



ORR's Policy on Third Rail DC Electrification Systems

Aim

ORR's aim is to ensure:

- The rail industry delivers an electrification system that is capable of being constructed, operated and maintained in accordance with their duties under all applicable health and safety legislation.
- The industry has a suitable long-term strategy to ensure it protects workers and members of the public from risks associated with railway electrification systems.
- Where development of the network involves considering new DC third rail electrification (which includes extension of existing infrastructure) there is a full assessment of the safety, technical and economic benefits of installing alternative electrification systems by the relevant duty holder.
- It will press for fundamental improvements to the design and management of DC electrification in order to ensure duty holders fully comply with their legal duties if they clearly have no other option and have fully demonstrated that any other specific option in comparison would be a grossly disproportionate approach.
- It will continue to question and challenge duty holders to drive excellence in the management of electrical safety risks – particularly those associated with third rail technology.

Purpose and scope of this policy statement

This statement sets out and clarifies ORR's policy on third rail DC electrification systems and is intended to provide duty holders with a clear view of the issues we, as the regulator, expect industry to consider and address when evaluating options for the proposed construction or renewal, upgrade or extension of third rail.

Our policy:

- (i) The relevant duty holder must be able to demonstrate that any proposed new-build or extended third rail proposal will comply with all applicable health and safety legislation.
- (ii) There is a presumption against the reasonable practicability of new-build or extended DC third rail in view of the safety requirements duty holders must satisfy in order to justify the use of third rail.
- (iii) Where existing third rail needs to continue to be operated, maintained and renewed for the purpose of the railway, the relevant duty holder must ensure it continually reviews such third rail and seek improvements in the design, operation and maintenance of the third rail systems.

Considerations:

1. ORR considers that the weight of safety evidence creates a presumption against new-build or extended third rail being reasonably practicable. A duty holder will therefore need to demonstrate, to ORR's satisfaction, that any proposed new-build or extended third rail proposal complies with the applicable legislation and be able to explain how and why it rebuts this presumption.
2. Infrastructure managers have a range of duties under health and safety law to design and operate their undertaking so that risk to workers, passengers and members of the public is minimised. There are more specific duties in the Electricity at Work Regulations 1989 (the "**EAW Regulations**") which require precautions to be taken to avoid death or personal injury from electricity at work activities. The existing DC network predates the EAW Regulations and consequently was not designed to comply with them. Therefore, when developing options for the design and implementation of electrification schemes, and when approaching maintenance and renewal of the existing network, we expect the industry to appropriately and robustly address the serious safety concerns associated with third rail DC electrification.

3. If, at the earliest design optioneering stage, a duty holder fully assesses the risks of a proposed electrification scheme then it is possible to exploit opportunities to design those risks out or minimise them, as required by legislation. For example, later DC systems – such as the DLR – have designed their traction arrangements so that the conductor rail is insulated or shrouded. Access to third rail by the public on this system is also more restricted than on the mainline as it is raised or underground and has no level crossings. Similarly, this has been the case where London Underground has expanded its fourth rail network. Physical limitations and compatibility considerations have constrained adoption of alternative traction current arrangements but this is set against the already greater levels of compliance achieved on that network, such as no live working and greater separation of members of the public from the network.
4. A suitable and detailed assessment of the risks at the start of any project – or project proposal – should identify the full range of statutory duties and associated requirements with which a duty holder must comply. A design option selected to minimise those risks will tend to satisfy any specific legal duties, although it is incumbent on the duty holder to ensure it complies with all such duties. The rail industry should take every opportunity to design out risk and shortcomings and install electrical infrastructure that is safer and will ensure greater compliance with the legal requirements than the current system.
5. ORR's most significant concern in regard to legacy third rail systems (the “**legacy network**”) is the running of bare, live conductors through publicly accessible areas. These conductors are not insulated or shrouded. The legacy network does not allow quick, secure isolations, and exposes individuals to a range of risks whilst carrying out isolations¹. Due to the difficulty in obtaining isolations on the legacy network, a lot of work tends to be carried out on or near the live conductor, further undermining safety and weakening compliance with the applicable legislation. This is not an abstract or theoretical risk: the harm done to both workers and members of the public by the legacy network occurs significantly more frequently than on the overhead AC network². A duty holder proposing the laying of new bare third rail (as used across the legacy network) would therefore have to make a compelling case that it had considered all other possibilities and could satisfactorily demonstrate that all such possibilities would be grossly disproportionate in comparison to using third rail.
6. No significant geographic extension of third rail electrification has taken place on the mainline railway for many years. However, smaller third rail renewal and very minor

¹ This weakness has been recognised by Network Rail in its acknowledgment of the safety benefits of DC – Electrical Power Asset Policy December 2012 (page 284) and is why ORR has agreed to a ring fenced fund for 'safer, faster isolations' in CP5.

² This is borne out by data from RSSB's safety risk model – despite the legacy network being only half the size of the AC network (4400km compared to 8200km), it contributes almost eight times more (in terms of fatalities and weighted injuries per year) to overall risks on the railway. See FWI comparative data for OLE / conductor rail / non-electrified: Network Rail Electrical Power Asset Policy December 2012 (Table 2.1, page 52).

extension schemes have been – and continue to be – proposed. For these small-scale projects, duty holders may be able to demonstrate that simple extension or replacement of the third rail is the only viable option in the circumstances.

Nevertheless, this does not detract from duty holders' obligations to show:

- i) they have evaluated the full range of options available;
- ii) proceeding with third rail is the only viable option in those circumstances; and
- iii) how compliance with applicable health and safety legislation will be delivered in relation to this project from the design stage onward³.

7. Where existing third rail needs to continue being operated, maintained and renewed, the rail industry must ensure continuous improvements in the design, operation and maintenance of such electrical systems.

How we expect duty holders to move towards our aim:

- To consider electrification options for new schemes (i.e. when extending a part of the DC network or introducing electrification to a route for the first time) at the optioneering design stage of projects, with recognition that extending the third rail requires a high degree of justification.
- Whenever renewal or upgrade of the electrification systems is being proposed a duty holder should carry out a thorough design risk analysis of the available electrification options and should develop a thorough and credible cost-benefit analysis to support any determination that alternatives to third rail electrification are grossly disproportionate.
- To achieve excellence in continual improvement in safety management and risk control approaches associated with the operation and maintenance of the legacy network.
- Duty holders should note that compliance with health and safety duties is not confined to the third rail network. The generic safety advantages of overhead electrification do not mean that its installation (for example in preference to third rail) automatically delivers full compliance with health and safety legislation. Duty holders must design, operate and maintain all electrification systems in such a way so as to prevent danger and reduce risks so far as is reasonably practicable, whatever technology is used.

³ For Network Rail this must at least include making optimal use of funding ORR has agreed for CP5 to deliver safer and faster isolations.