Risk-based Maintenance for Rail Fasteners

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Introduction

Rail fasteners are important for track configuration. Failures can lead to misalignments in the rail with respect to the sleepers and compromises in track resilience. These can in turn lead to undesired consequences such as derailment and aggravated damages to other track components. Unfortunately, the current inspection and maintenance regime for rail fasteners does not adequately address the credible failure modes (Setsobhonkul et al., 2017). It also tends to be reactive with potential for further optimization in terms of resource allocation. In response to these improvement opportunities, a risk-based maintenance philosophy, driven by a risk management framework, had been proposed for rail fasteners. This study focuses on the development of the enabling framework and the subsequent demonstration and analysis of which.

Analysis

The maintenance framework was primarily developed from ISO 31000 with underlying principles inferred from other applicable international standards. Reliability tools were then incorporated, allowing practitioners to arrive at an appropriate combination of reliability tools based on the circumstances under which the assessment is to be conducted. The resultant framework was then applied to the imbedded anchors of rail fasteners to simulate how it works and how it can bridge the gaps identified in the existing inspection and maintenance regime. After which, the framework was analysed by varying the parameters and assumptions used in the case study. This unveils the limitations that the framework may face and, accordingly, identifies the provisions necessary for meaningful risk-based maintenance outcomes. The general findings were then incorporated to finalize the risk management framework. It was highlighted that, before initiating on other failure modes of rail fasteners, the framework should be similarly simulated and analysed for each of them to identify any unique provisions.

Conclusions

It was found through the analysis that the lack of failure data can potentially undermine the accuracy of quantitative risk analysis. In this regard, help can be rendered from international rail networks; failure data can be consolidated and analysed at the industry level to support the implementation of risk-based maintenance at the corporate level. Where lack in failure data is inevitable, the qualitative risk analysis aspect of the framework can be leveraged upon to drive a risk-based maintenance approach. It is envisioned that the proposed risk management framework can serve as an enabler for the inspection and maintenance of rail fasteners to shift towards a more risk-based approach.

References

Setsobhonkul S, Kaewunruen S and Sussman JM (2017) Lifecycle Assessments of Railway Bridge Transitions Exposed to Extreme Climate Events. Front. Built Environ. 3:35. doi: 10.3389/fbuil.2017.00035