Research in Brief

The value, reliability and effectiveness of axle inspection techniques: Axle End Re-Assembly Human Factors Guidance T774

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Aims

The research aims were to:

1. Improve understanding of human performance in the axle inspection tasks.
2. Provide clear understanding on whether and how inspection performance can be optimised.
3. Provide guidance that can be adopted and implemented by depots, overhaul sites, and technical experts in the field of axle inspection.
4. Provide guidance on the process to allow the optimisation of axle non-destructive testing within the framework of axle maintenance.
5. Illustrate how the human factors guidance produced for axle end re-assembly can be implemented by industry.

Findings

The research concluded, for the axle inspection techniques reviewed, that greater consideration of human factors could provide valuable improvements to the process. To help operators realise some of the improvement benefits, guidance has been developed to support:

1. Integrating human factors, as outlined in the aims, into axle NDT tasks. In particular, further consideration of human performance while developing, validating and implementing procedures. This includes provision for feedback on NDT inspection performance and feedback to NDT inspectors.

2. Specific guidance related to:
   • UAT equipment functionality and viewing distances
   • Visual inspection work instruction
   • Generic NDT task including:
     • workload and task design
     • axle visual scanning strategy
     • task pacing strategy
     • minimisation of place losing errors
     • defining minimum timings needed for the implementation of the procedure
     • minimising error in axle end reassembly
• Documentation:
  • UAT work instruction
  • clear presentation of information, such as layout and legibility
• People and organisation including Personnel Certification in Non-Destructive Testing and competence arrangements
• Environment guidance:
  • optimum workplace layouts
  • optimum environmental characteristics.

Impacts and benefits

The documents have been reviewed and accepted by the industry for publication. The findings from the research have been presented to: RDG Safety Forum, Wheelset Management Group, and the Vehicle/Track System Interface Committee. RSSB is managing the delivery of case studies working with the project sponsor (Southern Railways) that will apply the human factors guidance to their existing processes. In parallel the Wheelset Management Group is encouraging train operators and maintainers to use the human factors guidance.

Six separate deliverables have been produced and are available on SPARK:

1. The effects of Human factors in axle inspection - scoping study. This presents the outputs of the scoping study carried out by RSSB human factors experts.
2. A detailed human factors guidance document containing all guidance, background and rationale for the human factors good practice.
3. A shorter document containing the guidance, in a usable format for sites to adopt and implement.
4. A summary report detailing the delivery of the human factors guidance, conclusions and implications of the guidance on industry and next steps.
5. A detailed report investigating the value, reliability, and effectiveness of axle inspection techniques. This report documents an outline process for optimisation of axle non-destructive testing based on the CSM RA.
6. A Human Factors guidance document which includes the good practice observed for the task of axle end re-assembly.
Background

In 2010, a human factors scoping study was carried out that provided practical insights into the axle inspection task. The scoping study identified that human performance is key to the axle inspection process. Inspectors search for and identify faults, most often using technologies such as Ultrasonic Testing or Magnetic Particle Inspection. These key inspection processes rely on the manual, visual, and decision-making skills of inspectors to identify and report faults. In addition, human performance is relied on to prepare axles for inspection and to return them to a safe state to re-enter service. The findings of the scoping study were presented to the Wheelset Management Group and further work was supported in this area.

The guidance developed focuses on the current non-destructive testing (NDT) methods used at depot and overhaul sites that were observed for the study: These were ultrasonic axle testing, magnetic particle inspection, and visual inspection. A further study has since been completed as part of this project in 2017 to develop Human factors - detailed guidance.

Where to find out more

The outputs for this project are available to read from SPARK, some are restricted to RSSB members.

For any other technical questions, contact enquirydesk@rssb.co.uk