



Bridge strikes

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This issue of the [Tranzinfo Hot Topics](#) series brings together recent material on bridge strikes for transport researchers, practitioners, libraries, and the wider transport sector. Vehicle bridge strikes, where vehicles or equipment collide with bridges, tunnels, or other overhead structures due to height incompatibility, have a significant impact on the transport network. As well as traffic and supply chain disruption, vehicle and bridge damage, and interruption to transport services, bridge strike incidents cost the Australian economy an estimated \$101 million in FY2025, according to [a new report](#) by HERE Technologies and the Australian Logistics Council (ALC).

Governments are investing in and trialling countermeasures to mitigate risks such as warning signs, height detection systems, road markings, changes to speed limits, flashing lights, warning gantries, roadside technology and in-vehicle technology. Agencies with the most successful approaches to preventing bridge strikes often use a combination of countermeasures and practices, according to [best practice reviews](#). There is also research into methods of strengthening bridges to withstand vehicle strikes, and assessing the condition of bridges after a strike.

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Australian trials and research

[First comprehensive study reveals the economic cost of vehicle bridge strikes in Australia](#)

HERE Technologies, 24 August 2026

Vehicle bridge strikes, where vehicles collide with bridges or other overhead structures due to height incompatibility, cost the Australian economy an estimated \$101 million in FY2025, according to [a new report](#) by HERE Technologies and the Australian Logistics Council (ALC). The study addresses a longstanding gap in national data and highlights the growing impact of bridge strikes on transport networks, supply chains and communities, according to the authors.

[New technology trial to combat bridge strikes in Queensland](#)

Rail Express, 14 July 2026

A trailer-mounted height detection system aimed at reducing bridge strikes is being trialled by Queensland Rail. The system identifies vehicles exceeding safe height limits and provides real-time warnings to drivers via a Variable Message Sign (VMS).

[Managing the risks of high vehicle impacts to bridges](#)

Austrroads, 2025

Reports on the outcomes of the AustRoads study ABT6014 - Managing the risks of high vehicle impacts to overpasses. Bridge strikes can have consequences from the annoying (traffic delays, costs to repair) to the serious (personal injury or loss of life). Using the Bow Tie concept to rationalise the bridge strike ecosystem this was an all-encompassing, holistic investigation that explored best practice across three aspects - prevention, actions at the event and the longer-term steps to address the outcomes. A set of guidelines, accessible to all parties involved is to be delivered that support, inform and advance the management of this task.

[Queensland Rail launches new trial to drive down bridge strikes](#)

Rail Express, 22 December 2025

Queensland Rail is conducting a trial of new road markings designed to help prevent bridge strikes. Bright red and yellow boxes have been installed on the road leading up to two notorious rail bridges that are often struck by over-height vehicles.

[Speed drop to beat strikes on 'truck-eating' bridge](#)

Australasian Transport News, 22 May 2025

In a new bid to prevent trucks from striking the Montague Street bridge in South Melbourne, the Victorian Government has announced that the speed limit approaching the bridge will drop from 60km/h to 40km/h.

[How to defeat the Montague Street Bridge](#)

Rail Express, 24 April 2024

The National Transport Research Organisation (NTRO) has broadened its focus to include the rail sector. A critical component of this expansion is to deal with some of Melbourne's rail landmarks, including the Montague Street Bridge, the subject of many bridge strikes. Now is an opportune time for a human-factors review on the warning systems around the bridge, the learnings of which may be applicable to other low bridges, according to the NTRO.

[Australian-first tech gives overheight trucks a real-time reality check](#)

NSW Government media release, 2 August 2024

State-of the art sensor technology to be trialled in Sydney will scan trucks in real time and use connected warning signage to divert drivers of overheight vehicles from their routes before causing traffic headaches for motorists.

[Smart rumble strip system to prevent over-height vehicle collisions](#)

Chan, RWK, 2024, Sensors, vol. 24, no. 19, p. 6191

Collisions of over-height vehicles with low clearance bridges are commonly encountered worldwide. They cause damage to bridge structures, interruption to traffic,

injuries or even fatalities to road users. To mitigate such risks, passive systems that involve warning gantries, flashing lights and illuminated signage are commonly installed. Semi-active systems using laser- or infrared-based detection systems in conjunction with visual warnings have also been implemented. Nevertheless, some drivers ignore these visual warnings and collisions continue to occur. This paper presents a novel concept for a collision prevention system which makes use of a series of sensor-activated, motorized rumble strips.

[Understanding bridge strikes: a Melbourne tram network case study](#)

Reynolds, J, de Waard, J, & Currie, G 2024, Australasian Transport Research Forum 2024 Vehicle collisions with bridges and tunnels ('bridge strikes' and 'tunnel strikes') appear common. Structural engineering has given the issue attention because of collapse risks, but knowledge in the road safety and transport engineering fields about what factors explain how and why such incidents occur appears limited. Many countermeasures are described in the literature, but there does not appear to have been many experiments, case-control, before-and-after or other studies of their effectiveness. This study discusses the research literature and reports a case study of bridges on the Melbourne tram network. Results support findings reported in the literature that incidents are under reported, and indicate most incidents occur at only a few sites. The paper also discusses future research directions, the potential reputational damage of these incidents, and the need to virtually eliminate them to meet the principles of Vision Zero.

[Technology detects bridge strikes at Melbourne hot spots](#)

Rail Express, 12 May 2023

Melbourne Metro has installed new technology to detect bridge strikes across the metropolitan network, limiting potential delays for thousands of train passengers. New state-of-the-art impact sensors on bridge beams and CCTV cameras have been installed at three hot-spots on the network.

[Low blow: is fixing Montague Street's 'pure evil' bridge beyond Melbourne?](#)

The Guardian, 2 April 2023

Despite numerous safety measures installed by the state government, drivers keep crashing into Melbourne's Montague Street Bridge due to a lack of familiarity with their vehicle or the location, according to a design expert.

[Heavy vehicle impacts on bridges: case studies in risk assessment](#)

Santhanam, B & Boroujeni, A 2022, Austroads, Sydney

Transport for NSW currently manages about 6000 bridges and bridge-sized culverts in for road traffic. These bridges were built during the last 130 years for various design loadings, clear heights, structural forms and materials. Some of these bridges were designed to carry even horse carriages and traction engine vehicles but are satisfactorily carrying present day legal vehicles with or without strengthening. Heavy vehicle impact on these bridges is not uncommon. There are even instances where vehicular impact has occurred for overhead bridges which are designed to current Australian Bridge Design Standard clear height requirements. These impacts not only disrupt traffic flow but also compromise structural integrity of the impacted bridges. This paper selects case studies from the recent past and discusses how systematic risk

assessment methodologies, both short term and long term, were carried out so that carriageways can be opened to traffic with minimal disruptions.

[Bridge strikes in Victoria and New South Wales: trends and factors](#)

Truong, L 2022, Australasian College of Road Safety, Mawson, ACT

Bridge strikes are costly, which can cause fatalities and injuries and incur substantial repair costs and traffic disruptions. This paper investigates bridge strikes in Victoria and New South Wales (NSW) using historical traffic crash data. Results show that, on average, there are 16.8 and 56 bridge strikes with casualties per year in Victoria and NSW, respectively. Fatal bridge strikes are much more frequent in NSW than in Victoria (i.e., 13 during the 2016-2020 period in NSW compared to 9 during the 2006-2020 period in Victoria). Results of the Chi-squared test show that bridge strikes tend to be associated with more severe outcomes, regional areas, high speed roads, heavy vehicles, and poor lighting conditions compared to other traffic crashes. While declining trends in bridge strikes in both Victoria and NSW are encouraging, future research should explore these issues in more depth and for more jurisdictions.

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International research

[BridgeSafe: An event-driven IoT architecture for real-time overheight vehicle detection and alerting](#)

S. S. Letha & V. Margapuri 2026, IEEE World AI IoT Congress (AlloT), pp. 0845–0852.

Each year, overheight vehicles collide with low clearance bridges on an average 15,000 times, resulting in millions of dollars in infrastructure damage. That is more than 40 incidents per single day, still the current detection systems are reactive rather than preventive. This study presents an event-driven software architecture for real time bridge clearance monitoring using Internet of Things (IoT) technology. The system integrates edge computing, message-based middleware and cloud-based analytics to detect violations with low latency. Beyond technical contributions, this study illustrates how software architecture principles apply to public safety challenges, offering a realistic framework for municipal/city applications.

[Countermeasures for preventing bridge and tunnel strikes from oversized vehicles: a review of best practices in Ireland, the Netherlands, and the United Kingdom](#)

Carrasco, B, Cempel, E, Chiarito, V, Harper, J, Lamba, N, & Purdy, J 2026, Federal Highway Administration

Bridge strikes are one of the leading causes of damage to bridges and resulting disruption to traffic. Oversized trucks, or the inadvertently raised portions of cargo such as dump beds or crane booms, frequently strike bridges and tunnels, causing considerable damage to infrastructure, traffic delays, and rerouting of traffic to remove the truck and repair damage. At worst, bridges can fail, potentially resulting in deaths and injuries and costly economic and quality of life impacts for entire regions until the facility can be reopened to traffic. After a review of best practices globally in prevention of bridge and tunnel strikes, the study team visited the United Kingdom, Ireland, and the

Netherlands. This report presents the range of countermeasures observed in these countries and insights and lessons learned.

[Explainable machine learning for predicting the load-carrying capacity of damaged steel girders after over-height vehicle strikes](#)

Ibrahim, AE, Fahnestock, LA, LaFave, JM, & Elbanna, AE 2026, Engineering structures, vol. 357, p. 122517

Steel bridge girders are often subjected to strikes by over-height vehicles that exceed the allowable vertical clearance underneath a bridge. Such strikes may affect the serviceability of a bridge structure and can significantly reduce the load-carrying capacity of damaged girders. Although finite element analyses are commonly used to estimate the residual capacity of damaged girders, developing and analyzing such models for every strike incident is computationally intensive and time-consuming. To address these limitations, this paper presents a new explainable machine learning methodology that can accurately and efficiently predict the residual load-carrying capacity of damaged steel I-girders.

[Examination of light-based directed vehicle to everything communications systems for bridge strike detection \(using ImpLi-Fi\)](#)

Lakshmanan, S 2026, University of Michigan

This project will deploy a reliable and directed light-based wireless infrastructure-to-vehicle communication technology to warn at-risk trucks of imminent bridge strikes. Once shown to be feasible, the same concept can also be extended to flash flood warning, wrong-way driving, etc. Unlike wireless communications using radio-frequency (RF), which are always omni-directional, ImpLi-Fi uses light, allowing transmissions to be focused so that they only target specific impacted vehicles, thereby avoiding the risk of annoying/desensitizing other parallel road users.

[Survey and review of bridge strikes and assessment methods for low-clearance steel-girder bridges](#)

Schissler, LR, Ahershing, S, Ibrahim, AE, Fahnestock, LA, LaFave, JM, & Elbanna, AE 2026, Journal of Structural Design and Construction Practice, vol. 31, no. 1

This study, undertaken in support of an Illinois Department of Transportation (IDOT) research project, reviews how US state highway agencies inspect and assess bridges after overheight vehicle strikes. Most damage occurs to girders, although diaphragms and cross-frames may also be affected. Agencies mainly rely on visual inspections, photographs and manual measurements, with decisions made case by case using engineering judgement. The study highlights the potential for laser scanning and drone photography to improve damage assessment, particularly for steel-girder bridges.

[Bridge and tunnel strikes: a guide for prevention and mitigation](#)

National Academies of Sciences, Engineering, and Medicine 2025

Presents state-of-the-art information to assist state DOTs in the prevention and mitigation of bridge and tunnel strikes by overheight motor vehicles. Bridge and tunnel strikes inflict serious damage to vehicles, highway bridges, and tunnels; cause injuries and fatalities; and impose detours and costly delays on highway users. Attempts by state departments of transportation (DOTs) and other bridge and tunnel owners to

prevent bridge and tunnel strikes include signing, lighting, height detection systems, and actuated warning devices.

[Design and research of bridge collision avoidance system based on camera calibration technology and motion detection](#)

Wang, X, Wang, S, Wei, Z, Ren, R, & Huang, J 2025, Scientific Reports, vol. 15, no. 1, p. 35146

Bridge collisions, particularly those involving over-height vehicles, pose significant threats to public infrastructure, economic stability, and human safety. This study presents an intelligent, vision-based Bridge Collision Avoidance System (BCAS) that leverages advanced camera calibration techniques, motion detection algorithms, and real-time risk assessment frameworks to proactively detect and mitigate potential collisions. This research contributes a modular, scalable, and fault-tolerant solution suitable for real-world deployment to enhance bridge safety in smart urban infrastructures.

[Parallel heterogeneous data-fusion convolutional neural networks for improved rail bridge strike detection](#)

Khresat, H, Sittton, JD, & Story, BA 2024, Computer-aided civil and infrastructure engineering, vol. 39, no. 15, pp. 2299–2311

Low clearance rail bridges provide vital crossings for freight and passenger trains and are susceptible to frequent strikes from overheight vehicles or equipment. Impact detection systems can help ensure the safety of railroad bridges and their users; such systems streamline monitoring efforts by providing near real-time strike notifications to rail managers responsible for assessing a bridge after a strike. This paper develops parallel heterogeneous data-fusion convolutional neural networks (PHD-CNN) operating on data collected from in-service rail bridges that improves detection and classification of from overheight vehicles.

[Review of low-clearance early warning device options for Illinois](#)

Sai, S & Ouyang, Y 2024, Illinois Department of Transportation

Bridge or tunnel strikes by over-height vehicles are a challenge to the transportation industry. This problem causes significant economic and social losses to the transportation industry. Low-clearance detection warning (LCDW) is one of the important technological means to address this issue. This research project was sponsored by Illinois Department of Transportation to review different LCDW systems in the current market and to collect information about their adoption in other states. The focus is on understanding the types of LCDW systems available in the market, the technology options, and their effectiveness and costs.

[Spatial digital twin framework for overheight vehicle warning and re-routing system](#)

Trembearth, O, Sun, Q (Chayn), Wang, S, & Duckham, M 2024, Urban Informatics, vol. 3, no. 1, p. 23

Overhead road obstacles present a significant logistical hazard to the heavy vehicle industry. Traditional overheight vehicle warning systems such as passive warning systems (PWS) and active warning systems (AWS) have not adequately reduced the frequency and impact of overheight incidents, encouraging transportation agencies to employ intelligent transport system (ITS) strategies using state-of-the-art advanced

technologies. This research takes an innovative approach in developing an immersive user-focused experience, harnessing multi-disciplinary methods and tools to engineer a spatial digital twin prototype for a novel Internet-of-Things (IoT)-based active warning alert and re-routing system (AWARS). LiDAR and 3D GIS were used to model the complex road environment, tailored to the strict fiscal objectives sought by economically mindful organisations.

[An Artificial Intelligence \(AI\) based overheight vehicle warning system for bridges](#)

Agrawal, A & Kumar, D 2023, Federal Highway Administration, USA

The impact of overheight vehicles on bridges is a major problem that causes extensive damage and leads to frequent traffic and mobility issues. This research proposes conceptual development of a low-cost Artificial Intelligence- (AI)-based overheight vehicle warning system for bridges based on the use of cutting-edge camera technology and AI-based height detection. The proposed system consists of a long-range camera and an AI-based overheight detection module that can detect an overheight vehicle from safe stopping distance. Successful implementation of the proposed research will lead to the prevention of a significant number of impacts on bridges by overheight trucks, which will improve safety of bridges and traffic mobility, thereby saving millions of dollars in damage to bridges and preventing injuries and fatalities.

[A case study of protecting bridges against overheight vehicles](#)

Aly, A & Hoffmann, M 2022, Louisiana State University

Bridges are becoming more vulnerable to collisions from overheight vehicles. The exact response under lateral impact force is difficult to predict. In this paper, nonlinear impact analysis shows that the degree of deformation recorded through the modelling of the unprotected vehicle-girder model provides realistic results compared to the observation from the US-61 bridge overheight vehicle impact. We proposed different sacrificial cushion systems to dissipate the energy of an overheight vehicle impact. The goal was to design and tune a suitable energy-absorbing system that can protect the bridge and possibly reduce stresses in the overheight vehicle, minimizing the consequences of an impact.

[Bridge and tunnel strikes by oversized vehicles](#)

Connolly, L, Bernadini, I, Kakouris, E, & Kelly, J 2022, World Road Association PIARC

The objective of the study was to examine proven countermeasures, practices, and technologies used to reduce the incidence of oversize vehicles striking bridges and tunnels along with effective processes for accurately reporting and tracking bridge strike occurrences. The study involved a detailed review of the causes, consequences and mitigation measures available in relation to the bridge and tunnel strike problem. Data was gathered through a combination of surveys, interviews and desk-based research. The key finding of the study was that the current state of the art is to move toward driver-based mitigation practices such as better driver education, advertising of the consequences and informing legislation in relation to the bridge / tunnel strike problem.

[Strategies for prevention, protection, and repair of bridge girders vulnerable to over-height vehicle impacts: a state-of-the-art review](#)

Das, S, Brenkus, NR, & Tatar, J 2022, Structures, vol. 44, pp. 514–533

Damage of highway bridges due to over-height vehicle collisions is experiencing a noteworthy increase in the United States. This paper provides an overview of various prevention and protection schemes, including re-routing methods, warning systems, clearance augmentation, impact absorbers, and a description of contemporary damage repair techniques. This review of the state-of-the-art will assist practitioners in their selection of appropriate damage mitigation methods, categorization of typical damage, and selection of appropriate repair techniques. Further research in full-scale over-height vehicle-bridge impact would advance characterization of the collision mechanism, facilitating the development of appropriate impact protection systems and damage repair guidelines.

[Ultrahigh-performance concrete for improving impact resistance of bridge superstructures to overheight collision](#)

Oppong, K, Saini, D, & Shafei, B 2021, Journal of Bridge Engineering, vol. 26, no. 9

Collision of overheight vehicles into bridge superstructures often leads to structural damage, posing an immediate risk to the safety of motorists and the functionality of bridges. Considering the proven vulnerability of current high-strength concrete (HSC) girders to impact-induced forces, the use of ultrahigh-performance concrete (UHPC) (to fully or partially replace HSC) is expected to improve the impact resistance of bridge superstructures. However, despite the growing attention that UHPC has received for various bridge applications, this important application has remained largely unexplored. This motivated the current study to perform a holistic investigation to (1) quantify how the performance of bridge girders subjected to overheight collision can be improved by a one-to-one replacement of HSC with UHPC; (2) assess how UHPC can be considered as a material of choice for repairing existing bridge girders impacted by overheight vehicles; and (3) examine how equivalent UHPC girders designed for a performance similar to HSC girders under service loads can introduce advantages when subjected to overheight collision.

[Experimental analysis on effectiveness of crash beams for impact attenuation of overheight vehicle collisions on railroad bridges](#)

Ozdagli, AI, Moreu, F, Xu, D, & Wang, T 2020, Journal of bridge engineering, vol. 25, no. 1

Collisions between overheight semitrailer trucks with low-clearance railroad bridges are one of the leading causes for railroad traffic interruptions on bridges in the United States. Current sensing efforts to inform drivers to avoid low-clearance bridges are not effective, and the number of bridge impacts is not decreasing over time. Railroad bridge owners are interested in attenuating the impact by adding crash beams. Furthermore, crash beams can establish safer transportation operations for railroads, roadways, drivers, and pedestrians, especially in congested cities and communities with several transportation modes. Additionally, crash beams can reduce the damage caused by highway strike incidents and can be easily replaced in those low-clearance bridges that are frequently impacted. This paper presents an experimental study for assessing the effectiveness of various crash beams in attenuating the impact consequences of overheight vehicle collisions against railroad bridges.

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