Safe and Efficient Drainage Inspections and Monitoring
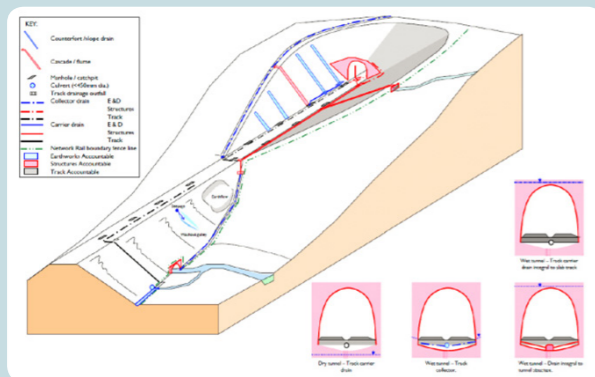
NetworkRail

What is the situation?

The effective control of water is essential to the safe and economic management of railway infrastructure.

Drainage has an important role in reducing the degradation mechanisms caused by water; such as the long-term softening of materials that form the track support system and earthworks.

Neglect of the drainage system can have significant cost and safety implications for the parent asset; such as delay minutes, poor track geometry, line closures and a likelihood of earthwork failures.

Analysis of causes

Location
- Technology limitations
- Buried assets
- Limited resource
- Poor availability of technology
- Poor knowledge transfer
- Incomplete asset inventory
- Unsafe / no / limited access
- Poor / incomplete data collection

Technology
- Hardware limitations
- No interactive map
- Inefficient use of existing data
- Field reach inefficiencies
- Accuracy of GPS
- No automated inspection for trend analysis
- No availability of tech to inspect hidden assets
- Unable to remotely monitor assets
- No uniformity across routes

Competency
- No repeatability and reliability
- Inconsistent conditional scoring
- Limited resources
- Delayed implementation of BCR
- Lack of available training
- Immature asset information
- Embedded BCR process and standards
- Recognition of deficit
- Poor knowledge transfer and familiarity
- Fear of technology
- No formalised competency assessments

Dedicated Resources
- Shared resources across multiple assets
- No dedicated drainage funding
- Drainage perceived as low risk
- Planning based on headcount not risk based inspections
- Devolution - conflicting prioritisation
- Poor reporting of planned / delivered volumes
- Risk on prioritisation for off-track work
- Reactive culture
- Poor knowledge of unit rates / norm time

System Approach
- Unable to export 'system' to calculate capacity / capability / criticality / priority
- Unable to edit GIS/asset data in Ellipse
- Culture change required in inspections
- No GIS competency on Routes
- Ellipse prohibits cross-asset mapping
- Unable to capture relationship data upstream / downstream
- Process inefficiency
- No system mapping

Safe & Efficient Inspections & Monitoring

Priority problems

Specific priority problems
- Limitations of Technology – hardware, software and middleware.
- Locating and accessing assets.
- Insufficient tools and datasets to manage, view, map drainage as a system.

Related goals
- To inspect 50 % of assets with automated technology by CP8.
- To be able to access all assets so as to collect the service and structural condition; whether physically or remotely by CP7.
- Drainage systems identified, connected, linked to system and mapped by CP6.

Benefits
- Safe and efficient inspections/monitoring activities will help to complete the asset inventory and capture the status of the asset.
- Timely and effective inspections will help reduce the number of failures, improving the safety of the network.
- The use of automated technology will provide workforce safety benefits, reliability and repeatability and data required to make correct decisions.
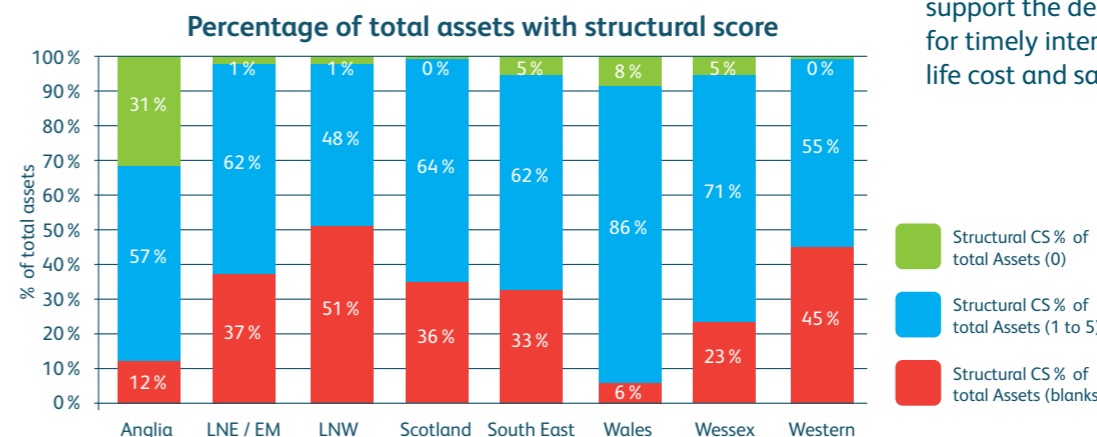
Scope

The effective management of the drainage system requires a complete, well maintained and up-to-date asset inventory. This is achieved by regularly inspecting the assets to capture the core attributes required to effectively manage the drainage systems.

The data captured by routine inspections and monitoring is used in decision making tools and processes to help manage the asset base in the most cost effective and safe manner. Inspections also identify the condition of the drainage assets such that degradation, priority and risk. The impact of the current drainage condition on the parent assets is vital in managing safety and performance.

The enablers to supporting safe and efficient inspections and monitoring are:

- Location.
- Technology.
- Dedicated resources.
- Competency.
- Systems approach.

fig. 1

fig. 2

Providing a solution to the issues highlighted allows for safer and more efficient inspections/monitoring. Providing a more complete dataset from which to manage drainage and its parent assets from a systems approach.

To address these challenges it is expected that R&D actions will need to address the following aspects:

Automated technology e.g. train borne, robotics, drones etc.
- How can automated technology be used to inspect and monitor drainage assets? In particular what train-borne devices can be used to regularly inspect and monitor assets? Considerations should also be made for how such technology would integrate with existing systems and the management of the data.

Manual technology e.g. handheld, desk based tools etc.
- What manual technology such as handheld inspection desk based tools can be used to improve the efficiency of drainage inspections?
- Can similar tools be used to remotely monitor and inspect assets in high-risk locations or where significant safety and efficiency gains can be achieved?

Locating & accessing assets
- How can buried assets or those that are hard to access be routinely inspected or monitored in a safe, efficient, reliable and consistent manner?

Tools and datasets to manage, view, map drainage as a system
- How can we map and view drainage as a system? Tools and datasets are required for the management of drainage from a holistic systems approach. The developed tools should support the decision making process and allow for timely interventions providing both whole life cost and safety benefits.

Percentage of total assets with structural score

Region	Structural CS % of total Assets (0)	Structural CS % of total Assets (1 to 5)	Structural CS % of total Assets (blanks)
Anglia	31 %	57 %	12 %
LNE / EM	1 %	62 %	37 %
LNW	1 %	48 %	51 %
Scotland	0 %	64 %	36 %
South East	5 %	62 %	33 %
Wales	8 %	86 %	6 %
Wessex	5 %	71 %	23 %
Western	0 %	55 %	45 %

% of total assets

fig. 3