Reliable and Resilient Crossings

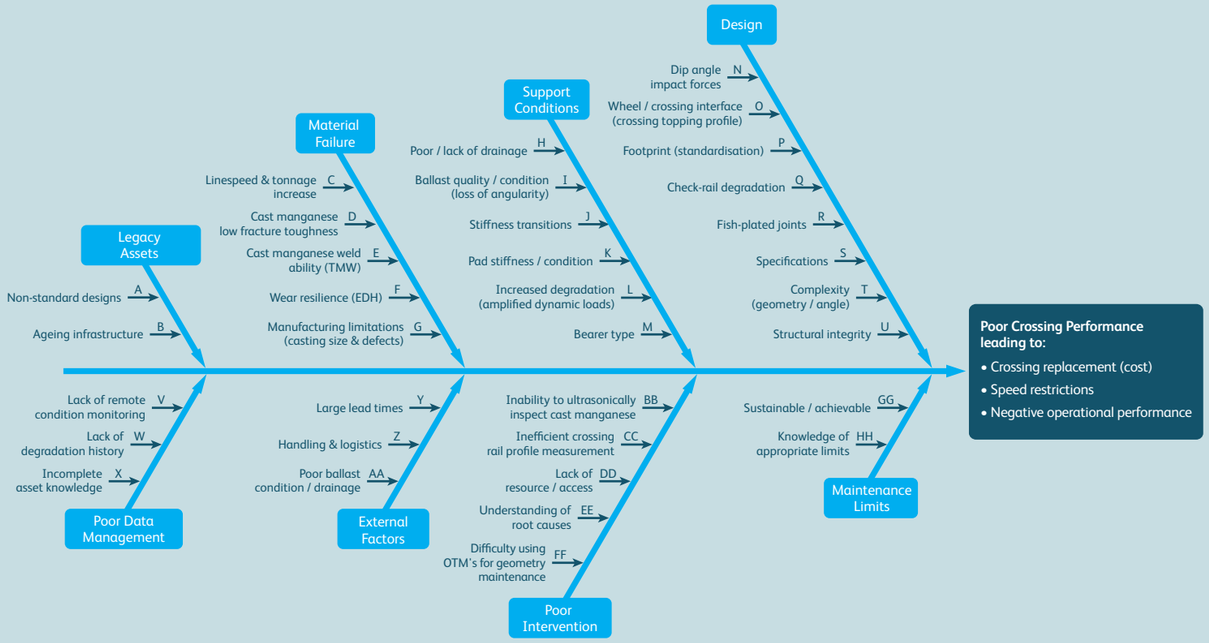
What is the situation?

Crossing failures can create major safety risks and generate huge annual costs. Repairing failures exposes rail staff to operational environments or risks are transferred to operations and managed with caution speeds and driver observations.

A total of 216 reported crossing faults occurred between 2013/14 and 2015/16 (3 years), totalling £12,336,998 in performance related (schedule8) costs alone. Of these, 80 % (£9,824,579) were associated with cracked cast crossings (054 failures).

Over a seven month period (April 2016 to November 2016) a total of 560 crossings were ordered, of which more than 75 % were related to cracks identified in crossings. The estimated annual costs for cast crossing replacements and their attributed delay penalties equates to over £24,000,000 per year.

Analysis of causes



Priority problems

Specific priority problems

- Poor resilience of cast Manganese crossings due to material susceptibility to fatigue cracking.
- Inability to efficiently monitor critical failure modes of existing crossings.
- Wheel to crossing interaction results in significant dynamic contact forces that drive accelerated whole asset degradation.

Related goals

- Reduce whole life cycle cost of cast crossings.
- Increase network capacity by improving RAMS performance of crossings.
- Improve remote condition monitoring of existing crossings.
- Improve remaining life predictions for risk-based maintenance of crossings.
- Reduction in Schedule 8 payments from cast crossing failures.
- Reduction in emergency crossing placements due to unforeseen failures.

Specific research needs

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

- How can alternative materials or coatings be utilised to enhance the performance of crossings? Improvements should prolong life, reduce whole-life cost and reliance on maintenance. Weld repair processes should be considered for any alternatives.
- Optimise crossing (wing and nose) profiles using a combination of analytical and practical techniques. Consideration of manufacturing methods should be given.
- How can improved inspection methods (both automated and manual) help predictive maintenance whilst furthering our understanding of precursors to wear/damage?
- A full system model of crossings, including ironwork, bearers and under-bearer support conditions will assist predictions for crossing failure.
- What improvements can be made to monitoring and maintenance of crossings including RCM? How can we use existing data to improve understanding of failures?
- Enhanced vehicle dynamics modelling will help drive improvements to crossing design and understanding of failure modes.