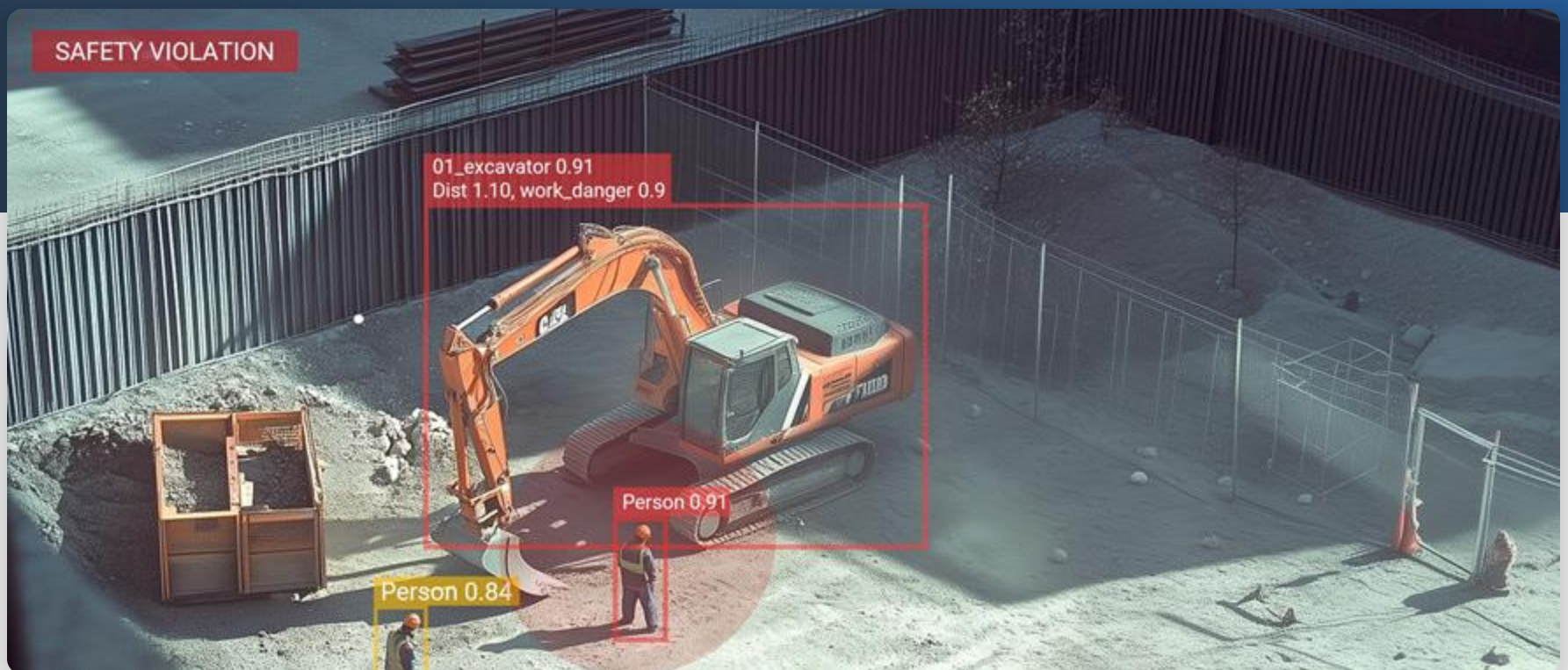


AI in Construction: Achieving 95% Early Hazard Identification with Computer Vision

The Case for End-to-End Computer Vision Solutions to Safety Challenges



Distance Monitoring for Collision Avoidance using Computer Vision with Viso Suite

Overview

Every year, the construction industry ranks as one of the most dangerous, with leading causes of fatalities and injuries known as the “Focus Four Hazards.” In the U.S., these incidents cost an estimated \$151B annually, highlighting that the financial and human toll of inaction outweighs the cost of prevention.

To combat the dangers of construction work while managing safety expenses, firms must implement proactive, high-road solutions that demonstrate a true commitment to occupational health and safety.

However, despite the urgent need for safety innovation, the construction industry remains one of the least digitized sectors, with many firms still relying on outdated, manual safety processes. Resistance to new technology often prevents managers from leveraging software to its full potential.

Rhomberg Sersa Rail Group (RSRG) stands out as a safety leader in the industry, setting a benchmark for eliminating worksite hazards through proactive and advanced high-road solutions.

This study highlights how RSRG adopted Viso Suite's AI as an extra layer of hazard prevention. Through automated PPE monitoring, collision avoidance, and restricted zone detection, the firm further mitigated risks associated with Focus Four injuries, such as caught-in/between and struck-by incidents, to enhance overall occupational safety.

Background

- Construction accounts for nearly 20% of all U.S. work-related fatalities.
- 65% of construction fatalities stem from the "Focus Four" hazards.
- Transport vehicles were the most common cause of struck-by injuries.

Injury Cost Breakdown

The costs of construction worksite injuries are substantial, impacting both financial and operational aspects of a company. According to reports, when construction companies do nothing to improve safety measures, their operational costs are more than 200% higher than companies prioritizing prevention.

Below is a list of costs associated with worksite injuries:

Direct Costs

- Medical & Workers Compensation
- Property Damage
- Equipment Damage
- Regulatory Fines and Lawsuits
- Emergency Response Costs
- Rehabilitation Costs
- Prescription Medications
- Insurance Premium Increases

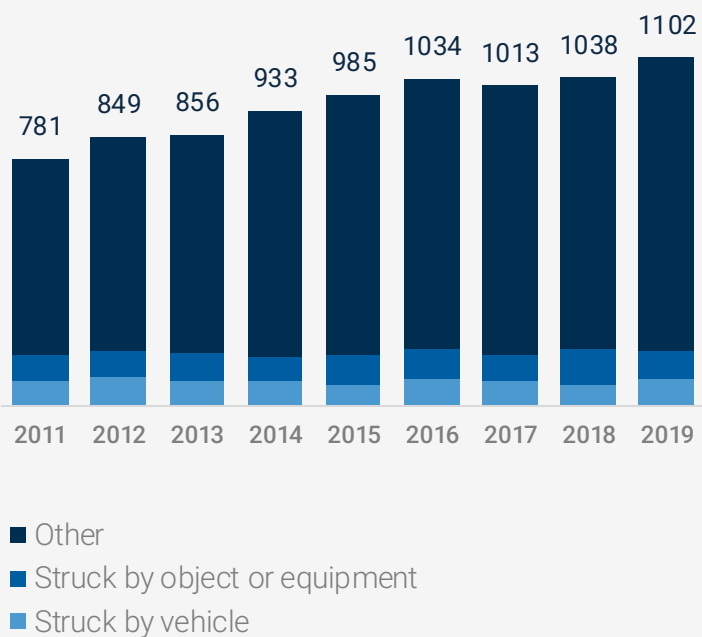
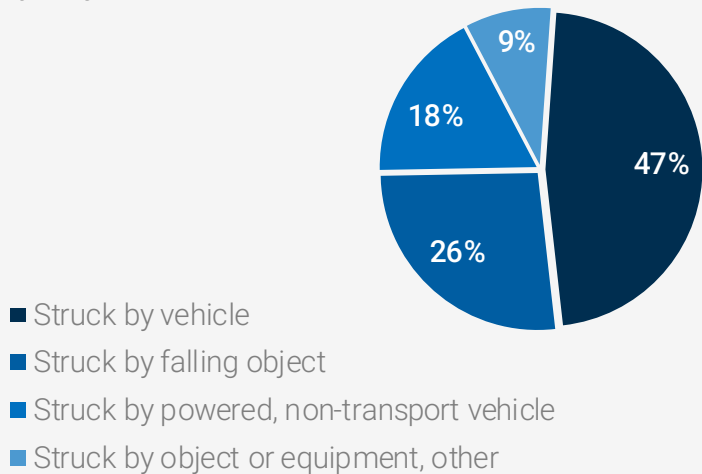
Indirect Costs

- Missed Deadline Penalties
- Administrative Hours
- Replacement Worker Training Expenses
- Lost Team Productivity
- Reputation Damage
- Employee Morale Impact
- Increased Turnover Rates
- Retraining Injured Workers
- Temporary Staffing Costs
- Reduced Worksite Efficiency
- Overtime Pay for Uninjured Workers
- Disruption of Workflows
- Potential Loss of Future Contracts
- Legal Fees (outside of settlements/fines)

The financial and operational repercussions of construction worksite injuries are extensive and multifaceted. By investing in safety measures, including advanced technologies like AI and computer vision, companies can significantly mitigate these costs.

Struck-by Fatalities in Construction

Struck-by fatalities in Construction, by major cause



Source: U.S. Bureau of Labor Statistics



While construction remains one of the most dangerous occupations in the country, steps can be taken to reduce the costs of construction-related fatalities. A “high road” approach to construction improves worker training, boosts worker productivity, and minimizes injury risks at minimal costs to taxpayers that are offset by these benefits.

Applied Computer Vision

Computer vision provides a high-road solution for preventing struck-by and caught-in/between injuries on construction sites. Struck-by injuries occur when a vehicle or moving object unexpectedly hits a worker, leading to serious injuries such as fractures, head trauma, or even fatalities. Caught-in/between injuries happen when a worker is trapped between a vehicle and a stationary object or another piece of machinery, resulting in crushing injuries, severe lacerations, or amputations.

With image recognition algorithms, computer vision systems can continuously monitor the movements of vehicles and workers, ensuring safe distances and identify where incidents could occur in the future. Strategically placed cameras around the worksite can detect when workers are too close to operating machinery or vehicles, immediately sending alerts to both the workers and vehicle operators to prevent potential accidents. This real-time monitoring and alert system significantly reduces the risk of injuries caused by moving vehicles, promoting a safer working environment.

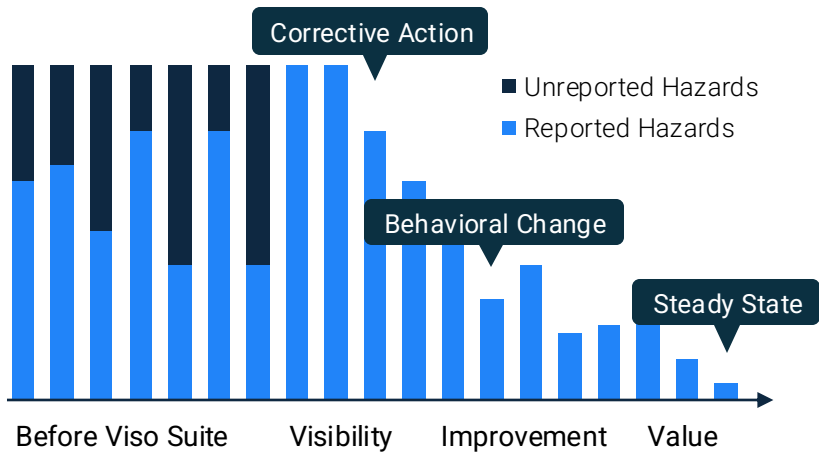
In addition to monitoring safe distances, computer vision is crucial for ensuring compliance with personal protective equipment (PPE) requirements. By scanning workers and automatically detecting whether they are wearing the correct PPE, such as helmets, gloves, and safety vests, these systems will flag any non-compliance in real-time. This not only helps maintain high safety standards but also ensures that safety protocols are consistently followed without the need for constant human supervision. Automated PPE detection reduces the likelihood of human error and oversight, contributing to a significant decrease in injury rates.

Opportunities

Decrease in Risk of Focus Four Incidents

Within the first 10 weeks of deployment, state-of-the-art computer vision algorithms can detect Focus Four Hazards with up to 95% accuracy, thus identifying and reporting on potential hazards before they happen.

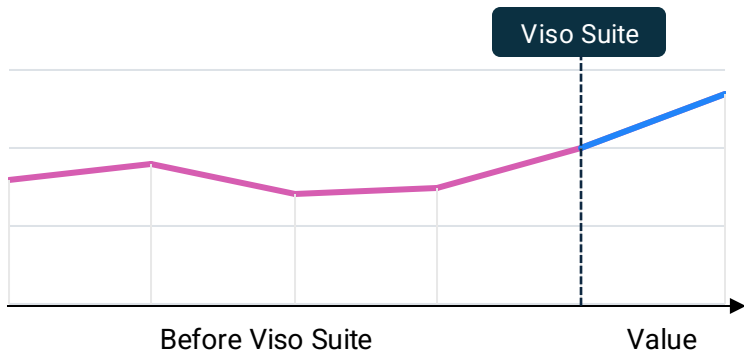
The main driver of value is the insight firms receive into their business processes. This must be followed up with corrective action and behavioral change to be able to realize the complete application value.



Increase in Project Profit

By investing 2.5% of the budget into technology, including AI computer vision-based safety measures, firms can see a 4-7% average increase in project profitability.

This increase considers the associated direct and indirect costs (Page 2). This proactive approach also allows firms to guarantee 100% regulatory compliance, safeguarding against the \$151B annual cost of occupational injuries.



Benefits

1. Closed Existing Safety Gaps

Site managers gain access to real-time data that allows them to pinpoint where the firm must improve safety protocols.

2. Elimination of Worksite Dangers

Both end-to-end monitoring and enforcement of safety guidelines reduces potential injuries through the detection and warning of dangerous situations before any harm could occur.

3. Reduced Operational Costs

By investing a portion of the project budget into safety measures, firms will experience a drop in highly expensive worksite injuries from Focus Four Hazards, compliance reporting and claims.

Building computer vision systems in-house requires an enormous investment of resources including research & development, deployment, and more. With Viso Suite, this process is outsourced and cuts the time-to-value of AI applications from months to days.

4. Adherence to Regulatory Guidelines

Full compliance with occupational health and safety measures means that firms can avoid penalties from organizations like OSHA or the European Agency for Safety and Health at Work.

5. Improved Human Resource Allocation

Automated safety systems omit the need to ensure PPE compliance manually and track safe distances between vehicles. With a more efficient use of manpower, workers can be reassigned to more critical tasks that require human intervention and judgment.

6. Innovation With High-Road Solutions

Innovation through high-road solutions offers significant benefits to construction firms, such as delivering superior quality projects, building stronger client relationships, and achieving sustainable growth in a rapidly evolving industry.

Case Study

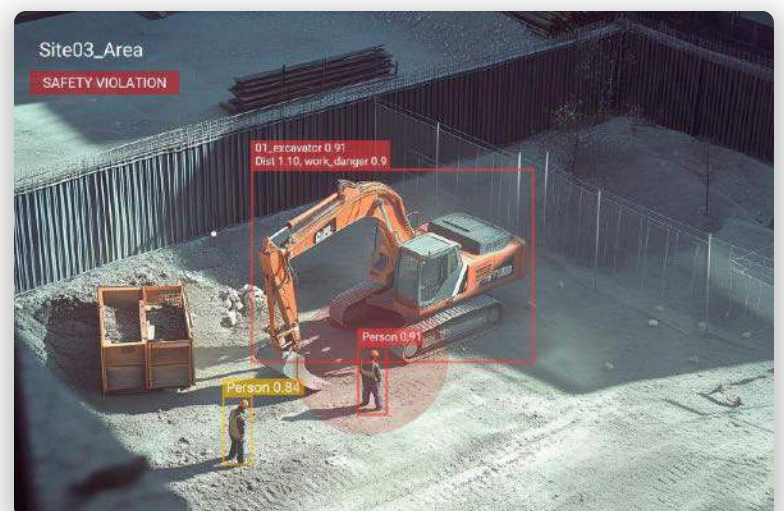
Background

Rhomberg Sersa Rail Group (RSRG) is a large, family-owned international company headquartered in Austria, specializing in construction, civil engineering, and railway technology. In 2023, the construction division generated over €760M in revenue and employed over 3,000 people.



RSRG's projects are primarily located in Europe, with a strong presence in Austria, Germany, and Switzerland, as well as Australia, the UK, Ireland, and North America. Their project duration can range from several months to multiple years depending on the project's complexity and scope. RSRG is a full railway engineering service provider and offers a comprehensive range of railway construction, infrastructure and service products. The Group's focus is on customer-oriented and tailor-made solutions for light rail, main-line railways, freight lines, private infrastructure operators and keepers and owners of track-laying machines.

RSRG is also renowned for its commitment to innovation, quality, environmental responsibility, and top-of-the-line workplace safety. By implementing cutting-edge technologies like automated PPE monitoring and collision avoidance systems, RSRG goes beyond compliance to anticipate and mitigate risks, reinforcing its position as a safety innovator in the industry.



AI Vision provides a powerful solution to monitor construction sites with algorithms for automated inspection.

Challenge

RSRG needed an extra layer of preventative measures for mitigating hazards while lowering project costs.

Solution

Viso Suite delivers a powerful AI vision infrastructure as a high-road solution that automatically detects PPE violations and unsafe distances between vehicles.

The scalable platform seamlessly connects cameras and edge devices, continuously monitoring safety conditions and sending real-time alerts when violations occur. All captured safety monitoring data is aggregated in compliance dashboards to track safety scores over time.

In this application, Viso Suite is integrated with Q-tainer, a mobile data center developed by Datwyler IT Infra and RSRG. This high-road safety solution provides plug-and-play connectivity for edge computing on construction sites. Viso Suite was chosen for its advanced real-time video analysis capabilities, enhancing site safety through cutting-edge AI vision technology.



Real-time AI inspection with Viso Suite leverages multiple AI models to detect hazards automatically.

Computer vision algorithms were developed, deployed, and monitored for real-time safety tracking. However, for Viso Suite to provide real value, just detecting the safety violations was not enough. The solution required a truly end-to-end approach:

- 1. Identification:** Leveraging AI for object detection and tracking to (A) monitor safe distances between machinery to prevent collisions, and (B) track personal protective equipment (PPE).
- 2. Tracking:** Regular reports are delivered through the creation of dashboards with live-reporting views and system-generated reports containing safety statistics sent out weekly and at the end of every workday.
- 3. Improvement:** Continuous improvement is an integral part of the required solution. Site managers can use the data-driven insight from the reports to identify gaps in safety practices, if necessary, and follow up with (A) further safety training and (B) adjusting or implementing safety protocols.

Viso Suite monitored PPE compliance, tracked vehicle routes, and identified potential collision risks, seamlessly integrating with Q-tainer's capabilities. The Q-tainer benefited from an extra layer of protection, further strengthening its already robust safety protocols.

“ This partnership is not only enjoyable but also productive. Viso Suite has been instrumental in helping us automate processes and simplify the development of video analytics, which has opened up new possibilities in video analysis.

Pascal Walther

Head of IT Solution Engineering at Datwyler

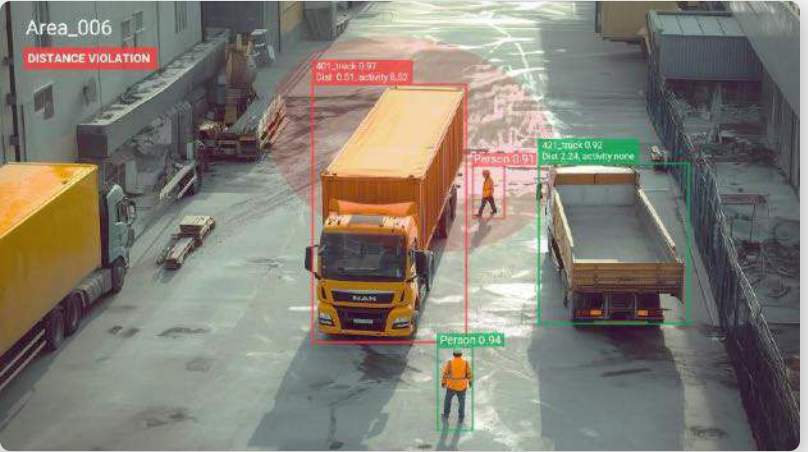
Capabilities

Equipment Utilization Tracking



Detect parking and loading area occupancy to analyze and enhance vehicle utilization.

Collision Risk Detection



Identify unsafe distances between vehicles or vehicles and people and trigger an alert.

Privacy-Preserving Computer Vision



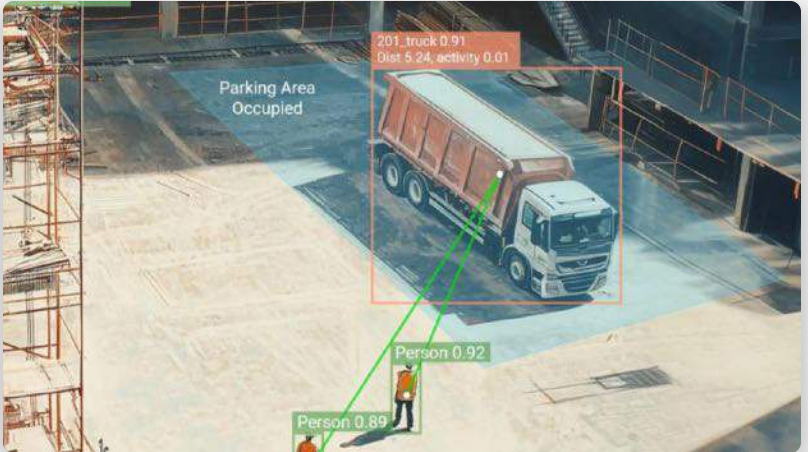
All visual data is securely processed, safeguarding all Personally Identifiable Information (PII).

Safe Distance Evaluation



The Safe Distances between multiple vehicles are continuously evaluated.

24/7 Activity Tracking



The system provides continuous data about detected people and vehicle across different areas.

The Mobile Data Center



The Q-trainer is a compatible Edge Computing and 5G hardware for on-site deployments.

The viso.ai Difference

Viso Suite is the industry-agnostic, full-scale computer vision infrastructure. By consolidating the entire machine learning pipeline into a single platform, Viso Suite enables firms to manage their applications at every step: development, deployment, management, security, and scaling.



Viso Suite is the all-in-one AI Vision Platform

Viso Suite streamlines computer vision projects, reducing complexity and boosting productivity. The platform supports rapid development and deployment, ensuring high accuracy and performance. Its open and extensible design allows integration with various tools and technologies, providing flexibility to meet evolving needs.

Viso Suite also prioritizes privacy and security, protecting sensitive data and ensuring compliance with industry standards. With Viso Suite, businesses can confidently develop, deploy, and manage their computer vision applications with a robust, all-in-one solution.

Terminology

Computer Vision: a field of artificial intelligence that enables machines to interpret and process visual information from the world, similar to how humans use eyesight. It involves the use of algorithms and models to analyze images and videos for tasks such as object detection, facial recognition, and scene understanding.

Edge Computing: the practice of processing data near the source of data generation to reduce latency and improve real-time data analysis and decision-making. This is typically done with a system of cameras, sensors, and machine learning algorithms.

Focus Four: an initiative developed by OSHA to combat the top four occupational health hazards, which are falls, caught-in/between, struck-by, and electrocution.

High-road Solutions: initiatives that prioritize long-term benefits, ethical practices, and sustainable outcomes, often focusing on quality, innovation, and fair labor practices while delivering benefits to all stakeholders.

Injury Types:

- i. Caught-in/between: dangers where workers can be caught, crushed, or squeezed between two or more objects, such as machinery, collapsing structures, or heavy equipment.
- ii. Electrocution: dangers where workers can come into contact with live electrical circuits or equipment.
- iii. Falls: dangers posed by unprotected edges, improperly constructed scaffolds, floor holes, and other elevated work surfaces that can lead to workers falling.
- iv. Struck-by: dangers where workers can be struck by falling, flying, swinging, or rolling objects.

Get Started

Contact us and speak with our team of experts to learn how you can get started with Viso Suite. Visit www.viso.ai.

Resources

Adjacent Digital Politics Ltd. (2022, August 18). Digital Transformation: Digitisation in the construction industry. PBC Today. Retrieved August 5, 2024, from <https://www.pbctoday.co.uk/news/digital-construction/digital-transformation-digitisation-in-the-construction-industry/114423/>

Brelloff, S. P., PhD, Garza, E., MPH, CPH, Brogan, A., MS, Bunting, J., MPH, Trout, D., MD, MHS, Pena, M., MS, & Earnest, G. S., PhD, PE, CSP (2023, April 4). Struck-By Injuries in the Construction Sector: Common Hazards, Barriers, and Opportunities to Keep Workers Safe. NIOSH Science Blog. Retrieved August 5, 2024, from <https://blogs.cdc.gov/niosh-science-blog/2023/04/04/2023-struck-by-stand-down/>

Graham, T. (2022, February 8). The Direct and Indirect Costs of Construction Injuries. Retrieved August 6, 2024, from <https://kpa.io/the-direct-and-indirect-costs-of-construction-injuries/>

Harris, W., MS, Yohannes, T., MPH, & Youngblood, A. B., DrPH (2023). Fatal and Nonfatal Focus Four Injuries in Construction. The Center for Construction Research and Training. <https://www.cpwrr.com/wp-content/uploads/DataBulletin-March2023.pdf>

Liberty Mutual Insurance (n.d.). Workplace Safety Index 2020: Construction. Retrieved August 5, 2024, from https://business.libertymutual.com/wp-content/uploads/2021/04/WSI_1002.pdf

McKinsey (2023, May 3). From start-up to scale-up: Accelerating growth in construction technology. Retrieved August 5, 2024, from <https://www.mckinsey.com/industries/private-capital/our-insights/from-start-up-to-scale-up-accelerating-growth-in-construction-technology>

Midwest Economic Policy Institute (MEPI) (2017, May 8). The Midwest Economic Policy Institute. Retrieved August 5, 2024, from <https://www.cpwrr.com/wp-content/uploads/DataBulletin-March2023.pdf>

National Safety Council (n.d.). Industry Incidence and Rates. Injury Facts. Retrieved August 5, 2024, from <https://injuryfacts.nsc.org/work/industry-incidence-rates/most-dangerous-industries/>

Occupational Safety and Health Administration, U.S. Department of Labor (n.d.). Construction Focus Four Training. Occupational Safety and Health Administration. Retrieved August 5, 2024, from <https://www.osha.gov/training/outreach/construction/focus-four>

U.S. Bureau of Labor Statistics (2023, December 19). Census of Fatal Occupational Injuries News Release. Retrieved August 5, 2024, from <https://www.bls.gov/news.release/cfoi.htm>