

Civil engineering assets

2. Our view of the risk

What the risk is and who it affects

Civil Engineering Assets include structures, earthworks, operational property and drainage systems. Their integrity is fundamental to safe railway operation. Failure of these assets can lead to derailment, potentially resulting in multiple fatalities, or can cause injury to staff, passengers and the public through falling parts, structural collapse or track obstruction.

Failures may occur suddenly, particularly during extreme or localised weather, and can arise from earthwork movement, drainage failure, scour, masonry collapse or impacts from ancillary structures. Such failures can obstruct the line or distort the track, creating risk to train operations.

Risks affect:

- **Passengers and public** (structural collapse, falling debris, station asset failure)
- **Train operations** (derailments, collisions following track obstruction)
- **Staff and maintainers** (defects in inaccessible or hidden locations)
- **Dutyholders** (managing degraded, ageing or poorly understood assets)

Fundamental risks

Derailment

Failure of earthworks, drainage, structures or ancillary assets can directly or indirectly derail a train. The Carmont derailment (2020), where a train struck washed-out drainage material following intense rainfall, illustrates how severe the consequences can be.

Personal Injury

Risks to individuals include falling components (e.g. signal posts, station elements), structural collapse (e.g. Northwich station gable collapse), or ancillary structure failures such as corroded posts or electrification supports.

Significant factors influencing civils assets risk

The Significant Factors



- Age of assets — most built before 1900
- Many assets at or near end of design life
- Legacy construction with variable materials and unknown details
- Assets historically “sweated” due to long perceived life
- Increased traffic loading
- Defects can be hidden or difficult to detect
- Vegetation weakening structures and obscuring early warning signs
- High vulnerability to adverse and extreme weather
- Climate change increasing frequency and severity of events
- Gaps in asset information, for example, incomplete drainage registers

Long-term exposures and system-level risk

Civils assets form part of a wider infrastructure system. Culverts, drainage, earthworks and track are interdependent; poor performance of one can generate defects in another. Neglect of drainage assets has also historically contributed to instability and defects. An infrastructure system risk management approach is required.

Civils assets are also vulnerable to actions by outside parties such as diverted drainage, water mains leakage, or changes in land use. Incidents at Corby and Barrow-upon-Soar show how third-party actions can rapidly create hazards without warning.

Ancillary structures, numbering in the hundreds of thousands, also present risk when examinations do not identify deterioration (e.g. Newbury signal post collapse). These assets include signal structures, OLE and telecoms masts, walkways, lighting columns and hoardings, and have been associated with an increasing number of incidents.

There are 17 major and 2,500 other stations and 8,200 commercial properties on the national network, with a further 270 stations on LUL and others on the light rail and heritage networks. These all require routine inspection, examination and assessment to ensure continued safe operation.

Emerging trends and weather-driven risk

Extreme weather events (heavy rainfall, convective storms, ground saturation, high winds) significantly increase the likelihood of Civils assets failures. Earthworks are particularly susceptible to rainfall-driven failures, and structures are at risk from scour.

Climate change has already resulted in more frequent and severe events. ORR's risk profile shows that weather-related precursors are a major driver of Civils assets failure risk and will remain so for future decades.

ORR's enforcement experience shows that even well managed and maintained infrastructure can fail under extreme conditions. Therefore, consequence management must be strengthened, as elimination of risk through renewal alone is sometimes not reasonably practicable for ageing infrastructure.

Sector differences (who is affected?)

Network Rail



- Assets largely Victorian; ageing structures and earthworks with variable design quality.
- Very large portfolio (e.g., ~20,000 km of earthworks) and highly weather-sensitive, especially to rainfall.
- Drainage and ancillary structures historically under-managed; information gaps persist.
- Backlogs in examination and evaluation have created delays in identifying and addressing defects.

London Underground



- High proportion of tunnels and deep tube sections; drainage critical to prevent flooding and seepage.
- Many assets over 100 years old; degradation often hidden and difficult to assess.
- Newer extensions benefit from modern resilience and modular design, but older assets remain vulnerable.
- Failures have greater operational impact due to confined spaces and high passenger density.

Tramways and Light Rail



- Generally fewer earthworks/structures, but risks arise where systems inherit legacy heavy-rail assets (cuttings, bridges, earthworks).
- Safe operation depends heavily on inspection intervals and operating assumptions; non-compliance leads to degradation.
- Staff competence is essential to maintain safe interfaces and prevent deterioration.
- Trams can stop more quickly, reducing derailment consequence, but poor maintenance can still introduce significant infrastructure risks.

Heritage Railways



- Lower speeds reduce derailment consequence, but ageing infrastructure, limited budgets, and variable volunteer expertise increase risk.
- Many lines operate on reinstated BR infrastructure or industrial-origin lines with incomplete records.
- Extreme weather has caused major damage (e.g., Severn Valley Railway 2007, revealing 108 undocumented culverts).
- Risk management requires coherent, risk-based inspection regimes.

- ← Previous Civil engineering assets
- → Next 3. Compliance expectations