

Electrical safety

5. Appendix

Table 1: Infrastructure on the mainline

This table shows the characteristics of the infrastructure on the rail network, Great Britain.

Annual data (financial year): 1985-86 to 2020-21

Nation	Financial year	Route open for traffic	Of which electrified	Route Open for Passenger & Freight Traffic	Route Open for Freight Traffic Only	Track kilometre
Great Britain	1985-86	16,752	3,809	14,310	2,442	:
Great Britain	1986-87	16,670	4,156	14,304	2,366	:
Great	1987-88	16,633	4,207	14,302	2,331	:

Nation	Financial year	Route open for traffic	Of which electrified	Route Open for Passenger & Freight Traffic	Route Open for Freight Traffic Only	Track kilometres
Britain						
Great Britain	1988-89	16,599	4,376	14,309	2,290	:
Great Britain	1989-90	16,587	4,546	14,318	2,269	:
Great Britain	1990-91	16,584	4,912	14,317	2,267	:
Great Britain	1991-92	16,588	4,886	14,291	2,267	:
Great Britain	1992-93	16,528	4,910	14,317	2,211	:
Great Britain	1993-94	16,536	4,968	14,357	2,179	:

Nation	Financial year	Route open for traffic	Of which electrified	Route Open for Passenger & Freight Traffic	Route Open for Freight Traffic Only	Track kilometres
Great Britain	1994-95	16,542	4,970	14,359	2,183	:
Great Britain	1995-96	16,666	5,163	15,002	1,664	:
Great Britain	1996-97	16,666	5,176	15,034	1,632	:
Great Britain	1997-98	16,656	5,166	15,024	1,632	:
Great Britain	1998-99	16,659	5,166	15,038	1,621	:
Great Britain	1999-00	16,649	5,167	15,038	1,610	30,846
Great Britain	2000-01	16,652	5,167	15,042	1,610	30,846

Nation	Financial year	Route open for traffic	Of which electrified	Route Open for Passenger & Freight Traffic	Route Open for Freight Traffic Only	Track kilometres
Great Britain	2001-02	16,652	5,167	15,042	1,610	31,972
Great Britain	2002-03	16,670	5,167	15,042	1,610	31,766
Great Britain	2003-04	16,493	5,200	14,883	1,610	31,564
Great Britain	2004-05 (b)	16,116	5,200	14,328	1,788	31,482
Great Britain	2005-06	15,810	5,205	14,356	1,454	31,105
Great Britain	2006-07 (b)	15,795	5,250	14,353	1,442	31,063
Great Britain	2007-08	15,814	5,250	14,484	1,330	31,082

Nation	Financial year	Route open for traffic	Of which electrified	Route Open for Passenger & Freight Traffic	Route Open for Freight Traffic Only	Track kilometres
Great Britain	2008-09	15,814	5,250	14,494	1,320	31,119
Great Britain	2009-10	15,753	5,239	14,482	1,271	31,073
Great Britain	2010-11	15,777	5,262	14,506	1,271	31,108
Great Britain	2011-12	15,742	5,261	14,506	1,236	31,063
Great Britain	2012-13	15,753	5,265	14,504	1,249	31,075
Great Britain	2013-14	15,753	5,268	14,504	1,249	31,092
Great Britain	2014-15	15,760	5,272	14,506	1,254	31,120

Nation	Financial year	Route open for traffic	Of which electrified	Route Open for Passenger & Freight Traffic	Route Open for Freight Traffic Only	Track kilometre
Great Britain	2015-16	15,799	5,331	14,552	1,247	31,194
Great Britain	2016-17 (b)	15,811	5,374	14,491	1,320	31,221
Great Britain	2017-18	15,878	5,766	14,548	1,330	31,038
Great Britain	2018-19	15,847	6,010	14,634	1,214	31,091
Great Britain	2019-20 (r)	15,904	6,049	14,668	1,236	31,218
Great Britain	2020-21	15,935	6,045	14,712	1,290	31,251
England	2012-13	11,575	4,617	10,321	954	24,392

Nation	Financial year	Route open for traffic	Of which electrified	Route Open for Passenger & Freight Traffic	Route Open for Freight Traffic Only	Track kilometres
England	2013-14	11,573	4,620	10,620	953	24,394
England	2014-15	11,580	4,623	10,622	958	24,422
England	2015-16	11,570	4,640	10,618	952	24,427
England	2016-17 (b)	11,582	4,681	10,556	1,026	24,455
England	2017-18	11,669	5,007	10,616	1,053	24,300
England	2018-19	11,637	5,021	10,693	944	24,365
England	2019-20 (r)	11,672	5,109	10,705	967	24,447
England	2020-21	11,702	5,104	10,688	1,014	24,478

Nation	Financial year	Route open for traffic	Of which electrified	Route Open for Passenger & Freight Traffic	Route Open for Freight Traffic Only	Track kilometres
Wales	2012-13	1,490	0	1,650	140	2,447
Wales	2013-14	1,490	0	1,350	140	2,458
Wales	2014-15	1,490	0	1,350	140	2,458
Wales	2015-16	1,492	0	1,352	140	2,460
Wales	2016-17 (b)	1,492	0	1,352	140	2,459
Wales	2017-18	1,490	0	1,350	140	2,458
Wales	2018-19	1,491	0	1,350	140	2,454
Wales	2019-20 (r)	1,532	56	1,371	160	2,497

Nation	Financial year	Route open for traffic	Of which electrified	Route Open for Passenger & Freight Traffic	Route Open for Freight Traffic Only	Track kilometres
Wales	2020-21	1,532	56	1,431	160	2,497
Scotland	2012-13	2,688	648	2,533	155	4,236
Scotland	2013-14	2,690	648	2,534	156	4,240
Scotland	2014-15	2,690	649	2,534	156	4,240
Scotland	2015-16	2,737	691	2,582	155	4,307
Scotland	2016-17 (b)	2,737	693	2,583	154	4,306
Scotland	2017-18	2,719	759	2,582	137	4,280
Scotland	2018-19	2,719	989	2,590	129	4,272
Scotland	2019-20	2,701	885	2,592	109	4,276

Nation	Financial year	Route open for traffic	Of which electrified	Route Open for Passenger & Freight Traffic	Route Open for Freight Traffic Only	Track kilometres
	(r)					
Scotland	2020-21	2,701	885	2,592	109	4,276

Source(s): Network Rail – Last updated: 14 October 2021 – Next updated: October 2022 – Email: rail.stats@orr.gov.uk.

Symbols: (.) Data not available; (r) Data revised; (p) Data are provisional; (b) Break in time series.

Notes

(b) Prior to 2004-05 route length data and electrification data was collected using various systems and collected on a semi-annual basis. These systems, whilst often the most accurate measures available at the time, would not have provided as accurate a measure as the GEOGIS system and there is therefore a break in the time series between 2003-04 and 2004-05.

(b) There is a break in the time series between 2006-07 and 2007-08 due to a new methodology where the route classification reference data was revamped.

(b) There is a break in the time series between 2016-17 and 2017-18 due to Network Rail replacing GEOGIS, its master database for track assets, with a new system called INM (Integrated Network Model). This means any comparison of the current route length with previous years must be treated with caution.

(b) Prior to 2012-13, data is only available for Great Britain as a whole and not split by country. However, the data for new electrification projects track km is available separately for England,

Wales and Scotland going back to 1995-96. This may not equal the Great Britain total due to rounding.

(r) The total Great Britain figure does not include Isle of Wight line, which is 17.4 track km. This line is leased from Network Rail to First MTR South Western Trains Limited (operating as South Western Railway).

1. High Speed 1 is not included in these figures. This has a route length of 109km.

2. The majority of the total new electrification projects track km was in England between 1995-96 and 2011-12. In 2005-06 5km of new electrified track km was added in Scotland. In 2010-11 106km of new electrified track was added in Scotland.

Rail infrastructure and assets release and quality and methodology report

ORR Revisions log

ORR's Policy on Third Rail dc electrification systems

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 dutyholder.



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 dutyholders 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



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

Considerations:

- ORR considers that the weight of safety evidence creates a presumption against new-build or extended third rail being reasonably practicable. A dutyholder 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.
- 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.
- If, at the earliest design optioneering stage, a dutyholder 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.

- 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 dutyholder must comply. A design option selected to minimise those risks will tend to satisfy any specific legal duties, although it is incumbent on the dutyholder 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.
- 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 isolations (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). 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 network (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)). A dutyholder 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.
- 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 extension schemes have been – and continue to be – proposed. For these smallscale projects, dutyholders 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 dutyholders' obligations to show:

- they have evaluated the full range of options available;
 - proceeding with third rail is the only viable option in those circumstances; and
 - how compliance with applicable health and safety legislation will be delivered in relation to this project from the design stage onward (for Network Rail this must at least include making optimal use of funding ORR has agreed for CP5 to deliver safer and faster isolations).
- 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 dutyholders to move towards our aim:

How we expect dutyholders 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.

- ← Previous 4. Sector overview and compliance expectations