Detection of Geotechnical Asset Failure by Means Other than Train Drivers or Lineside Staff

What is the situation?

Network Rail manage over 190,000 earthwork 5 chain assets on a cyclical inspection regime.

Geotechnical assets have a high passenger risk due to the high chance that a failed asset will derail a train when struck.

Geotechnical failures are frequently reported by train drivers reported as obscuredbank slips or rough rides. This is too late for preventative measures to be put in place.

Geotechnical failures are often first reported by train drivers, for example through rough rides on embankments. This is too late for preventative measures to be put in place. These observations are not currently integrated into earthwork examinations and analysis.

Condition inspections of geotechnical assets rely heavily on data collected by examiners in the field. Many of the data sets collected are subjective creating incomparable, and sometimes unreliable, data sets. This limits the extent to which asset condition and potential failure can be accurately determined.

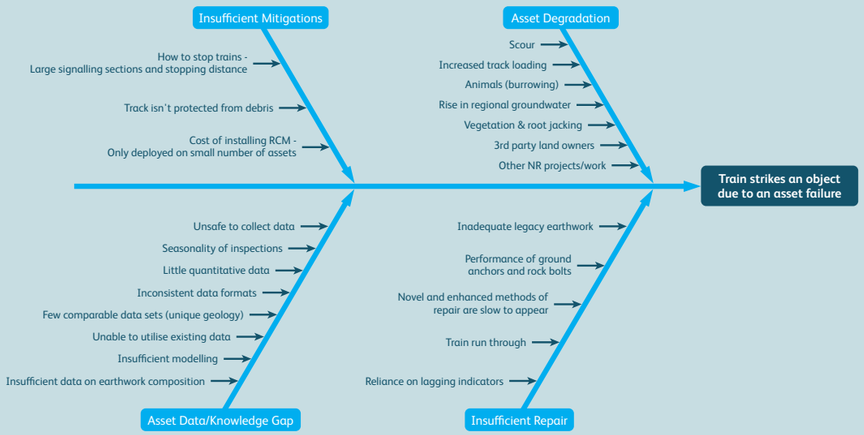
Most data capture requires an examiner to go on site. This is time-consuming and limits the frequency that condition data can be collected. Access to inspect assets is often difficult, especially when accessing through third party land. Some third party assets also pose a risk to the railway e.g. slopes outside our boundary and boulders.

The composition and soil parameters of embankments are poorly known making it hard to assess stability.

Data is collected across the network for specific projects (e.g. GI studies) but the data sets are not stored and collated centrally which leads to a lack of understanding of the geotechnical asset as a whole.

Full LiDAR survey of the network has been undertaken and base geometry data has been produced.

Analysis of causes



Priority problems

Specific priority problems

- Lack of quantitative data sets from Earthwork examiners.
- Unknown parameters and soil characteristics across the asset base affect the ease that 'off-the-shelf' solutions can be used.
- Processing and interpreting track data holistically across all embankments for geotechnical asset management.
- Access to third party land.

Related goals

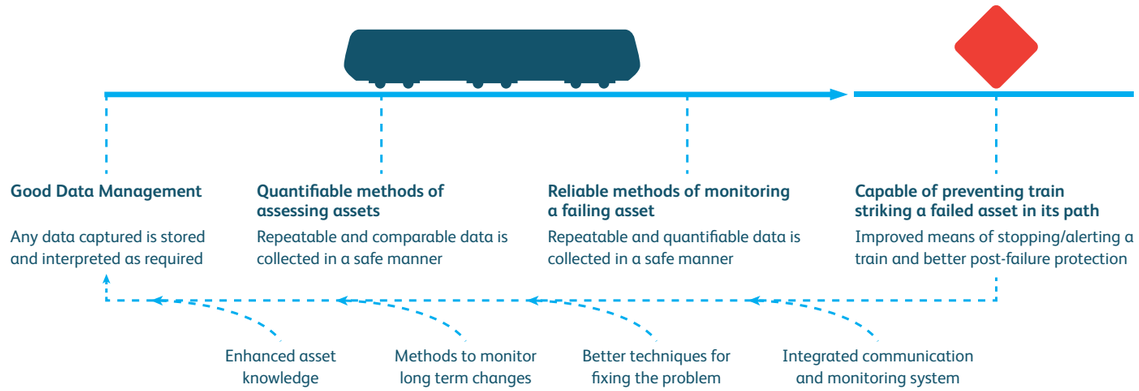
- To have access to more quantitative data sets on earthwork condition.
- Greater understanding of the asset base to feed into geotechnical assessments.
- Improved use of existing gathered data from other disciplines.
- Be capable of assessing the risks of third party land without needing to access non-NR property.

Scope

The scope of the challenge is to explore how quantitative data sets can be collected and combined so prioritised intervention can take place before failure.

The scope covers the development of novel techniques to monitor and assess earthworks at portfolio level. In addition data sets from other asset groups (e.g. track) currently collected require collation and integration to gain a better understanding of the geotechnical asset.

Consistency and repeatability of data outputs are key to ensure analysis can be carried out to detect change and prioritise intervention.



Specific research needs

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

- Using data sets from across different disciplines (e.g. Plain line pattern recognition, track recording vehicle) to analyse cross-level features on embankments. Crucially, analysis must link to earthwork 5 chain lengths.
- Carry out more frequent LiDAR flights to enable comparison of data. Proof of concept required to visualise changes, automated flagging of changes (e.g. toe bulges) and efficient data management and visualisation of large data sets.
- Novel techniques and cost effective technologies to consistently acquire and store ground investigation (GI) data to better understand soil characteristics across the asset base.
- Techniques to assess and monitor geotechnical assets outside our boundary.

Expected impact & benefits

- Better knowledge of asset with quantitative data across the whole geotechnical asset portfolio
- More informed decision making and prioritisation of intervention through use of consistent data
- Greater intervention before failure and therefore reduced risk of derailment
- Reduction in Schedule 8 costs by fixing before disruption and failure