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Engineering Controls, TAIC Findings, and Exposure in Rail Work Environments

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Dear Editor

The rail corridor remains one of the most unforgiving operational environments in New Zealand, where the margin for error is effectively zero. International experience has shown that SPAD (Signal Passed At Danger) events can result in catastrophic outcomes, while locally New Zealand has experienced multiple near misses during periods of major rail activity, including during the Auckland electrification programme and more recently with passenger services.

International rail experience reinforces this point. In the United Kingdom, railway crashes such as Ladbroke Grove in 1989 (Rt Hon Lord Cullen, 2000), Clapham Junction in 1988 (Hidden, 1989), and Southall in 1997 (Uff, 2000) demonstrate how reliance on human performance alone, in the absence of effective engineered controls, can lead to catastrophic outcomes with significant loss of life.

This aligns with other international experience, including the German Bad Aibling rail collision (US Department of Transportation, 2016), where engineering controls were reportedly present but were able to be compromised during operation, ultimately resulting in a catastrophic collision.

Fortunately, stronger engineered protections already exist within the New Zealand rail system. The Auckland Metro rail network (WSP, 2023) utilises the European Train Control System (Level 1), providing automatic speed supervision and reducing reliance on driver response alone (Walsh, 2025).

However, signalling and system controls are only broadly described within strategic planning as requiring ongoing investment, reflecting a history of underinvestment rather than a clear, system-wide emphasis on engineered protection

New Zealand experience

While not eliminating risk entirely, such systems materially reduce exposure and demonstrate what is achievable when engineering controls are prioritised. This is not a matter of opinion, but a finding consistently reinforced by Transport Accident Investigation Commission (TAIC, https://taic.org.nz/) over many years. Such findings have highlighted that SPAD events are regularly occurring at levels that expose systemic weaknesses in the rail safety framework.

The Commission's current investigation RO-2026-102 into a safe working irregularity near Dunedin provides a clear and contemporary example (Anon, 2026). In this event, a freight train entered an active worksite after passing a stop signal (SPAD), resulting in a near miss with a track worker operating a Hi Rail vehicle. The worker in this Dunedin event (Anon, 2026) had correctly obtained track occupancy through established protection processes. While no harm occurred, the conditions for a fatal outcome were clearly present.

This event is not isolated in New Zealand with another current example (Lawn, 2026) when a freight train passed two signals set at stop and entered the next section of single track without authorisation from train control.

Within New Zealand TAIC has highlighted a consistent pattern of system vulnerability. For example, 2025 TAIC Annual Report (TAIC, 2026) described a near miss where track workers were authorised onto the line before a train had cleared the section with only last-minute recognition preventing serious harm (Cook, 2025). This further highlights gaps in supervision and the execution of safety-critical controls.

Similarly, TAIC's investigation into the Te Huia passenger train SPAD near Penrose (Cook, 2024) identified that a train passed a stop signal without an effective engineering control to prevent it, leaving the system vulnerable to a collision between trains.

These events and others (eg, Asbery, 2019, 2020; Hoey, 2013, 2015; Lawn, 2024; Manuel, 2025) demonstrate that the track protection system continues to rely heavily on administrative controls to maintain safety, rather than engineered controls that inherently prevent or mitigate these scenarios.

The critical insight is not that these events occur, but that the system continues to permit conditions where they can escalate.

When work crews are required to occupy the rail corridor and their protection relies on administrative controls such as track warrants, blocking, communication protocols and lookout systems, the residual risk remains significant.

The absence of harm in these events should not be mistaken for the absence of risk.

It's important to remember that in each case the system functioned as designed — yet still allowed a pathway to failure with potentially catastrophic consequences.

This is not a criticism of frontline workers. TAIC investigations consistently show that individuals are operating within the systems provided to them. Rather, it is a question of system design. When workers must enter the hazard zone to install or maintain safety systems and when critical protections can be defeated by a single breakdown in process, it raises the fundamental question: have we truly applied the hierarchy of controls, or have we normalised exposure?

From a Human and Organisational Performance perspective, this reflects a system that depends on people to compensate for design limitations.

TAIC's body of work provides repeated evidence that this approach has limits; particularly in high-consequence environments. The opportunity now is to act more decisively on these insights. This includes:

- Treating TAIC findings as drivers for engineering design change, not solely procedural reinforcement.
- Expanding engineered protections that prevent or mitigate SPAD events and unauthorised train or on track vehicle movements.
- Designing work so that installation, inspection and maintenance activities can occur without occupying live track environments wherever reasonably practicable or expanding engineering protection solutions to protect workers as low as reasonably practicable.

The risk is foreseeable and solutions are available.

If the lessons identified through TAIC investigations are to achieve their intended purpose, they must result in a shift upstream from reliance on people and procedures, to systems that are inherently more tolerant of human failure.

Across multiple TAIC investigations, it is proven that the same pattern persists: exposure to the hazard is not being eliminated, while the system continues to rely on people to prevent the consequence of failure.

This also raises a broader consideration for organisations that hold system leadership roles within high-risk industries, including state-owned enterprises. If as a country we are serious about reducing harm, we must be equally serious about reducing exposure.

The degree to which state-owned enterprises prioritise engineered controls over administrative reliance effectively establishes the benchmark for the wider sector; and if that benchmark is not clearly demonstrated at the top, it becomes increasingly difficult to expect private sector organisations to independently achieve the same level of uplift in high-risk environments.

How strongly engineering controls are prioritised over administrative reliance inevitably sets the benchmark for others operating within similar high risk exposure environments. If this shift is not clearly demonstrated at that level, it becomes increasingly difficult to expect the same level of investment and prioritisation from private sector organisations operating under similar risk profiles.

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References

Anon. (2026). *Safe working irregularity, track workers and freight train, Dunedin, 24 March 2026* [Investigation Report RO-2026-102]. Transport Accident Investigation Commission, Wellington. https://taic.org.nz/inquiry/ro-2026-102

Asbery, C. (2019). *Rail inquiry RO-2018-102: Freight train SPAD and wrong-routing, Taimate, 1 October 2018* [Incident Investigation Report 2018-102]. Transport Accident Investigation Commission, Wellington. https://www.taic.org.nz/

Asbery, C. (2020). *Passenger service SPAD and near collision Wellington 6 November 2019* [Incident Investigation Report RO-2019-107]. Transport Accident Investigation Commission, Wellington. https://www.taic.org.nz/

Cook, L. (2024). *Passenger train (Te Huia) signal passed at danger and potential conflict Penrose, Auckland* [Incident Investigation Report RO-2023-104]. Transport Accident Investigation Commission, Wellington. https://taic.org.nz/

Cook, L. (2025). *Freight Train 882: Near miss with track workers: Main South Line, Hornby 27 km, 7 March 2024* [Investigation Report RO-2024-102 Final Report]. Transport Accident Investigation Commission, Wellington. https://www.taic.org.nz/inquiry/ro-2024-102

Hidden, A. (1989). *Investigation into the Clapham Junction Railway Accident* [Public Enquiry Report]. HMSO, London. http://www.railwaysarchive.co.uk/

Hoey, V. (2013). *Near collision between 2 metro passenger trains Wellington 9 September 2013* [Incident Investigation report RO -2013-108]. Transport Accident Investigation Commission, Wellington. https://www.taic.org.nz/

Hoey, V. (2015). *High-speed roll-over, empty passenger Train 5153, Westfield, South Auckland, 2 March 2014* [Incident Investigation report RO-2014-102]. Transport Accident Investigation Commission, Wellington. https://www.taic.org.nz/

Lawn, J. (2024). *Freight train MR1 Signal passed at danger and near miss with HRV Kereone station 2 August 2024* [Incident Investigation Report RO-2024-104]. Transport Accident Investigation Commission, Wellington. https://taic.org.nz/

Lawn, J. (2026). *Freight train SPAD A1 and conflict with HRV, near Morrinsville, 2 August 2024* [Incident Investigation Report RO-2024-104]. Transport Accident Investigation Commission, Wellington. https://taic.org.nz/inquiry/ro-2024-104

Manuel, D. (2025). *Loaded coal train 850 Signal passed at danger Cora Lynn, Midland line 27 February 2024* [Investigation Report RO-2024-101]. Transport Accident Investigation Commission, Wellington. https://www.taic.org.nz/

Rt Hon Lord Cullen. (2000). *The Ladbroke Grove Rail Inquiry* [Public Enquiry Report part 1]. Health and Safety Commission, London.

TAIC. (2026). *Published reports 1 July 2024 to 30 June 2025* [Annual Report]. Transport Accident Investigation Commission, Wellington. https://taic.org.nz/publications/published-reports-summaries-202425

Uff, J. (2000). *The Southall Rail Accident Inquiry Report* [Public Enquiry Report]. Health and Safety Commission, London.

US Department of Transportation. (2016). *Bad Aibling, GER Collision, February 2016*. Author. Retrieved 7 April 2026 from https://railroads.dot.gov/human-factors/elearning-attention/bad-aibling-ger-collision-february-2016

Walsh, K. (2025). *Leveraging technology now for the future of rail*. Rail Express. Retrieved 7 April 2026 from https://www.railexpress.com.au/leveraging-technology-now-for-the-future-of-rail/

WSP. (2023). *Auckland Rail Programme Business Case*. Author, https://www.kiwirail.co.nz/assets/Uploads/Our-Regions/Auckland-Metro/Strategic-Rail-Programme-PBC/Documents-Appendices/Auckland-Rail-Programme-Business-Case-Final-REDACTED.pdf