



Geotechnical Division Case Study Cold Blow Drainage Resilience Works

As part of the Network Rail Wales Route Asset Management CP5 renewals works, Griffiths completed the installation of new crest, slope and track drainage throughout a 1.50km-long site in Cold Blow, Narberth.

Cold Blow is a small hamlet located near Narberth, Pembrokeshire. The site consisted of a long and narrow section of railway cuttings supporting the single-track PEM line between Whitland and Narberth Stations. The cuttings were surrounded by farmland and pasture fields on both sides, with site topography draining surface water from these fields from South to North onto the railway.

In the absence of a formal drainage system, the Cold Blow site had significant natural drainage features incised within the cohesive soil embankments throughout the section. These channels often carved deep, narrow trenches along the crest and down the middle of earthworks to allow water to drain to the lowest point. This carving of earthworks promoted further weathering and degradation of these, and also meant that repeated wetting and drying cycles of the cohesive soil gave rise to slumping and rotational failures. Furthermore, field drains from adjacent farmland concentrated water flows within specific areas of the site, further exacerbating the degradation of earthworks due to surface water.

Water drained from the earthworks would collect within the railway cess, with this draining in an unlined cess ditch parallel to track and towards topographical low points. Site topography varied significantly, with a high point near the centre of the section and track geometry falling steeply away from this in both directions. As such, water drained towards the North and South dependent on the location of drainage features within the site. Where flat spots or obstructions were present in the cess, water percolated through the track bed and trapped silt and other debris within the ballast. This ultimately led to significant wet beds and ballast contamination, requiring continuous track maintenance and repairs.

In conjunction with Network Rail's in-house design team (NRDD), Griffiths were tasked with formalising the existing natural drainage features throughout the ~1.50km section of track, installing Concrete Canvas-lined drainage ditches, renewing existing track drainage and regrading significant trenches within earthworks.



ABOVE: Views of the initial site conditions with no formal drainage systems, resulting in erosion of earthworks

Due to the near-constant saturation of the earthworks at the site, construction access was highly complex. Plant access was required from both track and crest locations in order to effectively reach all elements of the site. Griffiths were able to construct a temporary haul road within the adjacent farmland in order to access all areas of the crest and the upper slopes, with the lower slope and track areas accessible via RRV. Where required, a spider excavator was utilised to complete work within difficult to access mid-slope areas.

From off-track positions, a consistent V-ditch crest drain profile was excavated for the full length of site using 13t excavators. This was critical in ensuring a consistent fall was achieved within the entire drainage system. This involved a cut and fill exercise using specialist bucket attachments to utilise the existing natural drainage features within the earthworks. This allowed a straight alignment to be pulled through each of the natural crest and downslope drainage features at the site, ready for installation of Concrete Canvas. These features were then blended into the adjacent earthworks to ensure an aesthetic finish.

All crest and slope drainage features were prepared meticulously in accordance with the requirements of Concrete Canvas. Working in collaboration with representatives of Concrete Canvas, Griffiths were able to mitigate many of the potential issues experienced with this installation through effective preparation. This included creating a regular, uniform ditch profile, clearing voids and sharp obstructions and utilising an effective anchor trench for canvas ends. Griffiths drainage specialists then installed Concrete Canvas using large batch rolls, serviced by excavators from off-track positions within the adjacent farmland. This resulted in an excellent standard of installation under normal rail operating conditions without requirement for possessions or passenger disruption.

In discrete areas of the site, downslope incision of the earthworks by natural surface water drainage meant that these earthworks became unstable and were at risk of future slumping failures. These earthworks were of low height and with relatively stable slope angles (typically $<30^\circ$), therefore the outcome of failures was likely to be limited to slumping and washout contained within the cess, thus contaminating ballast and requiring continual track bed maintenance. Simple repairs to the localised area of incision and drainage enhancements were therefore required in lieu of full earthwork renewals. These repairs consisted of regrading the earthwork to a benched profile, lining the existing drainage feature with a perforated pipe and geotextile, and backfilling of this with granular fill. Effective compaction of typical earthwork fill materials within the site constraints and topography was not possible. As such, repairs were undertaken using 6G self-compacting fill to ensure effective repairs within the practicalities of construction and to ensure a safe construction sequence.

Finally, cess ditches were reprofiled and protected with ballast retention to ensure effective drainage of all surface water away from the track bed. All features were successfully installed prior to the winter months, enhancing the resilience of this route section.



TOP: RRV and Spider excavator reprofiling existing downslope trenches to stable angles, installing perforated pipe and backfilling with 6G stone.

CENTRE: Progression concrete canvas ditches.

BOTTOM : Finished project, showing effective installation of concrete canvas drainage systems and catchpits.

Project details at a glance

Client: **Network Rail**

Location: **Narberth, Pembrokeshire**

Completed: **October 2018**

Value: **£387,000**

Contract: **NR9**

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