



UNINTENDED CONSEQUENCE OF THE ELECTRIC VEHICLE REVOLUTION

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THROUGH THE NEWS AND MEDIA, ROAD USERS ARE BECOMING MORE AWARE THAT WE ARE NOW SEEING A TRANSITION FROM THE TRADITIONAL PETROL AND DIESEL FUELLED CARS TO THE INCREASING USE OF ELECTRIC VEHICLES (EVs). BY SEPTEMBER 2017 WE SAW IN THE REGION OF 133,000 EVs ON THE UK ROAD NETWORK. ONE KEY CHALLENGE THAT WE CURRENTLY FACE IS THAT OF DRIVERS BREAKING DOWN AS A RESULT OF RUNNING OUT OF FUEL, HOW WILL THIS NEW FLEET IMPACT ON THIS?

THIS PAPER WILL CONSIDER WHETHER WE EXPECT THE NUMBER OF EVs BREAKING DOWN AS A RESULT OF RUNNING OUT OF ELECTRIC CHARGE TO INCREASE THE NUMBERS OF BREAKDOWNS ON THE NETWORK. THE PAPER CONSIDERS THE SCALE OF THIS PARTICULAR PROBLEM AND REVIEWS WHAT MITIGATION MEASURES COULD BE CONSIDERED IN ORDER TO CHANGE THE MIND-SET OF ROAD USERS AND INFLUENCE THE CHANGE OF BEHAVIOUR. IT PROVIDES A SERIES OF STEPS THAT SHOULD BE INTRODUCED BY NETWORK OPERATORS, GOVERNMENT ORGANISATIONS AND VEHICLE MANUFACTURERS IN ORDER TO ENSURE THAT THE ROAD NETWORK PERFORMS SAFELY AND EFFICIENTLY WITH MINIMAL NEGATIVE IMPACTS.



INTRODUCTION

The EV revolution is gathering pace, over the last four years there has been a remarkable increase in demand for EVs in the UK, according to national statistics new registrations of electric plug-in cars increased from around 3,500 in 2013 to in excess of 133,000 in September 2017.

This shift will undoubtedly continue following commitment from the government to prohibit any all petrol or diesel vehicles from 2040 onwards. There are clear benefits of owning an EV, they can be quick, they are very quiet and they are considered to be green or environmentally friendly. They could also be considered more reliable when compared to petrol or diesel cars.

However, although we can be aware of these benefits that will no doubt mean that car usage in the UK will transition from petrol or diesel vehicles to electric in the years to come there are performance issues, such as the expected increase in breakdowns as a result of the EV revolution that have not been thought through in any detail. Although EVs could be more reliable this particular challenge of breaking down due to running out of electric charge may have been masked by the need to be more environmental friendly.

AIMS AND OBJECTIVES

The aim of this paper is to:

- Review the issue of breakdowns across the network and summarise the scale of the potential issue
- Identify operational, safety and other issues relating to breakdowns
- Consider what mitigations can be put in place to manage potential challenges.

Breakdowns: The Network Challenge

POTENTIAL SCALE OF THE PROBLEM

The impact on road users is relatively clear, there is a need for a driver to understand the requirements of an EV and appreciate the variances that this technology brings. As an example, consideration given to the unfamiliarity of the fuel type in EVs and its associated performance is important. Whilst the benefits of the transition are clear and significantly outweigh negatives there will be the potential for unintended consequences. One such challenge relates to the operational impact of any increase in breakdowns, whereby any significant increase in vehicles breaking down is likely to impact on the flow of traffic on local and strategic road networks where capacity is already close to the limit and resilience is low.

A study by insurer LV shows that more than 800,000 vehicles run out of fuel each year¹, this statistic is primarily linked to petrol or diesel vehicles with ranges of around 300-500 miles on a full tank. Typical limits on a full charge of an EV are much lower, with some in the region of 100 miles.

There are exceptions noting capabilities with premium brands such as Tesla, where vehicles are capable of reaching distances over 300 miles on full charges. Will this reduced distance capability in the general EV fleet, comparative to traditional fuel sources, impact upon the frequency of vehicles running out of fuel (in this case electric charge)?

OPERATIONAL AND SAFETY CHALLENGES RELATING TO BREAKDOWNS

Breakdowns on the network can result in a number of operational and safety challenges. The performance of the network can be adversely affected along with the safety of the road user, the network operator and other key

operational stakeholders such as recovery operators. The safe operation of the network that allows traffic to flow smoothly is key to achieving a high performing network.

Highways England recognise that the customer experience is key to achieving a high performing and safe road network. Highways England's customer service strategy² states 'Our customers' experience using the network is about more than just the quality of roads we build and maintain. It's about how people feel – for example, our customers want to feel safe, they want to have control of their journeys and they want their journeys to be as stress-free as possible'.

A key objective for Highways England is to 'keep traffic moving and improve the safety of our road network'³. Highways England are introducing a programme of new congestion management schemes (known as Smart Motorways) to the network which make best use of the existing road space – the schemes convert the hard shoulder to a full time running. Without a hard shoulder one of the key safety hazards on these schemes is that of live lane breakdowns. In order to achieve the performance and safety benefits of these schemes it is important that the numbers of breakdowns are kept to a minimum. In the event of breakdowns occurring in live lanes, this can result in lane closures and the need to despatch traffic officer support. The consequence is that this results in congestion and means that the congestion management scheme is not meeting its intended objectives.

Any situation where 'normal operation' (defined as vehicles travelling in a uniform fashion at a speed appropriate for free-flow the conditions) is not maintained, is a potential hazard. This extends to vehicles stopping in live lanes in an emergency situation, in this case a breakdown. If this was to happen more often, whilst drivers continue to transition to EVs and understand the capabilities and requirement associated with running the new technology, the safety performance of the UK road network could be recovery operators will play a key role. Are the systems in place to enable the network and recovery operators to work closely together to achieve the highest level of customer service? Will the recovery operators require a change to the operational procedures, for example, will they be required to tow more vehicles to safety or should they carry extra electric charge that will perhaps enable them to get the vehicle moving again.

Understanding the Challenge

The first step is to understand the problem before a solution or mitigation measure can be put in place. We must be able to identify the influencing factors for the behaviours that we see on the network. Once we understand the problem, then we can consider what suitable and appropriate measures are required to change driver behaviour.

The cause of many breakdowns on the network is that the driver has run out of fuel. Do we really understand the human factors and reasons why drivers place themselves in this vulnerable and potentially unsafe position? Through analysis of breakdowns we can see that some road user populations, perhaps the younger worker, are more likely to break down towards the end of the month when they are trying to avoid spending money before they get paid. Also perhaps students who are likely to be short of money may also choose to run their vehicles on little fuel. We also need to consider whether there are specific locations across the network where drivers are more likely to run out of fuel.

Are there large gaps between service stations, long lengths of carriageways between junctions or steep inclines or areas where there is a high young worker population? These areas should be targeted as locations and a higher level of mitigation may be required.

A stepped approach can be undertaken to ensure that a successful outcome is put in place.

Figure 1 below provides an overview of the steps that should be taken.

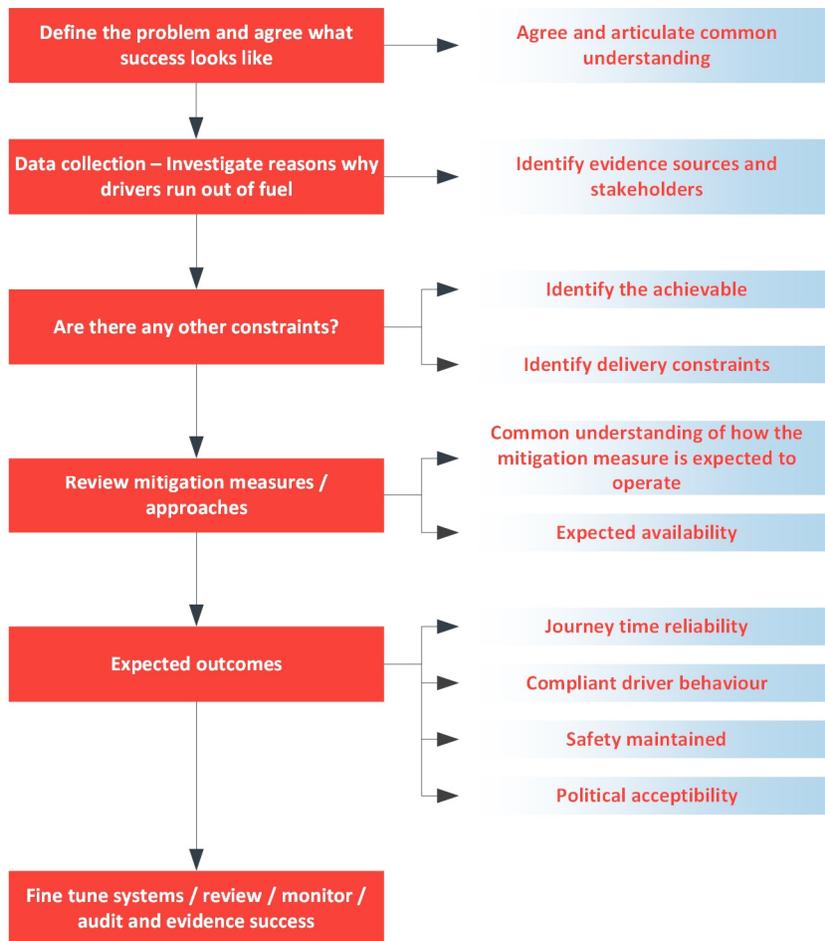


Figure 1: Stepped approach to ensure appropriate mitigations are put in place

Approach to Mitigation

When considering the options for mitigations measures that can be put in place in order address the problem, then the 4 Es approach can be used to achieve the ‘expected outcomes’ i.e. compliance and improve road safety. The 4 Es are engineering, education, encouragement and enforcement and the proposed mitigation measures outlined below use the 4 E approach in order to deliver the expected or anticipated outcome.

Some key mitigation measures that could be considered are as follows:

DRIVER EDUCATION ON RUNNING OUT OF FUEL (EDUCATION)

Inbuilt systems warning of low fuel levels already exist in most vehicles. However, whether drivers pay attention to these warning lights or whether some do not know what it means has not been determined. Are some drivers happy to take the risk and run their fuel level to a dangerously low level? There is a need for further driver education around this and the ongoing national problem associated with running out of fuel.

Addressing the problem now and changing road users mind-set, before a significant transition to EVs, will mean that drivers are fully aware and understand that running out of fuel is not an acceptable behaviour on the road network.

This will mean that by the time the driver owns an EV he/she understands the issue and this will result in a change to their behaviour. The driver will be aware that ensuring the EV vehicle is charged for the journey is important to not only their safety and reaching their destination in the expected timescales, but also the performance of the network and safety of other road users.

DRIVER EDUCATION ON PERFORMANCE OF ELECTRIC VEHICLES (EDUCATION)

With the introduction of EV becoming ever more apparent, starting to educate drivers on the implications of driving an EV would get road users thinking and becoming aware of the issues. Drivers may need to be more aware that they will need to change their everyday driving behaviour. They will need to plan their journeys better by perhaps thinking two or even three days in advance of making a journey. Will the vehicle be fully charged before the journey starts; which route will they take; where will there be charge points and which service stations would be the most convenient to stop at to maximise the electric charge and driving distance of the vehicle; do they need to set off earlier in the day in order to take account of a stop at a service station within the overall expected journey time. The majority of drivers who currently drive petrol or diesel fuelled vehicles would generally not consider these questions but an EV owner will need to change their mindset in order to ensure that they are well prepared.

The AA Trust has recognised the need for this driver education and have set up 'Drive Electric' which aims at introducing people to this new technology and the differences it brings to a driver experience.

A consistent approach to education through network operators, government organisations and vehicle manufacturers would allow the right road user populations to be targeted and would ensure that the right mind-set is put in place from the very start.

INCREASED LEVEL OF INFORMATION ON ROAD (ENCOURAGEMENT)

With the introduction of Smart Motorways and other technology based schemes on the motorway and APTR network, there is greater opportunity to change drivers behaviour as they are on their journey. Messages advising drivers to 'check their fuel' are often seen across the network but the question needs to be considered whether they are targeting the right locations, road user populations and at the right times. A targeted campaign along with different messages and pictograms could be considered to ensure that drivers take notice of the information.

CHARGING POINTS AND IMPROVED SIGNAGE (ENGINEERING)

The ability for drivers to safely reach charging points will be key to reducing the likelihood of vehicles breaking down. The locations for charging points should be strategically reviewed so that they are placed at appropriate places on the road network without significant gaps between them. This would mitigate against areas on the network where it is likely that there could be a higher number of vehicles running out of charge. There should also be a review into signage requirements for charging points where drivers should be clearly directed to charging points from the strategic road network. Also reviews should be undertaken with SatNav designers so that more information can be provided through navigation systems in order to improve awareness.

LOCATING PLACES OF SAFE REFUGE (ENGINEERING)

Highways England recognise that the customer experience is key to achieving a high performing and safe road network. Therefore the identification of safe areas of refuge on the road network is key to ensuring safety of road users. As noted, Highways England are introducing a programme of Smart Motorways, where the hard shoulder is converted to a full time running lane. On traditional motorways, vehicles would perhaps look to break down on the hard shoulder. However, within a Smart Motorway, Emergency Areas are positioned at appropriate locations for drivers to stop in emergencies. Driver education and better knowledge from the road user in terms of knowing where

these Emergency Areas are located on the network would mitigate against the hazard of breakdowns occurring in live lanes and thereby impacting on safety and lane availability. EV manufacturers and SatNav designers can also play a part in the provision of this information. Could navigation systems provide more location specific information in regard to locations of safe areas of refuge?

INCREASED LEVEL OF ENFORCEMENT AND PROSECUTIONS (ENFORCEMENT)

A driver who breaks down as a result of running out of fuel can be prosecuted for 'driving without due care and attention'. However, the perception for many motorists would be that unless a breakdown results in a serious accident, they would think it was unlikely they would face prosecution. A step up in the level of enforcement activities would help to influence driver behaviour so that they realise that breaking down because of a lack of fuel is not an acceptable driving behaviour.

Way Forward for Network Operators, Government Organisations, Scheme Designers, Vehicle Manufacturers and Other Key Stakeholders

The previous section considered some of the mitigation measures that can be put in place in order to reduce the impact of a possible increase in breakdowns as a result of the EV revolution. There are however a number of simple recommendations that can be taken forward by network operators, government organisations, recovery operators, scheme designers and vehicle manufacturers. These are as follows:

IMPROVED COMMUNICATIONS BETWEEN PARTIES

Network Operators and government organisations to work more closely with recovery operators and vehicle manufacturers so that there is a greater understanding of the issues and challenges that the network will face as a result of an increase in use of EVs.

GOVERNMENT ORGANISATIONS AND SCHEME DESIGNERS TO CONSIDER WHAT BEING 'FUTURE READY' LOOKS LIKE

Government organisations and scheme designers should be looking ahead to consider how the network will be operated and managed in future years. Being 'future ready' will mean that designers should consider what the road network will look like in years to come with the majority of vehicles in the fleet running on electric.

STRATEGIC APPROACH TO CHARGING POINTS

A strategy for where charging points should be located and how many are required across the network needs to be in place. This would need to provide an approach which proactively manages the transition to EVs. Network operators, vehicle manufacturers and electricity providers need to develop a strategy that enables demand to be met but also encourages the use of EVs as drivers transition from petrol or diesel to electric.

PENALTIES FOR BREAKDOWNS

Introducing penalties for breakdowns would encourage drivers to better plan their journeys and think before they commence their journey on to the road network. The perception that if a driver were to break down in their electric vehicle that they would be towed or charged up free of charge would need to be changed. The Network Operators would need to work closely with the recovery operators and Police.

And finally, which is likely to have the greatest impact....

EDUCATION FOR THE ROAD USER

Education is key to delivering a safe, efficient and high performing road network which changes the behaviour of drivers. There are specific road user populations that can be targeted. Having a centralised driver education campaign put in place by government organisations, network operators and vehicle manufacturers would ensure consistency across the network. Drivers of EVs need to plan their journeys well in advance of when they are expecting to be on the road network.

Conclusions

There is still more that is needed to be done in order find the right mitigations to solve the problem. Centralising driver education through a consistent approach by network operators, government organisations and vehicle manufacturers would target all customers and be a big step towards introducing the right driver behaviours. These parties have the forum to influence this driver behaviour and strive to provide positive outcomes. Understanding the human factors and defining the underpinning reasons for those drivers who run fuel levels to potentially dangerous situations would allow a targeted education campaign to deliver successful outcomes.

We expect the number of EVs breaking down as a result of running out of electric charge to increase the numbers of breakdowns on the network. However, as the EV revolution gathers pace, putting in place some of the mitigations and measures discussed within this paper is likely to go some way to ensuring that the road network performs safely and efficiently and maximises the customer experience for the road user.

References

1. Liverpool Victoria (2015). *Motorists run dry gambling on fuel levels*.
<https://www.lv.com/aboutus/press/article/motorists-run-dry-gambling-on-fuel-levels>
2. Highways England (2016). *Customer Service Strategy*
3. Highways England (2017). *Strategic Road Network Initial Report*