NIOSH Construction Program Update

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NIOSH Office of Construction Safety & Health

November 2023

National Construction Center Request for Proposals (RFP)

- 5-year cooperative agreement
- Expected budget of approx. $29M
- Announced in Grants.gov in **August 2023**
- Due Date **December 1, 2023**

Centers for Disease Control and Prevention (CDC)

The policies, guidelines, terms, and conditions of the HHS Centers for Disease Control and Prevention (CDC) stated in this notice of funding opportunity (NOFO) might differ from those used by the HHS National Institutes of Health (NIH). If written guidance for completing this application is not available on the CDC website, then CDC will direct applicants elsewhere for that information.

National Institute for Occupational Safety and Health (NIOSH)

National Center for Construction Safety and Health Research and Translation (U54)

U54 Specialized Center- Cooperative Agreements

Reissue of RFA-OH-19-001

None

RFA-OH-24-001

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Maui Wildfire Response

Hazard Advisory for Properties in the Burn Area

FOR MAUI RESIDENTS IMPACTED BY WILDFIRES

The burn area is hazardous. The Hawai'i Department of Health (DOH) advises avoiding the burn area until it is cleared of hazardous materials and structural ash. Enter at your risk.

Please take necessary precautions to protect yourself and your loved ones. If you are feeling unwell or have new health symptoms, please seek medical evaluation.

You may encounter dangerous conditions or be exposed to toxic materials. Wear protective gear and minimize your time of exposure.

Protect Yourself
Adults should wear protective face masks, goggles and gloves, long-sleeves, pants, socks and shoes to avoid skin contact with ash. Cloth masks will not protect you from ash. Instead, DOH recommends wearing a tight fitting respirator mask - look for words NIOSH or N95 printed on the mask. Remember, no mask is effective unless it is fitted properly.

Reduce Exposure to Ash & Hazardous Materials
Debris and ash may include lead, asbestos, arsenic or other hazardous materials. Dust, dirt, and soot can become airborne and be inhaled. Other heavy metals and chemicals may also be present in ash after a wildfire and could present a hazard.

Reduce your exposure to hazards by taking actions to protect yourself. We recommend changing clothes before being in contact with sensitive groups like children, pregnant people, people with asthma or COPD, and kupuna. Children and pregnant people should not be exposed to wildfire ash and debris.

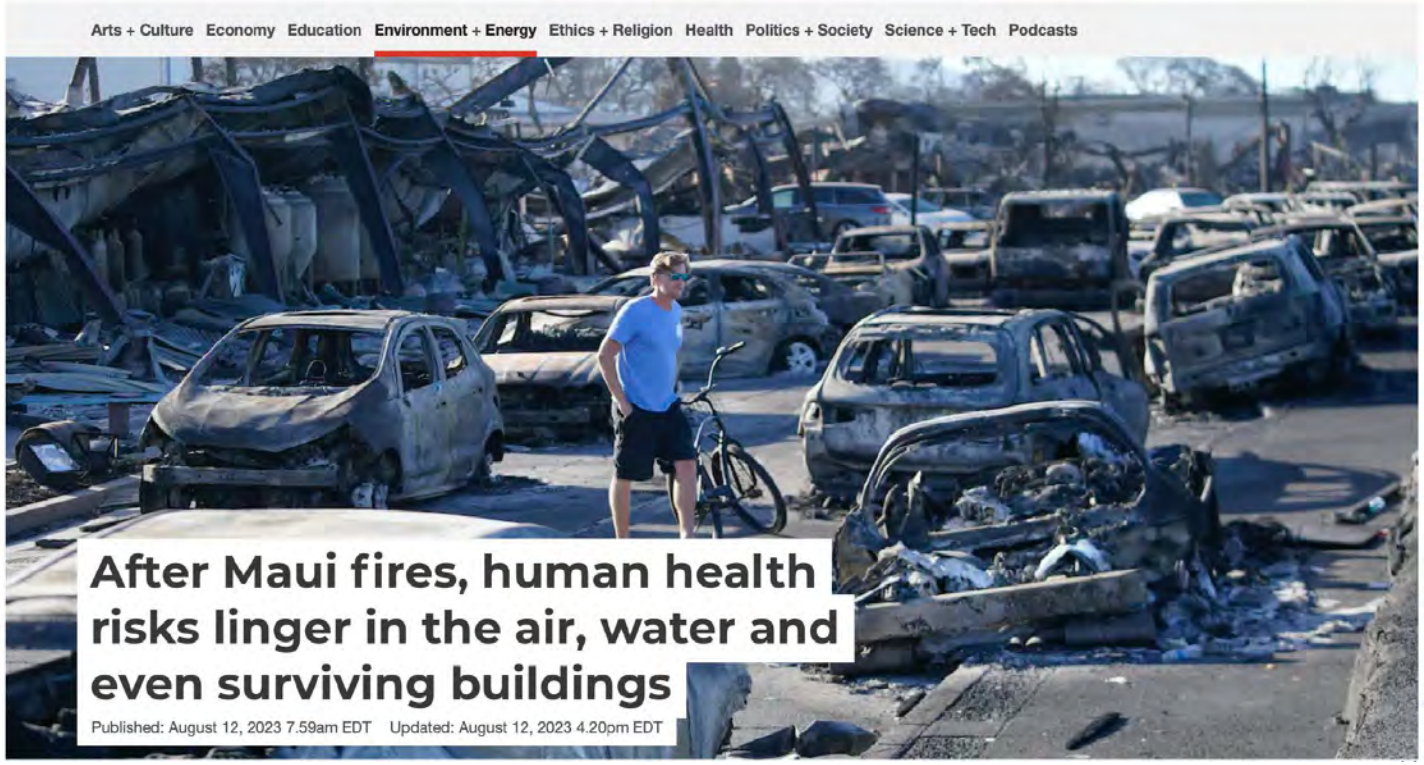
Do Not Remove Ash or Debris
Do not dispose of ash or debris at landfills, in dumpsters, or at transfer stations. Removal of hazardous material will be coordinated by authorities.

Be Aware of Trees, Power Lines, or Other Hazards
Trees may be identified as hazards due to the fire. Even if power has not been restored to your neighborhood, downed power lines should be avoided. Unstable buildings and structures could collapse and cause injury. If you identify that an area is unsafe, leave and report the hazard to emergencies.

QUESTIONS?
Hawai'i Poison Control Center: 1-800-222-1222
DOH: 833-833-3431 or 808-586-4468
health.hawaii.gov/mauiwildfires

PLEASE FOLLOW ALL INSTRUCTIONS FROM LOCAL AUTHORITIES.

Hazard Advisory
Updated August 28, 2023
English



CDC COVID-19 Ventilation Guidance Updates Released May 12, 2023


Opinion | We might be on the verge of an indoor air quality revolution

By Joseph G. Allen

May 15, 2023 at 3:39 p.m. EDT

Source: Washington Post


Opinion | The CDC takes a step toward virus-free air in schools and offices

By the Editorial Board | + Follow

May 15, 2023 at 6:29 p.m. EDT

Source: CNN Health


CDC sets first target for indoor air ventilation to prevent spread of Covid-19

by Brenda Goodman

Published 5:51 PM EDT, Fri May 12, 2023

Source: Washington Post

CDC COVID-19 Ventilation Guidance Updates

Improving Ventilation in Buildings:
https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/improving-ventilation-in-buildings.html

Summary List of Actions

- Know how your building's HVAC systems work, ensure that it operates as it should and gets regular maintenance. Consider improving or upgrading older systems.
- Increase air filtration in your HVAC system. **Use MERV 13 or higher filters** that fit well within the filter rack.
- Use air cleaners (also called air purifiers) with high-efficiency filters. Select a device that is appropriate for the size of your space.
- **Aim for at least 5 air changes per hour (ACH).**

NORA Construction Sector Work Groups

Preventing Falls

Co-Chairs:

Rich Trewyn

Cheryl Ambrose

Preventing Struck-by

Co-Chairs:

Brad Sant

Alanna Klein

*If interested in joining, reach out to Doug Trout DTrout@cdc.gov

NORA

Dump Truck & Quick Coupler Fact Sheets

Preventing Dump Truck-related Injuries and Deaths During Construction

Injuries from dump trucks led to the deaths of 809 construction and extraction workers from 2011 to 2020, an average of 81 deaths per year. Those operating dump trucks or working nearby are at risk of multiple hazards. This fact sheet gives employers ways to recognize and avoid these hazards and prevent dump truck-related injuries and deaths at construction sites.

Employers, contractors, and supervisors should take the lead in using these recommendations to help prevent dump truck-related deaths, injuries, and close calls. Employers have the responsibility to comply with applicable Occupational Safety and Health Administration (OSHA) regulations, including for example 29 CFR 1926 Subpart O (Motor Vehicles, Mechanized Equipment, and Marine Operations) and Subpart G (Signs, Signals, and Barricades), as part of an overall safety and health program. This fact sheet focuses on dump trucks that dump the material out of the rear of the bed, but many of the recommendations may apply to other types of trucks.

A dump truck rollover that occurred while operating on a soft surface.

Prepare and Plan for Safety

- Dvelop a written safety program that addresses the safety hazards to drivers and those who work on the ground near dump trucks (ground workers).
- Inspect the work area for potential hazards before each shift and during the shift as needed to address changing conditions. This should be done by one or more 'competent persons.'
- Provide staging areas to eliminate backing up or at least minimize backing up distances in work zones.
- Create internal traffic control plans (ITCPs) for areas involving dump truck travel. Focus on eliminating or decreasing the need for ground workers near moving vehicles and providing physical barriers where necessary.
- Anticipate ground conditions through pre-planning and provide a stable surface for all dumping operations.
- Prepare and deploy signs and markers to show workers where to walk in high-traffic areas.
- Enforce the applicable elements of consensus standards concerning work zone safety for roadway construction and high-visibility safety apparel.

Consider Using New Technologies

- Many workplaces are using sensors much more frequently for health and safety. Employers should consider installing cameras, electronic signaling devices, or sensors to reduce hazards. These can include:
  - o Audible, visual, and/or sensor-based (e.g., radar) devices to warn drivers of workers on foot in the immediate work area
  - o Back-up/proximity cameras with a video display for the driver to see their surroundings

Preventing Excavator Quick Coupler Attachment Struck-by Fatalities and Injuries

Excavator quick coupling devices (quick couplers) are widely used on construction job sites to rapidly change buckets and other attachments for various tasks. Quick couplers can use powered, manual, or combination systems. Additionally, different manufacturers use different mechanisms to keep the quick coupler engaged with the bucket or other attachment. While this factsheet focuses on buckets, these recommendations apply to any quick coupler attachment. There are three main reasons why buckets or other attachments unintentionally fall from excavators using quick couplers: (a) improper attachment of the bucket or attachment; (b) quick coupler mechanical or hydraulic failure; or (c) operator opening of the quick coupler in an unsafe position.

There are three main reasons why buckets accidently fall from excavators

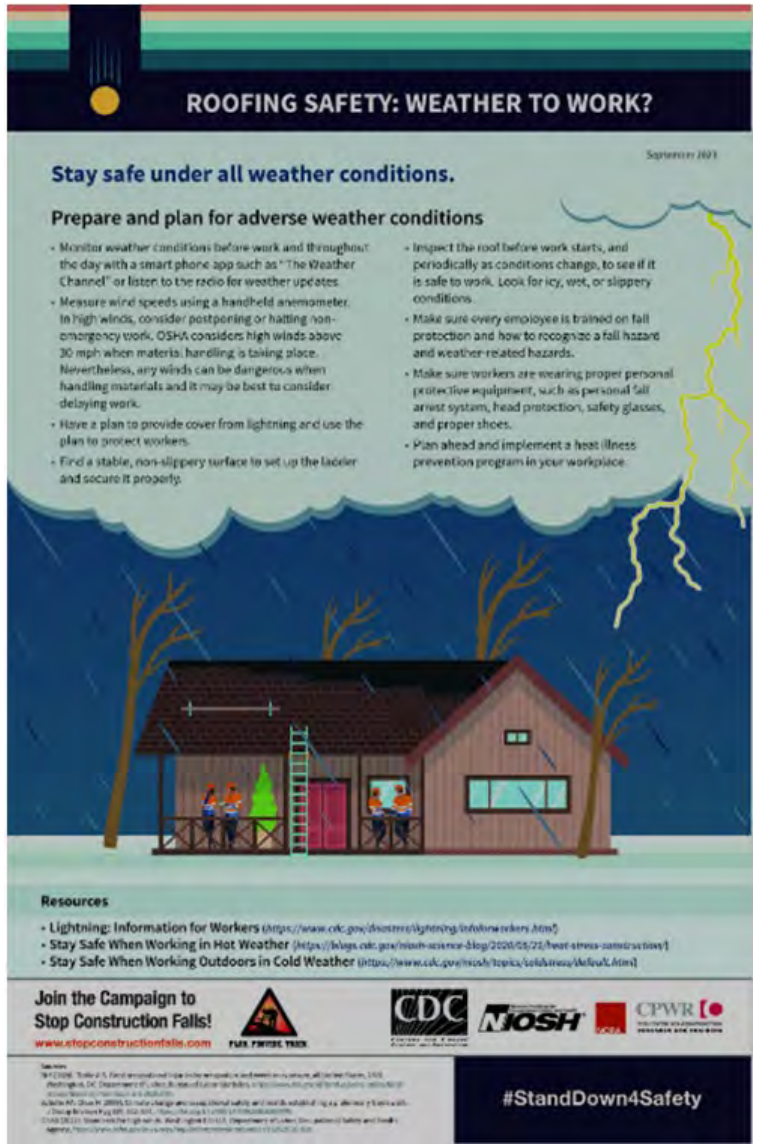
Misconnection – Operator thinks the bucket is correctly attached.

Cylinder failure / Loss of hydraulic pressure

Accidentally opening a quick coupler in an unsafe position

Three main reasons why buckets unexpectedly fall from excavators – example of quick coupler with powered mechanism.
Photos/Credit: Geith International, Ltd.

Infographics on Roofing Safety



Liberty Mutual and UCOR Fact Sheets

Help prevent being caught in between equipment and machinery

Risk Control Services
from Liberty Mutual Insurance

Highlights:

- Identify controls to help reduce the likelihood of injuries or fatalities.
- Educate workers on safe work practices.

This reference note was created in collaboration with the National Occupational Research Agenda (NORA) Construction Struck By workgroup.

Almost all construction projects use machinery with moving or rotating parts. "Caught-in between" hazards are present on most job sites and are among the construction industry's leading causes of death and injury. These injuries result from being squeezed, caught, crushed, pinched, or compressed between two or more objects or between parts of an object.

Using equipment and machinery might seem safe, but it requires training to educate workers on safe work practices. Often, workers must repair or perform maintenance on machinery and equipment, which puts them at risk for potential injuries ranging from amputations and fractures to death.

When working with machinery and equipment, the following controls should be considered and may be required by the Occupational Safety and Health Administration (OSHA).[1] When properly applied, these controls can help ensure workers are working safely and help reduce the likelihood of injuries from being caught in between machinery.

Emergency guards, stops, and barricades

- Place guards and barricades on machinery and equipment to help prevent contact with moving parts.
- Attach guards so workers cannot remove them. When available, install interlocking guards that require a special tool for removal.
- Install emergency stop systems to shut down the machine. Ensure markings for emergency shut-off switch are present, and conduct periodic testing to ensure they are functional.
- Evaluate equipment points of operation, transmission parts, rotating parts, etc., and determine if protection is required or is missing.
- Eliminate the need to remove guards for simple maintenance tasks by extending lube points.[2]

Safeguards

Select safeguards that offer the best protection, and verify that they are installed properly and comply with appropriate OSHA, American National Standards Institute (ANSI),[3] and other related standards.

Safeguards should:

- Prevent contact with moving machine parts.
- Be secure.
- Protect from falling objects.
- Create no new hazards.
- Allow machinery to operate without impeding normal operations.
- Enable safe lubrication and machinery maintenance.

Liberty Mutual. INSURANCE

RC 5153

Equipment Recovery Plan

Location:		**Date:**		**Time:**	
WP# (Type):		**FM:**		**Phone:**	

H&R Required:	**Yes** ☐	**No** ☐	**N/A** ☐	**Person Contacted:**
RADCON Required:	**Yes** ☐	**No** ☐	**N/A** ☐	**Person Contacted:**
EC&P Required:	**Yes** ☐	**No** ☐	**N/A** ☐	**Person Contacted:**

Type of recovery hardware used (check all that apply):

Winch System ☐	Tow Rope ☐	Pull Cable ☐	Nylon Sling ☐	Pushing ☐	Other:

Total Length recovery hardware: _____

Standoff Distance: (Minimum 2 times length of recovery hardware): _____

Type of attachment Point (Check all that apply):

Hook ☐	Equipment Pin ☐	Shackle/pin ☐	Sling ☐	Manufactured point ☐	Other:

Type of equipment used for recovery:

Dozer ☐	Excavator ☐	Loader ☐	Farm Tractor ☐	All terrain Forklift ☐	Other:

Evaluation of ground conditions:

Blacktop/Concrete ☐	Lawn/Grass ☐	Gravel/Stone ☐	Shallow Mud ☐
Wheel Deep Clay/Sand/Muck ☐	Body Deep Clay/Sand/Muck ☐	Other:	

Type of Communication:	Radio ☐	Hand Signals ☐	Verbal ☐
Vehicle Construction Equipment Spotter (VCES) Required	Yes ☐	No ☐	

Minimum Capacity Required (MCR) (MCR=W+ARR+AGR)

1. Weight (W) of equipment (include fluids, implements, screens, cargo): (W): _____
2. Additional Rolling Resistance(ARR): (ARR): _____

Note: Additional Rolling Resistance multipliers assume the wheels are level with each other.

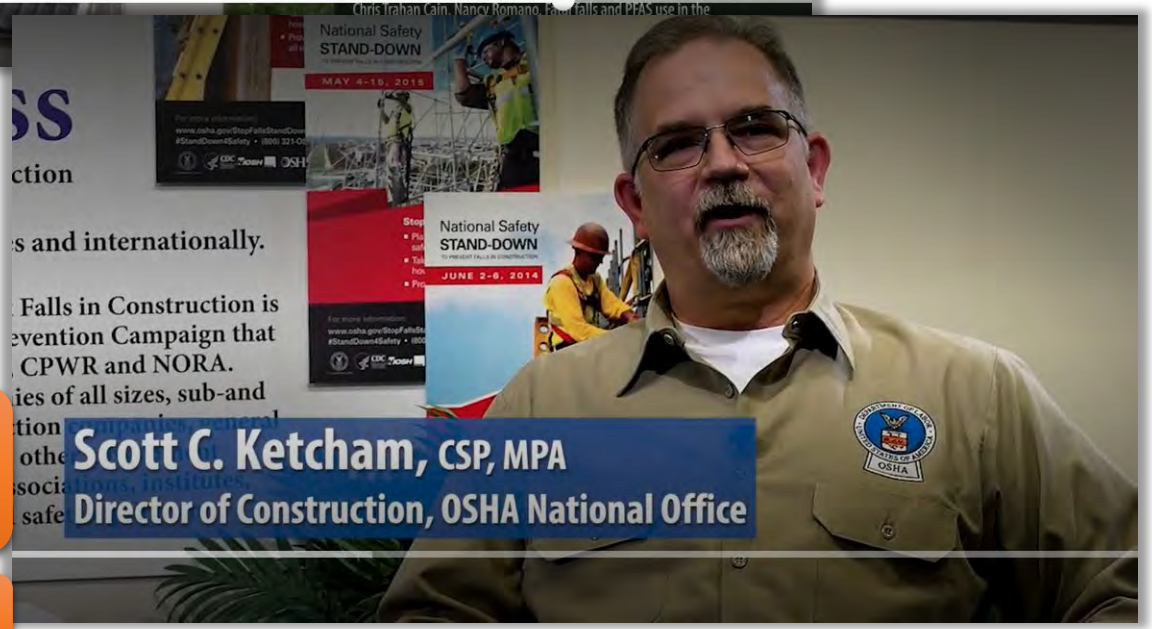
3. Additional Gradient Resistance(AGR) (NOTE: use zero if no slope): (AGR): _____

4. _____ Plus _____ Plus _____ Equals _____

WARNING – If Recovery Equipment or Attachment Points is less than Minimum

NORA 10 yr. Anniversary video, National Stand-Down

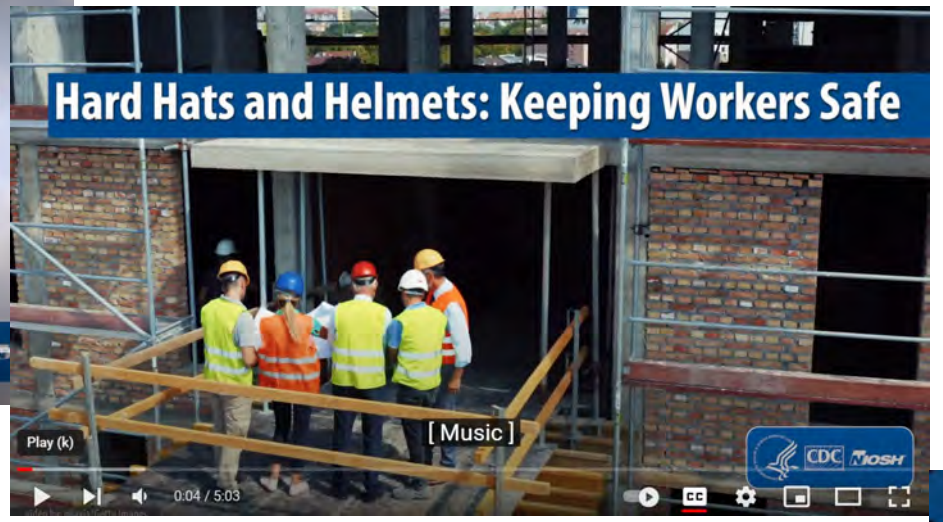
Stay tuned, more video testimonials in development based on footage taken in March…

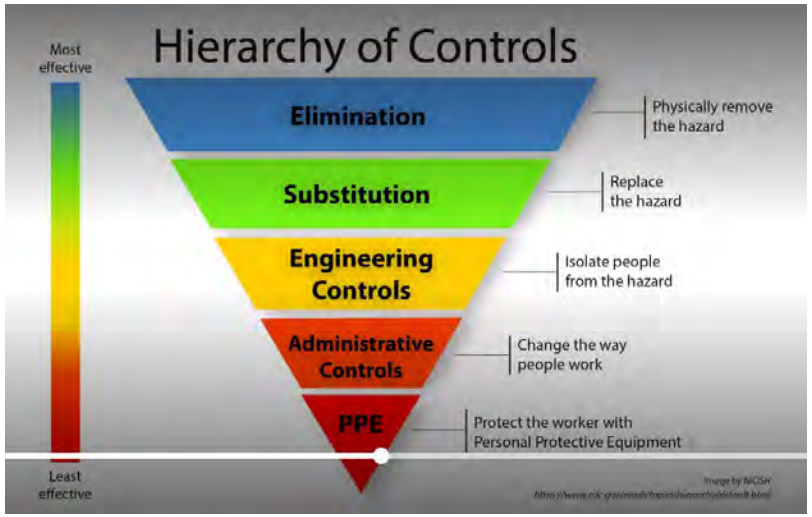


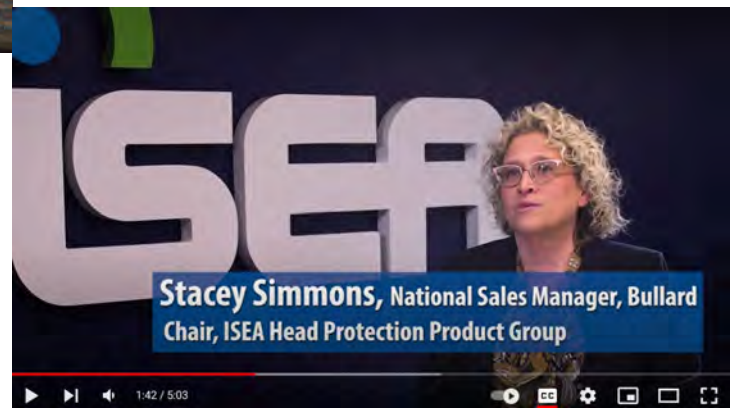
CDC Construction Safety & Health YouTube Playlist
https://youtube.com/playlist?list=PLvrp9iOILTQadpq9MKnkBOwOPE1VITZ9P&si=zYxExUI70yz7W0Qr

Direct link: https://youtu.be/AOZwsLm013M?si=XPcKa2mo_ErnWZta

Prevention through Design & Helmet videos







Direct link: https://youtu.be/oJ834e9wDQ4?si=hsqRlh6Re6EM4moc

Direct link: https://youtu.be/DfiBLI8lGM8?si=a_sHS7OHxN3AAdJ7

NIOSH Science Blogs

Prevention of Injuries and Fatalities Involving Overturn of Drill Rigs and other Specialty Equipment for Foundation Construction

June 20, 2023 by Peggy Hagerty Duffy, PE, DGE; Richard Marshall, CHST; Douglas Trout, MD, MHS; and G. Scott Earnest, PhD, PE, CSP

Introduction

Every year, drill rigs and other heavy, specialty equipment used for deep foundation construction (Figure 1) overturn potentially causing injuries and fatalities, as well as damage to the surrounding sites. There are many safety hazards associated with working around this heavy equipment, including the "Focus Four Hazards": falls, caught-in or -between, struck-by, and electrocution. However, the overturn of drill rigs and similar heavy equipment used for deep foundation construction can be considered an 'emerging hazard' because: (1) the circumstances and environments in which this heavy equipment is used for deep foundation construction vary over time and by location; and (2) data needed to better understand factors contributing to these equipment overturn incidents are incomplete.[1] This blog aims to raise awareness on this

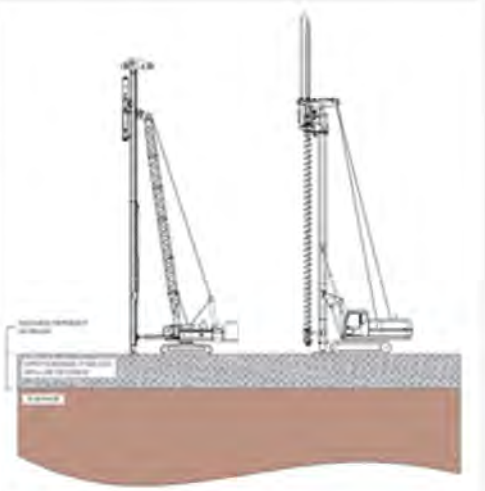


Figure 1. Image of two drill rigs preparing to drill on a safe work platform. (Image from ADSC)

Mental Health, Alcohol Use, and Substance Use Resources for Workers and Employers

October 10, 2023 by Jamie C. Osborne, MPH, CHES® and Sudha P. Pandalai, MD, PhD, MS

The workplace is an important setting to address mental health conditions, excessive alcohol use, and other substance use disorders among workers. In 2021, more than half of U.S. adults who reported a mental illness in the last year were employed. National U.S. data show that 70% of all adults with a substance use disorder (including alcohol or illicit drug use disorders) are employed. Alarmingly, rates of suicide, drug overdose deaths, and deaths from conditions fully caused by alcohol use[1] have been climbing over the last two decades. Rates of overdose and binge drinking[2], along with rates of suicide, are more common in some occupations, such as those in construction, mining, and the oil and gas industries. The National Institute for Occupational Safety and Health is working to address these issues in the context of work and the workplace.

Mental Health, Substance Use, and Work

Many safety and health issues straddle both work and non-work spheres. Mental health conditions and substance use can impact workers both on the job and away from work, as well as the worker's co-workers, staff, family, and community. The *Total Worker Health®** perspective views the worker as a

NIOSH Science Blogs

Clearing Up Myths About Older Workers While Understanding and Supporting an Aging Workforce

September 25, 2023 by Gretchen A. Petery, James W. Grosch, and L. Casey Chosewood

The National Center for Productive Aging and Work is a key part of the Total Worker Health® Program in the National Institute for Occupational Safety and Health (NIOSH). The center operates as a hub that conducts original research, fosters collaborations, and offers expert guidance to support an aging workforce. The center encourages workplaces to integrate workers of all ages, and it gives useful resources on age-related issues for businesses and industries.

Photos © Getty Images

Why It Matters

Trends in population aging[1] are expected to profoundly affect the workforce for years to come.[2]

In 2001, only about 1 out of every 7 U.S. workers was 55 or older. By 2021, the number jumped to almost 1 out of every 4 workers (a 93% increase). That's almost twice the proportion of older workers as before.[3] Older workers are staying on the job longer for various reasons, ranging from financial needs to the joy of work. More people are working past the age when they might have retired. They might be

Protecting Workers and the Public from Wildfire Smoke

June 29, 2023 by Maryann M. D'Alessandro, PhD; Meghan Kiederer, BA; Joseph Schall, MA; Maria Mirabelli, PhD, MPH; Susan Stone, MS; CAPT Lisa Delaney, MS, CIH; CAPT Christa Hale, DVM, MPH, DACVPM (Epi); Lew Radonovich, MD

New York City covered in smoke from Canadian wildfires causing hazardous air quality. Photo© Getty Images

The Canadian wildfires highlight the hazard of wildfire smoke, an issue faced annually by many communities across the United States. In this blog, the Centers for Disease Control and Prevention's National Institute for Occupational Safety and Health (NIOSH) and National Center for Environmental Health teamed up with the Environmental Protection Agency (EPA) to provide employers, workers, and the general public information to help stay protected from wildfire smoke. Wildfire smoke is a mixture of gases, vapors, and particles, some so small they can only be seen with a microscope, that can irritate your eyes, nose, throat, and lungs, causing coughing, wheezing and difficulty breathing. Some people, such as children, people with asthma, chronic obstructive pulmonary disease (COPD), or heart disease, and people who are pregnant are at higher risk for health problems from wildfire smoke.

Staying indoors is recommended when air quality is at unhealthy levels, but for outdoor workers, this may not be possible. Employers should be aware of the various ways they can limit worker exposure to wildfire smoke in and around their work environment.

New FACE reports

OREGON State **FACE** Program
Fatality Assessment & Control Evaluation

Oregon Institute of Occupational Health Sciences • Oregon Health & Science University
3222 SW Research Dr. L606 • Portland, OR 97239 • 503-494-2281

REPORT#: 2019OR01 REPORT DATE: June 29, 2023

Two Workers Killed in Boom Lift Rollover - Oregon

INCIDENT HIGHLIGHTS

- **DATE:** August 8, 2019
- **TIME:** ~4:40 PM
- **VICTIMS:** 27-year-old White male; 35-year-old White male
- **INDUSTRY/NAICS CODE:** Foundation, Structure, and Building Exterior Contractor/NAICS 238190
- **EMPLOYER:** Aerial fabric design and installation
- **SAFETY & TRAINING:** Insufficiencies in supervisor oversight and training in safe boom lift operation.
- **SCENE:** Hillside of music festival venue
- **LOCATION:** Oregon
- **EVENT TYPE:** Caught in/between

SUMMARY

On August 8th, 2019, two workers were operating a boom supported elevating work platform, also commonly referred to as a boom lift to remove hardware and cables anchored to trees after a music festival. They were working on a sloped hillside, with the boom extended and the counterweight on the downslope side. The boom lift tipped over and rolled down the hill with the two workers in the basket. Others witnessed the incident. Emergency responders pronounced both workers dead at the scene. Blunt-force trauma due to a fall from a moving object was ruled as the cause of death. READ THE FULL REPORT> (p.3)

CONTRIBUTING FACTORS

Key contributing factors identified in this investigation include:

- Deviation from equipment manufacturer's safe operation instructions:
  - Disabling safety alarms on machinery.
  - Operating a boom lift on a slope.
  - Moving a boom lift with the telescopic boom extended.
- Insufficient worksite-specific communication to the workers and supervisors regarding the hazards of operating equipment on a sloping terrain. LEARN MORE> (p. 7)

RECOMMENDATIONS

Oregon FACE investigators concluded that, to help prevent similar occurrences, employers should:

- Ensure manufacturer instructions regarding equipment operation are followed through adequate supervision.
- Ensure boom lift operators know not to move the boom lift with the boom extended by providing training and supervision.
- Maintain and regularly inspect equipment for its operational safety.
- Implement pre-task planning for jobs that include varying conditions or environments.
- Train employees to operate equipment safely. Verify training completion and check knowledge and skill level.

LEARN MORE> (p.8)

KENTUCKY State **FACE** Program
Fatality Assessment & Control Evaluation

Kentucky Injury Prevention and Research Center
Bona fide agent for Kentucky Department for Public Health
333 Waller Avenue, Suite 242 • Lexington, KY 40504 • 859 257-5839

REPORT#: 22KY011 REPORT DATE: 06/13/2023

Roofing Worker Dies from Fall—Kentucky

INCIDENT HIGHLIGHTS

- **DATE:** March 28, 2022
- **TIME:** 1:30 p.m.
- **VICTIM:** 36-year-old Hispanic male roofer
- **INDUSTRY/NAICS CODE:** Roofing Contractor/238160
- **EMPLOYERS:** Roofing contractors
- **SAFETY & TRAINING:** Some elements existed
- **SCENE:** Apartment building
- **LOCATION:** Kentucky
- **EVENT TYPE:** Fall

SUMMARY

At 1:30 p.m. on March 28, 2022, a 36-year-old Hispanic roofer suffered a fatal fall while installing roofing on a two-story apartment building. The worker fell approximately 18 feet to a sidewalk below and died on the scene due to injuries suffered from the fall.
... READ THE FULL REPORT> (p.3)

CONTRIBUTING FACTORS

Key contributing factors identified in this investigation include:

- Working at height
- Need for fall protection
- Need for effective safety training
- Need for effective safety policies
- Need for subcontractor comprehensive safety and health programs

...LEARN MORE> (p.6)

RECOMMENDATIONS

Kentucky investigators concluded that, to help prevent similar occurrences, employers should:

- Implement a job hazard analysis (JHA) process
- Ensure that workers utilize fall protection when exposed to falls at height
- Provide workers with training appropriate to the hazards they may face while at work
- Establish and administer written safety policies with clear work rules and ensure that workers follow them

WASHINGTON State **FACE** Program
Fatality Assessment & Control Evaluation

CONSTRUCTION FATALITY NARRATIVE

Foreman Falls 17 Feet from Leading Edge of Roof Deck

INCIDENT FACTS

- **REPORT #:** 71-244-2023
- **REPORT DATE:** August 28, 2023
- **INCIDENT DATE:** May 31, 2022
- **WORKER:** 59 years old
- **INDUSTRY:** Property Managers / Building Construction
- **OCCUPATION:** Construction Foreman
- **SCENE:** Commercial construction site
- **EVENT TYPE:** Fall from leading edge

Fall protection anchor, shock-absorbing lanyard, and lifeline near leading edge where worker fell.

For a slideshow version, click here.

SHARP Safety & Health Assessment & Research for Prevention

Washington State Department of Labor & Industries

SUMMARY

A 59-year-old construction foreman died after falling from the leading edge of a roof deck. He worked for his employer, a residential and commercial property management company, for eight months. His duties included leading work crews, basic carpentry, framing, sheeting, and siding.

The foreman had been at the construction site of a new single-story commercial building for almost a month. On the incident day, he was alone on top of the building constructing a plywood roof deck. He was using a personal fall arrest system (PFAS), including anchorage, lifeline, rope grab, body harness, and shock-absorbing lanyard. A framing helper was assisting from the ground by using a scissor lift to hand him tools and materials.

Lifeline with rope grab stretched to show excess length from worker's fall location (x).

The foreman was laying plywood sheets onto trusses that had brackets on each receiving end where the sheets would be set. He was using his heel to kick the sheets into the brackets. When he tried moving a sheet with his feet, it gave way and dropped under his weight. He fell 17 feet to the ground inside the building with the sheet landing beside him. The helper was outside the building and did not see the fall. A manager watching live-streamed job site surveillance video in the office saw the worker on the ground, had the helper check him, and called 911. He died at the hospital after six days on life-support.

Following the incident, investigators found:

- The worker's PFAS was in excess of 50 feet for a 17-foot fall. An unnecessary second shock-absorbing lanyard was connected to the anchorage. His chest strap was not connected and the leg straps were loose. If the worker had the correct fall distance needed for his PFAS to engage and arrest his fall, it is likely his body still would have slipped out of the harness.
- The employer did not provide adequate fall protection training, specifically:
  - How to evaluate the fall clearance needed in order to select, install and use an appropriate PFAS.
  - How to engage all connectors to ensure the worker stays fully secured in the harness during a fall.

REQUIREMENTS

Employers must:

- Employers with employees exposed to fall hazards must have policies in their accident prevention program (APP) that meet the Unified Safety Standards for Fall Protection. See WAC 296-880
- Ensure that a fall arrest system, fall restraint system, or positioning device system is provided, installed, and implemented in accordance with WAC 296-880-400 Fall protection system specifications when employees are exposed to fall hazards of six feet or more to the ground or lower level while constructing a leading edge. See WAC 296-880-30005(1)(b)
- Ensure a competent person trains each affected employee to know at least the following:
  - (a) The nature of fall hazards in the work area; (b) When fall protection is required; (c) What fall protection is required; (d) The correct procedures for erecting, maintaining, assembling, disassembling, and inspecting the fall protection systems to be used; (e) The use and operation of fall protection systems used; (f) Limitations of fall protection systems used; (g) Proper care, maintenance, useful life, removal from service; and (h) The requirements of this chapter. See WAC 286-880-10015(2)

RECOMMENDATIONS

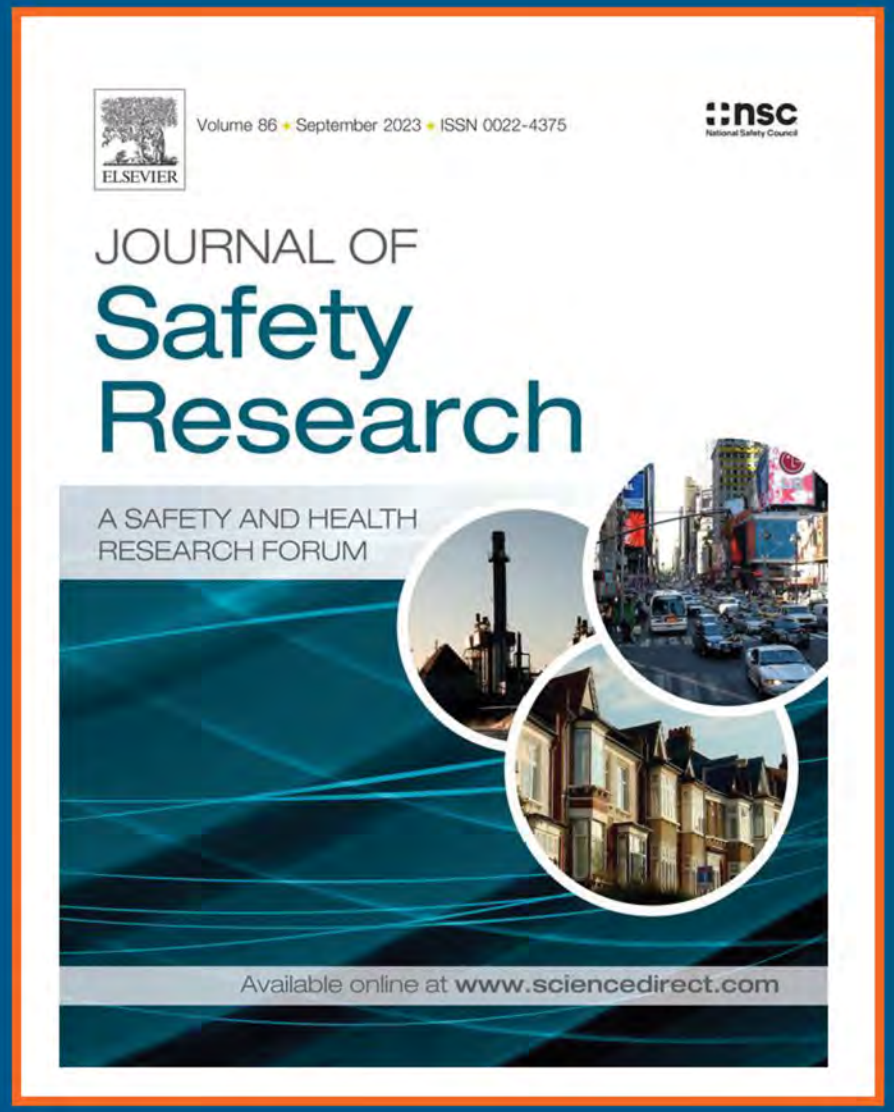
FACE investigators concluded that to help prevent similar occurrences employers should:

- Discuss fall protection policies at crew meetings, monthly safety meetings, and annual stand-downs.
- Provide recurring hands-on fall protection training and evaluate workers' ability to use it correctly.

RESOURCES

Fall Protection Fundamentals online training course - Oregon OSHA Public Education Spanish version

This narrative was developed to alert employers and workers of a tragic incident and is based on preliminary data ONLY and does not represent final determinations regarding the nature of the incident or the cause of the injury. Developed by WA State Fatality Assessment and Control Evaluation (WA FACE) and the Division of Occupational Safety and Health (DOSH), WA State Dept. of Labor & Industries. WA FACE is supported in part by a grant from the National Institute for Occupational Safety and Health (NIOSH grant# 5U60OH008487). For more information visit www.lni.wa.gov/safety-health/safety-research/ongoing-projects/work-related-fatalities-face.



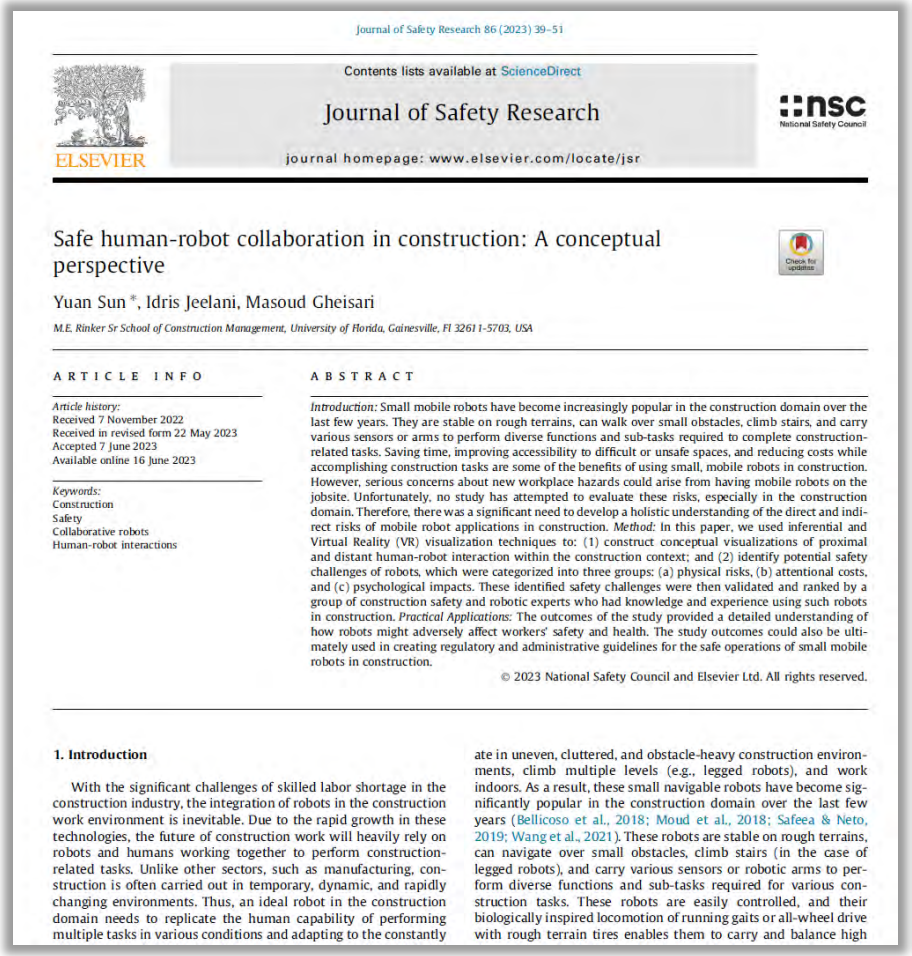
NOIRS

National Occupational Injury Research Symposium

https://www.sciencedirect.com/journal/journal-of-safety-research/vol/86/suppl/C

New Journal Articles of Interest

NORA



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Safe human-robot collaboration in construction: A conceptual perspective

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ABSTRACT

Introduction: Small mobile robots have become increasingly popular in the construction domain over the last few years. They are stable on rough terrains, can walk over small obstacles, climb stairs, and carry various sensors or arms to perform diverse functions and sub-tasks required to complete construction-related tasks. Saving time, improving accessibility to difficult or unsafe spaces, and reducing costs while accomplishing construction tasks are some of the benefits of using small, mobile robots in construction. However, serious concerns about new workplace hazards could arise from having mobile robots on the jobsite. Unfortunately, no study has attempted to evaluate these risks, especially in the construction domain. Therefore, there was a significant need to develop a holistic understanding of the direct and indirect risks of mobile robot applications in construction. *Method:* In this paper, we used inferential and Virtual Reality (VR) visualization techniques to: (1) construct conceptual visualizations of proximal and distant human-robot interaction within the construction context; and (2) identify potential safety challenges of robots, which were categorized into three groups: (a) physical risks, (b) attentional costs, and (c) psychological impacts. These identified safety challenges were then validated and ranked by a group of construction safety and robotic experts who had knowledge and experience using such robots in construction. *Practical Applications:* The outcomes of the study provided a detailed understanding of how robots might adversely affect workers' safety and health. The study outcomes could also be ultimately used in creating regulatory and administrative guidelines for the safe operations of small mobile robots in construction.

1. Introduction

With the significant challenges of skilled labor shortage in the construction industry, the integration of robots in the construction work environment is inevitable. Due to the rapid growth in these technologies, the future of construction work will heavily rely on robots and humans working together to perform construction-related tasks. Unlike other sectors, such as manufacturing, construction is often carried out in temporary, dynamic, and rapidly changing environments. Thus, an ideal robot in the construction domain needs to replicate the human capability of performing multiple tasks in various conditions and adapting to the constantly ate in uneven, cluttered, and obstacle-heavy construction environments, climb multiple levels (e.g., legged robots), and work indoors. As a result, these small navigable robots have become significantly popular in the construction domain over the last few years (Bellicoso et al., 2018; Moud et al., 2018; Safeea & Neto, 2019; Wang et al., 2021). These robots are stable on rough terrains, can navigate over small obstacles, climb stairs (in the case of legged robots), and carry various sensors or robotic arms to perform diverse functions and sub-tasks required for various construction tasks. These robots are easily controlled, and their biologically inspired locomotion of running gaits or all-wheel drive with rough terrain tires enables them to carry and balance high

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Construction industry workers' compensation injury claims due to slips, trips, and falls – Ohio, 2010–2017

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Slips, trips, or falls

ABSTRACT

Problem: Compared to other industries, construction workers have higher risks for serious fall injuries. This study describes the burden and circumstances surrounding injuries related to compensable slip, trip, and fall (STF) claims from private construction industries covered by the Ohio Bureau of Workers' Compensation. *Methods:* STF injury claims in the Ohio construction industry from 2010–2017 were manually reviewed. Claims were classified as: slips or trips without a fall (STWOF), falls on the same level (FSL), falls to a lower level (FLL), and other. Claim narratives were categorized by work-related risk and contributing factors. Demographic, employer, and injury characteristics were examined by fall type and claim type (medical-only (MO, 0–7 days away from work, DAFW) or lost-time (LT, ≥8 DAFW)). Claim rates per 10,000 estimated full-time equivalent employees (FTEs) were calculated. *Results:* 9,517 Ohio construction industry STF claims occurred during the 8-year period, with an average annual rate of 75 claims per 10,000 FTEs. The rate of STFs decreased by 37% from 2010 to 2017. About half of the claims were FLL (51%), 29% were FSL, 17% were STWOF, and 3% were "other." Nearly 40% of all STF claims were LT; mostly among males (96%). The top three contributing factors for STWOF and FSL were: slip/trip hazards, floor irregularities, and ice/snow; and ladders, vehicles, and stairs/steps for FLL. FLL injury rates per 10,000 FTE were highest in these industries: Foundation, Structure, and Building Exterior Contractors (52); Building Finishing Contractors (45); and Residential Building Construction (45). The highest rate of FLL LT claims occurred in the smallest firms, and the FLL rate decreased as construction firm size increased. *Discussion and Practical Applications:* STF rates declined over time, yet remain common, requiring prevention activities. Safety professionals should focus on contributing factors when developing prevention strategies, especially high-risk subsectors and small firms.

1. Introduction

Fall injuries are a leading cause of morbidity and mortality among workers in the United States, with the construction industry and construction workers bearing a disproportionate burden. The U.S. construction industry currently employs more than 10 million workers (BLS, 2022). Although this is less than 5% of the U.S. workforce, it accounts for 21% of the nation's work-related deaths (BLS, 2021a), which disproportionately affects Hispanic construction workers (Dong et al., 2009). Within the construction industry, slips, trips, and falls (STFs) are the leading cause (37%) of work-related deaths (BLS, 2021a; Socias-Morales et al., 2018) and the second most common cause (29%) of nonfatal injuries involving days away from work (BLS, 2021b). When nonfatal work-related STFs occur in the construction industry, they are frequently severe (Konda et al., 2016). Across all industries, 64% of all lost workday STFs resulted in more than 5 days away from work (BLS, 2021c). As a group, STFs are the most expensive category of injuries in direct U.S. workers' compensation costs (Liberty Mutual Insurance, 2022).

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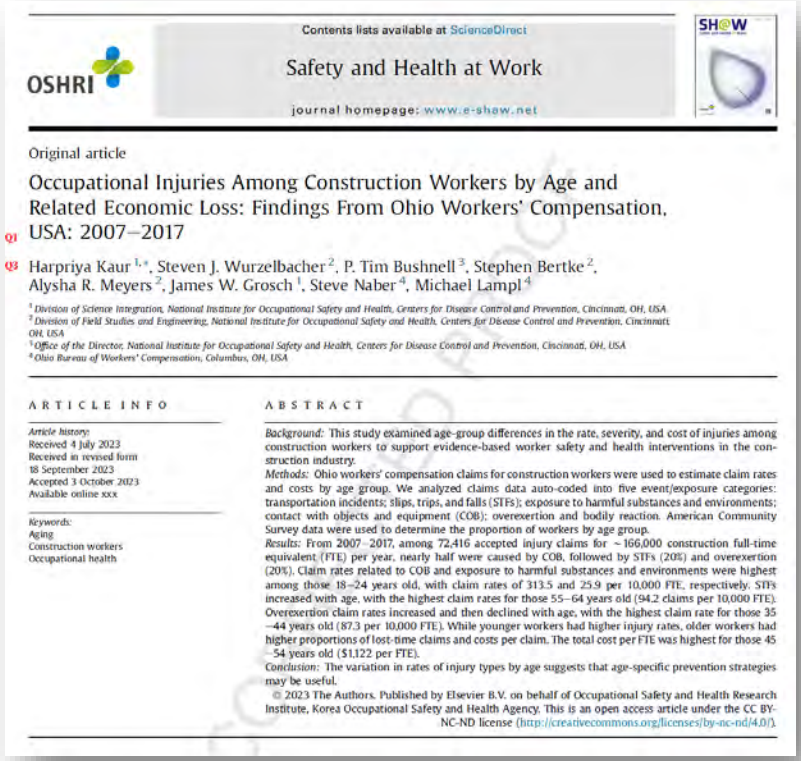

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Original article

Occupational Injuries Among Construction Workers by Age and Related Economic Loss: Findings From Ohio Workers' Compensation, USA: 2007–2017

Harpriya Kaur [1,*], Steven J. Wurzelbacher [2], P. Tim Bushnell [3], Stephen Bertke [2], Alysha R. Meyers [2], James W. Grosch [1], Steve Naber [4], Michael Lampl [4]

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ABSTRACT

Background: This study examined age-group differences in the rate, severity, and cost of injuries among construction workers to support evidence-based worker safety and health interventions in the construction industry.
Methods: Ohio workers' compensation claims for construction workers were used to estimate claim rates and costs by age group. We analyzed claims data auto-coded into five event/exposure categories: transportation incidents; slips, trips, and falls (STFs); exposure to harmful substances and environments; contact with objects and equipment (COB); overexertion and bodily reaction. American Community Survey data were used to determine the proportion of workers by age group.
Results: From 2007–2017, among 72,416 accepted injury claims for ~166,000 construction full-time equivalent (FTE) per year, nearly half were caused by COB, followed by STFs (20%) and overexertion (20%). Claim rates related to COB and exposure to harmful substances and environments were highest among those 18–24 years old, with claim rates of 313.5 and 25.9 per 10,000 FTE, respectively. STFs increased with age, with the highest claim rates for those 55–64 years old (94.2 claims per 10,000 FTE). Overexertion claim rates increased and then declined with age, with the highest claim rate for those 35–44 years old (87.3 per 10,000 FTE). While younger workers had higher injury rates, older workers had higher proportions of lost-time claims and costs per claim. The total cost per FTE was highest for those 45–54 years old ($1,122 per FTE).
Conclusion: The variation in rates of injury types by age suggests that age-specific prevention strategies may be useful.

New Journal Articles of Interest

Seminars in Hearing

NIOSH: Occupational Hearing Loss

November 2023

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Fatal fall-from-height accidents: Statistical treatment using the Human Factors Analysis and Classification System – HFACS

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ABSTRACT

Introduction: The civil construction industry (CCI) is one of the most dangerous sectors for occupational accidents. Studies conducted in several countries show that occupational accidents involving falls from height are the main cause of deaths in recent years. *Method:* This article analyzed the combinations of causal factors with the highest likelihood of accidents involving falls from height in construction to assist in decision-making. The methodology was divided into four stages: accident collection and sample definition; accident analysis; probability determination; and obtaining the theoretical curve of an accident probability distribution. The methodology was applied to reports of fatal fall-from-height accidents that occurred in the United States between 1997 and 2020. *Results:* The results show that among the accidents analyzed, the highest probability of fatality is when a roofer aged between 31 and 44 years performs their activity on a roof between 10:00 and 11:59 am. It is also noted that the three causal factors most present in the accidents were: organizational process (97.7%); poor management of worker resources (96.6%); and organizational climate (95.4%). From the probability distribution curve, 68% of the fatal accidents occurred after reaching between 18 and 34 causal factors present in the HFACS method categories.

1. Introduction

The civil construction industry (CCI), when related to Occupational Health and Safety (OHS), is pointed out as one of the most dangerous sectors, having relatively high rates of occupational accidents and fatalities (Gunduz & Ahsan, 2018; Jo, Lee, Kim, & Khan, 2017; OSHA, 2017; Shi, Du, Ahn, & Ragan, 2019). A study by the Occupational Safety and Health Administration (OSHA) indicated that 5,333 fatal accidents occurred in the private industry in 2019, and 20% of them were specifically in the CCI (OSHA, 2021). This is not only due to the world's need to upgrade its infrastructure, but also because the industry employs a large number of workers (Choi, Guo, Kim, & Xiong, 2019; Arifuddin, Latief, & Suraji, 2020). Such an accident rate may also be related to the large number of construction companies and small-scale building construction that show a significant lack in the level of development and understanding of occupational safety management system (Wibowo, Sukaryawan, Utomo, & Hatmoko, 2020; Olcay, Sakalli, Temur, & Yazici, 2021).

In a study conducted in Turkey analyzing 3,517 occupational accidents from 2012 to 2019, the occurrences in civil construction followed this order: falls from height (41.65%); traffic (11.09%); and machinery (9.04%; Olcay et al., 2021). Studies conducted in Australia, India, Scotland, Turkey, Poland, and Malaysia corroborate this by presenting accidents due to falling from heights as one of the main causes of injuries and deaths in the construction industry in recent years (SAFEWORK, 2019; Naveen Kumar, Jagannatha, & Venkatesha, 2019; Hola A., Hola B., & Szóstak, 2017; Cameron, Hare, & Davies, 2008; Olcay et al., 2021; Ayob, Shaari, Zaki, & Munaaim, 2018). Such studies reinforce that working at height on construction sites is associated with the highest rate of occupational accidents and needs to be properly managed to prevent injuries and deaths (Newaz, Ershadi, Carothers, Jefferies, & Davis, 2022).

According to the study conducted in Turkey, the most common factors causing fall-from-height accidents between 2012 and 2019 are related to falling from roofs and platforms, structural spans, and scaffolding, respectively, 32.42%, 25.32%, and 22.87% of the studied accidents (Olcay et al., 2021). Some causes of such accidents are linked to the misuse of personal protective equipment, lack of fixing floor openings, lack of protective barriers, inadequate work supervision, lack of proper procedures, and lack of safety guidance (Olcay et al., 2021; Wibowo et al., 2020; Zuluaga,

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Preventing Occupational Hearing Loss: 50 Years of Research and Recommendations from the National Institute for Occupational Safety and Health

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ABSTRACT

For more than 50 years, the National Institute for Occupational Safety and Health (NIOSH), part of the United States (U.S.) Centers for Disease Control and Prevention (CDC), has been actively working to reduce the effects of noise and ototoxic chemicals on worker hearing. NIOSH has pioneered basic and applied research on occupational hearing risks and preventive measures. The Institute has issued recommendations and promoted effective interventions through mechanisms ranging from formal criteria documents to blogs and social media. NIOSH has conducted surveillance and published statistics to guide policy and target prevention efforts. Over the past five decades, substantial progress has been made in raising awareness of noise as a hazard, reducing the risk of occupational hearing loss, improving the use of hearing protection, and advancing measurement and control technologies. Nevertheless, noise remains a prevalent workplace hazard and

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The National Institute for Occupational Safety and Health: Occupational Hearing Loss; Guest Editors, Elizabeth A. Masterson, Ph.D., CPH, COHC and William J. Murphy, Ph.D., M.S., M.Eng.

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Workers' Compensation Costs for Occupational Hearing Loss Claims in the United States, 2009–2013

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ABSTRACT

This study estimated the average annual number of U.S. workers' compensation (WC) claims for occupational hearing loss (OHL) and their associated cost and identified the industry/occupation classifications with the highest numbers of OHL claims. The most recent U.S. cost estimate ($242 million) was based on data from one state in 1 year (1991). WC data from the National Council on Compensation Insurance, Inc. (35 states) and two additional individual states were examined, incorporating data from 37 states and the District of Columbia. Costs and numbers of claims were estimated for the 13 missing states to develop estimates for the United States. Sensitivity analyses were also performed to develop ranges for the point estimates. The estimated U.S. average annual OHL claim cost fell within the range of $49 to $67 million during 2009–2013, with a point estimate of $60 million (2013 dollars). The estimated average annual number of OHL claims ranged from 4,114 to 5,986, with a point estimate of 4,965 claims. Based on data available from 36 states and DC, 18 of the 40 industry/occupation classifications with ≥50 OHL claims were in the

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Webinar on Hispanic Worker Outreach

Taiwan ILOSH meetings

勞動部 Ministry of Labor

Study on Reduction of Occupational Injuries in the Construction Industry

Chih-Hong Pan, PhD
Director, Division of Occupational Safety and Health Exhibitions, ILOSH

Chen-Chung Lin, PhD
Director, Division of Occupational Safety, ILOSH

勞動部勞動及職業安全衛生研究所

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Workplace Solutions

https://www.cdc.gov/niosh/docs/wp-solutions/2023-141/default.html

WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

Reducing Workers' Lead Exposure during Water Service Line Removal and Replacement

Introduction

Workers who replace lead water service lines may be exposed to lead pipes and lead-contaminated soil while removing the old water lines and replacing them with lead-free lines. The United States Environmental Protection Agency (EPA) estimates that there are between 6 and 10 million lead water service lines in the United States [EPA 2019]. Lead water service lines may be in the walls of structures or underground [EPA 2022; Lee and Lunney 2021] and may supply water to businesses, schools, childcare facilities, and residential homes. Infrastructure legislation has made funding available to improve municipal water systems and protect public health by replacing lead pipes [White House 2021]. Increased efforts to replace these lines may result in an increased risk of worker exposure to lead-contaminated pipes and soil. This document provides information about occupational lead exposure and recommendations for protecting workers' health during lead pipe replacement.

Lead Exposures during Replacement of Service Water Lines

Workers potentially exposed to lead during replacement of lead water service lines include managers, line supervisors, and field workers who service water utilities (such as from plumbing companies, water utilities, and construction firms). Workers may be exposed to lead if they work in excavated pits, cut and handle lead pipe and equipment, or prepare to pull the lead line or disconnect the service line. Workers may also be exposed to lead-contaminated soil during excavation using heavy equipment such as a backhoe or manual digging using shovels [NIOSH 2021c].

Replacing a lead residential or commercial service water line may involve the following steps [NIOSH 2021c]:

- Excavate soil and create trenches using a backhoe and shovels.
- Use the trenches to find the connections between the main line, the curb stop (shut off valve), and the home or business.
- Shut off water supply to the home or business and disconnect/cut the lead service line. This may generate lead dust [Koh et al. 2015].
- Connect a new copper service line to the old lead line and pull the line through the soil.
- Disconnect and remove the old lead line and reconnect the new copper line to the water main line. Test for leaks. On occasion, a steel cable is threaded through the inside of the lead line and pulled (using the backhoe bucket) to remove the line. The rope is then attached to the steel cable and pulled through. The process is repeated until the line is removed, and a new copper line is in place. A licensed plumbing contractor makes the final connection to the home or business.
- When the line replacement is complete, backfill soil and gravel into each excavation and repair the road surface/curb/sidewalk. This last step may expose workers to lead if the soil is contaminated.

Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

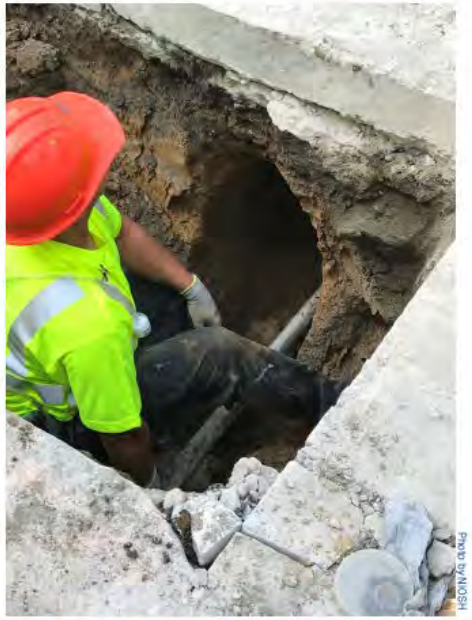

Photo by NIOSH

Figure 1. Photo taken at the HHE site.

Before the NIOSH evaluation, workers underwent BLL testing through their employee health services program. Two workers' blood test results indicated they had elevated BLLs (a BLL ≥ 5 μg/dL, the reference BLL for adults in the United States) [NIOSH 2021b,c]. NIOSH staff performed an exposure assessment among eight workers on two crews that worked 8-hour shifts. NIOSH collected personal air samples from workers and collected wipe samples from some workers' hands and various surfaces (truck cab components, handheld equipment, etc.). Lead was found on workers' hands, inside work gloves, and on surfaces inside trucks and inside the locker room. None of the air sampling results were above the occupational exposure limits for lead (NIOSH REL and OSHA [AL/PEL]). NIOSH also conducted medical interviews and observed work practices. They learned about and observed inadequate hand hygiene practices, improper use of lead removal wipes, and incorrect respirator use. These findings illustrate the significance of minimizing routes of exposures other than inhalation.

Recommendations to Reduce Lead Exposure in Workers

Employers and workers should take the measures outlined below to reduce occupational exposure to lead during water pipe replacement.

Reducing Lead Exposure

The hierarchy of controls states that the most effective ways of controlling a hazard are elimination or substitution (with a less hazardous substance) [NIOSH 2023a]. Although removing lead water pipes eliminates the hazard for future exposures, the process of removing the lead water lines has the potential for lead exposures. Since eliminating or substituting the lead during service line removal is not possible, the next most effective method is controlling the hazard at its source through engineering controls. Worker exposure can also be reduced through administrative controls (e.g., limiting the length of exposure). Lastly, personal protective equipment (PPE) is at the bottom of the hierarchy of controls and is used when a hazard cannot be controlled by other means.

What Employers Can Do

Employers should reduce workers' exposure to lead through the following [NIOSH 2019b, 2021c, 2023b; 29 CFR 1910.132(d)(1); **OSHA lead overview**]:

- Develop a written lead-monitoring and control program, a hazard communication program, and a job-hazard analysis for tasks that may involve exposure to lead.
- Monitor airborne exposures and ensure compliance with the OSHA lead standard.
- Engineering controls:
  - Provide portable high efficiency particulate air (HEPA)-filtered vacuums to clean up vehicles in the field, in addition to regular cleaning of work vehicles.
  - Provide and use tools that produce less dust.
- Work practices:

Training

  - Provide proper training regarding lead hazards and work practices when hiring a new worker. Provide refresher training annually for all workers including maintenance, cleaning staff, and others who may come in contact with lead-contaminated equipment, vehicles, or work areas.
  - Train workers on methods to keep hands clean. For example, wear appropriate disposable gloves (e.g., nitrile) and use a lead-removal soap or wipe, or hand cleaner after working with lead pipes.
  - Train workers on the use of cutting techniques that produce less dust (e.g., using a pipe cutter versus a saw).
  - Train workers on methods and PPE necessary to handle HEPA vacuum filter changeouts and disposal of contaminated vacuum contents.

Fact Sheet

https://www.cdc.gov/niosh/docs/2024-101/default.html

Leave Lead At Work

You can carry lead home from work on your skin, hair, clothes, shoes, and personal items. If this happens, it is called take-home lead and can contaminate your car and home.

Because lead doesn't break down, once it is in your car or home, it can be a source of lead exposure for you, the people who live with you, and your community.

If you are an adult, lead exposure may increase your risk of

high blood pressure

heart disease

kidney disease

infertility (inability to have children)

If you are pregnant, lead exposure may increase the risk of

miscarriage

your baby being born too early

harm to your baby's brain, kidneys, and nervous system

In children, lead exposure may

damage the brain and nervous system

slow growth and development

cause hearing and speech problems

Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

Take Home Lead: What can I do about it?

Before Work

- Remember that anything you take to work can get lead on it. Bring as few personal items as possible to work.
- When possible, bring food and water to work in containers that can be disposed of at work..

At Work

Don't take lead home with you! Keeping lead out of your home and car is easier than cleaning it up. Cleaning up lead is hard and can be expensive.

When you arrive:

- Change into work clothes and shoes that stay at your workplace.
- Store your clean clothes, shoes, and personal items in a dedicated clean locker or in a closed container away from lead.

When you take breaks and lunch:

- Always wash your hands with soap designed to remove lead before you eat, drink, touch your face, or smoke.
- Eat, drink, and smoke only in approved places away from lead dust.
- Never leave your work area without changing your clothes or at least washing your face, hands, and arms.

When you work with lead:

- Always wear required personal protective equipment (PPE) correctly.
- Avoid touching your face and mouth.
- Clean your work area throughout the day.
- Use a high-efficiency particulate air (HEPA) vacuum or wet methods to clean in places that have lead.
- Never dry sweep or use compressed air to clean up dust.
- After working with lead or after cleaning your work area, wash your hands with soap designed to remove lead with proper handwashing techniques as soon as you can.
- Do not remove PPE while in a lead work area. When removing PPE, follow the manufacturer's instructions.

When you are leaving work:

- Don't take home tools, scrap, and packaging that may have lead on them.
- Always shower and wash your hair before leaving work. If you can't shower at work:
  - Wash as much of your skin as you can with soap designed to remove lead before going home.
  - Change clothes and shoes before going home and leave dirty clothes and shoes at work for cleaning.
- If your workplace doesn't clean your work clothes:
  - Store work clothes in a closed plastic bag away from all other clothes.
  - Wash and dry work clothes alone and not with any other clothes.

At Home

- Never wear shoes in your home that you wore at work. Take off work shoes outside the car or home and store them in a closed plastic bag.
- If you can't shower at work, shower as soon as you get home. Do not touch household members or handle household items until after showering.
- Clean your car and your home often. For hard floors and furniture, use wet cleaning methods. For carpets and fabrics, use a vacuum cleaner with a HEPA filter.
- Use dedicated cleaning supplies to clean up lead. Do not use these supplies in the rest of the home. This will keep lead from spreading throughout your home.

At the Healthcare Provider's Office

- Tell your healthcare provider you work with lead. If your work doesn't test your blood for lead, ask your healthcare provider if you should be tested.
- Make sure **everyone in your household** tells their healthcare provider they live with someone who works with lead. Healthcare providers especially need to know if you are pregnant or trying to become pregnant, and if children live or spend time in your household.

NIOSH is the U.S. federal agency that conducts research and makes recommendations to prevent worker injury and illness. NIOSH was established under the Occupational Safety and Health Act of 1970. It is part of the Centers for Disease Control and Prevention in the U.S. Department of Health and Human Services.

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Get More Information

Find NIOSH products and get answers to workplace safety and health questions:

1-800-CDC-INFO (1-800-232-4636) | TTY: 1-888-232-6348
cdc.gov/info | cdc.gov/niosh
NIOSH monthly newsletter: cdc.gov/niosh/eNews

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October 2023

Heat stress training module

https://www.cdc.gov/niosh/mining/works/coversheet2223.html

Keeping Cool: Training to Reduce Heat Stress Incidents

Overview

What Puts You at Risk and How to Reduce that Risk

- Activities 1 & 2
- One Worker's Story
- Physiological Impact

Hot environments can be hazardous! Heat exposure can cause a range of effects on your body, from irritating rashes to heat stroke, which is often fatal.

Photo by ©IPGGutenbergUKLtd/Thinkstock

About

CDC NIOSH

Instructor's Guide

PREVENTION THROUGH DESIGN (PtD)

Series of workshops funded by NIOSH in collaboration with Arizona State University

- (2020-2024) 4th Workshop September, 2023
- Liberty Mutual HQ, Boston, MA

[Prevention through Design | (asu.edu)]

Arizona State University

Article on Jacob's PtD Program

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Civil Engineering

A new behavioural approach for the sustainable design of the built environment

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Global engineering consultancy Jacobs has developed a new behavioural management process for the sustainable design of the built environment. The process changes designer behaviour from focusing purely on technical and legal compliance, to a culture that leaves a lasting positive legacy, to benefit the health and safety of people who will construct or interact with the designs as well as benefitting the environment, climate and sustainability. This paper introduces the process and its associated support tools. It then explains how it was successfully applied on part of the High Speed Two railway project in the UK.

Keywords: design/design for safety/health & safety/prevention through design/sustainable design/UN SDG 3: Good health and well-being/UN SDG 6: Clean water and sanitation/UN SDG 9: Industry, innovation and infrastructure/UN SDG 10: Reduced inequalities/UN SDG 11: Sustainable cities and communities/UN SDG 13: Climate action

1. Introduction

The impact of built-environment design on fatalities, physical injuries, mental health and the environment has been documented in various academic studies:

- 60% of fatal accidents on building sites arise from decisions made before construction commences (EFILWC, 1991)
- a review of the National Institute of Occupational Safety and Health Fatality Assessment Control and Evaluation programme in the USA found that 42% of 224 construction industry fatalities were linked to design issues (Behm, 2005)
- poor design was the cause of 42% of work-related fatalities in Australia from 1997 through 2002 (Mroszczyk, 2014)
- 40% of the root causes of construction errors were related to design involving uncoordinated, incomplete, miscommunicated, unintelligible, late changes or just being incorrect (GIRI, 2018)
- the architecture, engineering and construction industry is responsible for 40% of the total energy use, 32% of carbon dioxide emissions and 25% of the generated waste in Europe on an annual basis (Carvalho *et al.*, 2019)
- people spend 90% of their time in buildings, and a lack of green space and crowded and noisy places are associated with psychological distress and depression (Xiao *et al.*, 2022).

The ability to influence the elimination or reduction of hazards reduces over a built asset's life cycle (Szymberski, 1997). Designers therefore have a significant influence and can either positively or negatively affect people and the environment over an asset's whole life cycle.

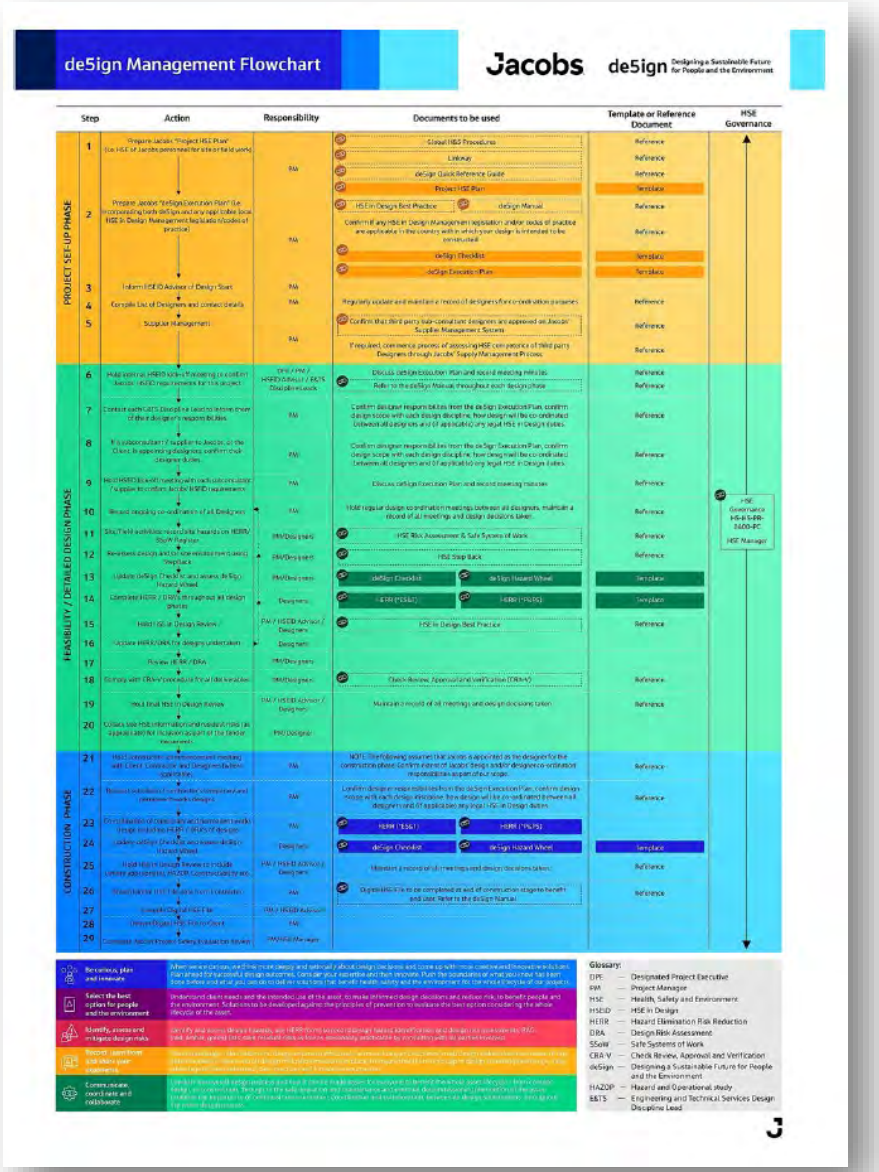
A number of countries have enacted legislation relating to the management of safety during the design process (e.g. countries within the European Union, UK, Singapore, Australia and New Zealand) (EUR-Lex, 2023; ILO, 2023a) or non-statutory guidelines (ASSP, 2021; OSHAD, 2019). This has resulted in various approaches and references, such as prevention through design, design for safety, design for construction safety, construction hazard prevention through design, safety by design, safety in design and safe design (Goh and Chua, 2016).

Research has suggested that a designer's nationality, age, experience, professional background and their organisation's safety culture can all influence their attitude towards designing for construction safety (Öney-Yazıcı and Dulaimi, 2015). The challenge facing the global built environment is the delivery of projects with designers who have either inconsistent (best case) or non-existent (worst case) experience of safety-in-design legislation, codes of practice or guidance.

(*i*) Considering the former, increasingly projects are being delivered through design teams that are based across multiple countries, with inconsistent legislation or non-statutory guidelines for the management of safety during the design process (Che Ibrahim *et al.*, 2022).

(*ii*) Considering the latter, this currently has an effect on the educational system in some countries where design safety education and training is inadequate (Jin *et al.*, 2023). A lack of education and training in combination with an increased risk of liability (i.e. due the absence of legislation) negatively affects the adoption of safety-in-design principles (Wan Azmi and Misnan, 2013).

The inconsistency and variation of mandatory/non-mandatory requirements lead to confusion and missed opportunities for



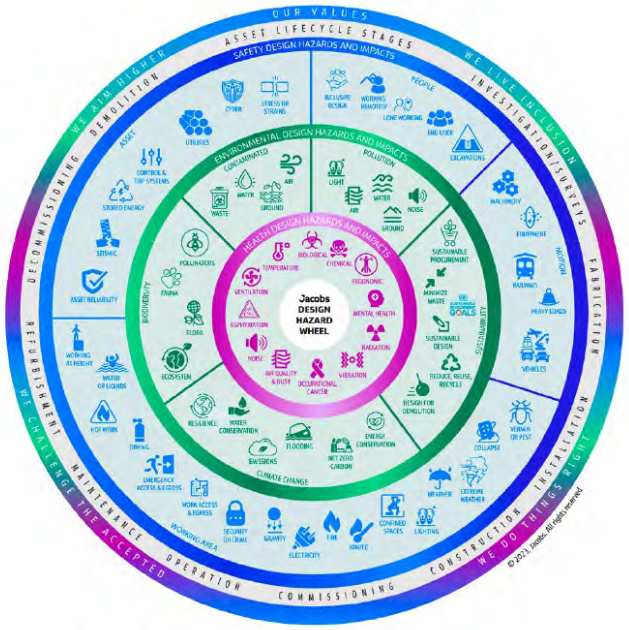


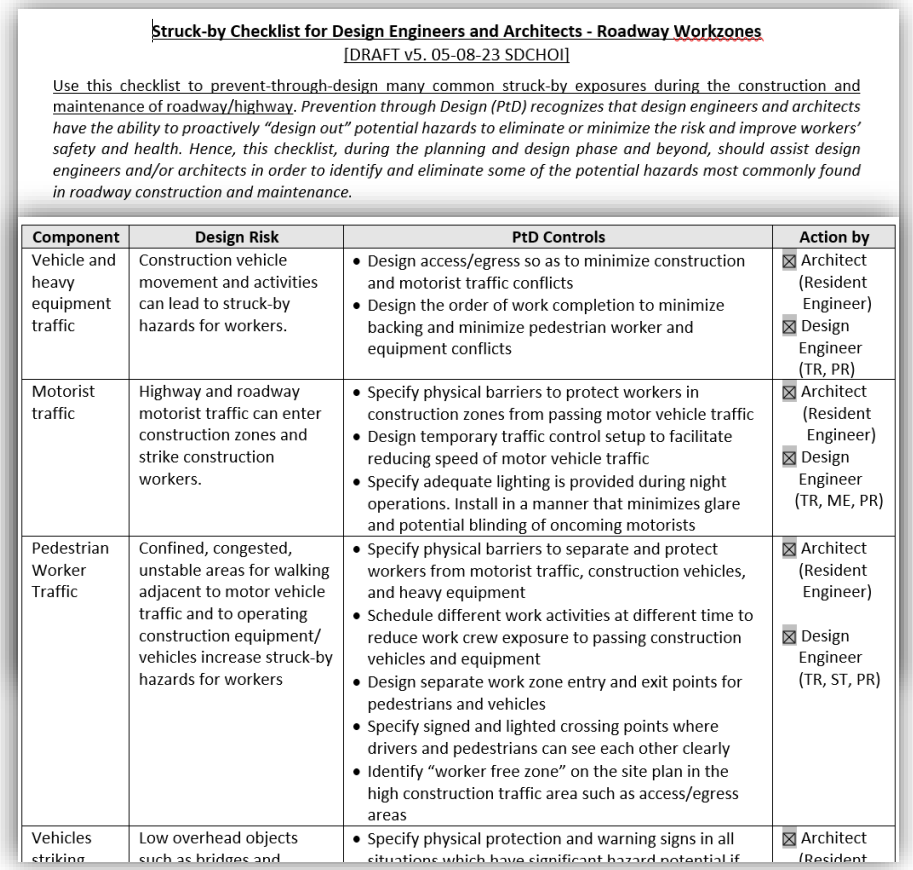
Figure 3. Hazard wheel

PtD Checklists - Interim

NORA Falls & Struck-by Work Groups
https://www.cpwr.com/research/prevention-through-design-resources/

CPWR
THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

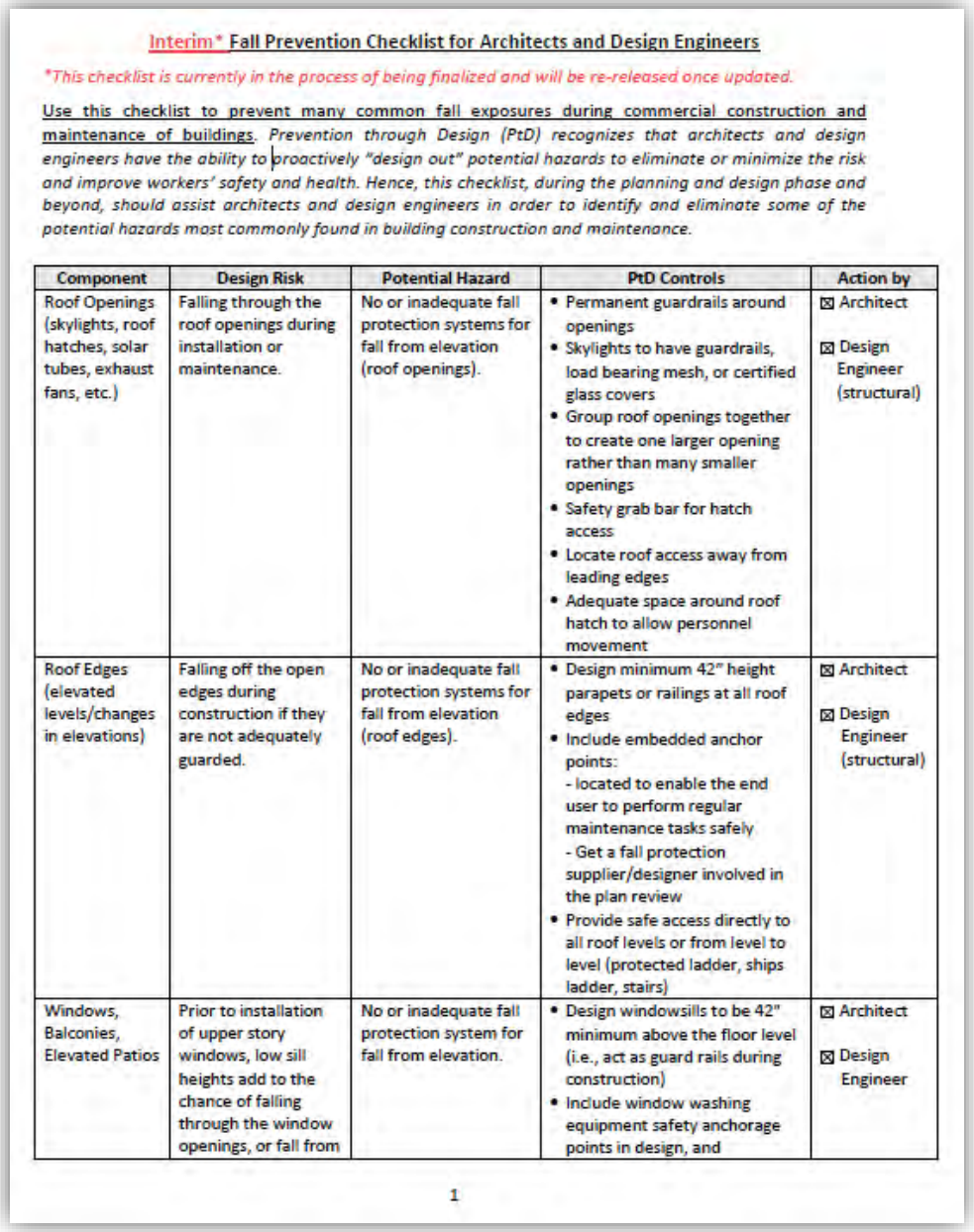
- **Struck-by: Building**
- **Struck-by: Workzone**
- **Residential**



Struck-by Checklist for Design Engineers and Architects - Roadway Workzones
[DRAFT v5. 05-08-23 SDCHOI]

Use this checklist to prevent-through-design many common struck-by exposures during the construction and maintenance of roadway/highway. *Prevention through Design (PtD) recognizes that design engineers and architects have the ability to proactively "design out" potential hazards to eliminate or minimize the risk and improve workers' safety and health. Hence, this checklist, during the planning and design phase and beyond, should assist design engineers and/or architects in order to identify and eliminate some of the potential hazards most commonly found in roadway construction and maintenance.*

Component	Design Risk	PtD Controls	Action by
Vehicle and heavy equipment traffic	Construction vehicle movement and activities can lead to struck-by hazards for workers.	• Design access/egress so as to minimize construction and motorist traffic conflicts • Design the order of work completion to minimize backing and minimize pedestrian worker and equipment conflicts	☒ Architect (Resident Engineer) ☒ Design Engineer (TR, PR)
Motorist traffic	Highway and roadway motorist traffic can enter construction zones and strike construction workers.	• Specify physical barriers to protect workers in construction zones from passing motor vehicle traffic • Design temporary traffic control setup to facilitate reducing speed of motor vehicle traffic • Specify adequate lighting is provided during night operations. Install in a manner that minimizes glare and potential blinding of oncoming motorists	☒ Architect (Resident Engineer) ☒ Design Engineer (TR, ME, PR)
Pedestrian Worker Traffic	Confined, congested, unstable areas for walking adjacent to motor vehicle traffic and to operating construction equipment/ vehicles increase struck-by hazards for workers	• Specify physical barriers to separate and protect workers from motorist traffic, construction vehicles, and heavy equipment • Schedule different work activities at different time to reduce work crew exposure to passing construction vehicles and equipment • Design separate work zone entry and exit points for pedestrians and vehicles • Specify signed and lighted crossing points where drivers and pedestrians can see each other clearly • Identify "worker free zone" on the site plan in the high construction traffic area such as access/egress areas	☒ Architect (Resident Engineer) ☒ Design Engineer (TR, ST, PR)
Vehicles striking	Low overhead objects such as bridges and	• Specify physical protection and warning signs in all situations which have significant hazard potential if	☒ Architect (Resident



Interim* Fall Prevention Checklist for Architects and Design Engineers

**This checklist is currently in the process of being finalized and will be re-released once updated.*

Use this checklist to prevent many common fall exposures during commercial construction and maintenance of buildings. *Prevention through Design (PtD) recognizes that architects and design engineers have the ability to proactively "design out" potential hazards to eliminate or minimize the risk and improve workers' safety and health. Hence, this checklist, during the planning and design phase and beyond, should assist architects and design engineers in order to identify and eliminate some of the potential hazards most commonly found in building construction and maintenance.*

Component	Design Risk	Potential Hazard	PtD Controls	Action by
Roof Openings (skylights, roof hatches, solar tubes, exhaust fans, etc.)	Falling through the roof openings during installation or maintenance.	No or inadequate fall protection systems for fall from elevation (roof openings).	• Permanent guardrails around openings • Skylights to have guardrails, load bearing mesh, or certified glass covers • Group roof openings together to create one larger opening rather than many smaller openings • Safety grab bar for hatch access • Locate roof access away from leading edges • Adequate space around roof hatch to allow personnel movement	☒ Architect ☒ Design Engineer (structural)
Roof Edges (elevated levels/changes in elevations)	Falling off the open edges during construction if they are not adequately guarded.	No or inadequate fall protection systems for fall from elevation (roof edges).	• Design minimum 42" height parapets or railings at all roof edges • Include embedded anchor points: - located to enable the end user to perform regular maintenance tasks safely - Get a fall protection supplier/designer involved in the plan review • Provide safe access directly to all roof levels or from level to level (protected ladder, ships ladder, stairs)	☒ Architect ☒ Design Engineer (structural)
Windows, Balconies, Elevated Patios	Prior to installation of upper story windows, low sill heights add to the chance of falling through the window openings, or fall from	No or inadequate fall protection system for fall from elevation.	• Design windowsills to be 42" minimum above the floor level (i.e., act as guard rails during construction) • Include window washing equipment safety anchorage points in design, and	☒ Architect ☒ Design Engineer

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Promoting productive workplaces through safety and health research NIOSH

NIOSH and Partners Announce Winner of the 2023 Prevention through Design Award

Print

NIOSH UPDATE: OCTOBER 23, 2023

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Today, the third annual Prevention through Design (PtD) Award was presented to the Port of Portland, the port authority responsible for overseeing the Portland International Airport and operating other transportation infrastructure in Portland, Oregon, for their outstanding leadership in reducing workplace hazards through design methods. The award ceremony was a collaborative effort of the National Institute for Occupational Safety and Health (NIOSH), the American Society of Safety Professionals (ASSP) and the National Safety Council (NSC).

Championing worker safety and health can be addressed in many ways. One innovative and long-term solution is by assessing the workplace environment and "designing out" hazards. According to the hierarchy of controls, the elimination of a workplace hazard is the most effective way to protect workers. The annual PtD Award highlights real world success in PtD efforts to protect workers. Through this award partners recognize leaders and encourage further use of PtD methods.

Questions?

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https://www.cdc.gov/niosh/construction/

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