

Trenching Injuries, Citations and Penalties in Construction

Thomas Yohannes, MPH, William Harris, MS, Jacob Hooper¹, Amber Brooke Trueblood, DrPH²

OVERVIEW

Trenching and excavation activities expose workers to [multiple hazards](#), such as cave-ins, inhalation exposures, and struck-by and/or caught-in between injuries. Despite [trench collapses being preventable](#) through planning, engineering controls, safety equipment, and safe work practices, the Occupational Safety and Health Administration (OSHA) reported [39 workers across all industries died](#) while performing trench or excavation work in 2022 compared to [15 in 2021](#).³ Additionally, [more than 80%](#) of all trenching fatalities from 2003 to 2017 occurred in construction, highlighting the need to protect the industry's workers from these hazards.

This Data Bulletin examines *trenching injuries* in construction and in all industries by *nature of injury*, demographics (age and ethnicity), and *time of day*. It also analyzes injuries where the *primary source* of injury was trenches, ditches, or excavations, and explores OSHA *citations and penalties* for violating OSHA CFR 1926 Subpart P- Excavations (*trenching standard*).

Fatal injury estimates for private industry were obtained from the U.S. Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI) public tool.⁴ Estimates for nonfatal injuries resulting in *days away from work (DAFW)* among *private, wage-and-salary* workers were from the BLS Survey of Occupational Injuries and Illnesses (SOII) public tool, based on employer logs. Nonfatal injury data are shown for two-year periods due to SOII changing from annual to biennial estimates in 2021. *Full-time equivalent workers (FTEs)* for *rate* calculations were obtained using the BLS Current Population Survey (CPS), compiled monthly and downloaded through IPUMS. Fatal injury rates were calculated per 100,000 FTEs, while nonfatal injury rates were calculated per 10,000 FTEs. Citation and penalty estimates were obtained from OSHA Enforcement Data.



THIS ISSUE

This issue examines 1) trenching injuries in construction and all industries by nature of injury, demographics, and time of day; 2) injuries where the primary source of injury was trenches, ditches, or excavations and 3) OSHA citations and penalties for violation of the federal trenching standard.

KEY FINDINGS

The construction industry in the United States accounted for 85% of fatal trenching injuries from 2011 to 2021 and 90% of nonfatal injuries from 2011 to 2022.

Charts 1 and 4

Over a third of fatal trenching injuries in 2022 were among Hispanic workers.

Chart 2

Nonfatal injuries with a trench source decreased 18% in construction from 2011-2012 to 2021-2022.

Chart 8

In 2023, violation of a trenching standard comprised of 4% of citations and 9% of penalties in construction.

Charts 9 and 11

From 2011 to 2023, 52% of citations for violating a trenching standard in construction were issued to companies in the Heavy and Civil Engineering Construction (NAICS 237) subsector.

Chart 10

NEXT DATA BULLETIN

Fatal Injury Trends in Construction

¹ Texas A&M University School of Public Health.

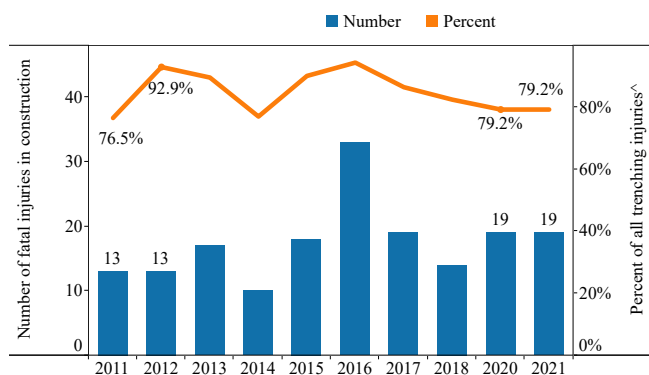
² Correspondence to: datacenter@cpwr.com.

³ OSHA data is specific to employers who are required to report under [OSHA jurisdiction](#).

⁴ CFOI data for construction trenching injuries is not available for 2019 or 2022.

Fatal trenching injuries (those with event/exposures classified as excavation or trenching cave-ins) were first examined (chart 1). From 2011 to 2021, the number of fatal trenching injuries in construction increased 46.2% (13 to 19).⁴ During this period, construction accounted for 85.4% of all fatal trenching injuries, with an annual average fatality rate of 0.18 per 100,000 FTEs (rate data not shown). The largest number of trenching fatalities was 33 in 2016. For the most recent year in which construction-specific data is available (2021), there were 19 fatal trenching with a rate of 0.18 per 100,000 FTEs. While CFOI does not provide construction trenching data in 2022, there were 40 fatal injuries reported for all industries, a 66.7% increase from 2021 (n=25; data not shown).

1. Fatal trenching injuries, 2011-2018, 2020-2021*, construction versus all industries



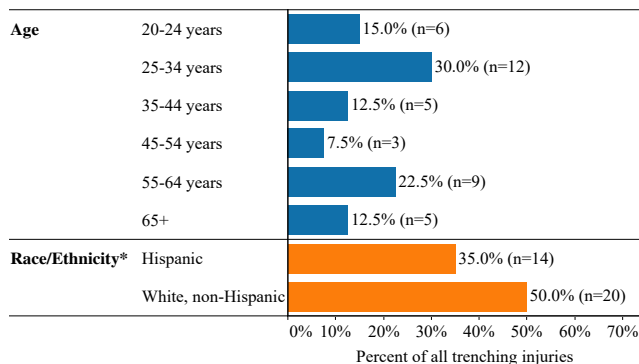
Source: U.S. Bureau of Labor Statistics, 2011-2022 Census of Fatal Occupational Injuries.

*Data for 2019 and 2022 in construction are missing.

[^]Calculated as Number of trenching injuries in construction / Number of trenching injuries in all industries.

The number of fatal trenching injuries in all industries in 2022 were analyzed by age and race/ethnicity (chart 2). In 2022, the largest percentage of injuries occurred among workers who were 25 to 34 years old (30.0%, n=12) and white, non-Hispanic (50.0%, n=20). [In comparison](#), 5.9% of fatal injuries occurred among workers 25 to 34 years old and 57.7% occurred among white, non-Hispanic workers.

2. Fatal trenching injuries by selected demographic, 2022, all industries

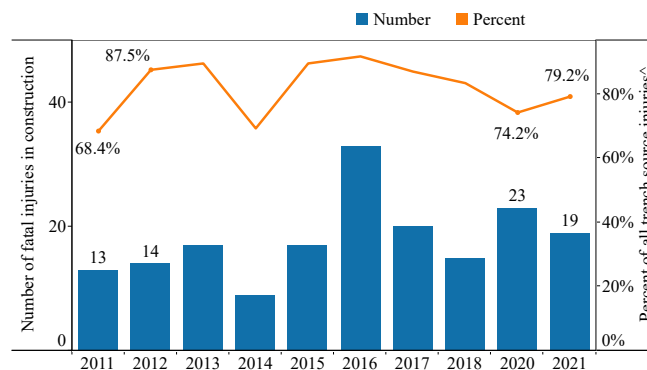


Source: U.S. Bureau of Labor Statistics, 2022 Census of Fatal Occupational Injuries.

*Due to missing data, injuries for category may not sum to total (40).

Fatal injuries where the primary source (e.g., factor responsible for the injury) was trenches, ditches, or excavations (*trench source*) were examined (chart 3). From 2011 to 2018, in construction, there were an average of 17 fatal injuries annually, with a high of 33 in 2016. From 2020 to 2021, fatal injuries decreased 17.4% (23 to 19). In 2021, 79.2% (n=19) of trench source fatal injuries were in construction, compared to 68.4% (n=13) in 2011.

3. Fatal injuries with a trench source, 2011-2018, 2020-2021*, construction versus all industries



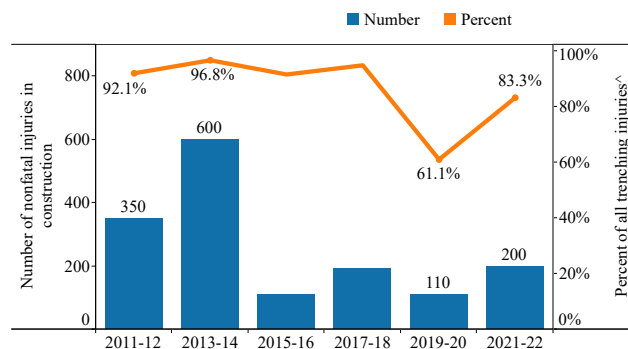
Source: U.S. Bureau of Labor Statistics, 2011-2022 Census of Fatal Occupational Injuries.

*Data for 2019 and 2022 in construction are missing.

[^]Calculated as Number of trench source injuries in construction / Number of all trench source injuries.

An examination of nonfatal trenching injuries from 2021-2022 (chart 4) found that compared to 2011-2012, the number of injuries in construction decreased 42.9% (350 to 200), while the rate decreased 57.1% (0.28 to 0.12 per 10,000 FTEs; rate data not shown). Almost 90% (89.7%) of nonfatal trenching injuries over this period occurred in construction. There was a peak from 2013-2014 with 600 injuries. Since then there have been 220 or fewer injuries for each two-year period. From 2021-2022, there were 200 nonfatal trenching injuries with a rate of 0.12 per 10,000 FTEs.

4. Nonfatal trenching injuries, 2011-2022*, construction versus all industries



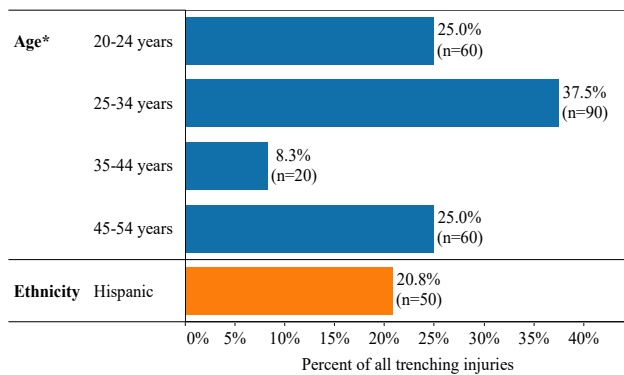
Source: U.S. Bureau of Labor Statistics, 2011-2022 Survey of Occupational Injuries and Illnesses.

*Sum is shown for each two-year period to produce comparable statistics following BLS data change to biennial estimates for 2021-2022.

[^]Calculated as Number of trenching injuries in construction / Number of trenching injuries in all industries.

Nonfatal trenching injuries by age and ethnicity were then analyzed (chart 5). During 2021-2022, workers aged 25 to 34 years old were the most likely to suffer a nonfatal trenching injury, accounting for 37.5% (n=90) of injuries, while Hispanic workers accounted for 20.8% (n=50) of nonfatal injuries. Both figures were higher than for all nonfatal injuries: 21.9% of them occurred among workers aged 25 to 34 years old and 13.0% among Hispanic or Latino workers.

5. Nonfatal trenching injuries by selected demographics, sum of 2021-2022, all industries

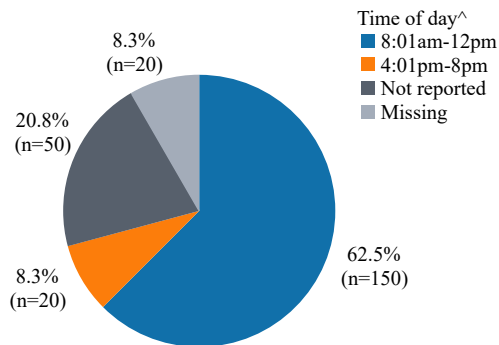


Source: U.S. Bureau of Labor Statistics, 2021-2022 Survey of Occupational Injuries and Illnesses.

*Due to missing data, injuries for category may not sum to total (240).

From 2021-2022, a majority (62.5%; n=150) of nonfatal trenching injuries in all private industries occurred from 8:01am to 12pm, while 8.3% (n=20) occurred from 4:01pm to 8pm, and 20.8% (n=50) of nonfatal trenching injuries had no reported time of incident (chart 6). In comparison, for all nonfatal injuries in private industry, 21.5% of injuries occurred from 8:01am to 12pm, 8.3% occurred from 4:01pm to 8pm, and 38.4% did not have time reported (data not shown).

6. Nonfatal trenching injuries by time of day, sum of 2021-2022, all industries*



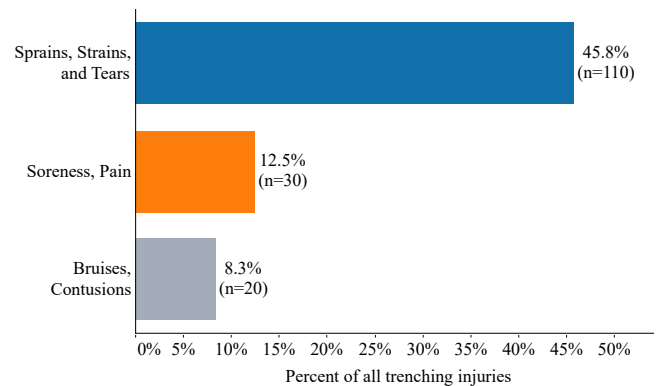
Source: U.S. Bureau of Labor Statistics, 2021-2022 Survey of Occupational Injuries and Illnesses.

* Data may not sum to 100% due to rounding.

^ Data not available for 12:01pm- 4:00pm.

The reported nature of injury for almost half (45.8%; n=110) of nonfatal trenching injuries from 2021-2022 were sprains, strains, and tears (chart 7). The next top reported nature of injuries reported were soreness, pain (12.5%; n=30) and bruises, contusions (8.3%; n=20).

7. Nonfatal trenching injuries by nature of injury*, sum of 2021-2022, all industries

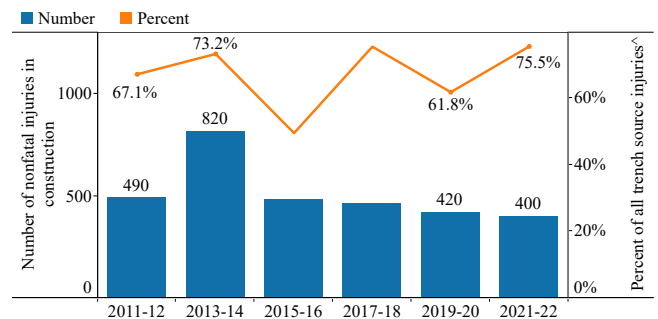


Source: U.S. Bureau of Labor Statistics, 2021-2022 Survey of Occupational Injuries and Illnesses.

*Injuries shown do not sum to total (240).

Nonfatal injuries with a trench source were examined from 2011 to 2022 (Chart 8). From 2011 to 2022, there were 3,070 nonfatal trench source injuries in construction. On average there were 512 trench source nonfatal injuries in construction per two-year period, which accounted for 67% of all trench source injuries. There was a peak from 2013 to 2014 with 820 trench source nonfatal injuries. Most recently, from 2021 to 2022, there were 400 nonfatal trench source injuries in construction, accounting for 75.5% of all trench source injuries.

8. Nonfatal injuries with a trench source, 2011-2022*, construction versus all industries



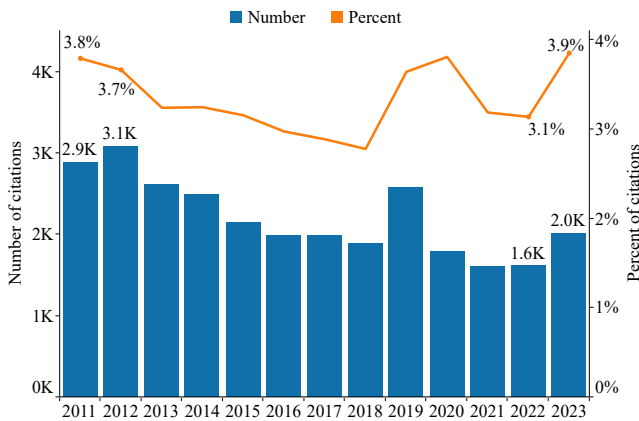
Source: U.S. Bureau of Labor Statistics, 2011-2022 Survey of Occupational Injuries and Illnesses.

*Sum is shown for each two-year period to produce comparable statistics following BLS data change to biennial estimates for 2021-2022.

^ Calculated as Number of trench source injuries in construction / Number of all trench source injuries.

OSHA citations and penalties were then analyzed for violations of trenching standards. On average, there were 2.2 thousand (K) trenching citations issued annually from 2011 to 2023, accounting for 2.8% to 3.9% of all citations issued in the construction industry (chart 9). Following the launch of [OSHA’s National Emphasis Program on Trenching and Excavation](#) in 2018, trenching citations increased 36.8% in 2019 (1.9K to 2.6K). In 2023, there were 2.0K trenching citations issued, 3.9% of all citations issued.

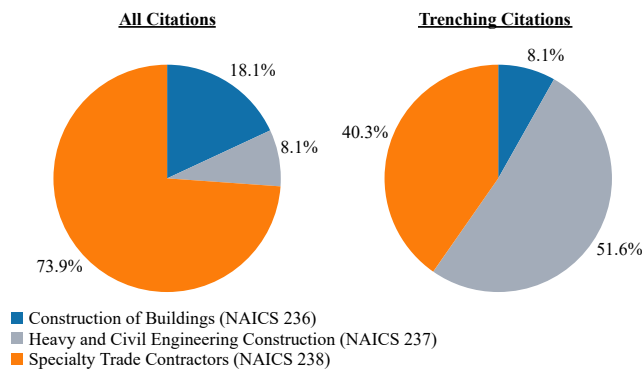
9. Number and percent of OSHA trenching citations in construction, 2011-2023



Source: 2011-2023 Department of Labor OSHA Enforcement Data.

Over half (51.6%) of trenching citations from 2011 to 2023 were issued to companies in Heavy and Civil Engineering Construction (NAICS 237; chart 10), while only 8.1% of all construction citations during this period were issued to firms in this category. Specialty Trade Contractors (NAICS 238) accounted for 40.3% of trenching citations, but over 70% of all citations.

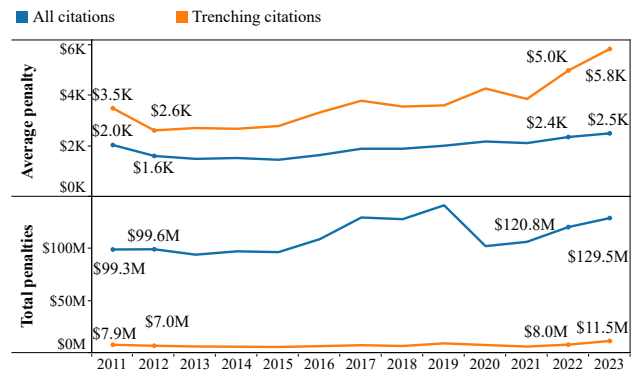
10. Citations by major subsector in construction, all versus trenching citations, 2011-2023



Source: 2011-2023 Department of Labor OSHA Enforcement Data.

In 2023, the penalties OSHA issued in construction totaled \$129.5 million (M), of which 8.9% were for trenching violations (\$11.5M; chart 11). From 2011 to 2023, total penalties increased 30.4% (\$99.3M to \$129.5M), while penalties for trenching standard violations increased 45.6% (\$7.9M to \$11.5M). The average penalty for all citations in 2023 was \$2.5K, while the average penalty for a trenching violation was \$5.8K. From 2011 to 2023, the average penalty increased 25.0% (\$2.0K to \$2.5K) for all citations and 65.7% (\$3.5K to \$5.8K) for trenching.

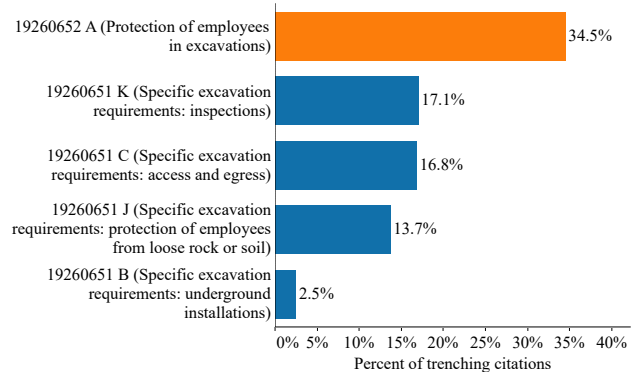
11. Average penalty per OSHA citation and total penalties in construction, all versus trenching citations, 2011-2023 (December 2018 dollars)



Source: 2011-2023 Department of Labor OSHA Enforcement Data.

Specific trenching standards cited were then examined (chart 12). Citations for Protections of employees in excavations (1926.652 A) accounted for 34.5% of all trenching citations from 2011 to 2023. The next two cited standards each accounted for 17% of trenching citations: 17.1% Specific excavation requirements; Inspections (1926.651 K) and 16.8% Specific excavation requirements access and egress (1926.651 C).

12. Top 5 cited trenching standards in construction, 2011-2023



Source: 2011-2023 Department of Labor OSHA Enforcement Data.

Trenching and excavation are among the most dangerous activities in construction, an industry that continues to be one of the most hazardous in the United States. With construction workers experiencing approximately [1,000 fatal and 70,000 nonfatal injuries annually since 2016](#), monitoring these trends and enforcing safety requirements at trenching and excavation sites is crucial.

An overwhelming majority of trenching and excavation injuries in the United States occurred among construction workers, accounting for 85% of fatal trenching injuries from 2011-2021 and 90% of nonfatal trenching injuries from 2011-2022. We found that nearly 4% of all OSHA construction citations were for trenching, with over half of those occurring in Heavy and Civil Engineering Construction in 2023.

Injuries and fatalities from trench collapses are preventable through planning, engineering controls, proper use of safety equipment, and safe work practices. In 2018, [OSHA identified trenching and excavation hazard reduction as a priority goal](#) as trenching cave-ins are preventable. Trenches should be [shielded, shored, or sloped](#), and employees should always be aware of escape routes.

[Planning](#) before the job can also prevent trench collapses by discussing work steps, available controls, and work hazards. CPWR has a number of [free planning resources](#) for contractors including a new [Pre-Task Planning \(PTP\) Assessment Checklist](#) to help contractors assess and improve upon their PTP process.

The [9th annual Trench Safety Stand Down](#) event, from June 17 to June 24, 2024, focuses on protecting workers from trenching and excavation hazards. [CPWR](#), [NIOSH](#), and [OSHA](#) have resources available to promote safe work in trenches.

ACCESS THE CHARTS & MORE

View the [charts](#) in PowerPoint and the [data](#) underlying the charts in Excel. Downloading will start when you click on each link. These files can also be found under the Data Bulletin at: <https://www.cpwr.com/research/data-center/data-reports/>. See our updated [Construction Fatality Map](#) and [Severe Injury dashboards](#).

DEFINITIONS

- **Citation** – violation of any OSHA standard resulting from an inspection in the construction industry (NAICS 23).
- **Days away from work (DAFW)** – nonfatal injury cases resulting in at least one day away from work beyond the day of injury or illness onset. A full definition with an example can be found in the [Survey of Occupational Injuries and Illnesses Handbook of Methods](#).
- **Event or exposure** – the manner in which the injury or illness was produced or inflicted, such as fall, heat-related illness, etc. Full definitions and examples for categories

can be found in the [Occupational Injury and Illness Classification Manual](#).

- **Trenching injury** – Fatal or nonfatal injury where event or exposure was trenching or excavation cave-in.
- **Full-time equivalent workers (FTEs)** – determined by the hours worked per employee on a full-time basis, defined as working 2,000 hours (40 hours x 50 weeks) per year.
- **Nature of injury** – physical characteristics of the work-related injury or illness. Full definitions and examples of categories can be found in the [Occupational Injury and Illness Classification Manual](#).
- **Penalty** – current penalty assessed for a citation, adjusted for inflation to December 2018 dollars.
- **Primary source** – the objects, substances, equipment, and other factors that were responsible for the injury or illness incurred by the worker. For example, a worker who was climbing up a ladder when they slipped and fell would have a reported primary source of, “Ladders.” Full definitions of primary source categories can be found in the [Occupational Injury and Illness Classification Manual](#).
 - **Trench source** – primary source 611 ditches, channels, trenches, and excavations which includes confined spaces that are open vertically but confined on the sides.
- **Rates** – calculated by dividing the count of injuries by the number of full-time equivalents for the time period then multiplying by 100,000 for fatal and 10,000 for nonfatal injuries. When multiple years are reported the injuries and populations were summed first.
- **Time of day** – the time that an injury took place expressed to the current minute.
- **Trenching standard** – all standards under OSHA CFR 1926 Subpart P- Excavations.
- **Wage-and-salary** – workers who receive wages, salaries, commissions, tips, or pay from their employer.
 - **Private** – workers who work for individuals or private companies.

DATA SOURCES

Sarah Flood, Miriam King, Renae Rodgers, Steven Ruggles, J. Robert Warren, and Michael Westberry. Integrated Public Use Microdata Series, 2011-2021 Current Population Survey: Version 9.0 [dataset]. Minneapolis, MN: IPUMS, 2022. <https://doi.org/10.18128/D030.V9.0>.

U.S. Bureau of Labor Statistics (BLS), 2011-2022 Census of Fatal Occupational Injuries (CFOI) Public and Restricted Use Data. <https://www.bls.gov/iif/>.

U.S. Bureau of Labor Statistics (BLS), 2011-2022 Survey of Occupational Injuries and Illnesses (SOII). <https://www.bls.gov/iif/>.

U.S. Department of Labor, OSHA Enforcement Data, 2011-2023. https://enforcedata.dol.gov/views/data_catalogs.php.

REFERENCES

CPWR—The Center for Construction Research and Training. [2023]. Fatal and Nonfatal Injuries in Construction. <https://www.cpwr.com/research/data-center/data-dashboards/fatal-and-nonfatal-injuries-in-construction/>.

CPWR—The Center for Construction Research and Training. [n.d.]. Trenches. <https://www.cpwr.com/wp-content/uploads/publications/TrenchingPDFforweb.pdf>.

CPWR—The Center for Construction Research and Training. [n.d.]. Trench Safety. <https://www.cpwr.com/research/research-to-practice-r2p/r2p-library/other-resources-for-stakeholders/trench-safety/>.

Echt, A., Earnest, S., Garza, E. [2019]. NIOSH Science Blog - Preventing Trenching Fatalities. <https://blogs.cdc.gov/niosh-science-blog/2019/06/06/trenching/>.

Hedmond, Shade. [2018]. Construction Junkie. OSHA Identifies Trenching and Excavation Hazard Reduction as Priority Goal for 2018. <https://www.constructionjunkie.com/blog/2018/3/12/osha-identifies-trenching-and-excavation-hazard-reduction-as-priority-goal-for-2018>.

National Utility Contractors Association. [n.d.] Trench Safety Stand Down. <https://www.nuca.com/tssd>.

National Institute for Occupational Safety and Health [2022]. Trenching and Excavation. <https://www.cdc.gov/niosh/topics/trenching/default.html>.

Occupational Safety and Health Administration. [n.d.]. National Emphasis Program on Trenching and Excavation. https://www.osha.gov/sites/default/files/enforcement/directives/CPL-02-00-161_0.pdf.

Occupational Safety and Health Administration. [n.d.]. Report a Fatality or Severe Injury. <https://www.osha.gov/report>.

Occupational Safety and Health Administration. [2015]. Trenching and Excavation Safety. <https://www.osha.gov/sites/default/files/publications/osha2226.pdf>.

U.S. Bureau of Labor Statistics. [2012]. Occupational Injury and Illness Classification Manual Version 2.01. <https://www.cdc.gov/Wisards/oiiocs/Doc/OIICS%20Manual%202012%20v201.pdf>.

U.S. Bureau of Labor Statistics. [2023]. R71. Selected worker characteristics by number of days by case type (Number). <https://www.bls.gov/iif/nonfatal-injuries-and-illnesses-tables/case-and-demographic-characteristics-table-r71-2021-2022.xlsx>.

U.S. Bureau of Labor Statistics. [2023]. Survey of Occupational Injuries and Illnesses Handbook of Methods. <https://www.bls.gov/opub/hom/soii/pdf/soii.pdf>.

U.S. Bureau of Labor Statistics. [2023]. Table 1. Fatal Occupational Injuries by Selected Demographic Characteristics, 2018-22. <https://www.bls.gov/news.release/cfoi.t01.htm>.

U.S. Department of Labor [2022]. OSHA National News Release - Alarming rise in trench-related fatalities spurs US Department of Labor to announce enhanced nationwide enforcement, additional oversight. <https://www.osha.gov/news/newsreleases/national/07142022>.

U.S. Department of Labor [2023]. OSHA News Release – Region 7 – Investigators find Cheney contractor exposed employees to potentially fatal hazards as two workers avoid tragedy in Salina trench collapse. <https://www.osha.gov/news/newsreleases/region7/07102023>.

ABOUT THE CPWR DATA CENTER

The CPWR Data Center is part of CPWR—The Center for Construction Research and Training. CPWR is a 501(c)(3) nonprofit research and training institution created by NABTU, and serves as its research arm. CPWR has focused on construction safety and health research since 1990. The Data Bulletin, a series of publications analyzing construction-related data, is part of our ongoing surveillance project funded by the National Institute for Occupational Safety and Health (NIOSH).

Besides cpwr.com, visit CPWR's other online resources to help reduce construction safety and health hazards:

- Choose Hand Safety
<https://choosehandsafety.org/>
- Construction Safety and Health Network
<https://safeconstructionnetwork.org/>
- Construction Solutions
<https://www.cpwrconstructionsolutions.org/>
- Construction Solutions ROI Calculator
<https://www.safecalc.org/>
- COVID-19 Construction Clearinghouse
<https://covid.elcosh.org/index.php>
- COVID-19 Exposure Control Planning Tool
<https://www.covidecpwr.org>
- Electronic Library of Construction Occupational Safety and Health
<https://www.elcosh.org/index.php>
- eLCOSH Nano
<https://nano.elcosh.org/>
- Exposure Control Database
<https://ecd.cpwrconstructionsolutions.org/>
- Nano Safety Data Sheet Improvement Tool
<https://nanosds.elcosh.org/>
- Safety Climate - Safety Management Information System (SC-SMIS)
www.scsmis.com
- Stop Construction Falls
<https://stopconstructionfalls.com/>
- Work Safely with Silica
<https://www.silica-safe.org/>

©2024, CPWR—The Center for Construction Research and Training. All rights reserved.

CPWR is the research and training arm of NABTU. Production of this document was supported by cooperative agreement OH 009762 from the National Institute for Occupational Safety and Health (NIOSH). The contents are solely the responsibility of the authors and do not necessarily represent the official views of NIOSH.