RailBusinessDaily

Composite mast promises greener and cheaper rail electrification

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Government has announced funding for the development of a railway mast that could dramatically reduce the greenhouse gas emissions from railway electrification.

Using composite materials and smart sensors, the mast is being designed to dramatically lower the lifetime carbon emissions of overhead line equipment, as well as their construction and maintenance costs.

Funded as one of 30 winners of Innovate UK's First of A Kind 2021 rail competition, in collaboration with the Department for Transport (DfT), it is hoped the new mast could extend the viability of rail electrification to more parts of the UK rail network.

Engineering firm Furrer+Frey are working with researchers at Cranfield University and composite materials manufacturer, Prodrive, to develop the prototype mast with rail technology developers, TruckTrain, as well as teams at Southampton and Newcastle Universities.

It is hoped the result will be big energy and carbon savings for each mast, which would add up to a

significant amount over the thousands of kilometres of electric railway.

While electrified rail is one of the greenest ways to travel and transport goods, building the infrastructure uses a significant amount of energy, known as “embedded carbon”.

Most masts today are made from energy-intensive galvanised steel on steel pile foundations.

The masts support the cables that provide electricity to trains, known as Overhead-Line Equipment (OLE).

Compared to steel, the construction benefits would include:

- A much greener manufacturing process
- Lower energy use in transportation to site
- Lower emissions from the machinery used for installation
- Less energy and materials required for the foundations

Built-in sensors will provide data direct to the infrastructure owners, helping to better target maintenance and do so more safely by reducing the need to go line-side for manual checks.

This will also help save fuel by avoiding trips by car to conduct the manual checks.

Work to electrify rail lines already has a short ‘carbon payback’ thanks to the savings from switching from diesel and helping attract people and goods off the roads.

The project aims to accelerate this shift by making more parts of the rail network viable for electrification.

Network Rail’s Research and Development team supported the funding bid, and it is hoped the prototype masts will be tested on their infrastructure, pending further approvals, and following tests at other rail facilities in the UK.

The project, named Innovative Mast for Green Electrification (IMAGE), is one of 30 rail innovation projects funded with a share of £9 million as part of the latest government funded Innovate UK First of a Kind rail innovation competition.

The project aims to demonstrate proof-of-concept by Spring 2022.

Noel Dolphin, Head of UK Projects for Furrer+Frey said: “To decarbonise transport, it is vital that we make a swift transition away from fossil-fuels and roll out electrified trains. But it is also important that the infrastructure involved in this process is as green as possible.

“We’re excited to be partnering with experts from across our industry to crack one of the big problems facing UK rail – that of lower carbon and lower cost electrification works.”

Matt Bradney, Director of Business Development at Prodrive Composites, said: “We are delighted to be involved in the IMAGE project. Recognised as industry leaders in sustainability at the 2020 Composites UK

Awards, we feel uniquely placed to lend our expertise to break new ground for rail.

“The composite ingredient for the masts is significantly lighter and stronger than steel by weight. We are aiming for a composite that has minimal, or even negative, embedded carbon.

“We hope this project will fuel further experimentation with composites in the rail industry to drive sustainable innovation forward.”

Jon Horsley, Transport Systems Development Manager at Cranfield University said: “Rail is already one of the greenest forms of transport, but it is also one of the oldest. Innovations to make the infrastructure smarter and greener, while bringing down the costs is vital.

“The team from the Advanced Vehicle Engineering Centre at Cranfield University, coordinated by Dr Marzio Grasso, will develop innovative structural solutions for the composite Overhead-Line Equipment that are capable of self-detecting damages, reducing downtime and the costs of maintenance.”

Professor David Richards, Head of the School of Engineering at the University of Southampton, said: “In the UK, we will need to electrify thousands of kilometres of rail track to meet our 2050 decarbonisation target.

“This project will offer a significant reduction in the mass of the support masts, but the real benefits lie in the cumulative positive effects of reducing the size of the foundations, cutting the cost and embedded carbon involved in reducing transport emissions.

“The decarbonisation of transport is a major goal and we are proud to contribute to this project.”

Phil Mortimer, TruckTrain said: “By creating a mast that is quicker, easier and cheaper to install, we hope to help extend the benefits of rail electrification to places it is currently considered too expensive – aiding the roll out of greener, more reliable trains for passengers and freight.

“We’ll look at how composite masts could measure up to their steel equivalents and how we can make them ‘self-aware’ through monitoring sensors to ensure their integrity.

“We could also be on to a winner for British industry with interest in this concept from the US and for its use in other rail, light rail and tram applications.”

Prof Mark Robinson, Newcastle University said: “At Newcastle University we have a focus on transport decarbonisation. This IMAGE project is key to developing cost and carbon savings in rail infrastructure electrification.

“This feasibility study will reveal the advantages in moving from a steel mast with significant foundations to a shorter composite mast with significantly reduced foundations. The key advantages will be that rail electrification can proceed at a faster pace and we can provide predictions of real cost reductions and carbon savings for the electrification works.”

Photo credit: Furrer+Frey