Rail Head Squats

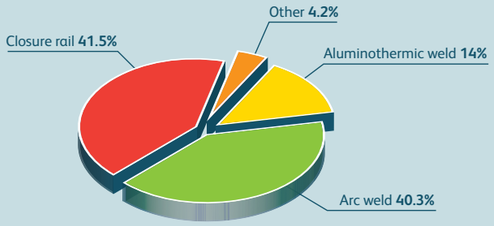
What is the situation?

A rail head squat is a surface defect caused by metal fatigue. Rail head squats cause a large volume of corrective maintenance which costs us millions of pounds every year. As squats grow they can result in speed restrictions being imposed due to the risk of rail breaks. These attract penalty charges due to the disruption to customers.

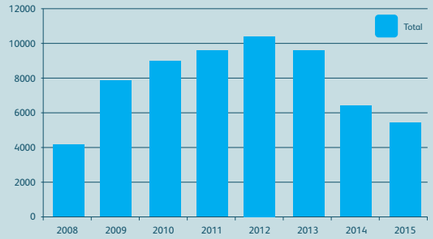
Information gathered from measurement trains detects thousands of new rail head squats every year. The increased number of squats isn't well understood.

Given the consequence of unrepaired squats deteriorating into rail breaks, there is a need to understand the causes of squat defects. We can then work to minimise or eliminate the causes, reducing their cost implications.

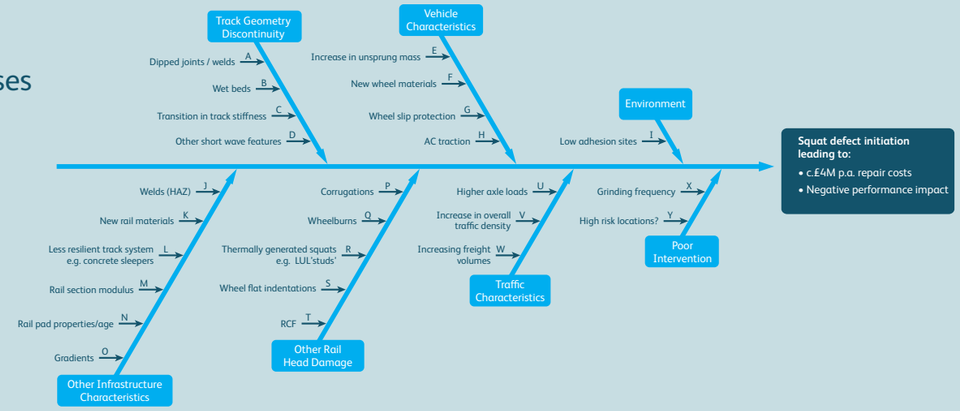
Squat repair method



Number of new squats per year (plain line)



Analysis of causes



Priority problems

Specific priority problems

- Lack of understanding of root causes of squats.

Related goals

- Identify track sections with the highest-risk of squats developing.
- Develop preventative maintenance that addresses the root causes of squat defect initiation in high-risk locations.
- Develop more effective and efficient corrective maintenance (minimum actions for grinding, weld repair).
- 75 % reduction in serious rail defects (reportable to ORR) due to squats by the end of CP6 (2015/16 baseline).
- 50 % reduction in the number of new squats detected per year by the end of CP6 (2015/16 baseline).

Scope

A lack of understanding of the root causes of squat defects and where they are likely to occur means we continue to suffer from rail breaks and serious rail defects. This results in speed restrictions on the network and the risk of derailment. Squats constitute the largest proportion of rail defects on the network and there is a need to reduce this by 50 % (based on 2015/16 levels)by the end of CP6.

A number of systems available, such as LADS (Linear Asset Decision Support) provide a visual representation of rail defects associated with geometry faults and other track features. However, there are gaps in this data that inhibit alignment at low adhesion sites. LADS also needs Intelligent algorithms developing to help detect rates of change and provide predictive information.

Modelling on vehicle dynamics to assess vertical rail damage, will help improve our understanding of the principal factors contributing to the initiation and development of squats on the gauge corner and running surface of rails and on curved and tangent track.

Specific research needs

To address these challenges further research and development will need to consider the following factors:

- Can we link operational and external (train) parameters into track condition data to gain a better understanding of rail squat propagation?
- Do the current inspection frequencies provide sufficient information to measure deterioration more accurately. Taking account of traffic volumes and wheel loading variations from different vehicles?
- Do we need to develop a better understanding of how rail head contamination and lubrication can lead to squats developing?
- Are there specific features in the trackform that can give rise to squats and do we understand the factors that cause these defects to arise?
- Can we explore the feasibility and benefits of installing rail head ultrasonic measurement devices on in-service trains, providing a more detailed picture of the propagation of rail head squats?

Expected impact & benefits

- R&D initiatives will identify the root causes of rail head squats and help to provide greater visibility of the features in the trackform that can result in squats.
- Research should help identify track sections at greatest risk of squat defects and help maintenance engineers develop maintenance strategies that will minimise the growth of squats.

This will support the development and implementation of efficient and effective corrective maintenance techniques. Delivering a 75 % reduction in the number of serious rail defects related to squats.