Case study

WA Route Overhead Lines Project

The WA Route OHL project is part of the greater South West Scotland (SWS) Renewables connection which, on completion, will see the construction and operation of a modern energy connection network, connecting renewable energy schemes across Scotland (East Ayrshire, Dumfries and Galloway) to the national grid. The WA overhead transmission line extends from the existing Coylton Substation in the north to the New Cumnock Substation (Meikle Hill) in the south. Supported by 46 steel towers, the transmission line is 14.3km long.

Construction and related environmental issues

Road construction in deep peat
During the planning stages of the project, initial investigations identified peat at 29 of the 46 tower locations. High concentrations of peat can mean that there is insufficient bearing pressure during construction which can cause stability issues. A peat management plan was compiled at this time however further peat was later identified:

• Along access roads to each tower location
• Between towers
• Crane pads and material storage areas
• Pulling and tensioner positions

Not knowing the extent of the peat made it impossible to route or design the access road network in advance. To help determine the best positions for working areas, crane pads and the best route for the access road network, an 80m wide swathe (40m each side of the centre of the route) between towers WA17 and WA46 were probed to determine the depth of the peat. Additional probes were also completed where access roads fell outside the 80m OHL route corridor. Peat probes were conducted 10m apart across the 80m wide swath at intervals of 50m along the OHL route. With the average length of each span approximately 300m, this entailed around 54 probes per span across the 29 spans.

Results showed varied peat depth along the OHL route ranging from <1m to over 6m. Often small deep areas of peat were flanked by areas of relatively shallow peat. Although it was initially decided that a traditional cut-and-fill design would be followed in areas where peat was found to be shallower than 1m, varying depth over short distances meant that the road surface needed to be stepped severely between the different designs. Following completion of the peat probe work only one span (WA38 – WA37) was found to be suitable for a cut-and-fill design.

By profiling the peat across the entire swathe the best routes, following areas of shallower peat, could be determined at the design stage. Essential two construction techniques were considered for the construction of the access routes and the work surfaces:

• Floating road design
• Cut-and-fill design / traditional road design
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The benefits of employing these methods included:

- By maintaining the surface layer of vegetation the basic ecology of the site was not affected to the same degree as would occur if traditional (cut-and-fill) construction methods were adopted.
- The environmental impact of construction activities and traffic can be reduced due to the quantities of aggregate required.
- Lower carbon footprint than that of an equivalent excavated road, and less carbon released through excavation of the existing peat.
- Not having the need to excavate the peat within the road corridor also means that there is no need to dispose of the surplus peat.

Construction of temporary roads

Given the scale of the project and the remoteness of tower locations, an extensive road network needed to be built to access the individual tower positions. The roads inevitably crossed a range of habitats and land use practices. Along the route the area mainly consists of commercial coniferous forestry, active and redundant opencast coal workings in the west and pasture farmland in the north. Along forestry ridges and open areas, large areas of bog, wet heath and marshy grassland habitats also needed to be crossed.

Two main construction methodologies were adopted namely floating road construction (within wet and boggy areas) and cut-and-fill (mainly within agricultural lands) type road construction. Due to consistent poor ground conditions, designing the roads was a challenge and often designs dictated road thicknesses of up to 1.2m. As a result, the amount of stone required was vastly more than originally thought.

By incorporating geogrid into the road design the stone was bounded together between two layers.

Extruded geogrids (monolithic structures that consist of two sets of perpendicular ribs typically made of drawn polyethylene or polypropylene) were explored and the Tensar TriAx were identified as most suitable. TriAx was trialled with great success and incorporated in all road constructed from that point forward.

Before the option of geogrid was explored the initial estimates of the amount of stone needed to complete all the access roads on the project was 385,716 tons. By incorporating the geogrid and adjusting the designs accordingly the amount of stone needed was recalculated to 252,661 tons, a reduction of 34.5%.

With the closest quarry an average of 16 miles away a positive side effect to this was a reduction of the total distance travelled by the company supplying the stone from 308,572 miles to 202,128 miles. With the 20 ton trucks averaging 1-2 miles per litre of fuel this resulted in an estimated 134,752 litres of fuel saved.
Surface water management
Along the OHL route and along the newly built access roads there are numerous small streams and rivers which can be considered the headwater of three major rivers in Scotland; the River Ayr, the River Nith and the River Doon. All three of these rivers are renowned for their salmon and trout populations and although most of the burns crossed during the construction of the access roads were several miles away from salmon spawning grounds, some of the smaller burns were found to contain a healthy population of small brown trout.

Removing and relocating the fish present within the affected sections of the watercourses, before the culverts were installed, was a priority and to assist the project involved the Ayrshire River Trust. At one of these crossings through a tributary to the Black Water, 27 small trout were netted within a mere 32m stretch.

Silt runoff from the roads and working platforms were also identified to have the potential to severely impact the water quality of the watercourses within close proximity to the working areas. To reduce silt migration from the roads and working platforms, several mitigation measures were used in conjunction with the standard silt fencing.

To monitor the effects of the road construction activities and the construction of the tower foundations on the aquatic environment, 14 surface water monitoring points were identified before work commenced on site. Baseline samples were taken at the start of the project and thereafter monthly samples were taken and compared to the baseline figures.

To control runoff along roads down steep slopes, sub-surface drains were installed at a number of high risk crossings. These drains consisted of perforated pipe encased in clean stone and wrapped with Terram. To allow any silt to settle out, the drains were then tied into a number of settling ponds positioned along the road. To further reduce the amount of suspended solids, water from the ponds was then directed through the grassy fields until it eventually was led through a set of silt fences before it reached the watercourse.

To restrict any fines from washing out the bottom of the road, especially at watercourse crossings, Terram was used to encase the stone. By tying in additional layers of Terram along the edges of the road and pulling it up vertically and fastening it to a fence, any silt laden water seeping from the bottom of the road was controlled. The Terram fence also ensured that no silt was splashed into the individual watercourses by passing vehicles.

“In such a small burn we didn’t expect to find many fish and I don’t think the environmental team knew what to expect but with 27 small trout netted from a 32m stretch, everyone seemed pretty astonished by the number of fish caught”

Stuart Brabbs
Ayrshire Rivers Trust