Broken Rail – Risk management for the future

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Introduction

Railways provide safe, reliable, and environmentally friendly transport. Steel rails are critical for efficient and safe train operations. Derailments, often caused by broken rails, pose a major risk of injury and economic loss. Traditionally, track circuits have provided broken rail detection as a by product of their train control function. New signalling technologies such as axle-counter-based Centralized Train Control (CTC) and Communications-Based Train Control (CBTC) do not include this capability.

Development Objective

To support a planned upgrade to CBTC signalling, a major customer and partner identified the need for an alternative broken rail detection method that does not rely on track circuits. Siemens Mobility has developed a solution that uses patented electromagnetic sensors, advanced navigation and communications installed on vehicles operating in revenue-service to scan for rail breaks. Development of the technology has included sensor simulation, laboratory testing, and field trials under heavy haul conditions.

System Performance

The On-board Broken Rail Detection (OBRD) instrumentation detects transverse rail discontinuities as narrow as 1 mm, with 98% probability, without needing a complete break or electrical discontinuity. Long-term operation has included over 10 million kilometres of heavy-haul network surveys, detecting breaks – including those in turnouts or in mainline not detectable by traditional track circuits.

Solution benefits include:

- Accurate, reliable detection of rail breaks – with precise location reported
- Vehicle-mounted, without additional track-based infrastructure requirement
- Effective for failures not detectable by track circuits
- Compatibility with new signalling technologies

System Operation

The Broken Rail Detection (BRD) system uses one or more vehicle-mounted OBRD subsystems, which detect rail discontinuities as ‘features’, reporting the precise location to a trackside Back Office System (BOS). The BOS maintains a ‘Track Map’ database of known features, and flags unexpected detections to the Train Control Centre for risk mitigation.

Figure 1. Detected Broken Rail

Conclusions

Partnering with our heavy-haul customer, we have developed a reliable, cost-effective broken rail detection solution that is compatible with modern train control. This collaborative approach delivers industry-wide benefits.

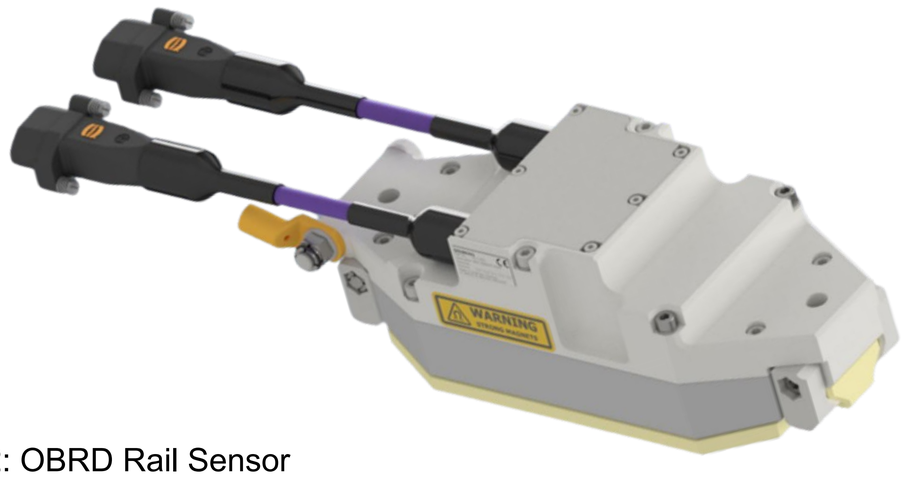

Figure 2: OBRD Rail Sensor

References

Baier, M., Blair, S., and Niven, J. 2021. Broken Rail Detection: An on-board solution for track monitoring. In: De Doncker, R., Nießen, N., and Schindler, C. P. ed. *3rd International Railway Symposium Proceedings, 21-23 Nov 2021, Aachen.* [Online]. Aachen: RWTH Aachen University, 82-92. [Accessed May 20 2025]. Available from: https://doi.org/10.18154/RWTH-2022-01608

Acknowledgments

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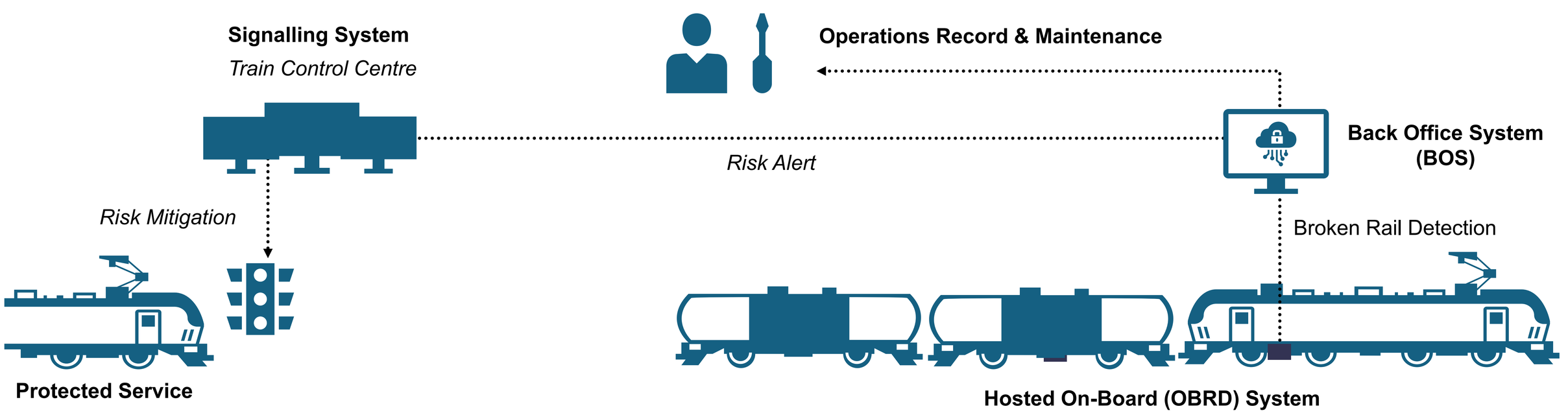

Figure 3: BRD System Operation

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	1	Pleasant to look at. Pleasing use of colors, text, and graphics
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