ORR's policy on electrical clearances to standing surfaces for 25kV overhead electrification

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Aim

ORR's aim is to ensure that:

- The rail industry delivers an electrification system that is capable of being constructed, operated, maintained and used 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.
- Our views are clear on what legal compliance on the issue of electrical clearances to standing surfaces[1] entails for publically accessible locations.
- Our approach to "difficult cases" where minimum standards for the separation of live conductors[2] from standing surfaces cannot be achieved without grossly disproportionate cost is transparent, fair and rigorous.

Purpose and scope of this policy statement

1. This statement sets out and clarifies ORR's policy on the issue of clearances from parts of 25kV electrification systems to standing surfaces to which members of the public may foreseeably gain access. The principles discussed here set down in one place a range of discussions with industry stakeholders over the last two years. We believe, therefore, that the contents of this document should be entirely consistent with discussions that we have had with projects which are currently underway and do not introduce any new requirements.

[1] A "standing surface" is defined in BS EN 50122-1 as "any point on a surface where persons may stand or walk about without great effort".

[2] "Live conductors" includes live parts of pantographs as well as the overhead line equipment.

2. This document is relevant only to those projects where overhead line equipment is being added to existing infrastructure or where new standing surfaces are to be provided in locations with existing overhead contact systems.

3. This document should act as guidance for people carrying out infrastructure design work, when looking specifically at the issue of electrical clearances.

Exclusions from scope

4. This document does not:

- seek to specify the solutions that designs should include, as the risk to persons from contact with live conductors is just one of many factors in designing a safe and efficient system of electrification;
- address electrical clearances between overhead line equipment and fixed infrastructure, although we recognise that the need to achieve appropriate clearances to fixed infrastructure will be a factor in achieving the outcomes discussed in this document;
- deal with lineside accessible locations e.g. signalling gantries, work platforms etc.

Our policy

- Duty holders must clearly demonstrate that they have **complied with relevant legislation**[3] which details the clearance dimensions that should be achieved. For standing surfaces in locations where the public may forseeable gain access, the required clearance is 3.5m and ORR considers this to be the **minimum** required for compliance without further mitigation (such as barriers or screens as specified or equally effective means).
- In all circumstances a **risk assessment** should show that the duty holder has done all that is reasonably practicable to increase the clearance distances to at least 3.5m and set out what steps have been taken to maximise the electrical clearance where 3.5m cannot be achieved.
- ORR does not believe that the distance of 3.5m has to be achieved irrespective of cost. 3.5m is the minimum clearance which duty holders should aim to achieve and exceed wherever practical. Where that cannot be achieved without

[3] Specifically the Electricity at Work Regulations 1989 and the Railway (Interoperability) Regulations 2011 (RIR), the Energy TSI & National Notified Technical Rule GL/RT1210 as set out in BS EN EN50122-1:2011+A1:2011.

grossly disproportionate expenditure then the full range of options to control the risk arising should be identified, evaluated and implemented.

- Where the 3.5m minimum clearance cannot be achieved, the duty holder needs to carry out a **site specific risk assessment** to clearly identify the hazards and controls that are required to ensure safety equivalent to the 3.5m minimum clearance.
- This should include a demonstration of all the items and factors considered in trying to achieve the 3.5m clearance and clearly evidence that the measures needed to achieve it are not **reasonably practicable** on the basis that the associated costs are grossly disproportionate.

Considerations

5. Electrification introduces new hazards into the railway environment. While the UK already has an extensive electrified network, much of its development pre-dates relevant health and safety legislation - in particular the Electricity at Work Regulations 1989 (EaWR). As a consequence, the standards to which existing infrastructure was constructed is not generally acceptable when judged against those requirements. In particular Regulation 7 of EaWR requires that:

> **Insulation, protection and placing of conductors**
>
> 7. All conductors in a system which may give rise to danger shall either–
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> a) be suitably covered with insulating material as necessary protected so as to prevent, so far as is reasonably practicable, danger; or
>
> b) have such precautions taken in respect of them (including, where appropriate, their being suitably placed) as will prevent, so far as is reasonably practicable, danger.

6. The Railways (Interoperability) Regulations 2011 transposes the requirements of the EU Interoperability directive 2008/57/EC into our national law. They require compliance with applicable Technical Specifications for Interoperability (TSIs), relevant National Notified Technical Rules (NNTR) and any standards cited within. BS EN 50122-1 is the standard that deals with protective provisions against electric shock and introduced two concepts for control of the risk from electrical hazard: protection by separation and protection by barrier.

7. It is important to recognise that duty holders must comply with all the relevant legislation. Interoperability legislation and safety legislation have different purposes: the former (in this case, the TSI for the energy subsystem) relates to the initial design integrity of railway subsystems and the latter (in this case, EaWR) relates to the control of risks to persons throughout the lifecycle of the system. This means that achieving compliance with TSIs does not always deliver compliance with health and

safety legislation, and vice versa. In both cases, the standard BS EN 50122-1 is relevant.

8. The standard has undergone a number of iterations and revisions. Most significantly EN50122-1:2011+A1:2011 revised an earlier special UK national condition which recognised the constrained UK loading gauge. Previously this had, for the UK specific case, established an electrical clearance of 2.75m as a minimum for any element of the electrification system , after revision the special national UK condition was removed and any utilisation of dimensions under 3.5m must now be justified by risk assessment.

9. A distance of 3.5m from a standing surface is therefore clearly established in the standard as the minimum clearance required to all live parts of the electrification system. However, the risk profiles and the associated control measures vary for the different components of the system:

   - Fixed live equipment, where we consider the risk to persons to be significant and as such requiring appropriately robust engineering level controls;
   - Static pantographs, where we consider that the risk can be influenced by a number of factors that collectively may adequately address the hazards; and
   - Transiting pantographs, where, while we recognise that they pose an electrical risk, the presence of a rail vehicle moving at speed is likely to present a greater risk. So provided suitable controls are in place to ensure that the risk from being struck by a moving vehicle is managed then we believe that electrical risk from passing pantographs can be considered negligible.

10. ORR notes that no other industry uses a dimension as low as 3.5m to achieve compliance with EaWR for 25kV systems, so its use already takes into account the constraints of UK rail infrastructure. As such, the scope for further compromise of this already significantly reduced clearance distance without accompanying mitigations is extremely limited.

11. Where the risk being considered is of death to members of the public then the judgement on what is reasonably practicable moves towards what is technically achievable (in other words, because the "quantum of risk" is at a very high level then the level of "time, trouble and effort" that is proportionate to control it will inevitably also be high). Where entirely new electrified infrastructure is being considered, then the duty to design out risk - rather than mitigate –is strengthened considerably[4].

[4] As HSE's memordandum of guidance on EaWR notes (at its paragraph 60): "Where the risk is very often that of death, eg from electrocution, and where the nature of the precautions which can be taken are so often very simple and cheap, eg insulation, the level of duty to prevent that danger approaches that of an absolute duty".

12. Costs of redesigning features and retrospective modifications due to lack of rigour in the duty holder's original design should not be used to inform any cost-benefit analysis. ORR's strategy document on safety by design[5] explains this in more detail and quotes RSSB's guidance: "It is not acceptable to argue that a measure is not necessary to ensure safety SFAIRP on the basis of excessive cost if that measure could and should have been identified at an earlier point in the project when its implementation would have been required".

How we expect duty holders to move towards our aim

13. Duty holders should aim to maximise clearances wherever possible, beginning at the design stage of the project. 3.5m is a minimum, and not a design target.

14. Duty holders should consider all practicable options to achieve the required clearance distance, including platform position, track lowering, track alignment and altering structures where they are the limiting factor. Where duty holders' internal company standards, for example around track gradient, pose an obstacle to achieving legal compliance then the onus should be on adhering to the law and considering any necessary revisions or variations to the standard(s) in question.

15. Duty holders must set out the alternative steps that they will take in their design to comply with regulation 7 of EaWR, including physical barriers or obstacles to prevent contact with live parts, where a 3.5m clearance cannot be achieved.

16. Duty holders must still prevent danger so far as is reasonably practicable in all the locations where achieving a 3.5m clearance is not achievable. Duty holders must carry out risk assessments for those locations to demonstrate that all reasonably practicable risk control measures have been identified and evaluated, and that design decisions are made in the light of risk against cost judgements that address the specific conditions at each location. Decisions on further mitigations to control risk should be made on the basis of proportionality and controls only rejected when a position of gross disproportionality is reached. Operational reliability, system performance and on-going maintenance costs in addition to the safety benefits should form part of any business case evaluation.

17. Duty holders should use location-specific narrative risk assessments for the "problem cases" rather than a project wide quantified risk assessment to provide greater rigour and transparency of decision making. Assessments must ensure the consideration and control of all risks which are foreseeable, i.e. arising from foreseeable behaviour of individuals, rather than rely on a particular measurement as an indicator of acceptable risk. The locations to be considered should include all areas where it is

[5] See: http://orr.gov.uk/__data/assets/pdf_file/0009/21402/2016-03-18-New-Strategic-Chapter-12-Health-and-Safety-by-Design.pdf.

foreseeable that members of staff and public may forseeably gain access and not be limited to locations where the public are normally allowed access. Historic analysis is unlikely to fully identify the likelihood of foreseeable risk, unless it fully considers all the aspects that might have influenced the historic performance and what factors have changed since the performance was established. (For example, RSSB's safety risk model contains only historic harm data so does not reflect forseeability.)

18. Duty holders must address the risk through the normal hierarchy of control, with steps being taken first to eliminate the risk wherever possible, before moving on to controlling the risk with hardware or engineering controls. Administrative controls, such as warning signs and announcements that may be appropriate to provide an extra level of advice to the public about the risk, are unlikely to be sufficient mitigation on their own to address the issue of compromised clearances in an area where members of the public and staff have access.