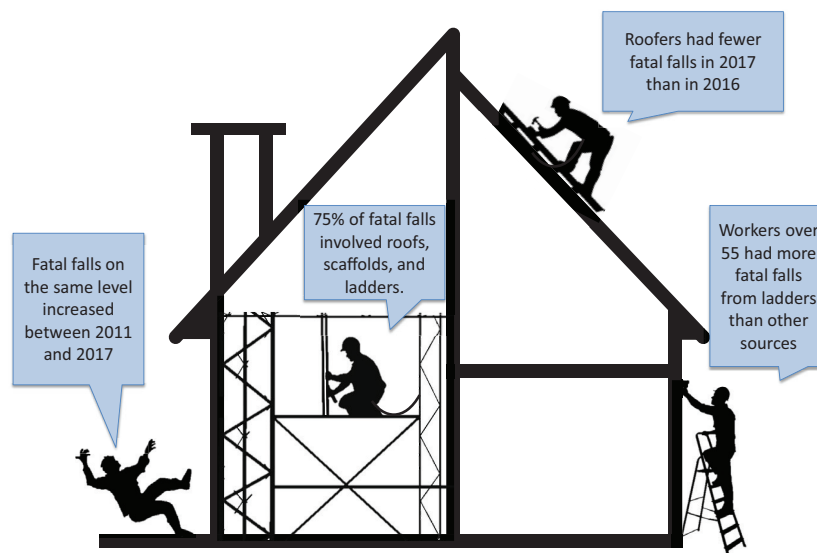


## Trends of Fall Injuries and Prevention in the Construction Industry

Xiuwen Sue Dong, DrPH\*<sup>1</sup>, Rebecca Jackson, MPH<sup>1</sup>, Danielle Varda, PhD<sup>2</sup>, Eileen Betit<sup>1</sup>, Jessica Bunting, MPH<sup>1</sup>

Falls are a common cause of fatal and nonfatal injuries in the construction industry. To prevent these injuries, the National Occupational Research Agenda (NORA) Construction Sector Council, CPWR – The Center for Construction Research and Training, the National Institute for Occupational Safety and Health (NIOSH), and the Occupational Safety and Health Administration (OSHA) launched the National Campaign to Prevent Falls in Construction (hereafter referred to as the Campaign) on Workers’ Memorial Day in 2012. This ongoing Campaign has reached more and more organizations and individuals. To continue to support this national effort, this Quarterly Data Report provides updated data on the characteristics of fatal and nonfatal falls among construction workers using data from the U.S. Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI) and the Survey of Occupational Injuries and Illnesses (SOII). While the report covers data back to year 2003, the main analysis focuses on the data between 2011 and 2017. For some estimates, several years of data were pooled together to increase data reliability. In addition, selected findings from a social network analysis of the Campaign are also included in this report.



### KEY FINDINGS

- In 2017, 367 construction workers died from falls to a lower level, accounting for over half of the total occupational fall fatalities to a lower level in all industries.
- Small employers with fewer than 20 employees accounted for 75% of fatal falls between 2015 and 2017, despite making up only 39% of construction payroll employment.
- Roofers had the highest risk of fatal falls, with 35.9 deaths per 100,000 FTEs, more than 10 times the rate of all construction occupations combined. However, both the number and rate dropped in 2017.
- The rate of fatal falls among construction laborers decreased by 25% from 5.6 per 100,000 FTEs in 2011 to 4.2 per 100,000 FTEs in 2017.
- Partners in the Campaign to Prevent Falls in Construction from diverse organizations reported reaching between 36 and 2.5 million individuals annually since they began participating.

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1. CPWR-The Center for Construction Research and Training.

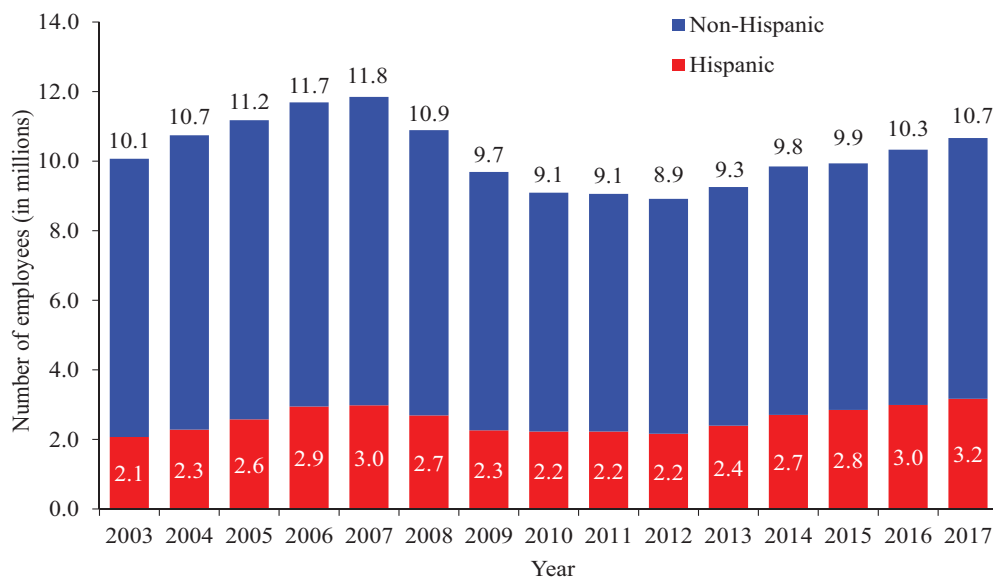
2. The School of Public Affairs at the University of Colorado Denver.

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## SECTION 1: Trends of Fatal Falls in the Construction Industry

In 2017, construction employment in the U.S. reached 10.7 million workers, a 20% increase from the low in 2012 (8.9 million workers), marking the fifth consecutive year of employment growth after the Great Recession (chart 1). Even though overall construction employment is still lower than the pre-recession level, the number of Hispanic construction workers reached 3.2 million in 2017, surpassing its peak pre-recession level of 3 million in 2007. Hispanic employment experienced more recession-associated volatility than the overall construction workforce. In 2017, 30% of construction workers identified themselves as Hispanic.

1. Construction employment in the United States, 2003-2017 (All employment)



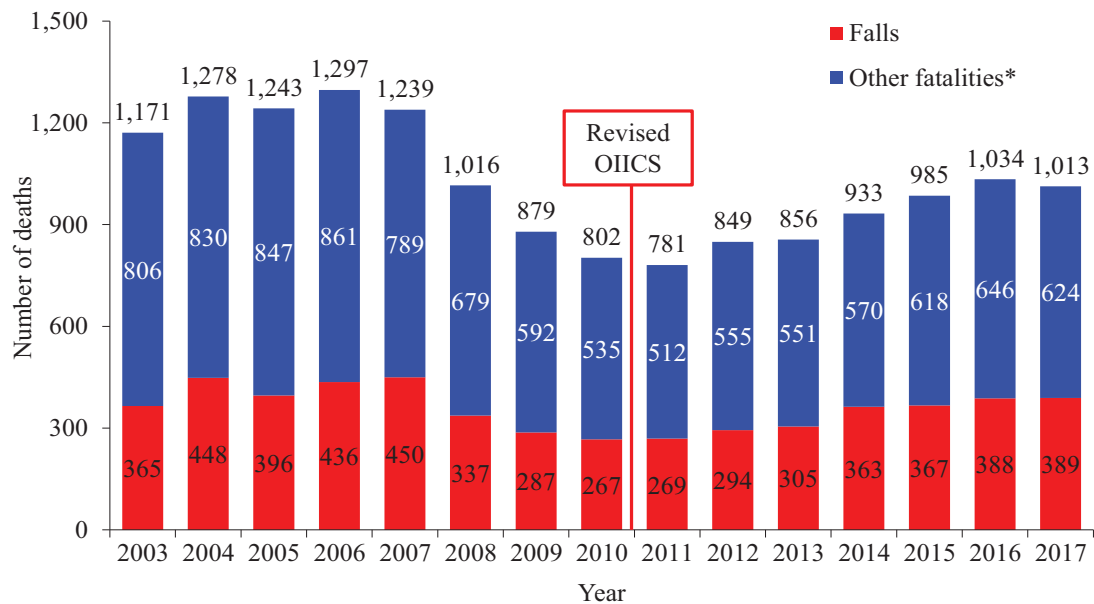
Source: U.S. Bureau of Labor Statistics, 2003-2017 Current Population Survey. Calculations by the CPWR Data Center.

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With the increase in construction employment, the number of fatalities among construction workers climbed to 1,034 in 2016, a more than 32% increase compared to the lowest point of 781 deaths in 2011 (chart 2). The number of overall fatalities in construction decreased to 1,013 in 2017, about a 2% decrease from 2016. However, fall fatalities experienced their seventh year of increase and have risen 45% since 2011.

2. Number of fatalities in construction, falls and other fatalities, 2003-2017



*Note:* In 2011, the CFOI switched to OIICS version 2.01 which categorizes slips, trips, and falls together. In previous years, slips and trips were categorized elsewhere.

\* Other fatalities are fatalities from all causes except falls.

*Source:* Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS.

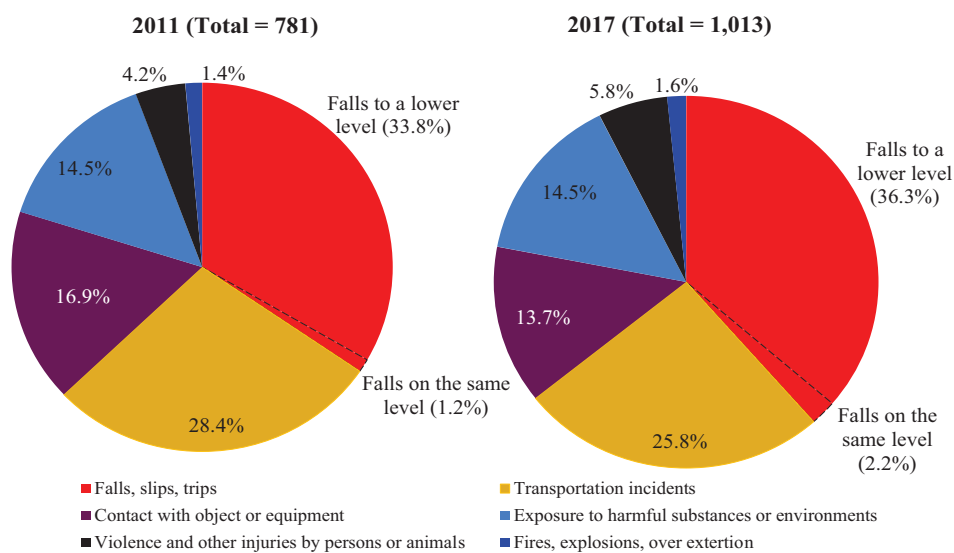
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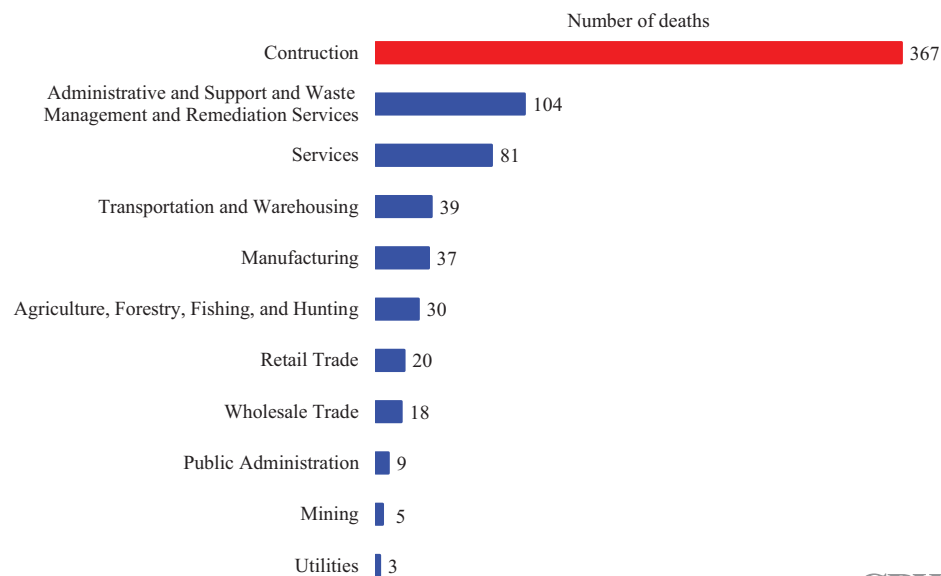
Falls to a lower level have remained the leading cause of construction fatalities over time. Of 389 fatal falls in 2017, 367 (94%) were to a lower level. While making up only a small percentage of total fatalities, slips, trips, and falls on the same level were responsible for an increased percentage of fatalities in 2017 compared to 2011 (chart 3). Overall, all types of falls, slips, and trips as a percentage of all fatalities in construction increased from 35.0% in 2011 to 38.5% in 2017.

The construction industry experienced more fatal falls to a lower level than any other major industry (chart 4). In 2017, more than half (51%, 367 of the total 713) of fall fatalities to a lower level in all industries occurred in construction.

3. Causes of fatalities in construction, 2011 and 2017 (All employment)



4. Number of fatal fall injuries to a lower level by major industry, 2017 (All employment)



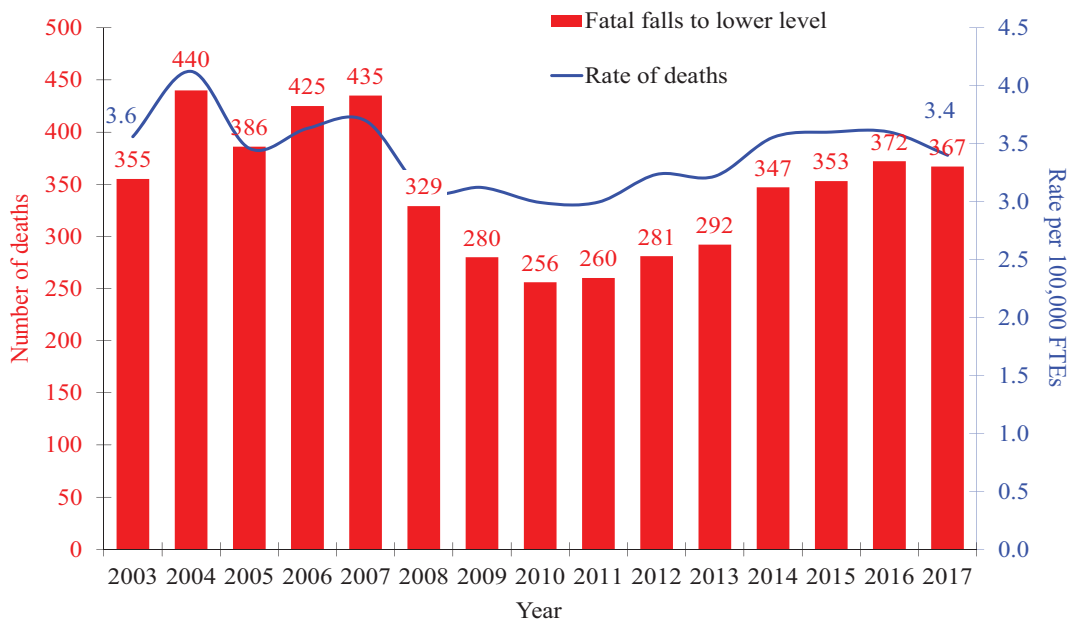
Source: Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS.

Section 1: Trends of Fatal Falls in the Construction Industry

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While the number of fatal falls to a lower level increased after the Recession, the rate was relatively stable. The rate rose slightly after 2011 (3 deaths per 100,000 full-time equivalents (FTEs)), and remained at 3.6 per 100,000 FTEs from 2014 to 2016 before decreasing to 3.4 per 100,000 FTEs in 2017 (chart 5).

**5. Number and rate of fatal falls to a lower level in construction, 2003-2017 (All employment)**



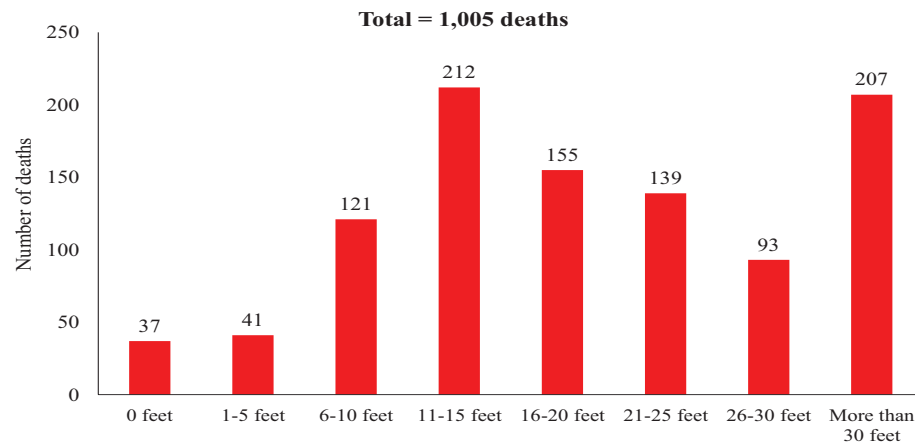
*Source:* Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS. Employment data were from the Current Population Survey. Calculations by the CPWR Data Center.

Section 1: Trends of Fatal Falls in the Construction Industry

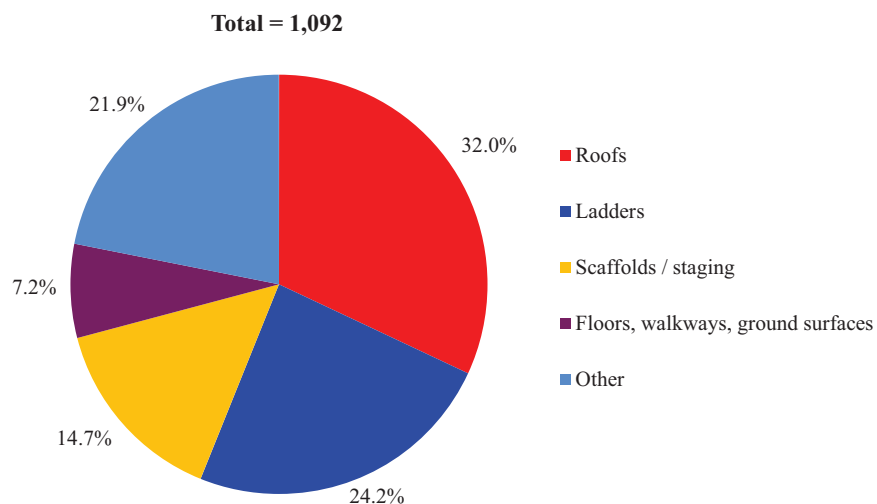
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Between 2015 and 2017, over a fifth (21%) of fatal falls were from between 11 and 15 feet in height, and another 21% occurred from a height of more than 30 feet (chart 6). Among falls to a lower level, falls from roofs were the most common, comprising almost one-third (32%) of all fall deaths in construction from 2015 to 2017, followed by 24% of falls that occurred from ladders (chart 7). Overall, falls from roofs, ladders, and *scaffolds and staging*<sup>3</sup> accounted for nearly three-quarters of fall fatalities to a lower level (71%).

**6. Fatal falls in construction, by height of fall, sum of 2015-2017 (All employment)**



**7. Fatal falls to a lower level in construction by primary source, sum of 2015-2017 (All employment)**



<sup>3</sup> This category includes all types of scaffolds and staging used inside or outside buildings, stadiums, or amphitheatres.

**Note:** There were 139 deaths without height information that were excluded.

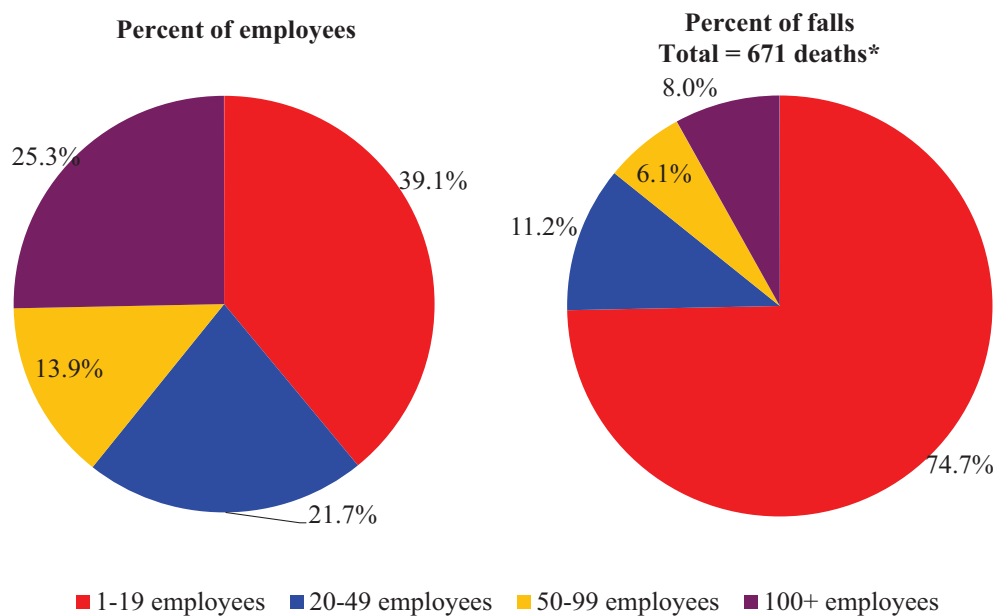
**Source:** Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS.

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## SECTION 2: Fatal Falls among Construction Subgroups

Small employers with less than 20 employees accounted for almost 75% of fatal falls between 2015 and 2017, despite only composing 39% of construction payroll employment (chart 8). Establishments with between 50 and 99 employees employed 14% of the construction payroll workforce but only 6% of fatal falls occurred at these workplaces.

**8. Percentage of fatal falls to a lower level in construction by size of establishment, sum of 2015-2017 (private wage and salary workers)**



\*145 fatalities without size of business information are excluded.

**Source:** Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS. Data on employees by establishment size from the Quarterly Census of Employment and Wages. Calculations by the CPWR Data Center.

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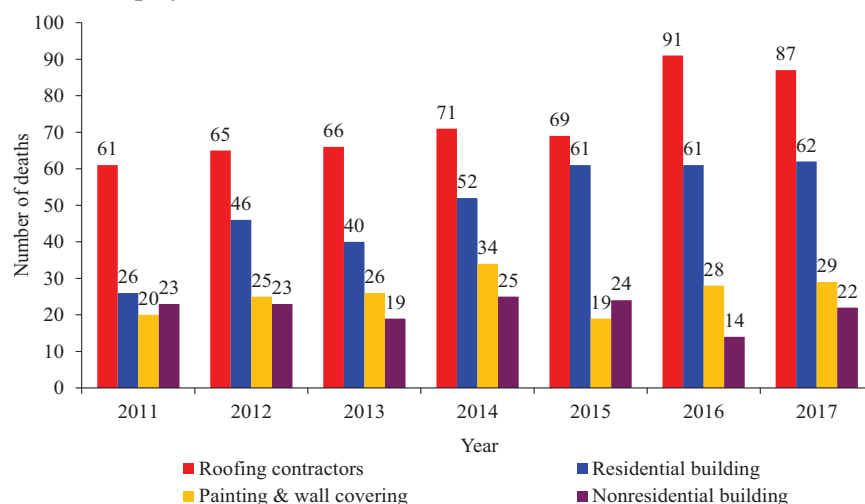
The risk of fatal falls varied among construction subgroups. From 2011 to 2017, the construction industry subsector with the most fatal falls to a lower level was Roofing Contractors (NAICS 23816) with 512 fatal fall events, followed by Residential Building Construction (NAICS 23611, 365 deaths) and Painting and Wall Covering (NAICS 23832, 182 deaths; chart 9).

Examining the yearly trend during this period, the number of falls to a lower level among Roofing Contractors decreased from 91 in 2016 to 87 in 2017 after steadily increasing since 2011 (chart 10). The number of fatal falls to a lower level in Residential Building Construction also steadily increased: there were 62 in 2017, over twice as many as in 2011.

**9. Number of fatal falls, selected construction subsectors, sum of 2011-2017 (All employment)**



**10. Number of fatal falls to a lower level, selected construction subsectors, 2011-2017 (All employment)**



*Source:* Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS.

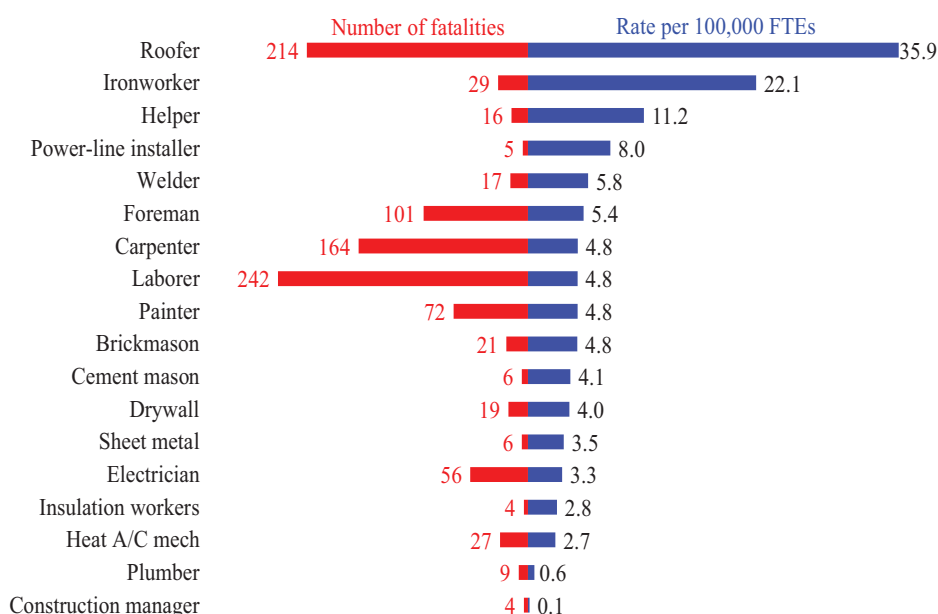


Section 2: Fatal Falls among Construction Subgroups

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More construction laborers died from falls to a lower level than any other occupation group: a total of 242 laborers died from this cause from 2015 to 2017 (chart 11). However, roofers had the highest risk of fatal falls, with 35.9 deaths per 100,000 FTEs, more than 10 times the rate of all construction occupations combined (3.4 deaths per 100,000 FTEs, *see* chart 5). Ironworkers, helpers, and power-line installers also had higher rates of fatalities than other construction occupations.

**11. Number and rate of fatal falls to a lower level in construction, selected occupations, sum of 2015-2017 (All employment)**



*Source:* Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS. Employment data were from the Current Population Survey. Calculations by the CPWR Data Center.

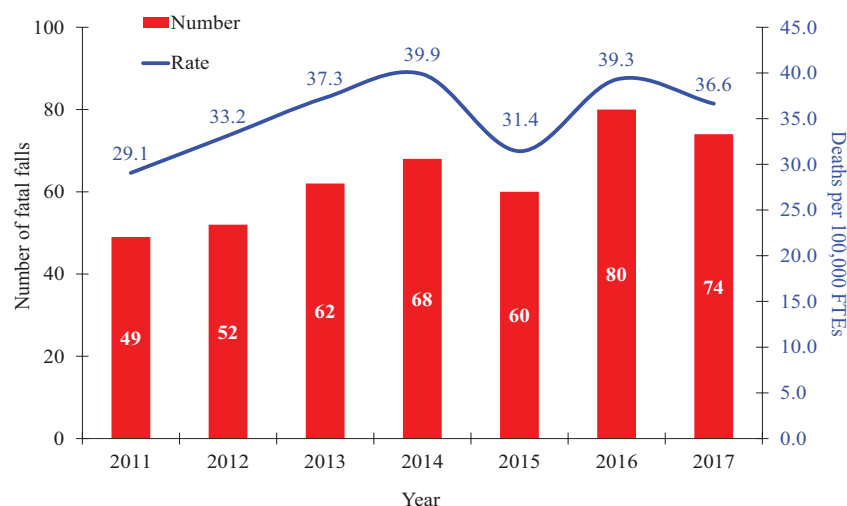
Section 2: Fatal Falls among Construction Subgroups

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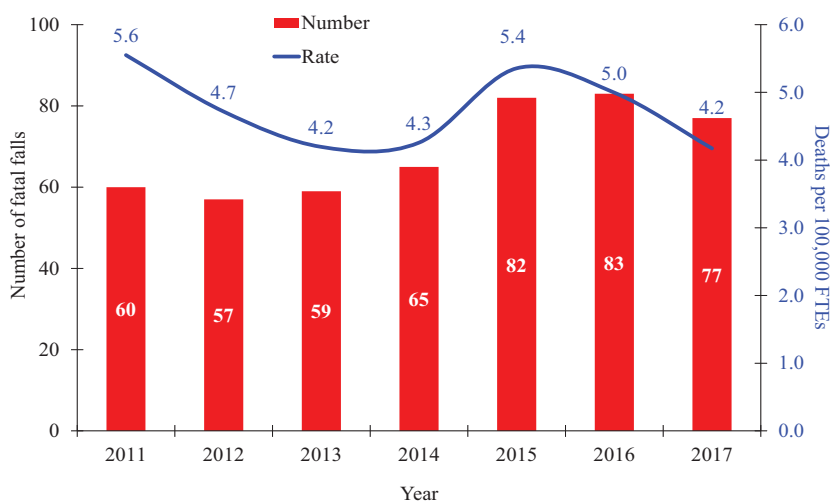
The annual trend analysis shows more fluctuations, particularly for smaller occupations. Similar to the trend in the Roofing Contractors subsector, both the number and rate of fatal falls among roofers as an occupation group showed signs of reduction in recent years. The number of fatal falls to a lower level among roofers decreased from 80 in 2016 to 74 in 2017, and the rate dropped from 39.3 deaths per 100,000 FTEs to 36.6 per 100,000 FTEs (chart 12).

Construction laborers, the largest occupation in construction, had more fatal falls to a lower level than any other occupation in this industry (see chart 11). However, the rate of fatal falls among this occupation has been gradually decreasing in recent years from 5.6 per 100,000 FTEs in 2011 to 4.2 per 100,000 FTEs in 2017 (chart 13).

**12. Number and rate of fatal falls to a lower level among roofers, 2011-2017 (All employment)**



**13. Number and rate of fatal falls to a lower level among laborers, 2011-2017 (All employment)**



**Source:** Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS. Employment data were from the Current Population Survey. Calculations by the CPWR Data Center.

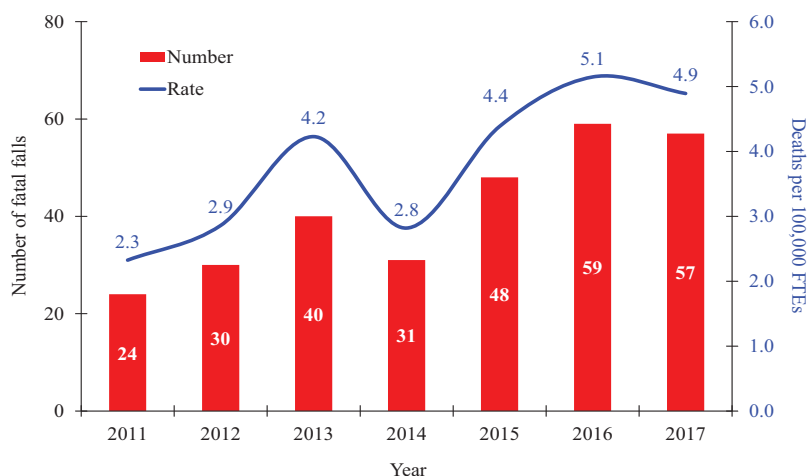
Section 2: Fatal Falls among Construction Subgroups

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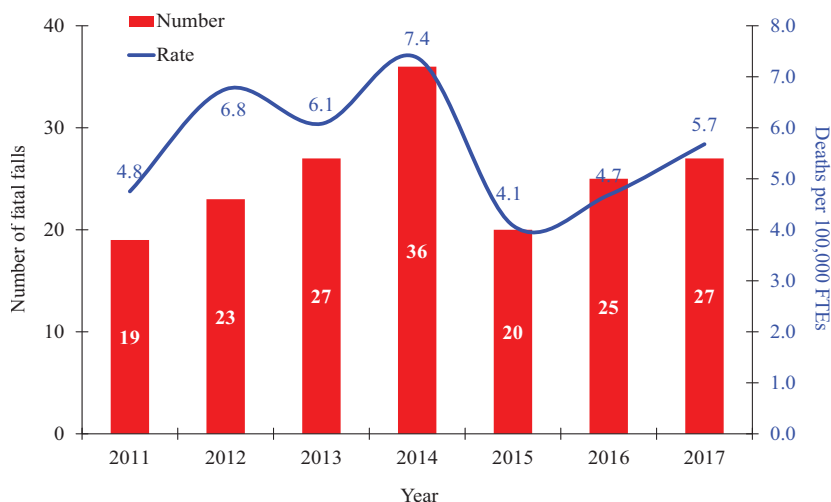
Since 2011, there has been an increase in both the number and rate of fatal falls to a lower level among carpenters. In 2017, 57 carpenters died from falls to a lower level (4.9 per 100,000 FTEs), more than double the 24 fatalities (2.3 per 100,000 FTEs) in this occupation in 2011 (chart 14).

The number and rate of fatal falls to a lower level among painters both fluctuated during this time period. After a dramatic decrease from 7.4 per 100,000 FTEs in 2014 to 4.1 per 100,000 FTEs in 2015, the rate has increased for the past two years and was 5.7 per 100,000 FTEs in 2017 (chart 15).

**14. Number and rate of fatal falls to a lower level among carpenters, 2011-2017 (All employment)**



**15. Number and rate of fatal falls to a lower level among painters, 2011-2017 (All employment)**



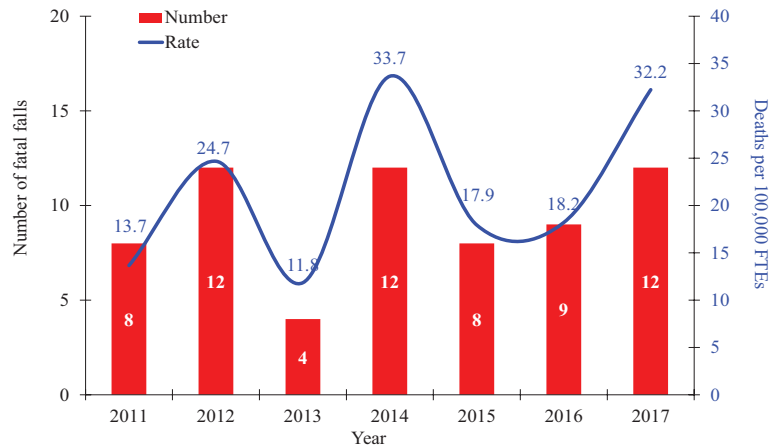
**Source:** Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS. Employment data were from the Current Population Survey. Calculations by the CPWR Data Center.

Section 2: Fatal Falls among Construction Subgroups

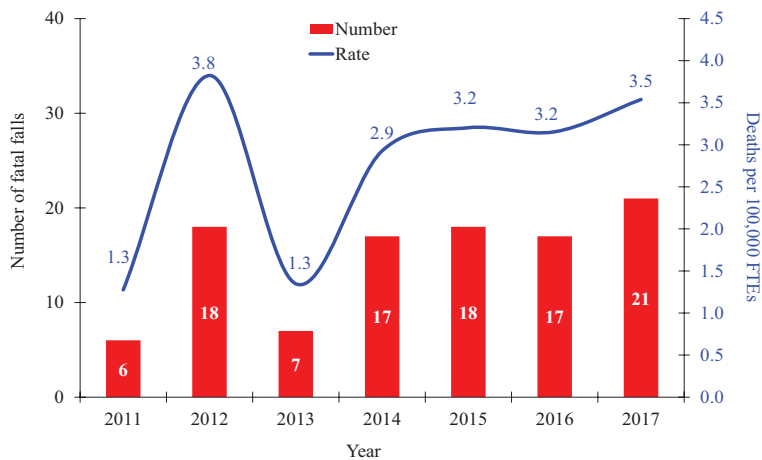
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The numbers and rates of fall fatalities among ironworkers and electricians have also fluctuated (charts 16 and 17). Due to the small number of fatalities each year, interpreting changes from one year to another should be done with caution.

**16. Number and rate of fatal falls to a lower level among ironworkers, 2011-2017 (All employment)**



**17. Number and rate of fatal falls to a lower level among electricians, 2011-2017 (All employment)**



**Source:** Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS. Employment data were from the Current Population Survey. Calculations by the CPWR Data Center.

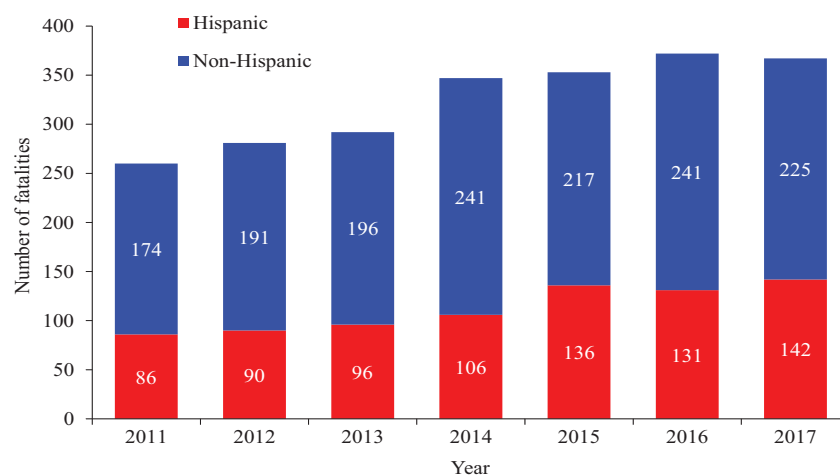
Section 2: Fatal Falls among Construction Subgroups

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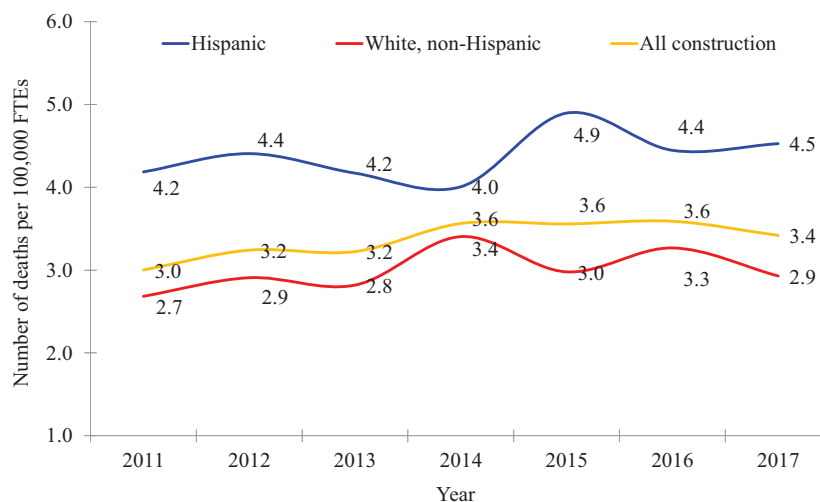
By worker demographics, fatal falls to a lower level increased among Hispanic construction workers with the increase of Hispanic employment. The number of fall deaths among Hispanic construction workers rose from 131 in 2016 to 142 in 2017, and it was 65% higher than the 86 fatalities in 2011 (chart 18). In contrast, the number of fall deaths among non-Hispanic construction workers dropped to 225 in 2017, a 7% decrease from 2016.

Hispanic construction workers also consistently had higher rates of fatal falls than their white, non-Hispanic counterparts between 2011 and 2017 (chart 19). From 2016 to 2017, the fatality rate for white, non-Hispanic workers decreased from 3.3 per 100,000 FTEs to 2.9 per 100,000 FTEs, while the rate among Hispanic construction workers increased slightly from 4.4 per 100,000 FTEs to 4.5 per 100,000 FTEs.

**18. Number of fatal falls to a lower level in construction, Hispanic versus non-Hispanic, 2011-2017 (All employment)**



**19. Rate of fatal falls to a lower level, Hispanic versus white, non-Hispanic, 2011-2017 (All employment)**



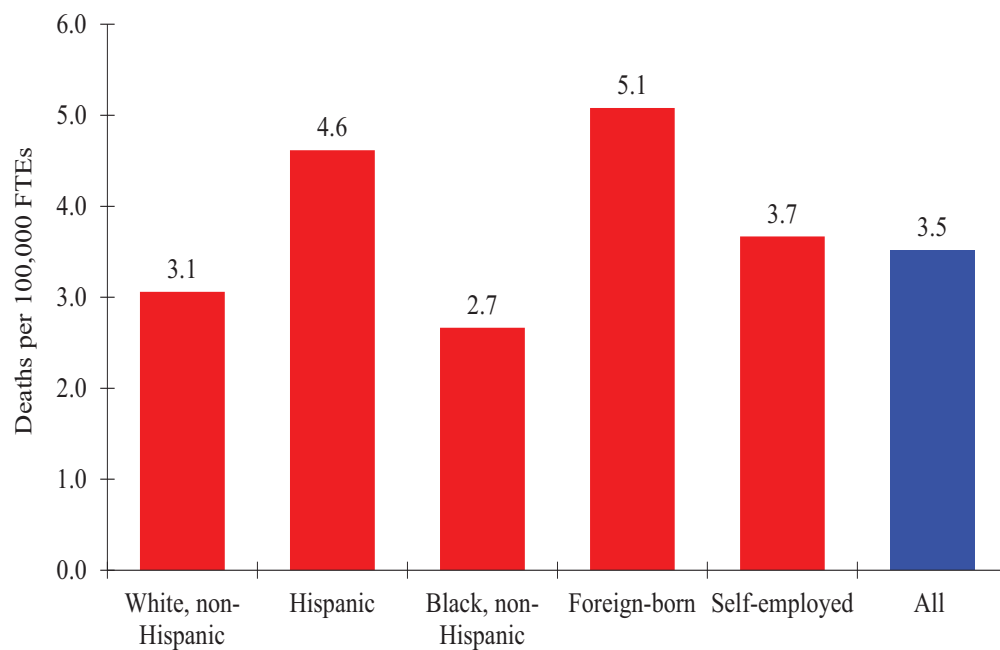
**Source:** Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS. Employment data were from the Current Population Survey. Calculations by the CPWR Data Center.

## Section 2: Fatal Falls among Construction Subgroups

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Foreign-born construction workers also had an elevated risk of fatal falls. The average rate of these falls to a lower level from 2015 to 2017 was 3.5 per 100,000 FTEs for all construction workers, 4.6 per 100,000 FTEs for Hispanic construction workers, and 5.1 per 100,000 FTEs for foreign-born workers (chart 20).

**20. Rate of fatal falls to a lower level in construction, selected characteristics, average of 2015-2017 (All employment)**



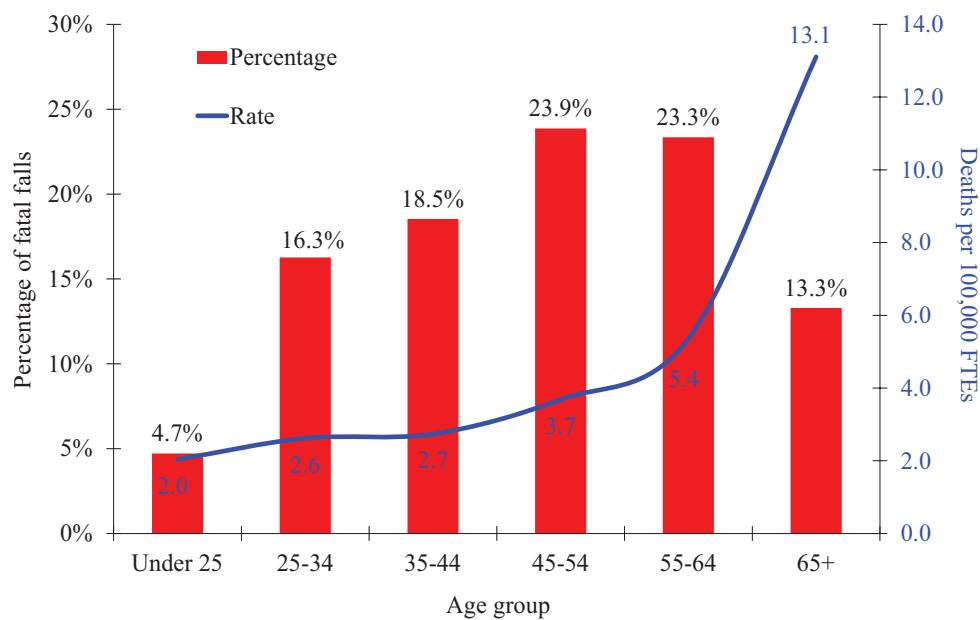
**Source:** Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS. Employment data were from the Current Population Survey. Calculations by the CPWR Data Center.

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The rate of fall fatalities increased with age. While only 13.3% of fatalities were among workers aged 65 years and older, the rate of fatalities among this group was 13.1 per 100,000 FTEs, the highest of all age groups. It was more than twice the rate among workers aged 55-64 years (5.4 per 100,000 FTEs), and more than six times the rate among workers under age 25 (2.0 per 100,000 FTEs; chart 21).

**21. Percentage and rate of fatal falls in construction, by age group, average of 2015-2017 (All employment)**



**Source:** Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS. Employment data were from the Current Population Survey. Calculations by the CPWR Data Center.

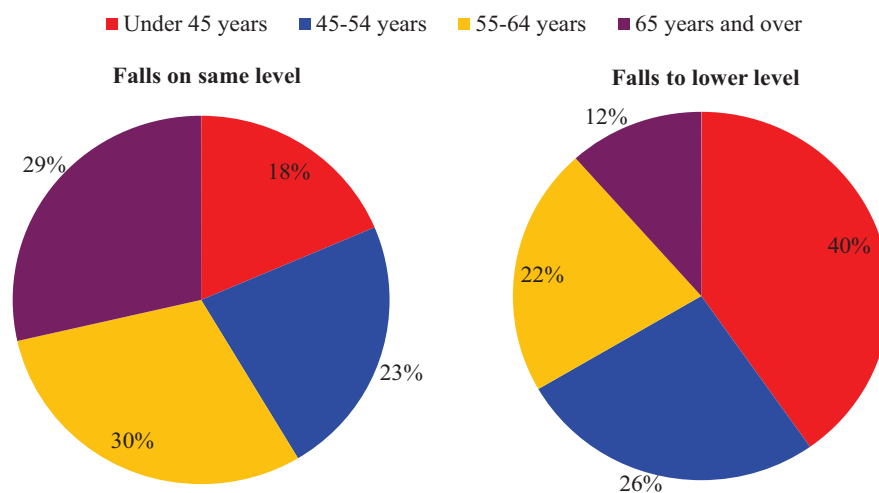
Section 2: Fatal Falls among Construction Subgroups

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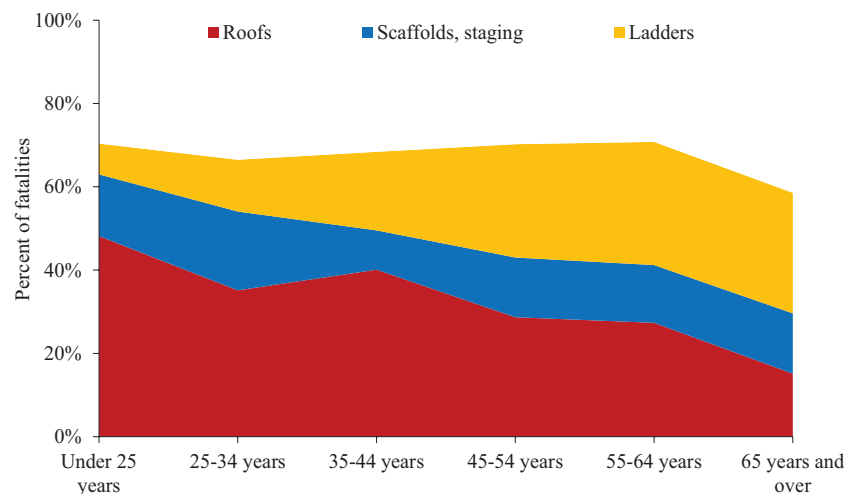
Fatal slips, trips, and falls on the same level were much less common than fatal falls to a lower level. From 2011 to 2017, about 4% of all slips, trips, and falls were on the same level. However, workers aged 65 years and older, experienced 29% of fatal falls on the same level but only 12% of falls to a lower level (chart 22).

The primary source of fatal falls varied across ages as well. While falling from roofs was the predominant source of fatalities among workers 44 years and younger, falls from ladders were the most common source of falls for workers over 55 years of age (chart 23).

**22. Fatal falls in construction, same level versus lower level by age group, sum of 2011-2017 (All employment)**



**23. Primary source of fatal falls in construction, by age group, sum of 2015-2017 (All employment)**



Source: Fatal injury data were generated by the CPWR Data Center with restricted access to the BLS CFOI micro data. The views expressed here do not necessarily reflect the views of the BLS.

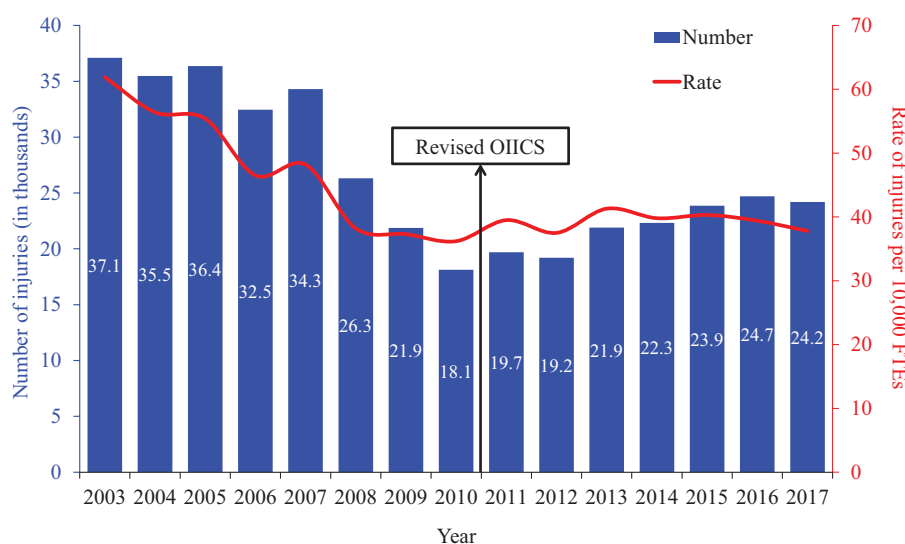


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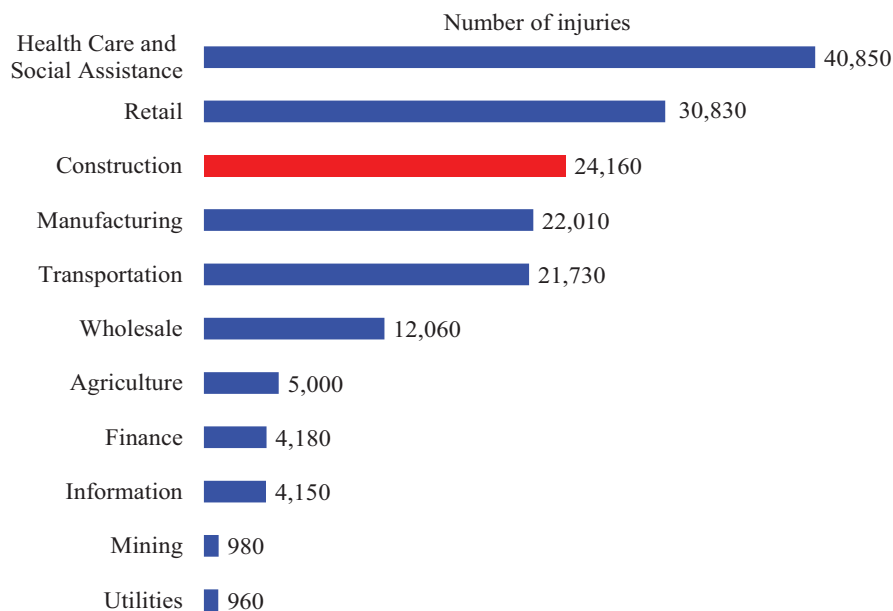
### SECTION 3: Nonfatal Fall Injuries in the Construction Industry

The number of nonfatal fall injuries resulting in days away from work in construction dropped to its lowest level during the recession (18,100 injuries in 2010), then steadily increased to 24,200 injuries in 2017. While the injury rates varied over time, the overall trend was downward, decreasing from 39.5 per 10,000 FTEs in 2011 to 37.8 per 10,000 FTEs in 2017 (chart 24). Despite the rate reduction, the construction industry still reported the third highest number of nonfatal falls out of all major industry sectors (chart 25).

**24. Number and rate of fall injuries resulting in days away from work in construction, 2003-2017**



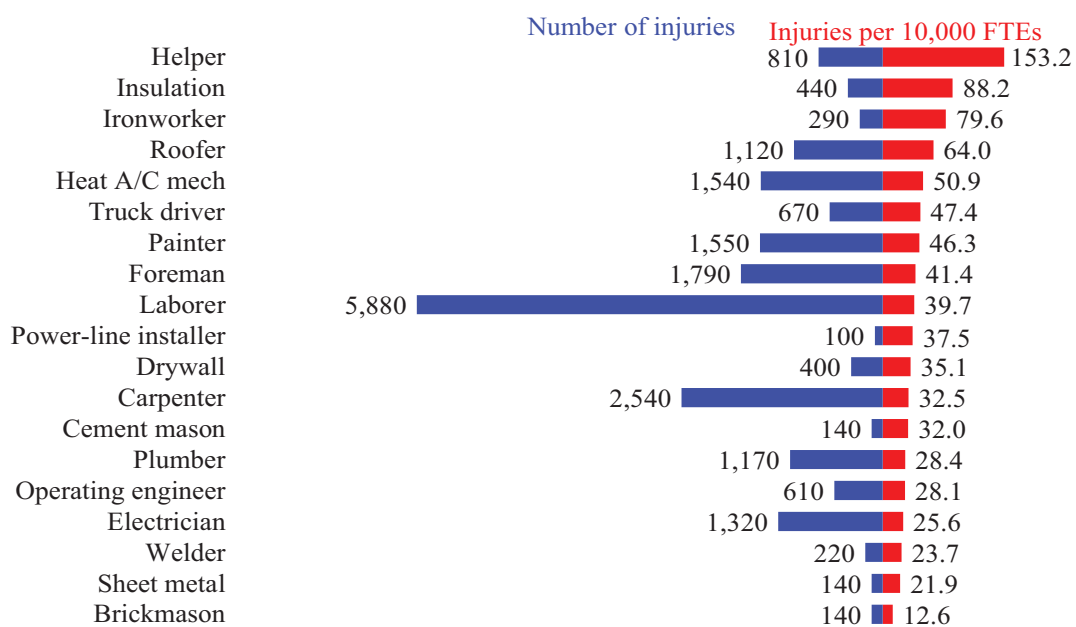
**25. Number of nonfatal fall injuries by major industry, 2017**



*Note:* In 2011, the SOII switched to OIICS version 2.01 which categorizes slips, trips, and falls together. In previous years, slips and trips were categorized elsewhere. Data cover private wage-and-salary workers.  
*Sources:* 2003-2017 Survey of Occupational Injuries and Illnesses for chart 24. 2017 Survey of Occupational Injuries and Illnesses for chart 25.

In 2017, construction laborers had more nonfatal fall injuries than any other construction occupation. However, the highest rates of nonfatal fall injuries were among helpers (153 fall injuries per 10,000 FTEs), insulation workers (88 per 10,000 FTEs), and ironworkers (80 per 10,000 FTEs) (chart 26).

**26. Number and rate of nonfatal injuries from falls resulting in days away from work, selected construction occupations, 2017 (Private wage-and-salary workers)**



*Note:* Falls include injuries from slips and trips.

*Source:* Number of nonfatal injuries are unpublished estimates from the U.S. Bureau of Labor Statistics (BLS), Survey of Occupational Injuries and Illnesses, and were obtained from the BLS through special requests. Numbers of FTEs were estimated using the Current Population Survey. Calculations by the CPWR Data Center.

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## SECTION 4: Evaluating the Reach of the National Campaign to Prevent Falls in Construction

In 2017, five years after the inception of the Campaign, CPWR in collaboration with the Center on Network Science at the University of Colorado and Visible Network Labs conducted a social network analysis (SNA) to gain a better understanding of the network developed through the Campaign and its reach. A total of 157 partners were identified by the lead organizations (OSHA, NIOSH, and CPWR), and of those, 77 responded to the survey. These partners identified an additional 117 organizations that they worked with on the Campaign, a total of 274 organizations identified as being involved in Campaign activities. These partner organizations represented a variety of stakeholders and reported reaching anywhere from 36 individuals to 2,500,000 individuals a year, excluding the lead organizations (chart 27).

27. Number of individuals being reached through the Campaign, by major partner category



*Note:* Counts exclude the lead organizations.

Section 4: Evaluating the Reach of the National Campaign to Prevent Falls in Construction

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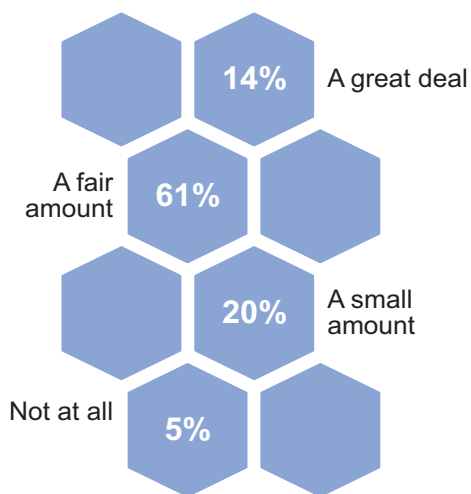
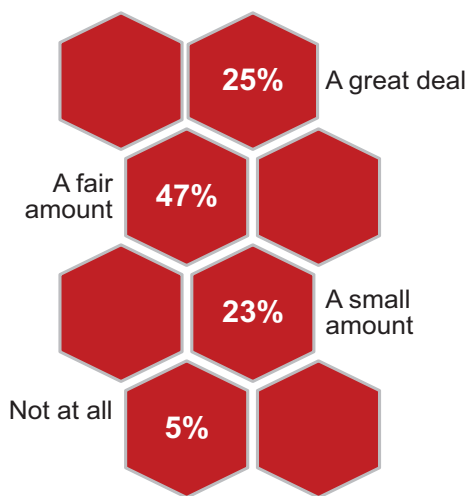
In addition, 46 respondents described 208 unique partnerships (defined as any two people or organizations and the relationship between them) with other organizations around the Campaign. These partnerships led to 951 Campaign-related activities, including several that highlighted the strength of the Campaign’s information sharing network:

- Sharing information between organizations (85% of partnerships);
- Specifically providing fall prevention information or materials to another organization (76% of partnerships); and
- Promoting the Falls Campaign (70% of partnerships).

In terms of outcomes, three quarters of the respondents to the SNA survey said they have seen an increase in fall prevention activities as a result of their involvement in the Campaign. Similarly, 72% of respondents said that they have observed “a fair amount” (47% of respondents) or “a great deal” (25% of respondents) of improvement in overall safety and health initiatives on topics other than falls within their organization or the construction industry (chart 28).

**28. Impact of the Campaign in the construction industry and beyond**

75% noticed an **increase in fall prevention activities** at their organization or in the industry (n=59)



72% noticed **improvements in overall safety and health initiatives with topics other than falls** at their organization or in the industry (n=60)

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## Conclusion/Discussion

Fall injuries remain the top cause of construction fatalities, and the number of fatalities has increased as construction employment rebounded with the economic recovery. However, the rate of fatal falls has been relatively stable over the past few years and slightly decreased in 2017. In addition, the rate of fatal falls showed signs of decreasing among roofers, the occupation with the highest risk of falls, and construction laborers, the largest occupation in this industry. These statistics are consistent with the results from the social network analysis of the Campaign and its reach, since more and more organization are involved in the Campaign and have seen improvements in both fall safety protections and overall health and safety initiatives. Fall protection efforts, such as OSHA's [Fall Prevention Training](#) and the [Campaign](#), may have contributed to the recent reduction of fall fatalities.

The findings in this report emphasize the importance of the ongoing Campaign, and the need to further reduce falls among construction workers. The construction industry continues to report more fatal falls than any other industry. Hispanic construction workers, foreign-born workers, older workers, and roofers still have a higher risk of fatal falls than the average of all construction workers. Moreover, fatal falls at small construction establishments with less than 20 employees are disproportionately high. Enhanced fall protection efforts should be targeted and available for small employers.

## Data Sources:

- U.S. Bureau of Labor Statistics, 2003–2017 Census of Fatal Occupational Injuries (CFOI)
- U.S. Bureau of Labor Statistics, 2003–2017 Survey of Occupational Injuries and Illnesses (SOII)
- U.S. Bureau of Labor Statistics, 2003–2017 Current Population Survey (CPS)
- U.S. Bureau of Labor Statistics, 2015–2017 Quarterly Census of Employment and Wages (QCEW).
- Social Network Analysis, 2012–2017 National Campaign to Prevent Falls and its Reach

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## 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 North America’s Building Trades Unions, and serves as its research arm. CPWR has focused on construction safety and health research since 1990. The Quarterly Data Reports – 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).

Please visit CPWR’s other resources to help reduce construction safety and health hazards:

Construction Solutions <http://www.cpwrconstructionsolutions.org/>

Construction Solutions ROI Calculator <http://www.safecalc.org/>

Exposure Control Database <http://ecd.cpwrconstructionsolutions.org/>

The Electronic Library of Construction OSH <http://www.elcosh.org/index.php>

Falls Campaign <http://stopconstructionfalls.com/>

Hand Safety <http://choosehandsafety.org/>

Safety and Health Network <https://safeconstructionnetwork.org/>

Work Safely with Silica <http://www.silica-safe.org/>

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