The Rest and Be Thankful carries the busy A83 trunk road between Arrochar and Inveraray through mountainous terrain in the Western Highlands of Scotland. During early 2014 a debris flow initiated at 350m above road level. Subsequent site investigation work identified the vulnerability of a large boulder, assessed to be in the order of 300 tonnes. The near under-mining of the boulder by the debris flow highlighted the need for protective action.

Controlled removal of the boulder was discounted at an early stage due to concerns that this may result in another debris flow. Site assessments suggested that the boulder was acting as a ‘choke’ to material behind and above making removal potentially very dangerous.

Additionally, the safety and cost of disposal of the large quantity of blasted material that would be produced, could not be assured at reasonable cost to the client Transport Scotland.

Scheme designer Waterman, decided that installation of a restraint system was the best way to achieve the required stabilisation of the boulder.
The Kevlar Parafil system was chosen to give the desired high strength, low weight and very long design life that mountain-side installation would require.

Following temporary stabilisation and monitoring of the boulder, anchors fitted with bespoke high-strength termination plates were installed into the slopes above. 90 mm diameter holes were then cored through the boulder to accept the tendons.

Each of the seven 45 tonne capacity Kevlar tendons was connected to the bespoke, high-strength steel anchor plates using proprietary shackles, before being fed through the holes in the boulder, and tensioned against the down-hill face of the boulder using post-tensioning terminations.

The tendons are positioned in a fanning arrangement to maintain the stability of the boulder in both the along-strike and down-dip directions on the slope.

This complex and demanding phase of site work at Rest and Be Thankful was undertaken by local geotechnical specialist contractor, Geo-rope working in contract to BEAR Scotland. The design was undertaken by the Perth office of Waterman, in consultation with Geo-rope and Linear Composites.