CASE STUDY
CONSTRUCTION PHASE

ADEILADU ARBENIGRWYDD YNG NGHYMRU | CONSTRUCTING EXCELLENCE IN WALES

eXemplar

Valley Lines Electrification: Overhead Line Equipment (TAM area)

Amey Infrastructure Wales (AIW) holds a contract with Transport for Wales (TfW) which aims to revitalise the Wales & Borders rail network. Central to this initiative is the refurbishment of the Core Valley Lines (CVL) to establish a contemporary, electrified, metro-like railway system.

A major part of the CVL programme is the installation of the **Overhead Line Equipment (OLE)** which allows the electrification of the line and the introduction of a new fleet of electric trains which will improve customer travel experience through increased frequency of trains and create an easier/convenient form of transportation.

However, this also means that there will be 25,000 volts running through the overhead wires along the railway at all times – the equivalent of 100 times standard household electricity.

For the construction of the OLE to enable the metro, the railway lines were split into two areas: **TAM (Treherbert, Aberdare, Merthyr) & CAR (Coryton and Rhymney);** this was to break down the work into sections and complete in a phased approach. The TAM OLE is the subject of this Exemplar Case Study.

PROJECT DETAILS

Client: Transport for Wales

Agent: Amey Infrastructure Wales

Contractors: Multiple - see 'What was delivered' for full list

Designer: Amey Consulting

Project Cost: c.£117m

Contract: NEC3 Option E

TRAFNIDIAETH CYMRU TRANSPORT FOR WALES

amey consulting

amey

CONTACT
info@cewales.org.uk

ADEILADU ARBENIGRWYDD YNG NGHYMRU | CONSTRUCTING EXCELLENCE IN WALES

What is an Exemplar project?

An 'Exemplar' is defined as 'something worthy of being imitated or copied' and this is exactly what we continue to seek to achieve with this programme.

Exemplars are intended to offer good practical examples of how to achieve Best Value Sustainable Construction solutions. An Exemplar considers all aspects of sustainability, including economic, social and environmental, demonstrating that the scheme is well rounded and has incorporated best practice and collaboration.

Our approach to Exemplar has been updated to reflect the Wellbeing of Future Generations Act and to provide greater value as well as inviting a programme approach to the process. It is anticipated that embarking on the Exemplar process will, in itself, lead to higher value being obtained from a project.

> **Case studies are normally prepared at 3 Key Stages; Design stage, Construction phase and Post-occupation, but we have recently added a Pre-design phase to our programme.**

Addressing these phases ensures that lessons learnt can be demonstrated throughout the development of a project.

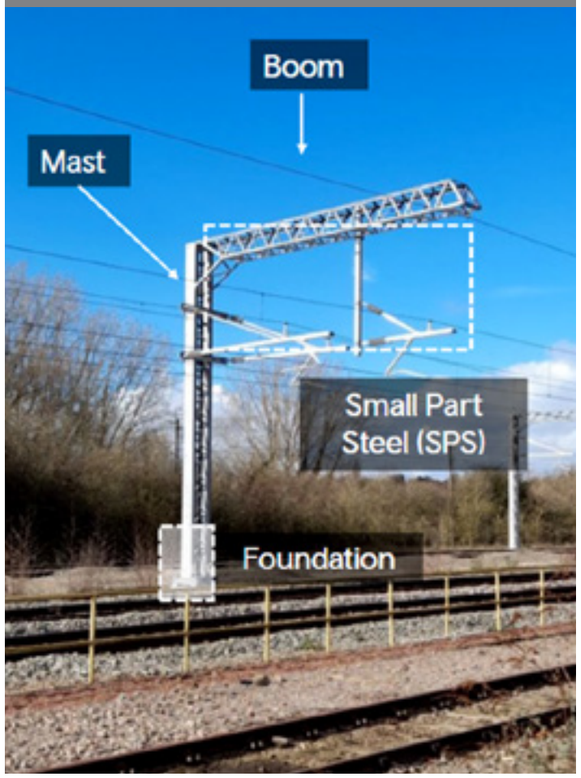
What was delivered

As part of the Electrification Programme on TAM, the key works included Trial holes, Foundations, Steelwork and Wiring.

Firstly, Trial Holes were completed to identify any services in the ground and confirm any obstructions such as concrete bases or utilities. Following the Trial Hole being dug and cleared, the foundations were installed which were either CHS (Circular Hollow Section), Auger or Plunge Piles.

After the foundations were complete, the steelwork to carry the wires was installed at approximately 40 metre intervals.

MASTS & BOOMS = MAIN PART STEEL (MPS)



The steelwork at each location consisted of two elements: Main Part Steel(MPS) to which Small Part Steel(SPS) was fixed:

- **Main Part Steel:** Mast height ranged from 5m-12m and the portals ranged from 12m-36m in length.
- **Small Part Steel:** Attached to the boom which holds the wire; cantilevers had a wide range of size options from 1.8m to 6.4m lengths.

The SPS holds 3 types of wire: Earth wire, Contact wire and Catenary wire, which all play a part in the OLE System. The Pantograph on the electric train touches the Contact wire which provides the power. The Contact wire is on average 5m above the track.

Across the TAM project, the works comprised:–

- c2100 Trial Holes
- c2100 Foundations
- c3000 Main Part Steel
- c5500 Small Part Steel
- c316km of wire installation

To deliver this large volume and variety of work, many contractors were utilised from undertaking Trial Holes to installing the OLE system.

The companies contracted by AIW to deliver the work were:

Foundations/OLE: Electrification Construction Services, Keltbray/Aureos Rail, MJ Hughes, Rail Op OHL, Readypower Terrawise, Van Elle

Engineering/Survey: Arch Utility Services (SW), Brimstone UXO, EcoViguor, Helix Rail, Geo-Info, Protech Infrastructure, Strata Geotechnics, RSS Infrastructure, Robert Walpole,

Labour/Civils/Telecomms: Ganymede Solutions, Gee Communications, Involve Rail, Infrastructure Support Solutions, McGinley, MPD Civils Group, SAS Rope and Rail, Vital Rail Recruitment

Consultancy: Corderoy, Fission Recruitment, Morson Projects, PSP Consultants, Project Safe

Collaborative Working

The OLE project was highly complex, involving integration and collaboration with the other 14 packages across the CVL Project such as Earthing and Bonding, Power and Distribution, Lineside Civils and Stations/Footbridges. Weekly integration meetings took place prior to any work commencing, allowing each package of work to get a preview of works commencing for that week.

By integrating work packages this allowed the project to maximise the use of possession time by often sharing machines and aligning work alongside each other. This ultimately led to goals being achieved quicker whilst also reducing costs for the client.

In order to maintain a healthy relationship with the local authorities, Environmental Health Officers were invited to bi-weekly meetings to discuss a two week look ahead on work that would be carried out by the project and ensure prior consents under s.61 of the Control of Pollution Act 1974 were in place. AIW then co-ordinated with the TfW Communications team bi-weekly to ensure letters were sent to lineside neighbours.

AIW partnered with Welsh Water to coordinate foundation installations. This collaboration stemmed from the identification of Welsh Water's underground services in close proximity to the designated site. Subsequently, AIW implemented a risk categorisation process (red, amber, green) for the assets. For assets categorised as red a representative from Welsh Water was invited to supervise the installation process to demonstrate adherence to their guidelines and AIW's internal mitigation procedures.

Health and Safety – Safety Step Ups

AIW conducted monthly Safety Step Up meetings with the OLE workforce to uphold high safety standards in the railway industry. These meetings served as key communication platforms, ensuring employees remained informed about protocols, procedures, and regulatory updates.

They also encouraged workers to voice concerns, share insights, and actively contribute to improving safety practices, fostering a culture of shared responsibility. Additionally, the meetings supported ongoing education and training, helping employees stay up to date with new regulations, best practices, and industry developments to maintain compliance with the latest safety standards.

These meetings also played a crucial role in reviewing and analysing incident reports. By discussing past incidents, the workforce were able to collectively identify root causes, trends, and areas for improvement. This proactive analysis helped in implementing targeted measures to mitigate risks and prevent similar incidents from occurring in the future.

Health and Safety – Energisation

Due to the nature of the project there was a legal requirement to inform and brief staff of the electrification work that was taking place.

The energisation of the railway in South Wales posed a new environment for many people who had never had to work with energised lines. To address this issue, Amey held mass briefings where around 500 staff at a time were informed of the dangers of the 25kv of electricity.

The energisation briefing emphasised the importance of adhering to specific rules, particularly the 9-foot (2.5m) rule. According to this rule, if any work is to occur within 9 feet of live equipment, a request must be made to shut off the electricity before starting the work.

Staff received an **'Energisation Card'** as proof of attendance, which is required for working in an energised area. A condensed version of this briefing was included in AIW's Project Induction pack, ensuring that all new starters on the CVL project received both the briefing and the card.

Innovation

Within the scope of the CVL Project there were several Victorian bridges which lacked the height to allow overhead electrified lines to pass through safely. To create the necessary headroom at these bridges, significant works would have been required such as lowering the track or raising parts of the bridge, both of which would have been extremely costly and time consuming.

As an alternative the CVL Project introduced the UK's first large scale use of discontinuous electrification. This approach utilised Catenary Free Sections (CFS) and Permanently Earthed Sections (PES).

CFS refers to segments of the railway where overhead wires have not been installed, instead trains are powered using on-board batteries or ground-level power. This avoided the need for distributive work on historic bridges/structures, whilst also reducing the cost of installation and labour.

PES refers to segments of the railway where wires are installed but are earthed (Not Live). Where there are PES the power is installed to carry it past this earthed section via HV Cable linking up both live ends of the PES.

The use of PES on this project had two fundamental benefits:

- It saved large volumes of work/cost as major bridge alterations did not have to be undertaken
- If standards are revised or new innovations are introduced in the future, the PES could become 'Live', enabling trains to be charged through the section.

On the CVL Project as a whole there are 30 CFS and 60 PES, which saved 81 and 24 single track kilometres of electrification.

This included complex locations such as Cardiff Central Station, Cardiff Queen Street Station and Caerphilly Tunnel. As a result, around £150 million of the capital cost was saved.

Sustainability/Environmental

Circular Hollow Section (CHS) piles formed many of the foundations for OLE equipment to be erected. This method replaced the original method of Concrete (Gravity) Pads, proposed for 38% of original planned foundations.

CHS piles offered several environmental advantages over gravity pads, including reduced soil disturbance, preservation of natural landscapes, lower erosion risk, reduced resource use, a lower carbon footprint, and minimal impact on groundwater and drainage patterns. These benefits made CHS piles a more environmentally friendly choice for foundation construction, particularly in sensitive or ecologically important areas.

The main disadvantage of gravity pads was that the production and transportation of large amounts of concrete for them contribute to higher carbon emissions. Across the TAM project area 828 concrete pad foundations were removed from the design plan and converted to CHS piles, saving 2,630kg CO^2e per location and 2,219,040 Kg CO^2e in total. Furthermore, it generated construction efficiencies and reduced time on site.

Reports were produced at the end of each shift to document activities, tasks and incidents occurring during a work shift. AIW used a paperless shift report system meaning reports were created and stored electronically, eliminating the need for physical paper. This online system lowered the carbon footprint associated with paper production, printing and disposal.

Community Engagement and Safety

Throughout the project, AIW and TfW colleagues worked collaboratively with TfW's community engagement team, with bi-weekly meetings to ensure communications for upcoming OLE work were sent out to communities before disruptive night works.

This collaborative approach enabled the engagement team to send over 40,000 letters to lineside neighbours across the Treherbert, Aberdare & Merthyr rail lines from mid-2022, providing communities with advanced notice of night-time piling works and, importantly, minimising the number of noise complaints received by both TfW and the local authority.

Alongside letter drops to those who live close to the railway line, project managers supported 'drop-in sessions' at key locations, to enable the public to ask questions about upcoming work and the installation of OLE across the network.

The South Wales Valley lines were being electrified for the first time, bringing increased risks for trespassers.

To ensure public awareness, the communications team collaborated with infrastructure teams, aligning outreach with Network Rail standards and informing emergency services, schools, and nearby communities.

Community Engagement and Safety (continued)

Additionally, their expertise contributed to TfW's **'No Second Chances'** safety campaign, targeting young people aged 13 to 24—the demographic most likely to trespass. The campaign used the popularity of second-hand fashion, featuring clothing worn by individuals who had lost their lives trespassing on railways, to deliver a powerful safety message.

Following its launch 12 months previously, survey results showed that awareness of electrified railways had increased from 55% to 64% and, importantly, that the overhead wires were always on had increased from 67% to 75%. Most critical was the 40% drop in trespass incidents in 2023 and the first quarter of 2024 combined compared with 2022. Key initiatives included:

- Campaign flyers to all homes within 200m of the railway, emergency services, local authorities, education establishments (c 55,000 addresses)
- Campaign posters at all 52 stations in the areas being electrified

- A local drama company to deliver an engaging safety workshop which visited 19 schools and involved 11,800 pupils.
- A short ad on Youtube which was seen over 2 million times by the target audience and the social media impressions across all channels (Instagram, Facebook, Youtube and Snapchat) were over 10 million.

The campaign was strategically aligned with the electrification timeline for each railway route, enabling targeted advertisements and physical outreach as each line became electrified.

A monthly OLE safety meeting, involving the project team, British Transport Police, and engagement representatives, ensured continuous evaluation of trespass risks. This forum identified areas requiring more communication, analysed trespass data, and implemented additional safety measures when necessary.

Well-Being of Future Generations Act

The Act requires public bodies in Wales to think about the long-term impact of their decisions, to work better with people, communities and each other, and to prevent persistent problems such as poverty, health inequalities and climate change.

The CVL Transformation programme and the subsequent introduction of the Metro will provide a major improvement to the public transport service, with significant benefits for the goals of the Act. In particular, the new electrified trains are beneficial for the environment by reducing carbon emissions.

The Welsh Government have set out their legal commitment to achieve net zero emissions by 2050 but are seeking to reach their target sooner in light of the challenges of climate change. For their part Amey have set their net zero aim for 2040.

CEWales was commissioned by the Future Generations Commissioner, in conjunction with CLAW, to develop a Project Directory framework which guides clients through the various phases of project delivery in relation to the requirements of the Act. Pilot projects were trialled for schools with the intention of rolling it out to all buildings and civils projects. The Act will increase in prominence within our Exemplar process going forward.

TfW Exemplar Programme

CEWales has set up an Exemplar programme with TfW. A number of projects, at varying stages of development, are identified for inclusion in the annual programme.

In this fourth year (2023/24) there are five projects, with three being delivered by AIW.

This Electrification project is the fourth completed case study for the year.