



ACRI Rail Knowledge Bank Update.

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Bridge

2018-07

[Experimental validation of piezoelectric energy-harvesting device for built infrastructure applications](#)

Cahill, P; Mathewson, A; Pakrashi, V

Vibration energy-harvesting devices are increasingly becoming more efficient and useful. This study presents a laboratory-based experimental procedure through which a piezoelectric energy harvester was experimentally verified for rail bridges in their operational condition with trains traversing them. The device and related experimental procedure will serve as a benchmark for similar unscaled tests within a laboratory environment and can be useful for assessing devices or their applications in monitoring built infrastructure under realistic conditions without the need for deployment on site.

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2018-06

[Live load distribution and dynamic amplification on a curved prestressed concrete transit rail bridge](#)

Khan, E; Lobo, J; Linzell, D

A recently constructed and commissioned in-service light rail transit bridge in Denver, Colorado was examined analytically and via field testing to study its live load performance. The bridge is a four-span horizontally curved structure, composed of chorded prestressed concrete bulb tee girders. The bridge was designed following the American Railway Engineering and Maintenance-of-Way Association (AREMA) guidelines from the Manual of Railway Engineering, which do not explicitly address transit rail structures. In-situ load testing and calibrated finite element analyses were conducted to study the live load performance and determine the effects of speed and centrifugal forces on dynamic amplification and live load distribution. Field-testing and model results indicated variations in live load distribution and amplification as train speed increased. In addition, live load

distribution and amplification values differed from results determined using equations from AREMA and the AASHTO guidelines, documents that are commonly used to assist analysis and design due to a lack of available provisions tailored to transit rail bridges.

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2018-07

Stress distributions in girder-arch-pier connections of long-span continuous rigid frame arch railway bridges

Gou, H et al

Because of their large stiffness and spanning capability, continuous rigid frame arch bridges are attracting increasing interest in the development of high-speed railway networks in China. The internal loadings are associated with both the continuous rigid frame and arch substructural systems. Thus, the bridges are subjected to complex stresses, in particular, at the girder-arch-pier connections. The evaluation of the mechanical performance and understanding of the stress distribution of the girder-arch-pier connection are critical for ensuring the effective design and condition assessment of the bridges. This paper investigates the stress distributions in the girder-arch-pier connections of the world's longest continuous rigid frame arch railway bridge, the Yichang Yangtze River Bridge.

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Environment

2018-09

Assessing the exposure-response relationship of sleep disturbance and vibration in field and laboratory settings

Persson Wayne, K et al

Exposure to nocturnal freight train vibrations may impact sleep, but exposure-response relationships are lacking. The European project CargoVibes evaluated sleep disturbance both in the field and in the laboratory and provides unique data, as measures of response and exposure metrics are comparable. This paper therefore provides data on exposure-response relationships of vibration and sleep disturbance and compares the relationships valuated in the laboratory and the field.

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High Speed Rail

2018-07

Does growth follow the rail? The potential impact of high-speed rail on the economic geography of China

Diao, M

This study investigates the impact of HSR on the economic geography of China. The authors find that HSR has improved the accessibility (as measured by weighted average travel time) of Chinese cities by 12.11% at the national level from 2009 to 2013. However, the accessibility benefit of HSR is not distributed evenly over space.

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2018-12

High-speed rail services development and regional accessibility restructuring in megaregions: a case of the Yangtze River Delta, China

Wang, L

This study investigates how HSR service development has restructured uneven regional accessibility by developing a new regional accessibility measurement to incorporate train service frequency into the prevailing speed-dominated calculations. We conduct a longitudinal study to examine the changing patterns and relevant determinants of regional accessibility in the Yangtze River Delta (YRD), China, as well as the differences between conventional rail (CR) cities and HSR cities.

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2018-11

Strategic formation and welfare effects of airline-high speed rail agreements

Avenali, A et al

Policy makers encourage airline-high speed rail (HSR) cooperation to promote intermodal passenger transport. We study the strategic formation of airline-HSR partnerships (depending on sunk costs and firms' bargaining power) and their effects on consumer surplus and social welfare.

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Public Transport

2018-07

Public transport: one mode or several?

Varela, J; Börjesson, M; Daly, A

This paper develops a methodology for testing and implementing differences in preferences for a set of public transport modes, relating to observed and unobserved attributes, in state-of-practice large-scale travel demand models. Results of a case study for commuters in the Stockholm public transport system suggest that there are preference differences among public transport modes. The authors found that the value of time for train is lower than for bus and metro, and that it is higher for auxiliary modes than for the main mode. Surprisingly, the authors found no evidence for differences proportional to the in-vehicle time between bus and metro, suggesting that characteristics of in-vehicle time in

these two modes are valued equally by the travellers. Nevertheless, unobserved preference for metro is higher than the preference for bus. Regarding the existence of a rail factor, the authors find evidence to support the hypothesis that rail-based modes have in fact a smaller time parameter (train) or higher alternative specific constant (metro), indicating that rail modes are preferable to bus, *ceteris paribus*.

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Safety

2018-12

“Tell them what they want to hear and get back to work”: insights into the utility of current occupational health assessments from the perspectives of train drivers

Naweed, A; Chapman, J; Trigg, J

Australian train drivers undergo periodic health assessments as part of a nationally standardised approach to reducing sudden incapacitation risk, given the demonstrated potential for occupational and public harm. These assessments occur pre-placement, then every 5 years to age 50, then every 2 years to age 60, and then every year. Despite some reported benefits to rail workforce health indicators since implementation, research suggests the assessments are not operating as effectively as they might. The aims of this study were to examine train drivers' perceptions and experiences of the assessments, understand how these experiences shape their engagement with the process, and to generate recommendations for improvement from a systems thinking perspective.

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Social media

2018-07

Trains and Twitter: firm generated content, consumer relationship management and message framing

Nisar, T; Prabhakar, G

In this paper, the authors examine the impact of Twitter content on users' train journeys and how train providers' message framing moderates these relationships. The authors thus go beyond the literature's current focus on consumer-generated content (CGC), and bring into contention the important role that marketer-generated content (MGC) plays in shaping the social media-based consumer relationship management (CRM) strategies. Specifically, the authors analyze commuter tweets about 14 train operators, along with the companies' Twitter feeds. The findings, obtained using sentiment analysis tools, suggest that consumer sentiments only moderately impact travel performance, as measured by operator ratings, CPM (consumer performance measure; a measure based on travel incidents) and firm financial performance. On the other hand, it appears that train operators

use tweets in relation to their services particularly well, while keeping customers engaged by listening to and learning from criticism, thus confirming the moderating role of their Twitter-based message framing strategies. Train operators should look to maintain their social media use practices, ensuring they are consistently applied within an overarching CRM framework, particularly in key 'pain' areas such as delay and cancellation.

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Station

2018-07

Improving transfer feasibility for older travelers inside high-speed

Zhao, W et al

China is faced with a severe aging crisis, and the seniors' long-distance travel is becoming more challenging with the rapid development of high-speed trains. This paper studies the transfer feasibility for elderly passengers passing through specific barriers at high-speed train stations.

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2018-09

Trip distribution model for regional railway services considering spatial effects between stations

Cordera, R et al

The railways are a priority transport mode for the European Union given their safety record and environmental sustainability. Therefore it is important to have quantitative models available which allow passenger demand for rail travel to be simulated for planning purposes and to evaluate different policies. The aim of this article is to specify and estimate trip distribution models between railway stations by considering the most influential demand variables. Two types of models were estimated: Poisson regression and gravity. The input data were the ticket sales and the prices between stations on a regional line in Cantabria (Spain) which were provided by the Spanish railway infrastructure administrator (ADIF – RAM). The models have also considered the possible existence of spatial effects between train stations.

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Timetable

2018-07

Cost functions and multi-objective timetabling of mixed train services

Chow, A; Pavlides, A

This paper investigates a set of cost functions for assessing and timetabling mainline train services. The present study incorporates considerations from both operators' and

passengers' perspectives including service running times, punctuality, waiting times, and comfort of the journeys.

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2018-07

Reducing passengers' travel time by optimising stopping patterns in a large-scale network: a case-study in the Copenhagen region

Parbo, J; Nielsen, O; Prato, C

Optimising stopping patterns in railway schedules is a cost-effective way to reduce passengers' generalised travel costs without increasing train operators' costs. The challenge consists in striking a balance between an increase in waiting time for passengers at skipped stations and a decrease in travel time for through-going passengers, with possible consequent changes in the passenger demand and route choices. This study presents the formulation of the skip-stop problem as a bi-level optimisation problem where the lower level is a schedule-based transit assignment model that delivers passengers' route choices to the skip-stop optimisation model at the upper level, and where the upper level in return provides an improved timetable to the lower level.

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Track

2018-07

Improved railway track geometry degradation modeling for tamping cycle prediction

An, R et al

Railway track geometry condition is a key factor influencing the safety and comfort of train operations, and controlling the tamping cycles of railway tracks. For the scientific disposition of limited maintenance resources, railway infrastructure managers need to predict the tamping cycles based on an accurate grasp of track geometry degradation rules. Taking each 200-m track segment as a research object, the authors analyze the uncertainty and heterogeneity of track geometry degradation based on the discrete evaluation of the track geometry condition.

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2018-08

Maintenance scheduling for railway tracks under limited possession time

Dao, C; Basten, R; Hartmann, A

Maintenance planning for busy railway systems is challenging because there is growing pressure on increasing operation time, which reduces the infrastructure-accessible time for maintenance. This paper proposes an optimization model that is aimed at finding the best maintenance schedule for multiple components in a railway track to minimize the total cost

in the planning horizon.

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2018-12

Monitoring and repair of isolated trackbed defects on a ballasted railway

Milne, D et al

Ballasted railway track suffers from a gradual loss of vertical geometry (level) as a result of settlements caused by trafficking and differences in support conditions. However, certain trackbed defects giving rise to a particularly rapid and severe loss of geometry are often localised, and possibly associated with zones of inadequate or variable support stiffness. Conventional line-tamping (usually by machine) may not be effective for these isolated trackbed defects. This paper demonstrates, with reference to three particular defect sites on a ballasted railway in the UK, the benefits in terms of both effectiveness and longevity of a more targeted repair strategy at such locations.

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2018-07

Uncertainty propagation assessment in railway-track degradation model using Bayes linear theory

Osman, M; Kaewuruen, S

Periodic inspection could be regarded as a form of insurance to check for variation in the performance of the empirical-based track degradation model. Excessive track inspection, however, hurts economic maintenance and probably occurs because of inadequate knowledge to manage uncertainty in the track degradation model. Through regularly assessing uncertainty propagation in the model parameters, the relative importance of inspection decisions can be evaluated, and this may remove the need for excessive inspection(s). Because the evaluation process has a strict time limit, (i.e., before the next inspection arrives), a simple assessment method is required. Thus, this paper introduces a semiprobabilistic method driven by the Bayes linear theory to assess uncertainty propagation in the parameters of the linear model of track-geometry degradation.

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Transit

2018-08

A data-driven methodology for equitable value-capture financing of public transit operations and maintenance

Falocchio, J; Malik, A; Kontokosta, C

Despite the importance of rail infrastructure to the effective and efficient functioning of dense urban areas and their commercial business districts, funding for operations and maintenance of transit systems is a common challenge for cities. Operational funds are

derived from a range of sources, including fare and toll revenues, taxes, and fees. In cities with aging infrastructure, traditional funding mechanisms are falling short of actual need, even as many cities experience record ridership levels. Therefore, new funding streams are necessary to safely, efficiently, and equitably operate and maintain an aging rail infrastructure in the face of growing demand. This paper presents a socio-spatial model of rail transit ridership demand to develop a computational method for value-capture funding mechanisms that link existing commercial properties and transit infrastructure operations.

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2018-11

Optimal infrastructure capacity of automated on-demand rail-bound transit systems

Cats, O; Haverkamp, J

Fully-automated services potentially allow for greater flexibility in operations and lower marginal operational costs. The objective of this study is to determine the capacity requirements of an envisaged automated on-demand rail-bound transit system which offers a direct non-stop service.

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