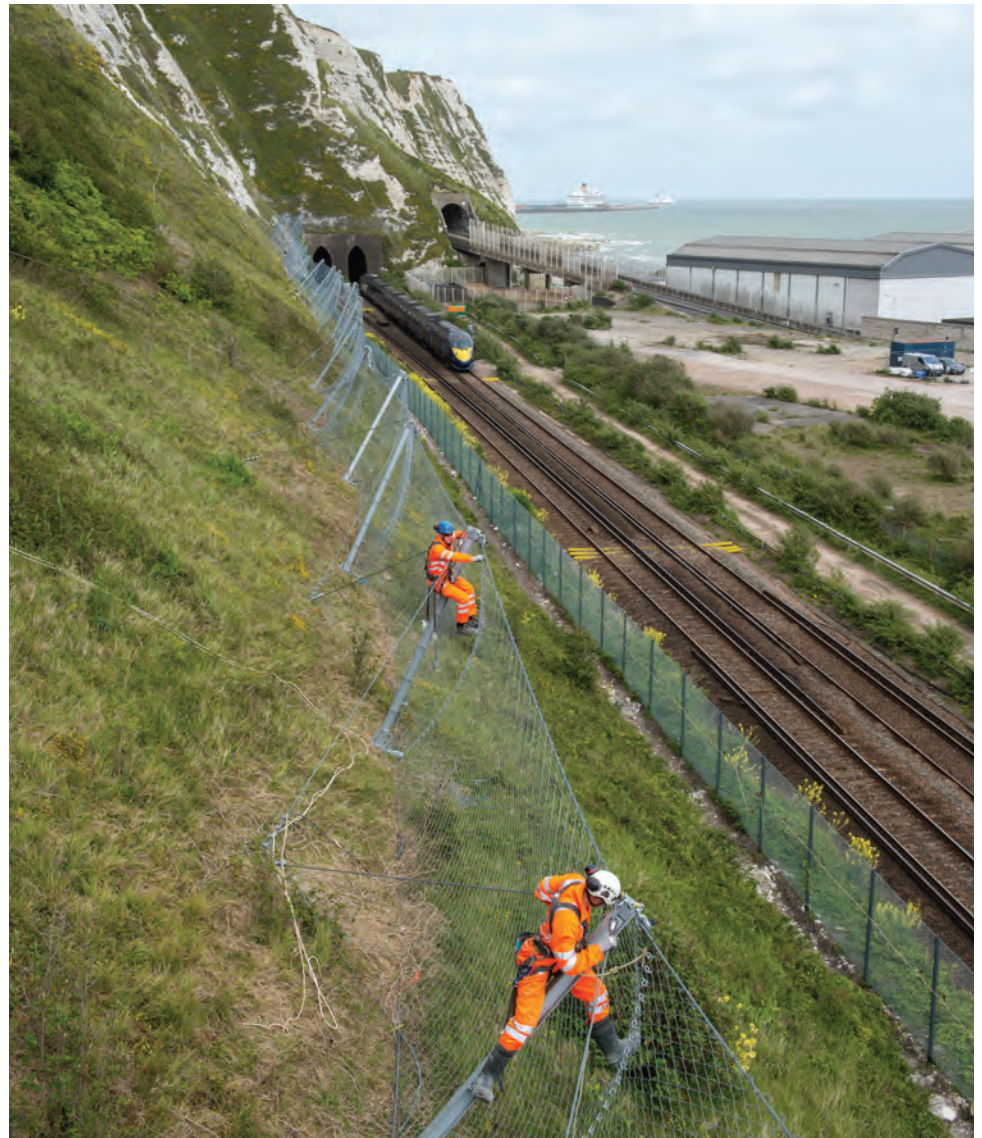
Slope failures that necessitated recent construction of 1,200m of rock fall catch fence above a coastal rail route in Kent can be directly linked to work to construct the line 170 years ago. Blasting work to remove parts of the Chalk cliffs cleared the route for construction but created a lasting legacy for the site in the form of regular rock falls.

Network Rail hopes that the new fence will signal an end to the risk of rock falls impacting on train services between Folkestone and Dover. While the work meets the design criteria, the proof of the record-breaking solution will come over the next six months, depending on how wet this winter proves to be.

Rock falls on the section of line between Shakespeare Cliff and Abbot's Cliff tunnels have been an ongoing issue since the line was opened in 1843. Blasting of excess Chalk away from what was known as Round Down was carried out by the Royal Engineers and was reported to be the largest man-made explosion at the time.

The blasting was known as the Great Fall and the post-blast effects and fracturing developed still affects the stability of the cliff.

"In 2000 a chunk of rock measuring about 8m³ fell from the cliff in a



rolling motion and bounced to land on the railway line," says Network Rail route asset manager for geotechnics (SE Route) Derek Butcher.

The site has a signalling trip wire running along the length of the site at the base of the cliff and the boulder triggered the system so train passengers were never in danger from that incident. Nonetheless, there is always a risk of material bouncing over the trip wire or an incident

Rock falls have affected the line since it became operational 172 years ago

occurring after trains have passed a signal. This risk combined with concerns over slope deterioration led to the recent rock netting and fencing work.

"With two tunnel portals within the site, the risk of failures reaching the tracks in these areas was classed as being high risk and high consequence," says Butcher.

The solution for the site was not straightforward though as the location is a Site of Special Scientific

Interest and is classed as an Area of Outstanding Natural Beauty (see box), so any solution needed to be licenced by Natural England.

Network Rail approached Fairhurst to find an appropriate answer to the issues in 2013. Options included widespread rock netting, soil nailing and rock netting or a rock fall catch fence with localised rock netting.

The latter was selected as the best option to minimise the visual impact and abseil inspections were carried out to identify the areas needing rock netting.

At its highest point the cliffs above Samphire Hoe are 150m high, but it is the standoff between the bottom of the cliff and the rail line that presents the potential for rock falls to reach the line. In some areas the standoff is quite wide, but in some parts there is very little space which has led to a raised area of catch fencing towards the eastern end of the site.

Fairhurst used the discontinuity data with Rocscience's Roc Fall software to model potential rock falls and design a fence system that would catch 99% of the falls.

"The resulting design has used three different fence sizes ranging from 2m to 4m and rock netting from Geobrugg," says Network Rail project manager for geotechnics (SE Route) David Jarman. "The mix of sizes is partly to minimise the visual impact and also came about through value engineering."

The work was undertaken by Costain with the specialist geotechnical work for the fences and netting installed by Can Geotechnical. Can used rope access techniques to avoid track possessions but the fences themselves were lifted into position during a 52-hour possession earlier this year.

Jarman says that the work on site went well and the only hold up was when, what has since been classified as exploded, ordnance from World War One was found on site.

The site has recently been handed back to Network Rail's earthworks maintenance team from the construction operation and all appears to be well with the work so far. "The proof of the solution will come when we have a wet winter but

RAIL-RICH HISTORY

Work on the rock slope was made easier through positioning of a site compound near the base of the cliff on Samphire Hoe, which is itself the result of another rail project – the Channel Tunnel.

Samphire Hoe is formed from spoil from the 1990s tunnel construction but was

also the site of the abandoned 1880s and 1970s tunnel scheme.

The site is still owned by Euro Tunnel but, over 20 years on, it is a haven for wildlife and hides its construction-related past well.

Euro Tunnel Samphire Hoe ranger Paul Holt worked with

the project team to help ensure the work did not impact on the ecology of the site and also delivered tool box talks to the site workers to help them identify rare species at the site that include the early spider orchid and birds such as peregrine falcons and black redstarts.



whether that is this year or next year, we will have to see," says Butcher.

In the long term, Butcher hopes that the rock catch fencing will be put to the test and prevent rock falls ever reaching the signal trip wire. "If the fence has proved to be successful in preventing signals being activated, then we may be able to consider removing the trip wire within five years," he says. "This would not only reduce maintenance at the site but it also removes the issues associated with false alarms, which are the usual reason for the system being triggered but still delay rail services."

A rock fall catch fence with localised rock netting was chosen as the best option

Other questions that still need to be resolved before the trip wire can be removed relate to inspections and maintenance of the catch fencing and rock netting. "We currently carry out annual expert walk over surveys at the Folkestone Warren landslide to the west of this site, so we will add the Samphire Hoe site into this in future years," says Butcher. The forms of the inspection itself is still under debate but Butcher is expecting to use criteria set by Geobrugg which is based on the installations used across continental Europe where this solution is more commonly used.