A tight squeeze

Tied back gabions and soil reinforcement were the solution to a road widening project within a steep sided, space constrained valley on the A72.

It is not often that a civil engineering project is technically challenging, solves the clients' problem and is situated in one of the most scenic locations in Britain.

The River Tweed accompanies the A72 in the Scottish Borders as it passes Dirtpot Corner between Innerleithen and Peebles.

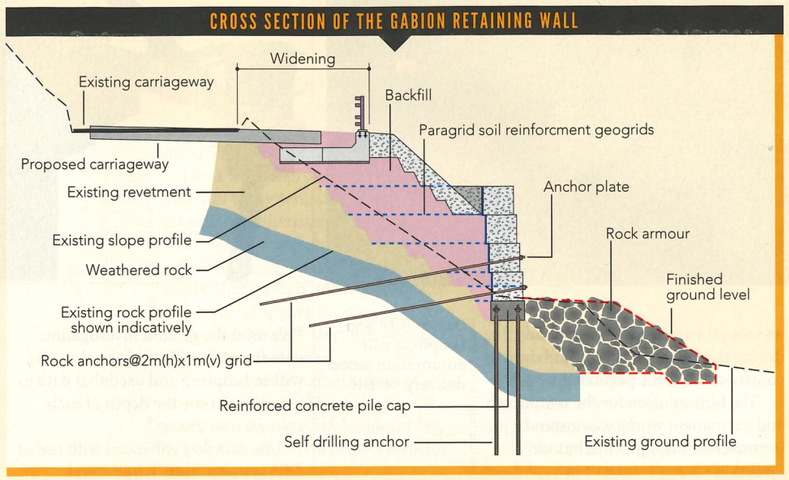
The highway narrows significantly as it rounds a promontory above the river and this has consequently been an issue for regular users of the road. Large vehicles were unable to pass each other without stopping and causing delays for users and damaging the existing walls adjacent to the highway.

Scottish Borders Council commenced a 10 month contract in mid-August 2018 to widen the A72 at Dirtpot Corner by around 3m. The existing low height retaining wall and revetment slope down to the river were to be replaced. The widening would also improve safety with the construction of a new parapet in line with current standards.

The challenging topography including steep slopes above the A72 and the River Tweed approximately 7m below the road, meant there was a the lack of space in which to construct a new retaining wall; the existing carriageway did not have verges at this location either.

A hybrid reinforced soil structure featuring numerous geotechnical elements was designed by MHB Consultants to retain the widened highway yet minimise the impact on the surroundings. The structure would be a maximum of 6m high and would run 150m alongside the River Tweed.

CROSS SECTION OF THE GABION RETAINING WALL



This element fitted within the overall improvement design works by the design services arm of Scottish Borders Council Contracts.

Working with the technical support of Maccaferri and Albion Drilling, MHB designed a tied-back gabion and Terramesh reinforced soil structure which did not have to be excavated back into the existing slope.

Construction and environmental problems were overcome by the design and installation of an upgraded rock armour platform constructed on top of the existing revetment profile. This would provide a narrow working corridor and would become the permanent works to protect the foot of the future wall from hydraulic erosion.

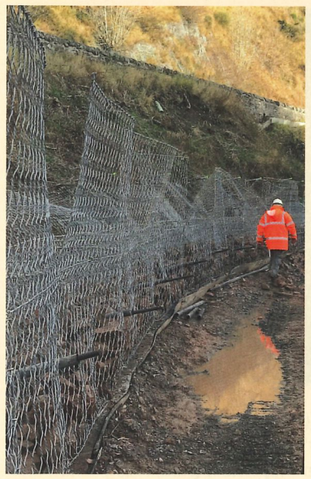
This platform enabled all of the works to be constructed from the riverbank and not from the A72 road above where it would have caused greater traffic delays. Building from the river would have increased costs and the risk of environmental impact on the Tweed.

To avoid excavating below the water level to locate a suitable firm horizon, a micro piled reinforced concrete foundation block was constructed by Albion. This provided a firm, level foundation to the gabions and reinforced soil walls above. Thirty eight millimetre diameter micro piles were drilled through the existing revetment into the rock head below. Maccaferri then commenced the construction of the gabions and Terramesh above.

The reinforced soil Terramesh structures required 5m long geogrids to ensure geotechnical stability. Where this space was unavailable, ground anchors were used to tie back a gabion wall. The tied back gabion solution was continued upwards until sufficient space for the reinforced soil solution was available. The anchors were installed through the existing revetment and back into the existing rock at 10° from horizontal on a 2m (horizontal) by 1m (vertical) grid.

The anchors were curtailed at the existing slope face in the short term, while the gabions were constructed at the wall face.

To suit the construction sequencing, the anchors were then extended using couplers as the gabion backfill material was placed. The anchors protruded through the face of the gabions within ducts which were subsequently grouted.



Clockwise from top left: The completed wall; the wall matches the curve of the River Tweed; and construction of the gabion baskets

Anchor plates measuring 400mm by 400mm by 10mm tied the gabions to the anchors.

Tight activity coordination was required as Albion Drilling installed the anchors, Maccaferri constructed the gabions and placed backfill to the wall.

Once there was sufficient space for the 5m geogrid tails to be inserted, the design required that the gabion fascia changed to Maccaferri's Terramesh system. This is a soil reinforcement system featuring a 1m by 1m gabion fascia block with an integral geogrid tail that extends back into structural backfill. The Terramesh and gabions have the same aesthetic of a dry stone packed wall which was selected as being sympathetic to the surroundings. Class 6I backfill was placed and compacted in layers onto the geogrids to complete the reinforced soil structure. BBA Hapas certificates for the gabions, and Terramesh provided reassurance of longevity.

Where there were slopes immediately above the new structure and they had a gradient greater than 1:2, Paragrid geogrids were used to provide additional slope reinforcement supplementing the Terramesh.

A new parapet and vehicle impact barrier were then installed on top of the reinforced soil wall and 1:2 slope, followed by the final road surfacing works.

In addition to normal management and oversight, Scottish Borders Council also placed an environmental clerk of works on the project to monitor and minimise the impact of the construction works on the local environment.

The £2.2M scheme was completed in early summer 2019.