

Iarnród Éireann Irish Rail

Root Cause Analysis for a national rail provider delivers new insight into axle box failures



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Damien Lambert,

Technical Support Manager - Bogies and Wheel Sets
Iarnród Éireann Irish Rail

Carrying 40 million passengers a year, Iarnród Éireann Irish Rail is the national railway operator of Ireland, responsible for all internal intercity, commuter and freight services and, with Northern Ireland Railways, the service between Dublin and Belfast.

When the company started seeing an increasing number of failures of bearings in a particular fleet of rolling stock, it wanted to track down the cause - but soon faced a complex situation requiring an external viewpoint. “We were experiencing problems with bearings on relatively new stock,” says Damien Lambert, Technical Support Manager - Bogies and Wheel Sets. The previous three years had presented a rising incidence of premature breakdowns in journal bearings. “We started to explore the issue with the supplier and manufacturer, but it soon became evident that an independent external view was required to get to the root cause of the problem.” Romax provided the solution.

In this case, the axle box bearing provides support for the vehicle weight and dynamic loads during service such as curving. Iarnród Éireann Irish Rail had observed

Client

National provider of rail and related services in Ireland, Iarnród Éireann Irish Rail is a subsidiary of Córas Iompair Éireann (CIÉ - Irish Transport System).

Challenge

Increasing failures of axle box bearings on a modern fleet of diesel multiple units caused growing concern; separate investigations by manufacturer and supplier failed to reach an agreed conclusion, requiring an independent expert with objective external view.

Solution

Root cause analysis by Romax engineers and consultants: a detailed and cost-effective investigation based on deep knowledge of axle box bearing and gearboxes, comprising three linked work packages and using optimised simulation software.

Benefits

A fast, focused and high-quality impartial investigation of root causes, helping Iarnród Éireann Irish Rail identify root cause of problem, with robust findings enabling it to move to the next stage in its plans to optimise rolling stock, protect operations and reduce risk.

a wobbly wheel phenomenon: actually, a wobbly axle box. The bearings - double row taper bearings, typical for this type of intercity train - were expected to provide a service life of three million kilometers but some were failing at only 750,000km. Lambert describes this as “the highest failure rate on any bearing in this fleet. Not catastrophic failures, but the condition of the bearings at overhaul are such that an unacceptable percentage cannot be overhauled. It’s a relatively new fleet so there are cost implications.”

Why Romax?

Iarnród Éireann Irish Rail ran a tender process, with Romax awarded the contract in spring 2013. “We didn’t have preconceived ideas on causes, or the types of analysis needed,” Lambert says. With the various parties at loggerheads on whether it was a bearings issue, loading issue or another cause, he says, “We knew we needed some degree of modelling and analysis of loads. Romax’s submission covered that. We chose Romax because of the expertise it demonstrated. Value for money is also important.” Romax pitched three Work Packages, which included using RomaxDesigner software as “a faster, more effective and streamlined way to achieve our goals. We could do what we needed but at a controlled cost and with faster processing times. We didn’t enter into this contract lightly: we knew these issues were being disputed and findings would be queried, so reports had to stand up – they would be pulled apart. Another reason was the experience Romax demonstrated on similar investigations. We knew it was more than capable of delivering what we wanted.”

Review, model, analyse, report

Lambert says it was important not to prejudge possible outcomes. The initial scope and remit was deliberately broad, enabling Romax to start broad and so examine all possible causes, with the Work Packages comprising:

- Full review of design and service data, calculations, reports and other documentation – “To examine if the bearings and system as a whole were up to the job, and working within accepted parameters” - plus a stripdown of a suspect wheel set that showed considerable corrosion and severe spalling on the inner bearing race.
- Physical analysis by Romax consultants of bearings, plus metallurgical and grease analysis: the materials properties were confirmed as acceptable, while inspection showed evidence of water ingress; the possibility of seal damage due to debris could not determine if water was the cause of the problem or an effect. This analysis enabled the team to eliminate root causes.
- Simulation and modelling using RomaxDesigner, and sensitivity analysis for various conditions. This phase of the project enabled Romax to identify the most important parameters (such as bearing clearance, assembly, static loads) influencing the bearing life.

The output was three reports, showing a process to eliminate non-contributing root causes with recommendations and suggestions for further investigation. Lambert says, “Sensitivity analysis was particularly beneficial, and showed that no single issue was likely to have caused the degradation. So while no definitive root cause was established, we could rule out certain issues, with results suggesting multiple causes” - including water ingress initiated by a static condition and unequal loading as a contributory factor. The company is considering its next steps, including further grease sampling, determining the effects of static loads caused by bogie to wheel set tolerances, general suitability of the bearings, improved sealing, and the suspension set-up.

Lambert adds, “Romax was exceptional. The individuals had extensive experience and industry knowledge, and the Romax project manager tied it all together. The resources Romax has at its beck and call were also extremely valuable. So Romax not only had the resources and technical expertise we needed, it was all managed in a comprehensive and even-handed way. We are now far closer to identifying the causes. Another important point was Romax’s ability to tailor the work for us, including financial constraints we faced. They were very flexible. The main point is that we needed substance in the findings so they could stand up to scrutiny. That’s what Romax provided.”



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Our technologies are shaping production and people-related ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

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