ElectroRoad

An advanced feasibility study of the application of Honda ERS technology to a 44-tonne demonstration on the UK Strategic Road Network (SRN)

Research Organisations	Galliford Try, Honda, Transport Research Lab (TRL), Miralis
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Background

To help decarbonise heavy goods transport, the Government set a target that all new heavy goods vehicles (HGVs) sold in the UK will be zero emissions by 2040. This action led to the Innovate UK Zero Emission Road Freight Trials (ZERFT) programme, which provided funding for a phased demonstration and scale up of zero emission freight fleets operating on an electric road system deployed across the strategic road network (SRN).

ElectroRoad was a 9-month advanced feasibility study of the application of an innovative Electric Road System (ERS) which utilises side conductive power segments applied to 44t Heavy Goods Vehicles. An ERS can be used to propel and charge a vehicle's battery dynamically (i.e. whilst it is travelling along the road). For HGVs, this can provide unlimited range without stopping to recharge and the possibility to downsize batteries, which enables the HGV to carry more payload and reduce its capital costs.

The Honda ERS technology has been developed over the last 10 years and successfully demonstrated and tested on electric 44t heavy goods vehicles in Japan. For this project, the team aimed to develop detailed proposals for a long-term, large scale, fleet demonstration on UK roads, and how this trial would be monitored and evaluated.

ElectroRoad was a multi-national collaboration between Honda R&D UK, Honda R&D Japan, Galliford Try, Miralis, and TRL. Galliford Try led the deployment phase, which involved conducting a road location assessment, developing road deployment scenarios, and static charging assessments.

Objectives

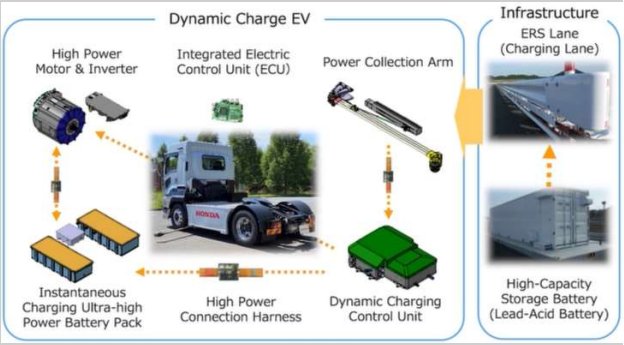
The team evaluated the practical charging, battery and installation requirements in preparation for a future UK on-road demonstration. The objectives of the project were as follows:

Technology: to understand the technical feasibility of demonstrating the ERS on the SRN

Safety: to understand the safety and regulatory implications of the technology and developing a safety roadmap for the demonstration phase

Deployment: to understand how the technology could be demonstrated on the SRN, including the route for the proposed infrastructure and the requirements/locations for static chargers and battery energy storage

Cost / benefit analysis: to understand what the costs and benefits are, and to investigate theoretical approaches to modelling them, to inform the development of a future business case, and to help identify the range of impacts that need to be assessed in future trials.



Technology

The Honda ERS is a dynamic vehicle charging system utilising side conductive power segments. While driving, on-board batteries are charged via a collector arm which extends from one side of the vehicle and attached to a charging rail fitted to the roadside vehicle restraint system (VRS). The charging rail is powered by a combination of electricity from the grid, with high-capacity lead acid energy storage batteries sited every 1km along the roadside providing redundancy to the system. The system is applicable to any type of adapted road vehicle and reduces the requirement for on-board batteries.

Safety

Because ERS is a new technology, there is currently no specific framework or regulation covering the installation, operation, maintenance and removal of it. The safety element of ElectroRoad involved developing operational safety and regulatory frameworks and a risk analysis for the ERS at suggested locations, underpinned by engagement with a wide range of stakeholders to gather views about a trial and wider implementation.

Deployment

This involved identifying a suitable testbed for trialling the ERS. A wide range of motorways and trunk roads were reviewed against a set of specific criteria. Once a testbed was selected, a road deployment scenario was developed, identifying the process involved in deploying the technology on the proposed testbed. Finally, a static charging assessment was undertaken. This involved a understanding the implementation of fast charge stations in depots to enable eHGVs to reach a segment of the SRN equipped with an ElectroRoad system.

Cost-benefit analysis

A high-level theoretical model for the analysis of costs and benefits for vehicle makers and users, infrastructure providers, charging operators, road owners and operators was developed. The team investigated the costs associated with changing the existing goods vehicle fleet to electric traction, supported by equipping part of the SRN with ERS, and developed a tool for analysing the possible benefits that this investment would bring.

Key findings

The project found that an on-road demonstration trial using the Honda ERS is not feasible at this time. The main reasons for this include:

1. **Safety risks:** 13 “black” (intolerable) risks, and a further 25 red risks were identified. Intolerable risks were mainly associated with ERS in use and related to electrical safety risks, collision risks at the roadside and risks to other road users. It is likely that with further development of the system these risks could be mitigated.
2. **Prohibition of the use of All Lane Running (ALR) smart motorways for on-road trials:** due to the nature of the ERS it is necessary for HGVs to be able to drive on the hard shoulder, meaning that the suitable trial sites were ALR smart motorways. However, during the project IUK notified the project partners that the technology would not be approved for use in the way thus making a demonstration trial at this time unfeasible.
3. **Cost-benefit uncertainty:** a high-level model was developed, however in the absence of robust data on the costs of implementing the system, initial results were obtained using more generic published literature. The long-term value proposition of the technology is therefore unclear.
4. **Regulatory challenges:** several regulatory challenges were identified, including electrical safety, hard shoulder running, vehicle restraint systems, land use planning, and vehicle approvals.
5. **Stakeholder feedback:** the end users of the technology (the logistics industry) were not very accepting of the technology on the basis of safety, costs, and operational impacts. It will be necessary to adequately address their concerns prior to implementing such a system.

Innovation maturity level: the Honda ERS was judged to be at innovation level 2 (feasibility), and that in order to be ready for a larger-scale pilot, innovation level 3 (development and verification) would need to be achieved. A roadmap describing the main activities to reach this level was developed.

Further development work is necessary to address the challenges identified by this study.