

Project title	COP26 Battery Train Compatibility Support
Client name	Vivarail
Completed by	AEGIS Engineering Systems

Project Overview



Figure 1: COP26 Battery Train

The Vivarail D-Train is a new concept designed specifically for regional services that utilises the bodyshells and bogies of ex-London Underground D78 stock. The D-Train has many variants including a DEMU; Third-Rail EMU; Diesel-Battery Hybrid; and a Battery (only) Train that was initially manufactured as a demonstrator unit for the 2021 United Nations Climate Change Conference, COP26, in Glasgow. AEGIS has developed a strong working relationship with Vivarail supporting the safety & compatibility approvals of the D-Train designs, including the COP26 Battery Train. Vivarail's COP26 Battery Train successfully demonstrated at the event, a practical and economical solution towards the decarbonisation of the railways.

Compatibility Strategy

In order to manufacture the Battery Train and have the necessary approvals in place in time for the COP26 event, Vivarail had to work to ambitious timescales. AEGIS devised a compatibility strategy that utilised delta analysis and an optimised EMC test plan to expedite Network Rail's acceptance. This allowed mainline testing to commence as early as possible and meant that Vivarail was able to progress the project unimpeded by

constraints on the test programme, which is of vital importance to a project of this nature.

Electromagnetic Compatibility (EMC)

EMC forms a major part of the infrastructure compatibility assessment of any train being introduced to new routes. The railway is a harsh and complex electromagnetic environment that contains powerful electrical emissions sources and potentially susceptible, safety critical, low power electronics in close proximity. Hence, the proper assessment and control of any EMC threats is essential for a safe and reliable railway. As the COP26 Battery Train is self-powered the scope of credible EMC threats is less than that of a train powered using infrastructure electrification. However, the novel nature of battery trains means they introduce new considerations not yet fully covered by standards, in particular this includes EMC during traction battery charging from a shore supply.

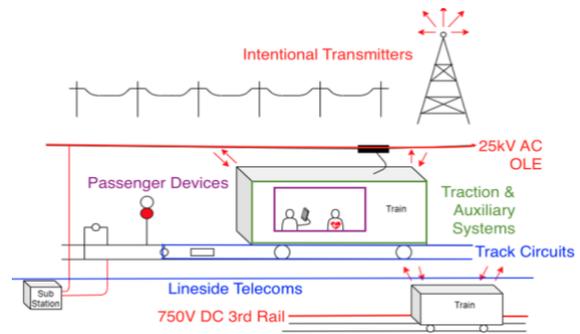


Figure 2: Overview of Typical Railway EMC Considerations

Another consequence of introducing this relatively novel train traction supply technology is that many of the battery systems and sub-systems manufacturers do not yet have railway EMC standards compliance. AEGIS's team of EMC specialist engineers combined their expertise in EMC,

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rolling stock and railway infrastructure to devise a practical and effective method of demonstrating that EMC threats are acceptably controlled. This approach maximised efficiency through a combination of comparison and gap analysis to form robust engineering arguments, which then only needed to be supplemented by a simple test programme. Network Rail was engaged and informed throughout the process which facilitated their prompt acceptance at each stage and allowed Vivarail to focus on other aspects of the project, knowing AEGIS was effectively managing EMC on their behalf.



Figure 3: Radiated Emissions Testing of the COP26 Battery Train

D-Train Development

AEGIS has defined and managed all required EMC and EMF activities for the D-Train development, including as required:

- Producing all necessary EMC and EMF documentation
- Battery traction system design
- Creation of the EMC & EMF Requirements document
- Test specification and management
- Longitudinal voltage assessment

Because AEGIS has worked with Vivarail throughout the development of the different D-Train platforms we have been able to utilise our existing knowledge to reuse existing evidence wherever possible, optimising the

introduction of each new variant by omitting any unnecessary repetition of activities allowing us to facilitate Vivarail's agile and ambitious progress.

Forming Lasting Partnerships

AEGIS's ongoing commitment to remain flexible whilst delivering quality work in short timescales has been recognised by Vivarail, meaning we continue to develop a strong working relationship. Some existing Vivarail projects AEGIS has supported include:

- Route compatibility (EMC, EE&CS and non-EE&CS) of Class 230 Diesel-Battery Hybrid units for Wales & Borders transit and operational routes.
- EMC and safety approvals of Class 484 750VDC 3rd rail variant for the Isle of Wight, including the specification and management of all EMC testing.
- EMC and safety approvals of Vivarail's patented Fast Charge Battery System

The AEGIS Difference

The AEGIS Safety and EMC teams offer an unparalleled combination of expertise in all areas of safety (for EMC, EE&CS and non-EE&CS) with the added ability to provide a full suite of EMC test services.

This gives Vivarail the assurance that it is partnering with a company that has the expertise and capability to take ownership of delivering its Safety, Approvals and EMC activities, from start to finish, with continuity and the same high quality of work throughout.

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