



ACRI Rail Knowledge Bank update

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GROUP

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Human Factors

[Railway accidents caused by human error: historic analysis of UK railways, 1945 to 2012](#)

Many railway accidents have been caused by degraded human performance and human error, and the tasks of train drivers and signallers have remained essentially the same. Although new technologies and equipment have gradually reduced railway operation accidents, no investigation has been conducted to investigate whether railway

performance shaping factors (R-PSFs), attributed to degraded human performance, have changed or remained constant. Focusing on UK railways, this paper analyzes railway accidents involving human error for the period 1945 to 2012. The purpose of the analysis is twofold: to identify whether the number and type of factors that affect human performance and contribute to human errors have changed during this period and to assess the quality of data collected by investigation reports and to determine whether the collection of such data has evolved and improved.

Level Crossings

[Who does what, where and why? Optimising allocation of functions in rail level crossing systems](#)

Level crossings represent one of the key strategic risks on railways across the world. Recent research has indicated that collisions at rail level crossings (RLXs) may be better prevented through more sophisticated allocation of functions within these environments. The aim of the research described here was to explore this further and to identify potential design remedies.

[Human factors evaluation of a novel Australian approach for activating railway level crossings](#)

There are currently 23,500 level crossings in Australia, broadly divided active level crossings with flashing lights; and passive level crossings controlled by stop and give way signs. The current strategy is to annually upgrade passive level crossings with active controls within a given budget, but the 5,900 public passive crossings are too numerous to be upgraded all. The rail industry is considering alternative options to treat more crossings. One of them is to use lower cost equipment with reduced safety integrity level, but with a design that would fail to a safe state:

[Distracted motor vehicle driving at highway–rail grade crossings](#)

Distracted driving of a motor vehicle increases a driver's susceptibility to crash involvement. Because distracted driving at HRGCs is somewhat under researched, the objectives of this research were to (a) investigate the occurrence of distracted motor vehicle driving at HRGCs, (b) identify characteristics of those distracted motorists, and (c) ascertain empirically factors associated with distracted driving at HRGCs.

[The psychological underpinnings of young pedestrians' deliberate rule-breaking behaviour at pedestrian railway crossings: a cross-sectional study utilising the theory of planned behaviour](#)

School children continue to be disproportionately represented in train–pedestrian collisions. Although this is often thought to be the result of deliberate rule violations, scant research has been conducted into the determinants of rule-breaking behaviour at pedestrian railway crossings among this cohort. The current study used a Theory of Planned Behaviour model, including a sensation-seeking construct, to investigate the underpinnings of young pedestrians' railway violations.

[Comparison of perceived and measured accessibility between different age groups and travel modes at Greenwood Station, Perth, Australia](#)

Although there has been a significant focus on evaluating accessibility to facilities, the differences between age groups and/or mode of access to train stations is less clear. This paper compares perceived and measured accessibility to train stations among three age groups: young adults (18-24), middle aged adults (25-59) and elderly adults (60+) and three travel modes, Park and Ride (PnR), Bus and Ride (BnR) and Walk and Ride (WnR).

Light Rail

[Light rail crossing safety performance functions](#)

This paper presents the development of safety performance functions (SPFs) for light rail crossings or roadways. The paper also develops an empirical Bayes method for adjusting the initial crash estimates from the SPF to account for the actual crash experiences at light rail crossings. The validity of the light rail crossing SPFs is compared with that of the U.S. Department of Transportation (DOT) crash prediction models. It is found that SPFs specific to light rail crossings provide improvements to crash estimates that are statistically significant compared with that of the U.S. DOT crash prediction models.

Metro

[Melbourne Metro business case](#)

The Melbourne Metro Business Case contains a robust appraisal of the project's costs and benefits, taking into account economic, social and environmental benefits. Due to commercial sensitivity, some content within the business case has been partially or fully redacted.

[Mining missing train logs from Smart Card data](#)

This paper shows how to recover the arrival times of trains from the gate times of metro passengers from Smart Card data. Such technique is essential when a log, the set of records indicating the actual arrival and departure time of each bus or train at each station and also a critical component in reliability analysis of a transportation system, is missing partially or entirely.

Railroad Track and Wheel

[Ballast settlement ramp to mitigate differential settlement in a bridge transition zone](#)

Differential settlement in railroad track transitions, often associated with differences in track stiffness, may apply considerable impact load and may cause rapid deterioration of track geometry. Such differential settlement commonly seen in bridge approaches may lead to problems in ride comfort, track safety, and reliability. Ballast and subballast layers have been identified as a major cause of differential settlement related to the particulate nature of the aggregate deformation behavior causing degradation and breakdown associated with increased track usage. This paper describes an innovative field approach that successfully demonstrated the use of engineered ballast materials for reducing or mitigating the differential settlement problem in a bridge transition zone.

[Cost and delay of railroad timber and concrete crosstie maintenance and replacement](#)

Because railroad crossties are the second most valuable railroad asset, it is critical that they be maintained and managed in a cost-effective manner. Compared with timber crossties, concrete crossties offer several potential benefits but also have a greater initial

cost. This paper presents a model for evaluating the life-cycle economics of tie types by comparing concrete and timber crossties. A sensitivity analysis demonstrates how various inputs affect the cost comparison between timber and concrete ties.

Data-driven wheel wear modeling and reprofiling strategy optimization for Metro systems

Maintenance costs for a rail track subsystem represent more than half the total maintenance costs for a metro line. In this study, historical data are used to analyze wheel wear curves, and the flange thickness and wheel diameter are identified as the most important profile parameters. A new data-driven model of wheel wear trends is given for variations in wheel diameter and flange thickness. An approach for optimizing the wheel reprofiling strategy is based on this model and determines the optimum reprofiling point that maximizes wheel life while minimizing relevant costs.

Evaluation of tie support at transition zones

This paper discusses two instrumentation techniques, linear variable differential transformers (LVDTs) and accelerometers, used to monitor and evaluate track structure behaviour with the goal of nondestructively and quickly identifying track structural problems that eventually cause track geometry problems. LVDT results at a poorly performing bridge approach and corresponding open track site are used to show a relationship between poor tie support and the observed permanent vertical displacements..

Examination of the effect of concrete crosstie rail seat deterioration on rail seat load distribution

Loss of material beneath the rail can lead to wide gage, cant deficiency, reduced clamping force of the fastening system, and an increased risk of rail rollover. Previous research conducted at the University of Illinois at Urbana–Champaign (UIUC) identified five primary failure mechanisms associated with RSD: abrasion, crushing, freeze–thaw damage, hydroabrasive erosion, and hydraulic pressure cracking. This paper focuses on the analysis of data gathered from MBTSS experiments designed to explore the effect of manufactured RSD on the load distribution and pressure magnitude at the rail seat.

Impact of water level rise on the behaviours of railway track structure and substructure: full-scale experimental investigation

Extreme weather events, such as floods and heavy rainfall, have become increasingly severe worldwide. Railways can be exposed to high water levels, which may decrease their performance and jeopardize the safety of running trains. This paper evaluates the performance of high-speed railways under various water levels.

Influence of frequency-dependent dynamic parameters of rail pads on environmental vibration induced by subways in a tunnel

On the basis of verification of a new frequency-domain method with measured data, the influence of frequency-dependent dynamic parameters of rail pads on environmental vibration is investigated. The contrast between theoretical and measured data shows that the new approach is reasonable and provides high accuracy.

[Traffic safety at road–rail level crossings using a driving simulator and traffic simulation](#)

Several intelligent transportation systems (ITS) were used with an advanced driving simulator to assess its influence on driving behavior. Three types of ITS interventions were tested: video in vehicle, audio in vehicle, and on-road flashing marker. The results showed that exposure to ITS devices at active crossings did not influence drivers' behavior significantly according to the traffic performance indicator, such as delay time, number of stops, speed, and stopped delay. However, the results of traffic simulation for passive crossings, where low traffic volumes and low train headway normally occur, showed that ITS devices improved overall traffic performance.

[Use of matrix-based tactile surface sensors to assess fine-scale ballast–tie interface pressure distribution in railroad track](#)

The pressure distribution at the ballast–tie interface of conventional railroad track plays a key role in overall track support. Loads exceeding the strength of the ballast or tie can contribute to degradation of track quality. In this study, matrix-based tactile surface sensors (MBTSS) were used to study the load distribution at the ballast–tie interface.

Railroad Systems

[Railroads: freight and passenger systems, volume 1](#)

This issue contains 12 papers concerned with freight and passenger system aspects of railroads. Specific topics addressed include: global high-speed rail experience; high-speed rail lines and market competition; high-speed rail and urban decentralization; the financial relationship between railway industry players in shared railway systems; high-speed rail revenue management; and life-cycle cost, system reliability, and service reliability in passenger rail system design. Additional topics include energy efficiency of passenger rail systems; passenger train capacity and level of service; sequencing and scheduling in railway classification yards; online rail freight exchange; optimization of shunting yard operations; and capacity issues of single-track railway lines with short sidings,

[Sensitivity of freight and passenger rail fuel efficiency to infrastructure, equipment, and operating factors](#)

After labour expenses, the cost of fuel is the largest operating budget expense item for freight and passenger rail operations in the United States. An understanding of the factors that affect fuel consumption and their interactions is valuable for analyzing the feasibility of a given technology. This research investigates the relative effects of infrastructure, equipment, and operating parameters on fuel efficiency for freight and passenger railroads on a mixed-use corridor.

Restructuring

[Best methods of railway restructuring and privatization](#)

This study was developed as a reference work to provide practical information for public policymakers and railway executive managers and to provide context and guidance for their efforts to restructure the railways for which they have responsibility.

It is designed to address the distinct structural issues associated with rail enterprise reform, the design of specialized intermediary institutions that carry out much of the work

of railway restructuring, and the management techniques that are appropriately adapted to railway reform and restructuring. The study found that no single restructuring approach adequately addresses the reform requirements of all carriers and all national transportation markets. However, valuable lessons can be learned in specific restructuring contexts that have general application to most other situations. This paper represents an effort to discover some of these lessons and to benchmark “best” enterprise reform structures, “best” designs for transformation institutions, and “best” restructuring management methods.

[NIS informing the LinkedIn community](#)

A LinkedIn group presence for NIS has recently been established, which will offer to transport professionals on LinkedIn who join, notification of Australian and international transport research projects; transport topic overviews and online resources. Information added to NIS on LinkedIn complements rather than duplicates other offerings such as Making News in Transport, and allows for a more dynamic sharing of information on research projects. [Click here](#) to join.



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[National Interest Services supporting an informed land transport community](#)

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This email was sent by Jill Aron, ARRB Group, Vermont South, Victoria, Australia

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